Infection Control/Antimicrobial Resistance (IC/AR) Webinar November 21, 2019 1:30pm-2:30pm

Today's Topic: Containing Novel and Targeted Multidrug- Resistant Organisms (MDROs)

NJDOH, Public Health and Environmental Laboratories (PHEL)

Alyssa MacMillan, PhD

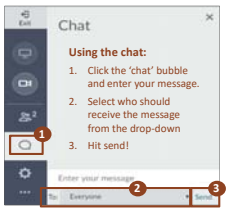
Public health surveillance testing for Carbapenemase Producing Carbapenem-Resistant Enterobacteriaceae (CP-CRE), *Pseudomonas aeruginosa* (CP-CRPA) and other novel and targeted MDROs (e.g., CRAB, *C. auris*)

NJDOH, Communicable Disease Service (CDS)

Tara Fulton, MPH

Update on *Candida auris* (*C. auris*) epidemiology, detection, and control strategies

Housekeeping



You will be on MUTE for the duration of this webinar

If you have a question please type into the "question" or "chat" box

This webinar is being recorded

Slides will be distributed after the webinar

If your question has not been answered at the end of the webinar, we will try to follow up with a written response

Next Webinar scheduled for winter 2020 - stay tuned!

Webinar Opportunity Tomorrow!

Edward Lifshitz, MD, FACP, Medical Director, Infectious & Zoonotic Disease Program, Communicable Disease Service of the New Jersey Department of Health will be speaking on an Antimicrobial Stewardship Webinar tomorrow!

Topic: Antimicrobial Stewardship: Protecting a Critical Resource

When: November 22, 2019, 11:00 AM - 12:00PM

Register here: https://rutgers.ca1.qualtrics.com/jfe/form/SV_eDx9V3p7odmYHZ3

New Jersey and the Antibiotic Resistance Laboratory Network (ARLN):

Public health surveillance testing for Carbapenemase Producing-Carbapenem-Resistant *Enterobacteriaceae* (CP-CRE), *Pseudomonas aeruginosa* (CP-CRPA) and other novel and targeted MDROs

ALYSSA MACMILLAN, PHD
PHLS MICROBIOLOGY PROGRAM MANAGER

ANTIBIOTIC RESISTANCE LAB NETWORK
NEW JERSEY DEPARTMENT OF HEALTH

ARLABnetwork

NJ Health
New Jersey Department of Health

CDC Reports: Antibiotic Resistance Threat in the United States 2019

- More than 2.8 million antibiotic-resistant infections in the US each year (35,000+ deaths)
- Since 2013, increase in number of cases but 18% decrease in deaths
- Categorized pathogens into threat categories

Urgent Threats

- Carbapenem-resistant *Acinetobacter*
- *Candida auris (C. auris)*
- *Clostridioides difficile (C. difficile)*
- Carbapenem-resistant Enterobacteriaceae (CRE)
- Drug-resistant *Neisseria gonorrhoeae (N. gonorrhoeae)*

The Highlights:

What is carbapenem resistance?

How is it affecting New Jersey?

How do we detect and characterize it?

How are clinical and public health labs working together to control it?

Carbapenem Antibiotics

Broadest spectrum of activity **and** greatest potency against gram-negative and gram-positive organisms

Inhibit cell wall formation

Relatively resistant to β-lactamases (bacterial defense mechanism)

First discovered in 1976, first available for treatment in 1985

Now include imipenem, meropenem, ertapenem, doripenem
*FDA approved

Considered "last resort": used for complicated or resistant infections

Acquiring Resistance

Mutation Based

1. Alter the protein target
2. Reduce permeability of outer membrane
3. Overexpress drug exporter proteins

Gene Acquisition

Plasmid (small genetic element) acquired from co-infecting organism

Enzyme-mediated resistance

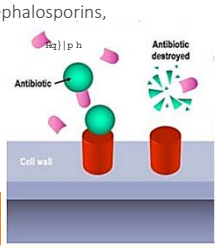
Carbapenemase

β-lactamases with ability to hydrolyze penicillins, cephalosporins, monobactams, carbapenems

Big Five:

KPC: *Klebsiella pneumoniae* carbapenemase
NDM: New Delhi metallo-β-lactamase
OXA-48: oxacillinase
VIM: Verona integron-mediated metallo-β-lactamase
IMP: imipenemase

CP-CRE: **Carbapenemase-producing** carbapenem resistant *Enterobacteriaceae*



Dr. Mangala Nischal

New York/New Jersey: epicenter for KPC-CRE
Highest prevalence of CRE in the US
10% *Klebsiella pneumoniae*-bacteremia carbapenem resistant
Of all CP-CRE, **90%+ KPC**-producing
NDM: sporadic
VIM/IMP/OXA-48: rare

Satlin, Kreiswirth, et al, Antimicrob Agents Chemother, 2017

Who is at risk?

Acute and long-term healthcare settings
Compromised immune system
- Cancer or transplantation

Ventilators, urinary catheters, central lines, chronic wounds
Long term antibiotic use
History of medical care abroad
30-70% mortality rate
2-3 times more likely to be fatal than infection with susceptible bacteria

Antimicrobial Resistance Laboratory Network

CDC-supported initiative established in 2016

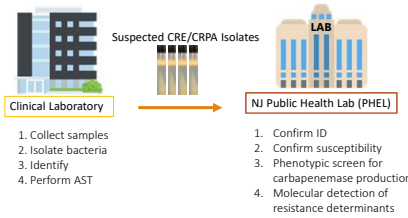
Supports state and local health department surveillance

ARLABnetwork

Beyond CRE:

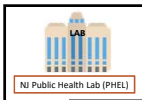
- *Clostridium difficile*
- *Streptococcus pneumoniae*
- *Neisseria gonorrhoeae*
- *Mycobacterium tuberculosis*
- *Candida auris*
- MRSA

ARLN: Carbapenem Resistance



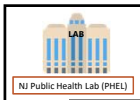
1. Collect samples
2. Isolate bacteria
3. Identify
4. Perform AST

1. Confirm ID
2. Confirm susceptibility
3. Phenotypic screen for carbapenemase production
4. Molecular detection of resistance determinants



Testing Menu

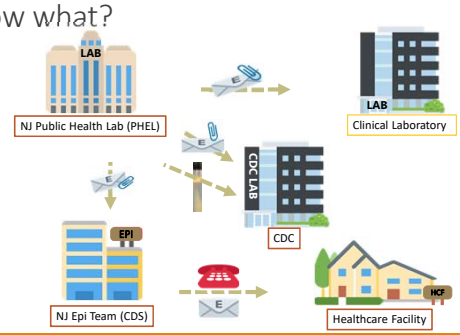
Task	Method
Species ID	VITEK 2 or Bruker MALDI ToF
Susceptibility Testing	Disk Diffusion
Carbapenemase Screening	Modified Carbapenem Inactivation Method (mCIM)
Molecular Detection of AR Determinants	Real-time PCR KPC, NDM, OXA-48, IMP, VIM



Drugs used to confirm and further characterize CRE and CRPA

Drug Class	CRE	CRPA
Carbapenems	ertapenem, imipenem, meropenem, doripenem	imipenem, meropenem, doripenem
Cephems	ceftazidime, ceftriaxone, cefepime	ceftazidime and cefepime
β-lactam/β-lactamase inhibitor combinations	piperacillin-tazobactam	piperacillin-tazobactam
Monobactams	aztreonam	aztreonam
Combinations	ceftazidime-avibactam, ceftolozane-tazobactam	ceftazidime-avibactam, ceftolozane-tazobactam

So now what?



Alert Values

Pan-resistance

Possible novel resistance
- Carbapenemase+ but PCR negative

non-KPC CP-CRE

CP-CRPA

Other AR Laboratory Services
provided by New York Department of Health

Candida auris isolate characterization
- Identification (MALDI-ToF)
- Antifungal susceptibility

Candida auris culture from patient swab (surveillance samples)

Carbapenemase-producing *Acinetobacter baumannii* characterization (including whole genome sequencing)

Expanded Antimicrobial Susceptibility Testing for Hard-to-Treat Infections (including aztreonam-avibactam)

Thanks!

NJ PHL ARLN Team
Maria Orsini
Parul Patel
Hita Shah
Krupa Patel
Lisa Schlitt
Tom Kirn

NJ HAI/AR Epidemiologists (past and present)
Patricia Barrett
Tara Fulton
Aaron Rosenbaum

Lab-Epi Liaison Alicia Sloughfy
Regional Laboratory Partners: NY DOH
Centers for Disease Control & Prevention ARLN Team
Funding
Submitting clinical lab partners

Multidrug Resistant *Candida auris*: Update on Current Epidemiology, Detection, and Control Strategies

TARA FULTON, MPH
HEALTHCARE ASSOCIATED INFECTIONS & ANTIMICROBIAL RESISTANCE EPIDEMIOLOGIST

CDC Says NJ Has Third-Most Hospitalizations with Drug-Resistant Fungus

JON HURDLE | APRIL 9, 2019 | HEALTH CARE

DEADLY GERMS, LOST CURES

A Mysterious Infection, Spanning the Globe in a Climate of Secrecy

The rise of Candida auris embodies a serious and growing public health threat: drug-resistant germs.

Calls For Health Emergency As Dangerous NJ 'Superbug' Cases Rise

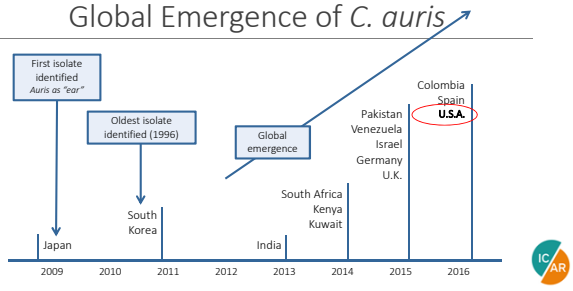
Concerns About *Candida auris*

Highly drug-resistant

Patients can become colonized and develop invasive infections

Spreads in healthcare settings

Global Emergence of *C. auris*



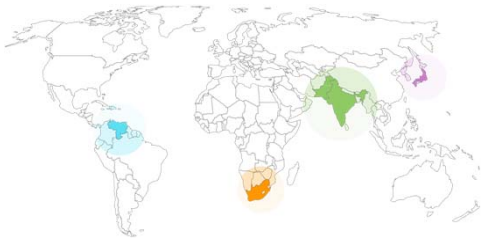
Chowdhary et al., 2017

Year of first identification

Countries Reporting Cases of *C. auris*
September 30, 2019

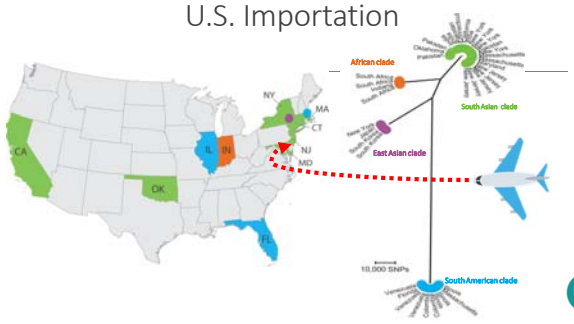
https://www.cdc.gov/fungal/candida-auris/tracking-c-auris.html

Four Distinct Clades of *C. auris*



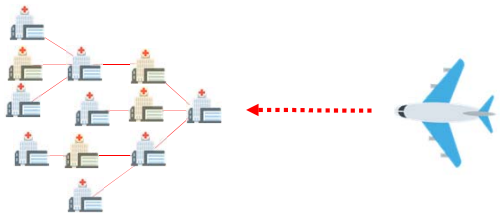
Lockhart et al., 2017

U.S. Importation



Chow et al., 2018

U.S. Importation Followed by Local Transmission



Clinical Cases of *C. auris* by State

August 31, 2019

https://www.cdc.gov/fungal/candida-auris/tracking-c-auris.html

Concerns About *C. auris*

Patients can become colonized and develop invasive infections

C. auris Drug Resistance in the U.S.

Azoles
87.6%

Polyenes
33.7%

Echinocandins
1.7%

33% multidrug-resistant

Data provided courtesy of CDC Mycotic Diseases Branch

Pan-resistance

- Two pan-resistant *C. auris* cases in 2019 (NY)
- Cases were unrelated
- Developed resistance on echinocandin treatment
  - already resistant to fluconazole and amphotericin B
- No transmission of resistance seen
- Pan-resistance reported from a few other countries

Concerns About *C. auris*

Highly drug-resistant

Patients can become colonized and develop invasive infections

Spreads in healthcare settings

Risk Factors for *C. auris*

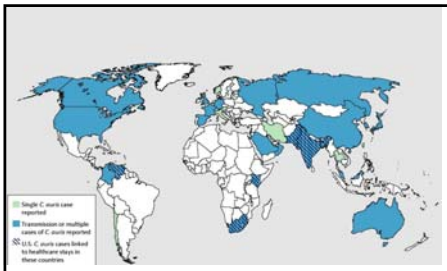
- Ventilator-dependent
- Invasive medical devices
- Extensive healthcare exposure
- Recently received antibiotics and antifungals
- Colonized with other MDROs

Risk Factor: Stays in Certain Types of Post-acute Care Facilities

VENTILATOR SKILLED NURSING FACILITY
7.7% PREVALENCE

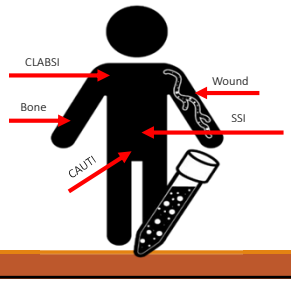
SKILLED NURSING FACILITY
0.7% PREVALENCE

Adams et al., 2018



Risk Factor: Healthcare Abroad

Invasive Infections Caused by *C. auris*



Concerns About *C. auris*

Highly drug-resistant

Patients can become colonized and develop invasive infections

Modes of Transmission

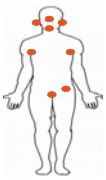
Person to Person

Contaminated Environment

Shared Equipment

C. auris Colonization

- Primarily on skin, but other body sites can become colonized
- Persistent, perhaps indefinitely
- No known decolonization strategies
- Risk factor for infections
- Risk factor for transmission



Persistence in the Environment

Mobile Equipment: Contributor to Transmission

Colonization Spreads Beyond Roommates

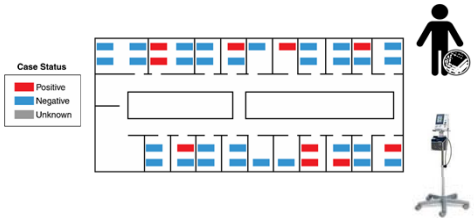
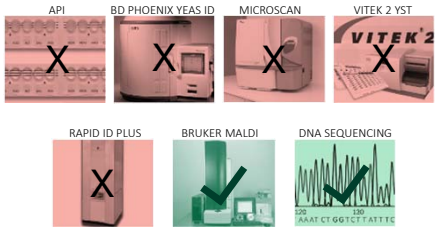


Image provided courtesy of NYSDOH

Identification

Challenges with Identifying *C. auris*



Common Misidentifications

Identification Method	Organism *C. auris* can be misidentified as
Vitek 2 YST Proper ID with ver. 8.01	*Candida haemulonii* *Candida duobushaemulonii*
API 20C	*Rhodotorula glutinis* *Candida sake*
BD Phoenix yeast identification system	*Candida haemulonii* *Candida catenulata*
Microscan	*Candida famata* *Candida guilliermondii* *Candida lusitaniae* *Candida parapsilosis*
RapID Yeast Plus	*Candida parapsilosis*

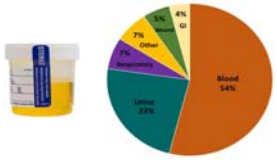
cdc.gov/fungal/candida-auris/recommendations.html

Misidentification Improvements

- FDA Approvals
  - VITEK MS MALDI
  - Bruker Biotyper MALDI
  - GenMark ePlex BCID-FP panel blood culture test
  - VITEK 2 8.01 update
  - rt-PCR
- Awareness of the organism
- Confirmation at reference and public health labs

Identification Challenge: *Candida* speciation

- Yeast not determined to species level in many labs, except by request
- Sterile site isolates may only be performed by request
- Species from non-sterile isolates often not identified



Initial culture site of *C. auris* clinical cases (U.S.)

Data provided courtesy of CDC Mycotic Diseases Branch

Recommendations for Laboratory Diagnosis

Speciate all *Candida* isolates from normally sterile sites

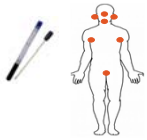
Speciate *Candida* isolates from non-sterile sites when:

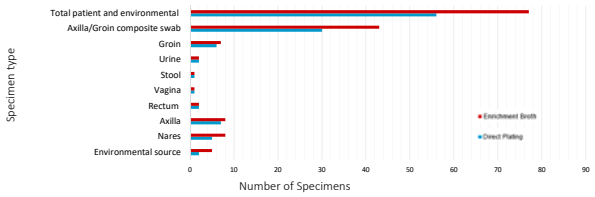
- When *C. auris* patients have been identified in the facility or unit
- When patient had overnight stay at healthcare facility in a country with *C. auris* transmission within 1 year
- Clinically indicated in the care of a patient
- When patient is not responding to therapy

Suspect *C. auris* when there is an increase infections of unidentified *Candida* spp. in a patient care unit

Challenges with Detecting Colonization

- Asymptomatic
- Limited testing availability through CDC, ARLN
  - Specialized enrichment broth
  - PCR
- Turnaround time
  - Specialized enrichment broth ~ 12 days
  - PCR ~ 3 days

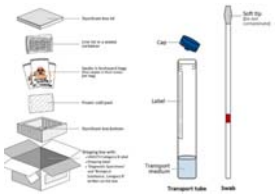




Direct plating methods misses ~25% of the positive *C. auris* patients screened compared to enrichment broth procedure

Welsh et al., 2017

Identification and Containment Support



- *C. auris* confirmatory testing (isolate submission)
- Surveillance testing of high risk contacts and when transmission is suspected
- Support includes shipping costs and screening supplies

Infection Prevention Strategies

Facility Level Prevention Strategies: Back to the Basics

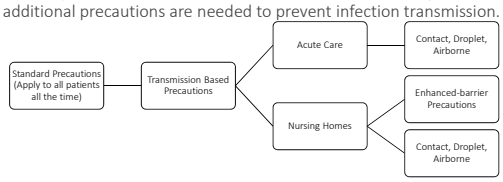
Hand Hygiene when dealing with *C. auris*

Alcohol-based hand rub (ABHR) is preferred over soap and water except when hands are visibly soiled because it:

- Is more effective at killing germs on hands than soap
- Requires less time
- Is more accessible than handwashing sinks
- Produces reduced bacterial counts on hands
- Improves skin condition with less irritation and dryness than soap and water

Personal Protective Equipment: Transmission Based Precautions

Transmission Based Precautions - Second tier of basic infection control and are to be used in addition to Standard Precautions for patients/residents who may be infected or colonized with certain infectious agents for which additional precautions are needed to prevent infection transmission.



Personal Protective Equipment: Enhanced Barrier Precautions

- Specific to MDROs in nursing homes - **not intended for use in acute care or long-term acute care hospitals**
- Falls between Standard and Contact Precautions
- CMS acknowledges least restrictive isolation
- CDC recommendation
- Does not replace existing guidance regarding use of Contact Precautions for other pathogens (e.g., *C. difficile*, norovirus) in nursing homes


Implementation of Personal Protective Equipment in Nursing Homes to Prevent Spread of Novel or Targeted Multidrug-resistant Organisms (MDROs)

https://www.cdc.gov/hai/containment/PPE-Nursing-Homes.html

Personal Protective Equipment (PPE): Acute and Long-Term Acute Care Hospitals

Patients that are colonized or infected with C. auris in **acute care or long-term acute care hospitals**, should be placed on Contact Precautions in a single room, with dedicated equipment and minimal staff entering the room.

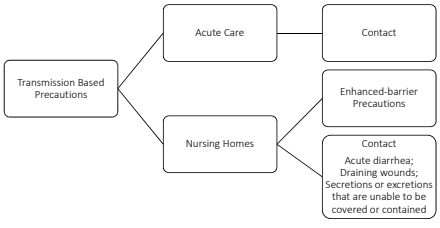
Personal Protective Equipment (PPE): Nursing Homes

Patients that are colonized or infected with C. auris in **nursing homes**, should be placed on **Enhanced Barrier Precautions**

- Gown and gloves during high-contact resident care activities that provide opportunities for transfer of MDROs to staff hands and clothing. https://www.cdc.gov/hai/containment/PPE-Nursing-Homes.html
- Can leave their rooms as long as secretions, excretions, and bodily fluids are contained and the resident can perform hand hygiene when appropriate, e.g., prior to leaving their room.

Contact precautions should be implemented in nursing homes, **when there is presence of acute diarrhea, draining wounds, secretions or excretions that are unable to be covered or contained**

C. auris Transmission Based Precautions



Environmental Cleaning & Disinfection: Products

Product must have an EPA claim for:

- *C. auris*
  - Medline Micro-Kill Bleach Germicidal Bleach Wipes EPA # 37549-1
  - Oxivir® 1 Ready-to-use EPA #70627-74
  - Oxivir® 1 wipes EPA # 70627-77
- If not, *C. difficile* (see EPA List K)
- Consider use of these products throughout facility if multiple cases of *C. auris*

Cleaning and Disinfection of Shared Medical Equipment

Multidisciplinary approach (e.g., EVS, patient/resident care staff)

All equipment should be cleaned/disinfected after contact with or use on resident/patient (e.g. stethoscopes, X-ray machines, respiratory therapy equipment)

Recommendations for Facilities Caring for *C. auris* Patients

- **Dedicate staff and medical equipment for *C. auris* patients**, if possible (e.g., temperature probe, pulse ox, etc.)
- For *all* staff and visitors, **round strategically to prevent spread of *C. auris***
  - Standard Precautions → General iso rooms → *C. auris* iso rooms
- Prioritize auditing and additional rounding in units with *C. auris* patients
  - Hand hygiene, PPS use, environmental cleaning, etc.

Recommendations for Facilities Caring for *C. auris* Patients

Speciate *Candida* isolates from all patients to ensure *C. auris* possible transmission is identified quickly

Recommendations for Facilities Caring for *C. auris* Patients

Communicate the patient's *C. auris* status to any receiving facilities

https://nj.gov/health/cd/topics/cauris.shtml

When *C. auris* Transmission is Suspected

Intensify Infection Control efforts throughout the units where transmission is suspected

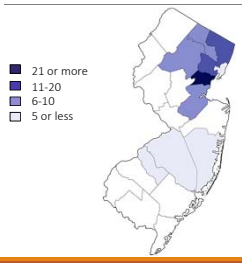
Identify overlaps in location, equipment and care types for patients with *C. auris* (possible sources of transmission)

Conduct point prevalence screening for *C. auris* colonization in areas deemed 'high risk'

- Findings from screening will inform next steps

Consultative onsite visit from HAI/AR team to identify areas for improvement

Clinical Cases of Candida auris, as of October 31, 2019



Confirmed clinical case count: 145

Confirmed clinical cases are those with isolates that have been confirmed as *C. auris* in the laboratory.

Reporting

- When C. auris is confirmed or suspected contact CDS!
  - 609-826-5964
  - Tara.Fulton@doh.nj.gov; HAIAR@doh.nj.gov
- Ensure C. auris specific infection prevention and control measures are in place
- Conduct surveillance in collaboration with CDS

Questions?

THANK YOU!

TARA.FULTON@DOH.NJ.GOV
JASON.MEHR@DOH.NJ.GOV