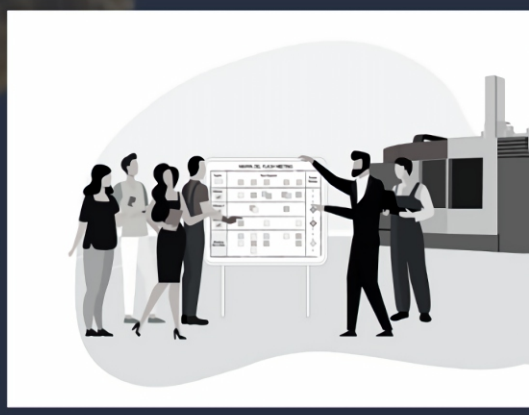
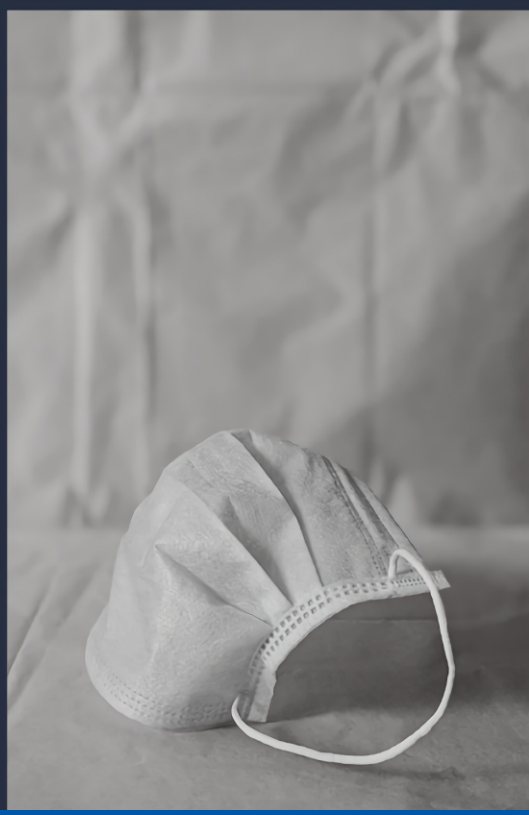
CANDIDA AURIS: OUTBREAK PREPAREDNESS & RESPONSE GUIDELINES

NATIONAL FUNGAL DISEASE SURVEILLANCE SYSTEM





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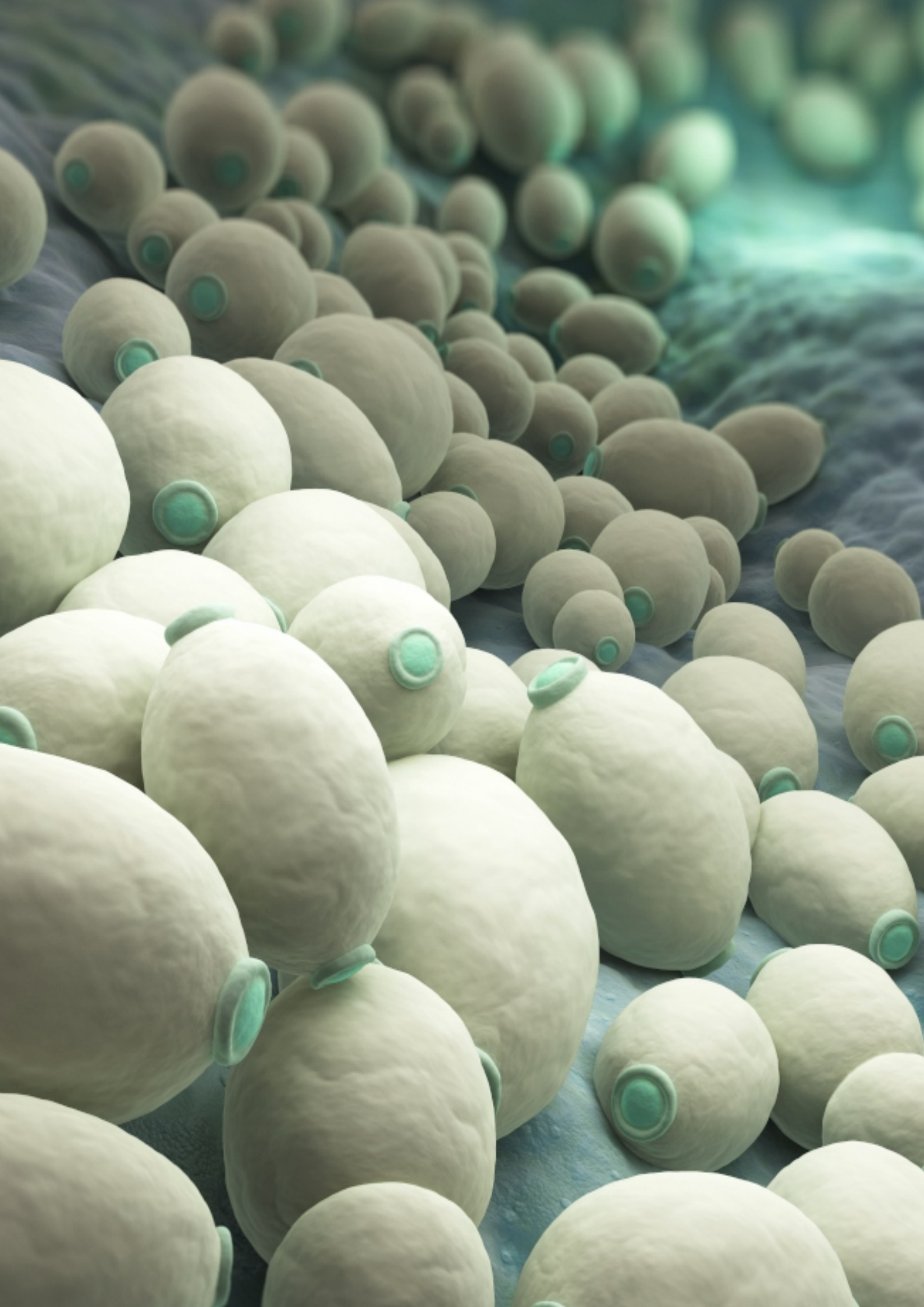
NATIONAL INSTITUTES OF HEALTH ISLAMABAD PAKISTAN



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NATIONAL FUNGAL DISEASE SURVEILLANCE SYSTEM

2024

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Foreword

The emergence of *Candida auris* as a multidrug-resistant pathogen has posed a significant challenge to healthcare systems worldwide, including our healthcare facilities in Pakistan. Over the past three years, our commitment to building capacity for *Candida auris* diagnosis, case management, and infection prevention and control (IPC) at 14 tertiary care hospitals across Pakistan has made measurable progress, despite the challenges posed by resource limitations and pathogen resistance.

The gravity of this endeavor has been underscored by recent cases of multiple *Candida auris* infections, with some facilities witnessing possible outbreak scenarios. These events highlight the urgent need for enhanced outbreak preparedness and response strategies. In this context, our work is deeply supported by the Centers for Disease Control and Prevention (CDC), whose partnership and funding have been essential to the success of this initiative.

This document has been developed under the able stewardship of Dr. Muhammad Salman (CEO of NIH), Dr. Mumtaz Ali Khan (Chief of CDC- NIH) and Dr. Muhammad Amjad Khan (Coordinator CEOH - NIH), by the technical wing of CEOH-NIH: Ms. Tarbia Aamir, Mr. Muhammad Waleed, Dr. Amna Ali and Dr. Mahwish Bhatti. The scientific overview and contributions of Dr. Tehreem Ansari are also commendable.

The contributions of Dr. Afreenish Amir, Dr. Rabia Tabassum, Ms. Kiran Nisa, Ms. Ayesha Zulfiqar and the dedicated members of the NFDSS team nationwide is also highly acknowledged.

Additionally, we would like to extend our heartfelt gratitude to the CDC-USA for their ongoing partnership and support, which has greatly strengthened our capacity to combat *Candida auris*. Their expertise, resources, and collaborative efforts have been critical in the successful expansion and implementation of this initiative.

These guidelines reflect current best practices and are tailored to address both the unique challenges and the critical importance of IPC practices in our healthcare context. They will aid healthcare facilities in promptly identifying, containing, and mitigating the spread of *Candida auris*.

We believe that by equipping healthcare providers with these practical tools, we are not only better prepared to confront outbreaks but are also strengthening our broader public health resilience.

Dr. Mumtaz Ali Khan
National Focal Point for IPC
Chief of CDC
National Institutes of Health
Islamabad, Pakistan

Table of Contents

Table of Contents

Table of Figures

Glossary

1. **Antifungal Susceptibility Testing**: Laboratory testing to determine the effectiveness of antifungal medications against *Candida auris*.
2. **Antimicrobial Stewardship**: Programs or practices aimed at optimizing the use of antimicrobial medications to combat resistance and ensure effective treatment.
3. ***Candida auris***: A multidrug-resistant fungal pathogen that poses a serious threat in healthcare settings due to its resistance to standard treatments and ability to cause outbreaks.
4. **CHROMAgar**: A type of culture medium used to identify and differentiate fungal species, including *Candida auris*, based on colony color and morphology.
5. **Comorbidity**: The simultaneous presence of two or more chronic conditions or diseases in a patient, increasing vulnerability to infections.
6. **Contact Precautions**: Infection control measures, including the use of personal protective equipment, to prevent the spread of infections through direct or indirect contact.
7. **Echinocandins**: A class of antifungal drugs used to treat infections caused by Candida species, including *Candida auris*.
8. **Environmental Cleaning**: The process of thoroughly disinfecting surfaces and equipment in healthcare settings to prevent the spread of pathogens.
9. **Fishbone Diagram**: A tool for root cause analysis that categorizes potential causes of a problem into key areas, such as processes, people, and equipment.
10. **Infection Prevention and Control (IPC)**: A set of measures designed to prevent and control the spread of infections in healthcare facilities.
11. **Isolation**: The separation of patients with contagious infections from others to prevent transmission.
12. **Line Listing**: A systematic documentation of information about individuals affected by an outbreak, including clinical and demographic details.
13. **MALDI-TOF MS**: Matrix-Assisted Laser Desorption/Ionization-Time of Flight Mass Spectrometry, a diagnostic method used for the identification of microorganisms, including *Candida auris*.
14. **Nosocomial**: Referring to infections acquired in a hospital or healthcare facility setting.
15. **Outbreak**: The occurrence of two or more cases of a particular disease linked to a common source or setting.
16. **PCR (Polymerase Chain Reaction)**: A molecular diagnostic technique used to detect the genetic material of pathogens, including *Candida auris*.
17. **Personal Protective Equipment (PPE)**: Items such as gloves, gowns, masks, and eye protection used to protect healthcare workers and patients from infectious agents.
18. **Root Cause Analysis**: A method of problem-solving used to identify the underlying causes of issues, such as outbreaks.
19. **Surveillance**: Continuous monitoring of disease incidence and spread to inform public health interventions.
20. **Terminal Cleaning**: The thorough disinfection of a room or area after the discharge of a patient with a contagious infection to eliminate pathogens.
21. **VITEK 2 Compact**: An automated system for the rapid identification and antimicrobial susceptibility testing of microorganisms.

1. Introduction

Candida auris is a multidrug-resistant fungal pathogen recognized globally as an urgent public health threat. First identified in Japan in 2009, this pathogen has since caused outbreaks in over 30 countries. Its ability to survive on surfaces, resist standard disinfectants, and exhibit multidrug resistance makes it uniquely challenging to manage, particularly in healthcare settings.

In low- and middle-income countries (LMICs) like Pakistan, *Candida auris* poses a critical threat due to resource limitations, overcrowded healthcare facilities, and inconsistent infection prevention and control (IPC) practices. The spread of this pathogen is exacerbated by delays in diagnosis, often stemming from inadequate laboratory capacity, and by high patient loads that overwhelm existing IPC systems.

Candida auris is particularly dangerous for patients with comorbidities, those in intensive care units (ICUs), and individuals requiring invasive devices such as catheters or ventilators. Prompt identification and management are essential to mitigate its impact, as outbreaks can result in significant morbidity, mortality, and economic burden.

A robust outbreak preparedness and response plan is vital to containing *Candida auris* effectively. These guidelines aim to equip healthcare facilities with a comprehensive framework that includes enhanced surveillance, IPC measures, laboratory capacity building, and coordinated response strategies to manage outbreaks efficiently and protect vulnerable populations.

2. Goals and Objectives

2.1 Primary Goal

To minimize the transmission and clinical impact of *Candida auris* in healthcare facilities.

2.2 Objectives

- Ensure early detection and effective management of *Candida auris* cases.
- Implement robust IPC measures and environmental cleaning protocols to reduce transmission by 30% within six months.
- Build laboratory capacity for accurate diagnosis and antimicrobial susceptibility testing within 48 hours of sample collection.
- Educate healthcare workers and laboratory staff about best practices for outbreak containment and foster compliance with IPC protocols.

3. Epidemiology and Risk Factors

3.1 Global Epidemiology

Since its identification, *Candida auris* has become a significant global health challenge. Unlike other Candida species, it is predominantly nosocomial, thriving in healthcare environments with suboptimal infection control practices. To date, more than four distinct clades of *Candida auris* have been identified, each correlating to different regions worldwide. These clades suggest simultaneous and independent emergence on different continents, including South Asia, East Asia, South Africa, and South America, among others. The genetic diversity of these clades has implications for global surveillance, as well as the development of region-specific diagnostic and control strategies. Recent trends indicate that outbreaks are increasingly reported in long-term care facilities and acute care hospitals, emphasizing the need for stringent infection prevention measures globally.

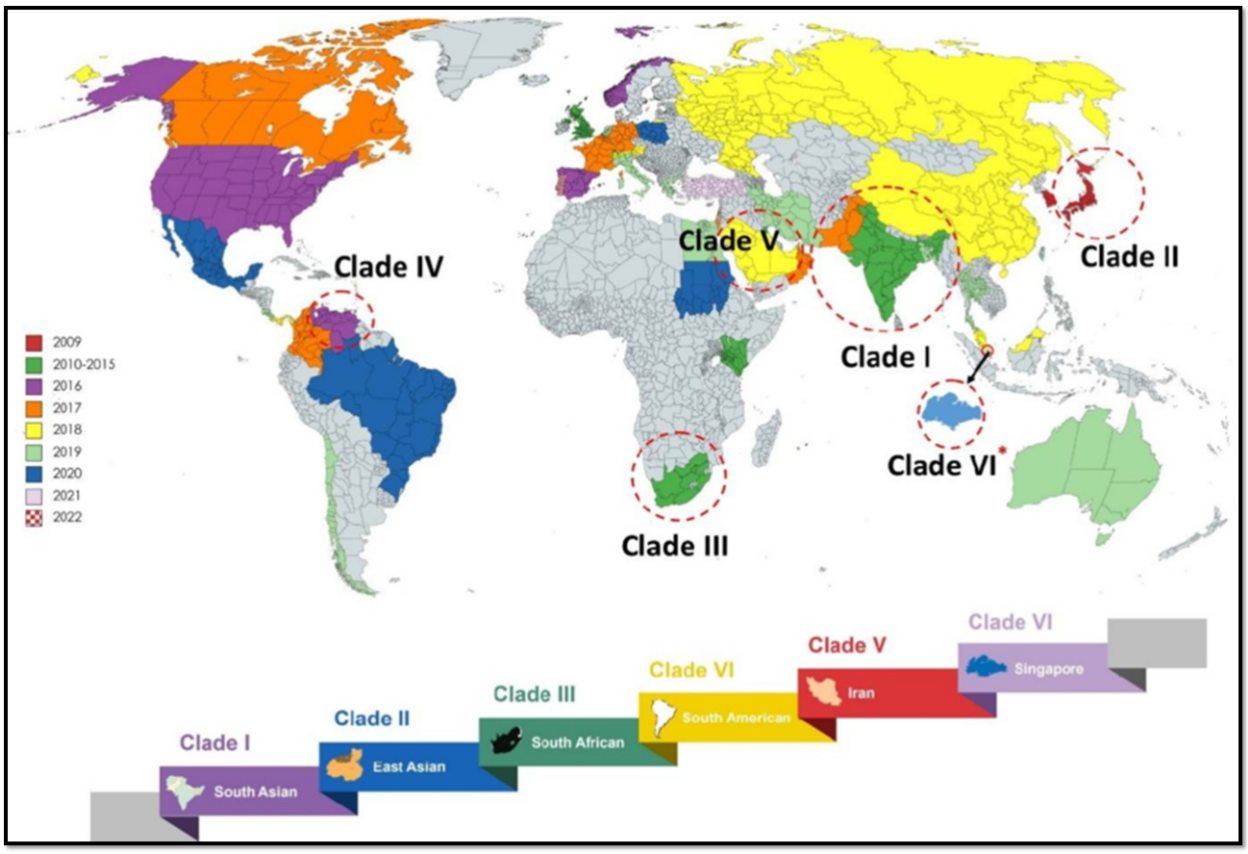

Figure 1: This diagram provides a comprehensive overview of the global distribution of Candida auris across six major genetic clades (Clades I to VI). Each clade is associated with specific geographical regions, reflecting independent and simultaneous emergence in different parts of the world. The timeline illustrates the spread of C. auris from its initial detection in 2009 through 2022, highlighting its rapid global dissemination and the diversity of regions affected. The clades are color-coded for clarity, with notable hotspots including South Asia (Clade I), East Asia (Clade II), South Africa (Clade III), South America (Clade IV), Iran (Clade V), and Singapore (Clade VI). This distribution emphasizes the need for region-specific strategies in addressing the challenges posed by this emerging pathogen.

3.2 Risk Factors in Pakistan

3.2.1 Overcrowded Healthcare Facilities

Overburdened hospitals with limited space and resources create an environment conducive to the rapid transmission of *Candida auris*, particularly in shared patient wards and intensive care units (ICUs). Patient-to-bed ratios in many healthcare facilities in Pakistan far exceed recommended standards, increasing the likelihood of cross-contamination and nosocomial outbreaks.

3.2.2 Inconsistent IPC Measures

Gaps in infection prevention and control (IPC) protocols significantly amplify the risk of *Candida auris* transmission. Challenges include inadequate hand hygiene compliance, improper sterilization of medical equipment, and inconsistent availability of personal protective equipment (PPE). Local studies indicate that hand hygiene compliance rates in healthcare settings in Pakistan often fall below WHO-recommended benchmarks, further exacerbating transmission risks.

3.2.3 Limited Diagnostic Facilities

The lack of advanced diagnostic tools in Pakistan often leads to the misidentification of *Candida auris* as other *Candida* species. This delays timely and targeted treatment, allowing infections to spread unchecked. The absence of molecular diagnostic techniques, such as PCR-based methods, in most healthcare facilities highlights the urgent need for capacity-building in diagnostic capabilities.

3.2.4 High Burden of Comorbidities

The high prevalence of chronic illnesses, such as diabetes, cardiovascular diseases, and immune-compromising conditions, in Pakistan makes patients particularly vulnerable to invasive *Candida auris* infections. For instance, diabetes affects approximately 26.7% of the adult population, creating a large pool of immune-compromised individuals at risk for severe infections.

3.2.5 Antimicrobial Misuse

The indiscriminate use of antifungal medications, both in clinical and community settings, contributes to the development of drug-resistant strains of *Candida auris*. Studies indicate that poor prescribing practices and a lack of robust antimicrobial stewardship programs exacerbate this issue. Efforts to regulate antifungal use remain limited, underscoring the need for national policies to promote judicious prescribing and monitoring of antifungal resistance.

3.2.6 Highlighting Extensive Transmission in Pakistan

The map in Figure 2 illustrates the global distribution of *Candida auris* cases, categorized into four levels: single case reported (green), multiple cases reported (orange), extensive inter-hospital transmission (red), and regions with no reported cases (grey). The red zone indicates countries experiencing extensive inter-hospital transmission, underscoring a significant healthcare challenge.

Pakistan is highlighted in red, signifying extensive transmission of *Candida auris* within healthcare settings. This reflects the critical gaps in infection prevention and control (IPC), limited diagnostic capacity, and high patient load in hospitals. These challenges create an environment conducive to the rapid spread of *C. auris*. Addressing this situation requires targeted interventions, including enhanced IPC measures, robust antimicrobial stewardship programs, and investments in diagnostic infrastructure to control the ongoing transmission effectively.

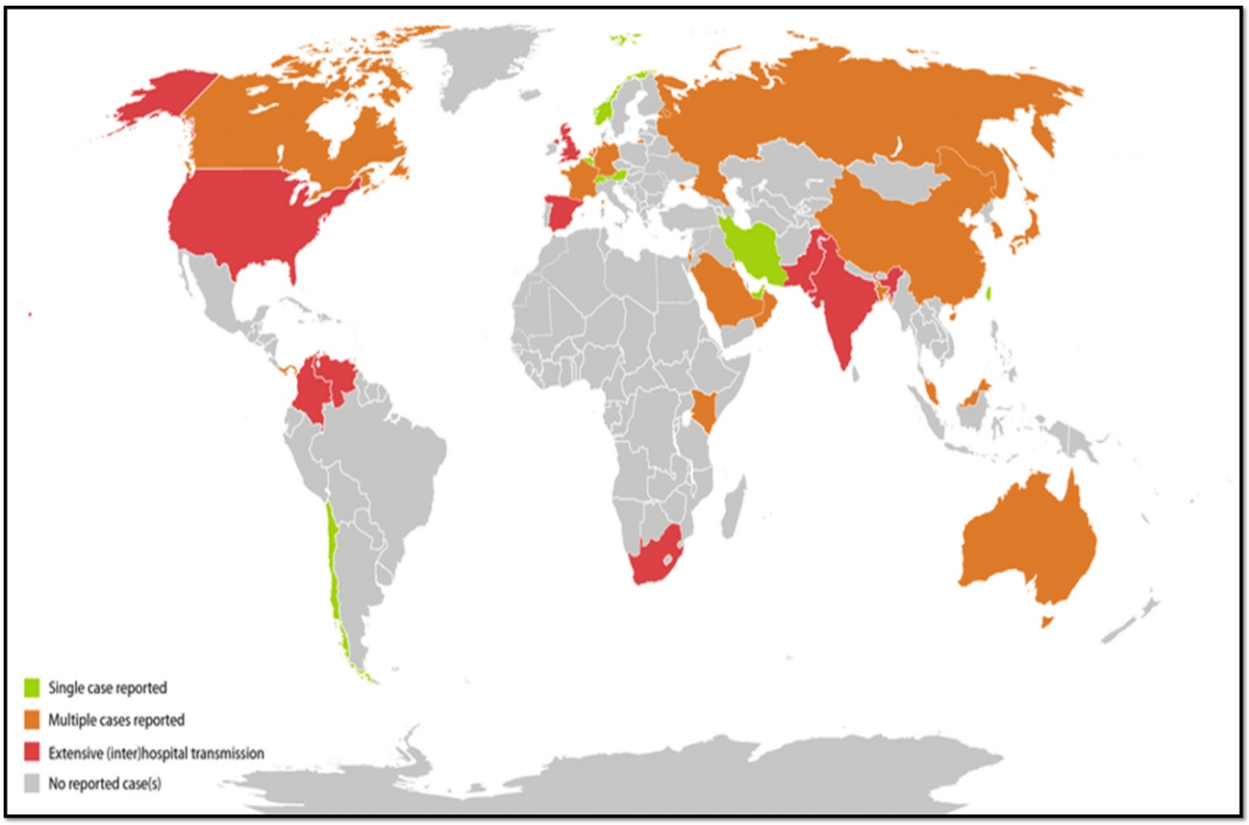

Figure 2: Global epidemiology of Candida auris. Updated map of the C. auris epidemiology based on data presented by the Centers of Disease Control (Atlanta, GA, USA; https://www.cdc.gov/fungal/candida-auris/tracking-c-auris.html;)

4. Surveillance and Detection

4.1 Screening Protocols

- Actively screen high-risk patients, particularly those in ICUs or with prior exposure to healthcare facilities experiencing outbreaks.
- Collect composite swabs from axilla and groin areas for patients which came in contact with *Candia auris* infected patient.
- For detailed information and specific protocols, please refer to **Annexure E**.

4.2 Root Cause Analysis: Fishbone Diagram for *Candida auris* Outbreak Lapses

To understand and address the root causes of a *Candida auris* outbreak, a fishbone diagram categorizes potential lapses into five critical areas: *Diagnostic Lapses*, *Infection Prevention and Control (IPC) Lapses*, *Environmental Cleaning Lapses*, *Staff Training Gaps*, and *Communication Failures*.

By systematically identifying and analyzing these categories, this approach emphasizes the complexity of outbreak challenges and facilitates the development of targeted interventions to mitigate risks and prevent recurrence. Refer to **Annexure F** for visual aids and educational materials designed to support *Candida auris* outbreak management and awareness.

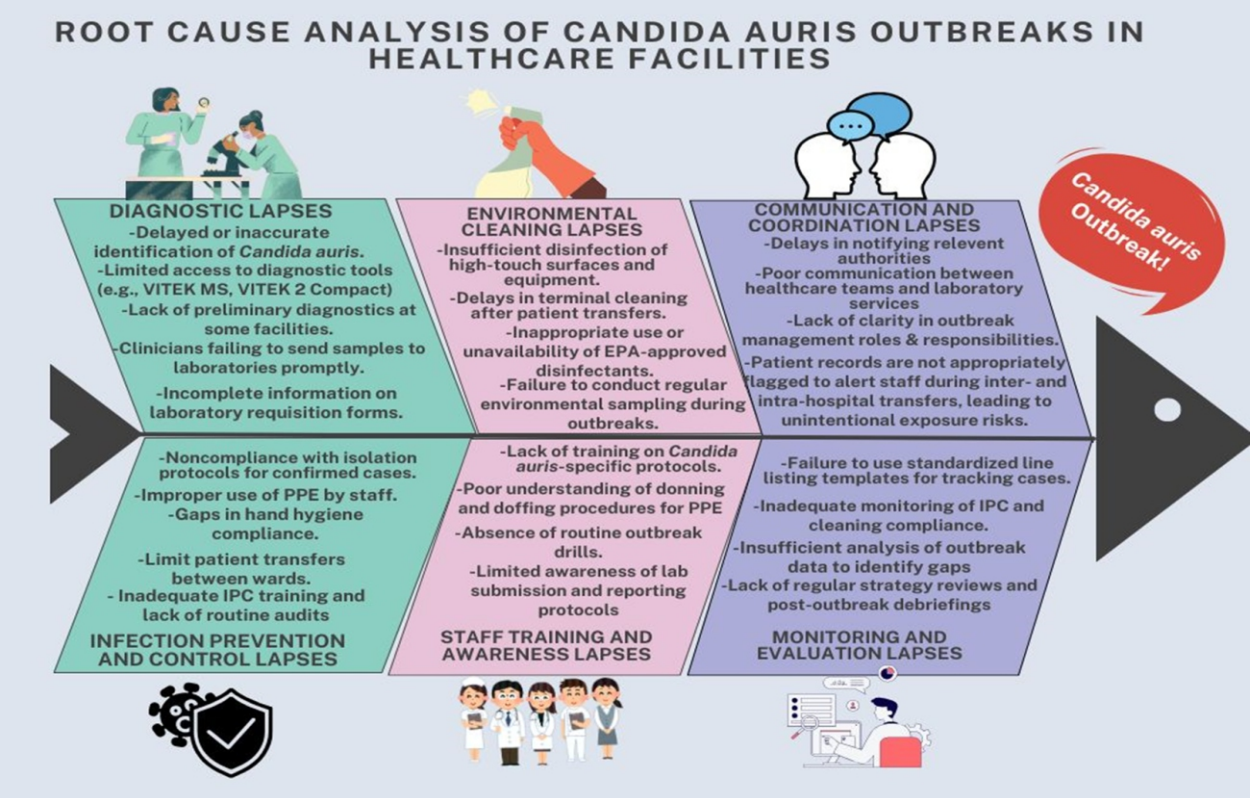

Figure 3: To analyze the lapses contributing to a Candida auris outbreak, the fishbone diagram categorizes potential causes into key areas: This structured approach highlights the multifaceted nature of outbreak challenges and supports targeted interventions to mitigate future risks.

5. Laboratory Responsibilities

5.1 Utilize Advanced Diagnostic Tools

Employ reliable methods such as VITEK 2 Compact, MALDI-TOF MS, or PCR for better identification of Candida auris. These methods are preferred due to their accuracy, rapid processing times, and ability to differentiate *Candida auris* from closely related species.

5.2 Preliminary Diagnostics at Equipped Sites

Facilities equipped with CHROMAgar should initiate preliminary diagnostics, as CHROMAgar enables visual differentiation of *Candida auris* through distinct colony morphology, which aids in early detection. Confirmed or suspected isolates must then be promptly sent to the National Institute of Health (NIH) for verification to ensure diagnostic accuracy and standardization.

5.3 Protocol for Non-Equipped Sites

Healthcare facilities without diagnostic capabilities (like VITEK2 Compact) send cultures on CHROMAgar / SDA directly to the NIH, with clear communication about the sample type and suspected growth (with clinical information) for timely and accurate diagnosis at NIH, which facilitates timely processing and notify the site about isolate identification..

5.4 Susceptibility Testing

Conduct or request NIH to conduct antifungal susceptibility testing to guide effective treatment plans and monitor resistance trends. Common resistance patterns include reduced susceptibility to azoles and echinocandins, highlighting the need for tailored antifungal therapies.

5.5 Integration with Public Health Surveillance

- Report confirmed cases to regional and national health authorities, such as the District Health Office and NIH, using standardized reporting platforms for better coordination and response.
- Share data with global surveillance networks to monitor trends and resistance patterns.

NOTE: Guidelines on sample acceptability, labeling, handling, and storage can be found in **Annexure D**, and **Annexure E** outlines the procedure for collecting patient swabs for *Candida auris* screening.

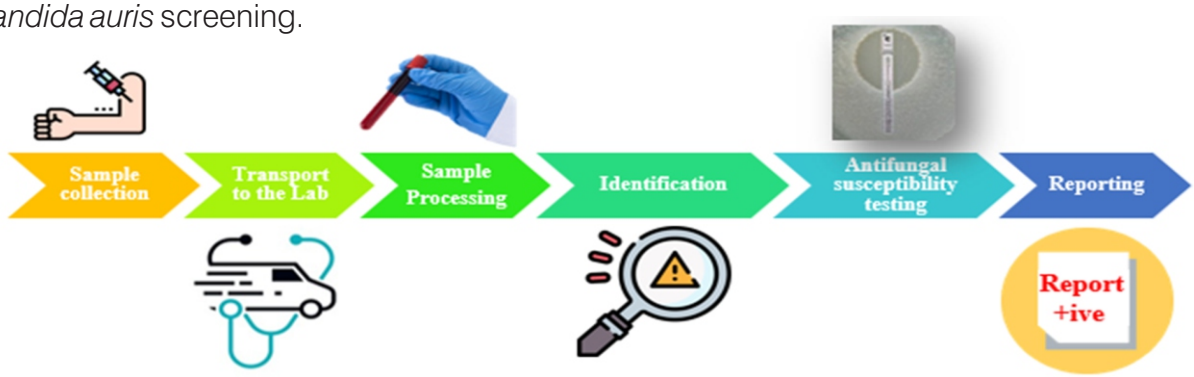

Figure 4: Stepwise laboratory workflow for Candida auris diagnosis and management: from sample collection and culture to molecular identification and antifungal susceptibility testing, ensuring accurate detection and effective outbreak response.

6. Infection Prevention and Control (IPC) Measures

The following tables outline core Infection Prevention and Control (IPC) measures essential for managing *Candida auris* outbreaks in healthcare settings. Each table highlights specific actions under a critical area—Patient Management, Environmental Cleaning and Disinfection, Hand Hygiene, PPE Protocols, and Auditing IPC Practices—emphasizing their role in breaking the chain of transmission. Designed as quick-reference tools, these tables aim to guide healthcare workers in implementing evidence-based IPC practices that minimize fungal spread, protect patients and staff, and enhance overall infection control efforts.

6.1 Patient Management

Key Actions	Goal
- Isolate confirmed cases in single rooms where possible.	Prevent cross-transmission of *Candida auris*.
- Cohort colonized patients, ensuring separation from non-colonized patients.	Prevent cross-infection and protect uncolonized patients.
- Limit movement between areas to essential needs only.	Minimize exposure and transmission.
- Clarify the duration of isolation for confirmed cases based on clinical recovery or negative cultures.	Ensure timely removal of isolation when appropriate to optimize resource use.

6.2 Environmental Cleaning and Disinfection

Key Actions	Goal
- Use disinfectants effective against *Candida auris* (e.g., chlorine-based or hydrogen peroxide-based solutions).	Eliminate fungal contamination in the environment.
- Disinfect high-touch surfaces (e.g., bed rails, doorknobs) daily.	Reduce environmental reservoirs of infection.
- Perform thorough terminal cleaning of rooms post-discharge.	Ensure no residual fungal contamination after patient discharge.
- Clean shared equipment (e.g., blood pressure cuffs, thermometers) after every use.	Prevent cross-contamination through medical devices.

6.3 Hand Hygiene

Key Actions	Goal
- Enforce WHO's 5 Moments of Hand Hygiene, emphasizing before and after patient contact.	Minimize the risk of hand-mediated transmission.
- Provide alcohol-based hand rub (e.g., containing 70% isopropyl alcohol) at care points.	Facilitate adherence to hand hygiene practices.
- Train staff on correct hand hygiene practices.	Improve compliance and reduce transmission risks.

6.4 PPE Protocols

Key Actions	Goal
- Ensure availability of gloves, gowns, masks, and other required PPE.	Prevent self-contamination and protect staff.
- Train staff on proper donning and doffing procedures to avoid contamination during PPE removal.	Reduce risks of exposure to pathogens during PPE handling.
- Escalate procurement strategies in case of PPE shortages.	Maintain consistent PPE supply to address demand during outbreaks.

6.5 Audit of IPC Practices

Key Actions	Goal
- Conduct regular audits of IPC compliance using standardized tools or checklists (e.g., WHO IPCAF).	Ensure adherence to IPC measures and identify areas for enhancement.
- Provide actionable feedback to staff for improvement.	Promote a culture of continuous improvement in IPC practices.
- Use audit data to guide training sessions and adjust IPC policies as needed.	Align practices with observed trends and needs for optimal results.

NOTE: Specific disinfectant recommendations, sample handling protocols, and isolation duration guidelines may require supplementation from national or institutional policies. Guidelines on sample acceptability, labeling, handling, and storage can be found in Annexures D and E. **Annexure F** includes visuals and instructions for donning and doffing PPE, as well as a visual representation of WHO's 5 Moments of Hand Hygiene.

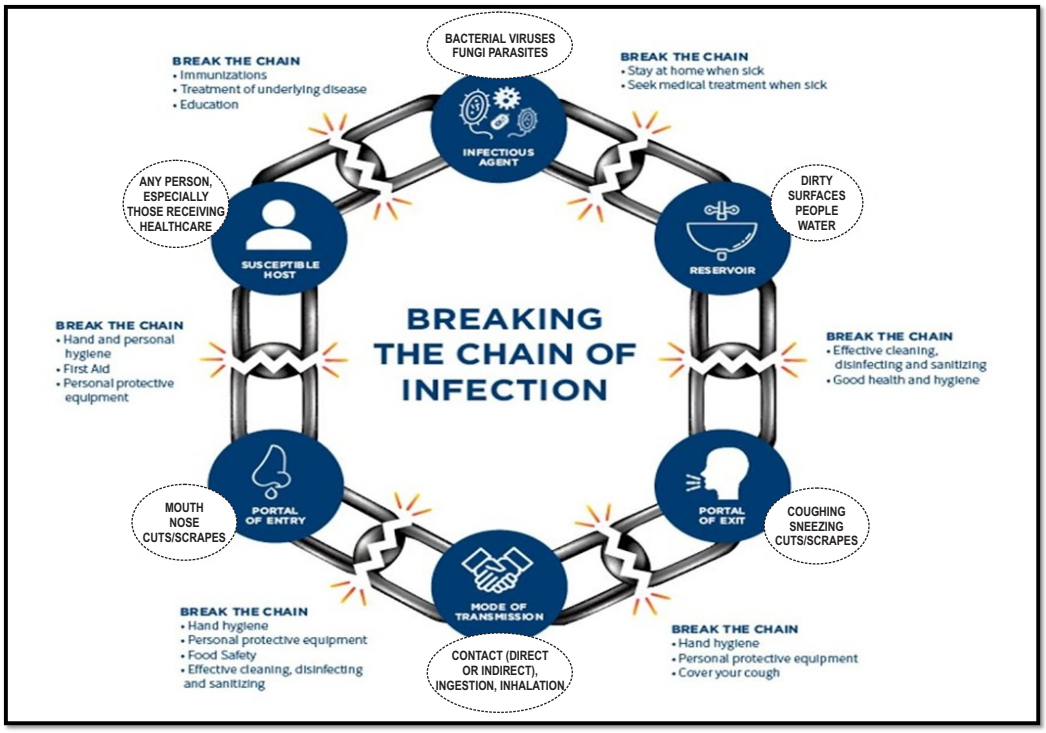

Figure 5: Illustration of the Chain of Infection

6. Infection Prevention and Control (IPC) Measures

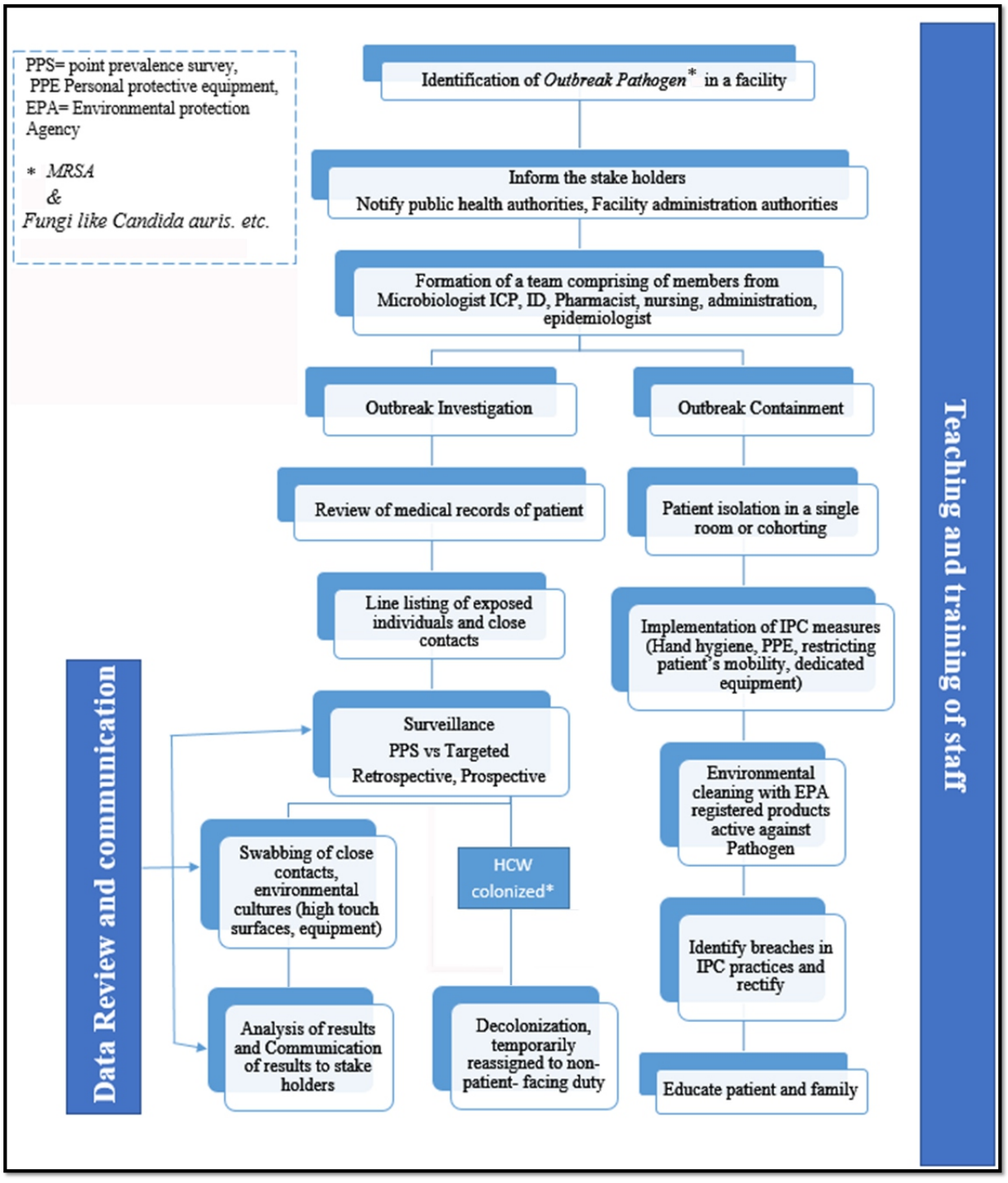

Figure 6: This flowchart outlines the process of managing healthcare-associated outbreaks, including Candida auris. It begins with pathogen identification, followed by notifying stakeholders and forming a multidisciplinary response team. Key actions include outbreak investigation (reviewing records, contact tracing, and environmental surveillance) and containment measures (patient isolation, IPC implementation, and environmental cleaning). The chart emphasizes communication, data review, and staff training to ensure effective outbreak control and prevention.

7. Response Framework

A structured response framework is essential for controlling *Candida auris* outbreaks and preventing recurrence. The following steps outline a comprehensive strategy for outbreak management, emphasizing rapid identification, containment, and lessons learned.

7.1 Outbreak Definition

An outbreak is defined as two or more epidemiologically linked cases of *Candida auris* within a healthcare setting. This definition aligns with international public health guidelines to ensure standardized detection and response.

7.2 Activation of Response Team

Form a multidisciplinary team including clinical microbiologists, IPC specialists, infectious disease physicians, and environmental services staff. Assign a team leader to coordinate efforts effectively. Refer to Annexure A for a comprehensive outbreak response checklist outlining roles and responsibilities.

7.3 Outbreak Management Steps

7.3.1 Immediate Isolation

- Enforce strict isolation protocols for confirmed and suspected cases.
- Assign dedicated medical equipment to isolated patients to prevent cross-contamination.
- Limit patient transfers between wards to essential needs only.
- Implement patient cohorting strategies if single isolation rooms are unavailable.

7.3.2 Comprehensive Contact Tracing

- Identify all patients exposed to confirmed cases, within 24–48 hours of case detection.
- Monitor exposed individuals for signs of infection and collect clinical samples where necessary.
- Implement preemptive isolation or screening for high-risk contacts.
- Utilize electronic tools or outbreak management software for efficient tracking.

7.3.3 Targeted Environmental Assessment

- Perform detailed environmental assessments to identify contamination sources, focusing on high-touch surfaces, shared medical equipment, and communal areas.

- Use effective cleaning methods and EPA-registered disinfectants (e.g., chlorine-based or hydrogen peroxide-based solutions) to eliminate contamination.
- Consider advanced disinfection methods such as UV light disinfection in high-risk zones.

7.3.4 Systematic Data Collection

- Use standardized line listing templates (refer to **Annexure B**) to document patient details, exposure history, clinical outcomes, and containment measures.
- Integrate electronic medical records (EMRs) or outbreak management software for real-time data updates and tracking.
- Refer to **Annexure C** for a template for standardized documentation of outbreaks.

7.3.5 Regular Updates and Strategy Adjustments

- Hold daily briefings with the outbreak response team to review progress and challenges.
- Evaluate the effectiveness of containment measures and identify any breaches in protocols.
- Adapt strategies based on emerging trends, feedback, and expert recommendations to enhance outbreak control efforts.
- Document strategy adjustments for future reference and training purposes.

7.3.6 Declaring an Outbreak Over

- Declare the outbreak over when at least two incubation periods (4 weeks) have passed without detecting new *Candida auris* cases, including colonization or infection, through active surveillance.
- Document lessons learned and share insights through presentations, publications, or training sessions.
- Revise IPC protocols and train staff based on identified gaps to prevent recurrence.

NOTE: Refer to **Annexures A, B,** and **C** for detailed tools and templates. Include specific disinfectants, isolation strategies, and electronic tracking tools based on institutional capabilities for a tailored response framework.

7. Response Framework

Team Members	Responsibilities
Clinical Microbiology Team	Issuing an alert to the treating physician, IPC and outbreak response team when *C. auris* is isolated. The process of outbreak identification is initiated from Microbiology.
IPC team	Routine training on IPC practices to the nursing team.
	Monitoring adherence of IPC practices in the locations where the cases were identified.
	Ensure appropriate isolation or cohorting of patients.
	Ensuring timely and sufficient supply of personal protective equipment (PPE), disinfectant solutions and hand rubs.
	Ensure approp riate cleaning of locations occupied by the patient.
	Education of staff and bystanders regarding IPC practices.
	Prospective surveillance of *C. auris* cases
Infectious Diseases Physician	Decide appropriate therapy and procedures for the patient
	Monitor for clinical improvement and microbiological cure (wherever appropriate)
	Create awareness among primary team and tailor treatment.
	Ensure isolation and proper disinfection
Clinical pharmacist from Outbreak responce team	Dedicated member of the team receives critical alert from the Microbiology once *C. auris* is isolated.
	Prepare appropriate treatment regimen and inform the primary team.
	Coordinate efforts of all stakeholders in the management of the patient.

Figure 7: Outbreak response team responsibilities

8. Conclusion

Candida auris poses a significant and escalating threat to healthcare systems worldwide, especially in resource-limited settings. Its effective management demands a proactive, coordinated approach that prioritizes early detection, robust infection prevention strategies, and streamlined response protocols. By adopting the measures outlined in these guidelines, healthcare facilities can not only reduce the severity of *Candida auris* outbreaks but also safeguard vulnerable populations and enhance overall infection control practices.

Collaboration is the cornerstone of containment efforts. Strong partnerships among healthcare teams, public health authorities, and diagnostic laboratories are vital to curbing the spread of this pathogen. Continuous improvement through systematic learning from each outbreak and integrating these lessons into preparedness plans will bolster healthcare systems' resilience against *Candida auris* and other emerging infectious threats.

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Annexure A: Outbreak Response Checklist

Candida auris Outbreak Response Checklist

1. Initial Detection and Reporting

Task	Completed (Yes/No)
Confirm identification of *Candida auris* in clinical samples.	
Notify the infection prevention and control (IPC) team immediately.	
Report the case to relevant public health authorities.	

2. Case Investigation

Task	Completed (Yes/No)
Identify and document all confirmed and suspected cases.	
Trace patient movements within the facility to identify potential sources.	
Collect and analyze clinical and environmental samples as needed.	

3. Infection Prevention and Control Measures

a. Patient Isolation

Task	Completed (Yes/No)
Place confirmed cases in single-patient rooms or cohort patients with the same strain.	
Ensure appropriate signage outside the room indicating contact precautions.	

b. Personal Protective Equipment (PPE)

Task	Completed (Yes/No)
Provide gloves and gowns for all staff entering patient rooms.	
Ensure proper donning and doffing procedures for PPE.	

c. Environmental Cleaning and Disinfection

Task	Completed (Yes/No)
Use hospital-grade disinfectants effective against fungal pathogens.	
Perform enhanced cleaning of patient rooms and high-touch surfaces.	
Document and audit cleaning protocols regularly.	

d. Hand Hygiene

Task	Completed (Yes/No)
Ensure availability of alcohol-based hand rubs at all key points.	
Reinforce hand hygiene compliance among staff and visitors.	

4. Laboratory Testing

Task	Completed (Yes/No)
Collect and process clinical samples for identification.	
Conduct antifungal susceptibility testing for all isolates.	
Perform environmental sampling if warranted (e.g., in high-risk areas).	

5. Communication and Coordination

Task	Completed (Yes/No)
Inform staff and stakeholders about the outbreak and containment measures.	
Provide regular updates to public health authorities.	
Engage with patients and families to explain precautions and minimize panic.	

6. Surveillance and Monitoring

Task	Completed (Yes/No)
Monitor for new cases daily and track trends in infection rates.	
Implement active surveillance in high-risk areas (e.g., ICUs).	
Review adherence to IPC protocols through regular audits.	

7. Antimicrobial Stewardship

Task	Completed (Yes/No)
Review and optimize antifungal therapy for confirmed cases.	
Ensure antifungal agents are used judiciously to prevent resistance.	

8. Post-Outbreak Actions

Task	Completed (Yes/No)
Conduct a debrief with all stakeholders to evaluate outbreak response.	
Update IPC protocols and training based on lessons learned.	
Perform follow-up environmental sampling to confirm eradication.	

9. Documentation

Task	Completed (Yes/No)
Maintain detailed records of all cases, interventions, and outcomes.	
Compile a final outbreak report for internal review and external reporting.	

Note: Ensure this checklist is adapted to align with local guidelines and resources available in the healthcare facility.

Annexure B: Line Listing Template for Patient Tracking.

Patient ID	Name	Age	Sex	Contact Type	Date of Contact	Screening Date	Screening Result	Colonization Status	Isolation Required	Follow-Up Date	Notes
001	*John Doe 1*	*45*	*Male*	*Close Contact*	*2025-01-01*	*2025-01-02*	*Negative*	*Not Colonized*	*No*	*2025-01-08*	*No further action needed*
002	*John Doe 2*	*34*	*Female*	*Close Contact*	*2025-01-01*	*2025-01-02*	*Positive*	*Colonized*	*Yes*	*2025-01-08*	*Initiated antifungal treatment*
003	*John Doe 3*	*60*	*Male*	*Healthcare Worker*	*2025-01-01*	*2025-01-02*	*Negative*	*Not Colonized*	*No*	*2025-01-08*	*Advised enhanced precautions*

Column Descriptions:

- **Patient ID**: Unique identifier for each contact.
- **Name**: Full name of the contact (can use initials for anonymity).
- **Age**: Age of the contact in years.
- **Sex**: Gender of the contact (Male/Female/Other).
- **Contact Type**: Specify whether the contact is a patient, visitor, or healthcare worker.
    - **Close Contact:** Direct physical contact or prolonged proximity (e.g., roommates in a ward, family members providing care).
    - **Healthcare Worker:** Clinical staff or personnel who have attended to the patient or handled contaminated materials.
- **Date of Contact**: Date the contact occurred with the *Candida auris* case.
- **Screening Date**: Date when the contact was screened for *Candida auris* colonization.
- **Screening Result**: Indicate whether the screening was positive or negative.
- **Colonization Status**: Specify whether the contact is colonized or not colonized.
- **Isolation Required**: Indicate if isolation precautions are needed (Yes/No).
- **Follow-Up Date**: Scheduled date for follow-up screening or check-up.
- **Notes**: Additional observations or actions taken.

This table allows healthcare teams to systematically document and monitor contacts during a *Candida auris* outbreak. It can be expanded or modified based on specific facility needs.

Annexure C: Outbreak Investigation Report Template.

The *Candida auris* Outbreak Report Template is designed to provide a structured and comprehensive framework for documenting outbreak investigations and response efforts. This template ensures consistency in reporting key elements such as patient demographics, clinical outcomes, infection prevention and control (IPC) measures, environmental cleaning practices, and contact tracing activities. By capturing critical data in a systematic manner, the report facilitates analysis of outbreak trends, identification of root causes, and development of targeted strategies to mitigate future outbreaks. It is an essential tool for healthcare facilities to enhance communication, guide decision-making, and improve overall preparedness and response to *Candida auris*.

Candida auris Outbreak Report Template

1. Incident Information

Field	Details
Date of Outbreak Detection	
Facility Name	
Location	
Reporting Person(s)	
Designation(s)	

2. Case Details

Case Number	Patient ID	Age	Sex	Date of Admission	Date Sample Taken	Date of Positive *C. auris* Culture	Infection Type (e.g., bloodstream, UTI, colonization)	Outcome (e.g., recovered, deceased)

3. Immediate Actions Taken

Action	Details
Isolation Initiated (with Signage)	☐ Yes ☐ No
Date Isolation Initiated	__-__-____
Contact Precautions Enforced	☐ Yes ☐ No
PPE Used	☐ Gloves ☐Gowns ☐Masks ☐ Eye Protection
Environmental Cleaning Protocols	☐ Initiated ☐Not Initiated
Disinfectant Used	
Cleaning Frequency	☐ Daily ☐ Twice Daily ☐ After Discharge

4. Environmental Cleaning Audit Record

Facility Name: _____Department/Area: _____
Date of Audit: ____/____/_____Audit Conducted By: _____Audit Time: : AM/PM

a. General Cleaning Compliance

Checklist Item	Compliant (✓)	Non-Compliant (✗)	Comments/Observations
Cleaning staff follow facility IPC protocols	☐	☐	
Cleaning schedule is visibly displayed and followed	☐	☐	
Appropriate PPE (gloves, aprons, etc.) is donned and doffed appropriately while cleaning	☐	☐	
Correct cleaning solutions/detergents used	☐	☐	
High-touch surfaces cleaned regularly (e.g., doorknobs, bed rails)	☐	☐	
Mop heads and cleaning cloths are changed per protocol	☐	☐	
Proper disposal of waste and used cleaning materials	☐	☐	

b. Surface-Specific Cleaning Compliance

Area/Surface	Cleaned & Disinfected? (✓/✗)	Comments
Patient beds & side tables	☐	
Door handles & light switches	☐	
Washroom surfaces (toilet, sink, etc.)	☐	
Floors & walls	☐	
Medical equipment surfaces	☐	
Waiting area & chairs	☐	

c. Cleaning Materials & Supplies

Item	Sufficient Stock? (✓/✗)	Comments
Cleaning detergents/disinfectants	☐	
PPE for cleaning staff (gloves, masks, goggles etc.)	☐	
Mop heads & cloths	☐	
Waste bins & disposal bags	☐	

d. Staff Knowledge & Training

Question	Yes (✓)	No (✗)	Comments
Are cleaning staff trained on IPC cleaning protocols?	☐	☐	
Do staff follow the correct sequence of cleaning (clean to dirty areas)?	☐	☐	
Are staff aware of the contact time required for disinfectants?	☐	☐	

e. Glow Pen/Gel Audit– Cleaning Effectiveness Assessment

(To be conducted after routine cleaning to assess surface cleanliness effectiveness)
Pre-Cleaning Application

Surface Marked with Glow Pen/Gel	Mark Applied? (✓/✗)	Initial Visibility Under UV Light? (✓/✗)	Comments
Patient bed rails	☐	☐	
Side tables	☐	☐	
Door knobs	☐	☐	
Light switches	☐	☐	
Restroom fixtures (sink, flush handles , taps)	☐	☐	

Post-Cleaning Assessment

Surface Rechecked Under UV Light	Mark Removed? (✓/✗)	Cleaning Effective? (✓/✗)	Comments
Patient bed rails	☐	☐	
Side tables	☐	☐	
Door handles	☐	☐	
Light switches	☐	☐	

f. Audit Summary & Recommendations

Overall Compliance Score:
☐ Excellent (90-100%)
☐ Good (70-89%)
☐ Needs Improvement (<70%)

Areas of Concern/Non-Compliance:

Immediate Corrective Actions Taken:

Further Recommendations:

Auditor's Name & Signature: _____

How to Use This Enhanced Template?

- Routine Cleaning Audit: Complete Sections 1-4 for general IPC compliance.
- Glow Pen/Gel Audit: Apply gel on frequently touched surfaces before cleaning, then assess effectiveness post-cleaning (Section 5).
- Address Deficiencies: Identify areas needing improvement or retraining based on findings.
- Document and Review: Use results to improve cleaning protocols and track progress over time.

5. Communication and Notification

Communication Type	Details
Internal (e.g., IPC Committee)	☐ Notified ☐ Not Notified
Date of Notification	
External (e.g., Health Authorities)	☐ Notified ☐ Not Notified
Date of Notification	
Contact Person	
Phone/Email	

6. Infection Control Measures

Measure	Details
Patient Isolated	☐ Yes ☐ No
Screening Conducted	☐ Yes ☐ No
Number of Patients Screened	
Additional Cases Detected	
Frequency of Screening	☐Weekly ☐Monthly ☐Other: _____
Staff Training Conducted	☐ Yes ☐ No
Date of Training	
Topics Covered	_____ _____ _____

7. Challenges Faced

Category	Challenge	Root Cause
Resource Limitations		
Compliance Issues		
Infrastructure Gaps		

8 Outcomes and Monitoring

Outcome	Details
Total Cases Resolved	
Left Against Medical Advice	
Total Deaths	
Environmental Contamination Reduced	☐ Yes ☐ No
Final Sampling Date	
Monitoring Frequency	☐ Monthly ☐ Quarterly ☐Other: _____

9 Summary and Recommendations

Section	Details
Key Lessons Learned	
Recommendations for Future Outbreaks	

Annexure D: Sample information (acceptability and rejection criteria, labeling, volume, handling, storage)

Specimens received for testing must be labeled according to minimum requirements of the laboratory. Collect patient skin swabs using BD ESwab collection and transport system (cat. 220245; Becton Dickinson and Company, Sparks, MD) or a similar collection and transport system containing 1.0 mL of Amies buffer.

After the specimen is collected, the swab should be placed into the tube containing the Amies buffer and stored at 4°C–25°C. Ship with an ice pack to the laboratory for processing within 96 hours of specimen collection.

Laboratory should develop specimen rejection criteria. Rejection criteria may include specimens:

- Received >4 days after collection.
- In damaged or leaking transport tubes.
- Missing submission forms.
- In tubes without specimen identifiers.

Annexure E: *C. auris* screening: Patient Swab Collection

FUNGAL DISEASES

APRIL 24, 2024

Candida auris (C. auris)

Screening Recommendations for Healthcare Facilities

KEY POINTS

- Patients in healthcare facilities can be asymptomatically colonized with *C. auris* and can spread it to other patients.
- Screening helps identify patients who are colonized with *C. auris* by testing swabs of the skin.
- Screening results should inform infection and control measures around the patient and in the facility.
- Facilities determine screening strategies based on local epidemiology, patient risk factors, facility characteristics, and intended purpose of screening.

Background

C. auris is an emerging, frequently antimicrobial-resistant yeast that can cause severe illness. *C. auris* can spread easily among patients and cause outbreaks in healthcare settings.

Patients in healthcare facilities can be asymptomatically colonized with *C. auris.* Patients who are colonized with *C. auris* can spread it to other patients.

Patients colonized with *C. auris* spread it onto surfaces and objects where it can spread to other patients. Some surfaces and objects that can be contaminated and cause transmission include:

- Bedrails and bedside tables.
- Mobile medical equipment (e.g., glucometers, ultrasound machines.)
- Hands or clothing of healthcare personnel.

C. auris can persist on patients and surfaces for long periods of time. Many commonly used hospital grade disinfectants are not effective against it.

Screening

Screening for *C. auris* colonization is a key strategy to prevent spread in healthcare facilities.

Identifying patients or residents who are colonized allows healthcare facilities to implement appropriate infection prevention and control measures. Results from screening can inform the use of barrier precautions and disinfectants that are effective against *C. auris.*

Deciding which patients or residents to screen and how often to perform screening should be based on several factors. Important considerations include local *C. auris* epidemiology and burden, epidemiologic linkages to other cases, patient risk factors, and the purpose of screening.

Guidance for *C. auris* colonization screening

Detailed guidance for who to screen and when to perform *C. auris* colonization screening can be found in:

Interim Guidance for a Public Health Response to Contain Novel or Targeted Multidrug-resistant Organisms (MDROs) PDF [MDRO Containment Strategy | HAI | CDC]

Interim Guidance for Public Health Strategies to Prevent the Spread of Novel or Targeted Multidrug-resistant Organisms (MDROs) PDF [MDRO Prevention Strategies | HAI | CDC]

These guidance documents apply to multiple multidrug-resistant organisms, including *C. auris,* and to all healthcare facility types, allowing implementation and adaptation of strategies and measures based on local burden and epidemiologic stage as well as facility type.

Who and when to screen

Consider screening patients who are at high risk for *C. auris* colonization, such as:

- Those with an epidemiologic link to a patient or resident who is infected or colonized with *C. auris*. Examples of epidemiologic links include:
  - sharing the same room, unit, or other care areas as a patient or resident with *C. auris*, even if that person has been discharged,
  - receiving care from the same healthcare personnel during the same time as a person with *C. auris*,or
  - being exposed to common mobile medical equipment that was used by a patient or resident with *C. auris*, especially if there are concerns about adequate cleaning and disinfection.
- Patients with current or previous healthcare encounters at facilities including:
  - facilities with currently suspected or confirmed *C. auris* transmission
  - high acuity post-acute care facilities including long-term acute care hospitals [LTACHs] and ventilator-capable skilled nursing facilities [vSNFs])
  - facilities located outside the United States or in a part of the country with a high burden of *C. auris*
- Patients with risk factors for acquiring *C. auris*, including:
  - mechanical ventilation
  - indwelling medical devices, including central lines, feeding tubes, urinary catheters, etc.
  - receipt of complex or high acuity medical care
  - frequent or long healthcare stays, especially at high-risk facilities
  - colonization or infection with other multidrug-resistant organisms

Screen patients for *C. auris* with complex or invasive medical care.

Screening strategies for different scenarios

Screening can be conducted using a prevention-based approach (i.e., not in response to a newly identified case), or a response-based approach (i.e., after detection of a new *C. auris* case). Screening can be conducted at different points during a patient's healthcare stay, depending on the goal. Patients might be screened

- on admission to identify new introductions of *C. auris* cases needing appropriate infection prevention and control precautions and to identify other facilities with *C. auris* cases or transmission,
- during a healthcare stay to identify new cases resulting from intra-facility transmission or to assess the effectiveness of infection control interventions, or
- at discharge or transfer to identify patients or residents needing appropriate infection prevention and control precautions at a receiving facility. However, screening should be used to inform infection control measures to prevent transmission and not be used to deny or delay transfers.

Scope of screening

Screening can be conducted using a broad approach by conducting a point prevalence survey (PPS) (e.g., screening of all patients or residents on a unit or in a facility at the time), or by a more targeted approach (e.g., screening only certain patients based on risk factors, epidemiologic links, or clinical characteristics). However, broad screening using **PPSs is preferred** because a targeted approach may miss patients who are colonized.

Follow-up screening: Expanded screening or follow-up response screening after a PPS is often recommended if there is evidence or suspicion for ongoing transmission and considerations for follow up screening are described in more detail in the MDRO containment guidance. Routine prevention-based screening may be recommended by health departments at certain frequency intervals as described in the MDRO prevention guidance.

Reassessment of colonization: *CDC does **not** recommend re-screening* patients known to be infected or colonized with *C. auris* because patients in healthcare settings can be colonized for a prolonged period, perhaps indefinitely. Colonized patients and residents may intermittently have negative results followed by a positive result. Negative results for a colonized patient should not be used to discontinue implementation of appropriate infection prevention and control precautions.

Healthcare worker screening: C*DC does **not** recommend screening healthcare workers* for *C. auris*. Following recommended infection control precautions including barrier precautions and hand hygiene will prevent spread to healthcare workers. During studies performed during previous *C. auris* outbreaks, screening found that colonization of healthcare workers happened rarely, if at all.

**For this guidance, the term 'healthcare facility' refers to all acute care hospitals and post-acute care facilities that care for patients or residents who remain overnight and require medical care, nursing care or rehabilitation services. This generally excludes assisted living facilities.*

How to screen

Skin swabs are used to screen for C. auris.

For *C. auris* colonization screening, CDC recommends using a composite swab of the patient's bilateral axilla (i.e., armpit) and groin. Testing for *C. auris* colonization is available through CDC's Antimicrobial Resistance Laboratory Network (AR Lab Network). For laboratories interested in performing colonization testing in house, see CDC's Guidance for Detection of Colonization of *Candida auris*.

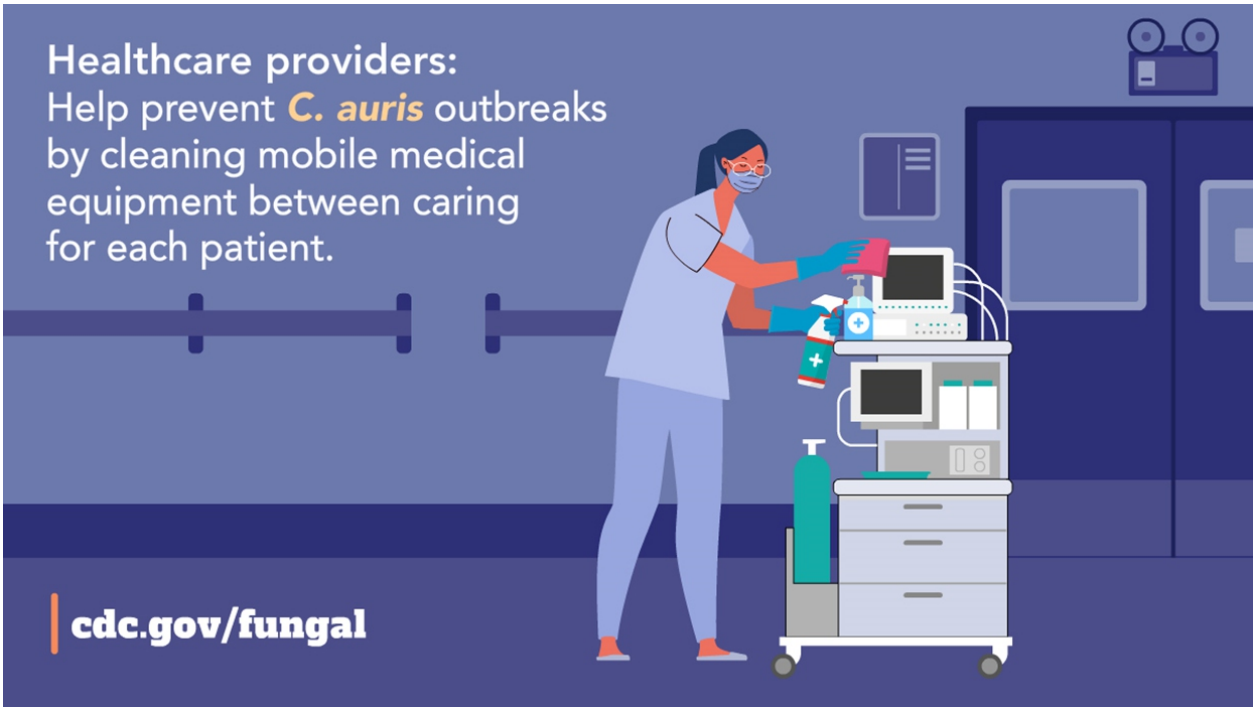
Health Care Providers:
C. auris Screening: Patient Swab Collection

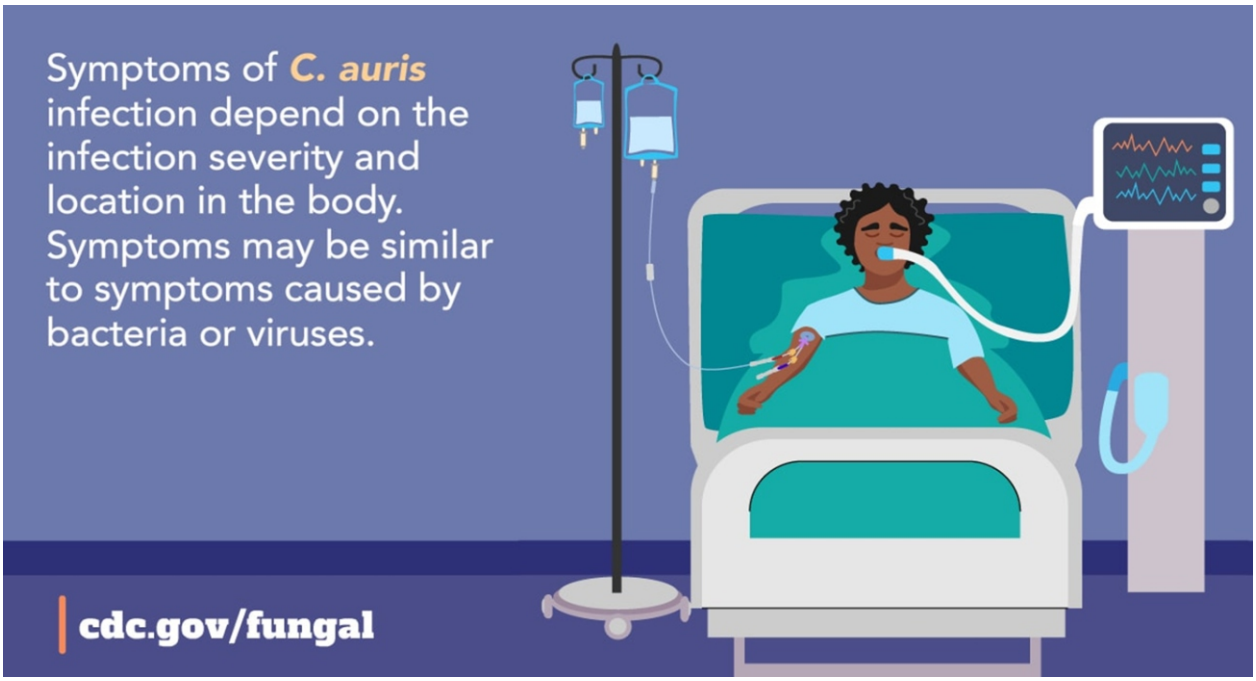
SOURCES

CONTENT SOURCE:
National Center for Emerging and Zoonotic Infectious Diseases (NCEZID)

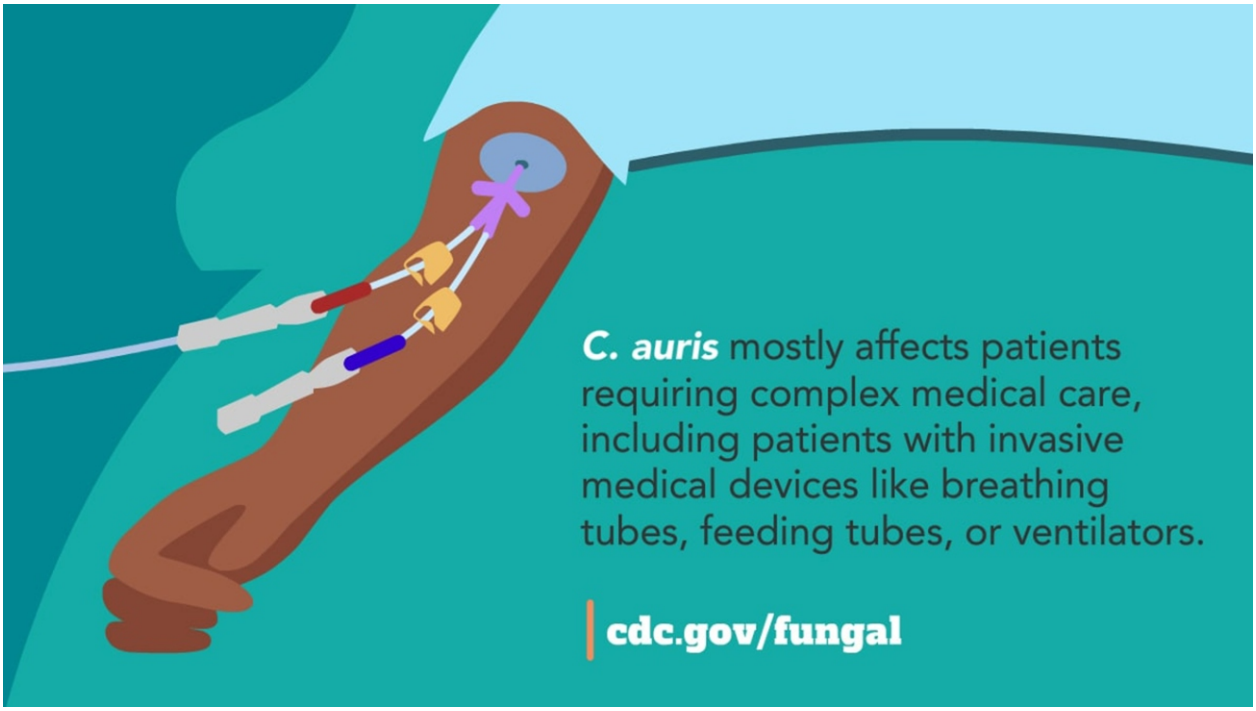
Annexure F: Visual Communication and Educational Materials

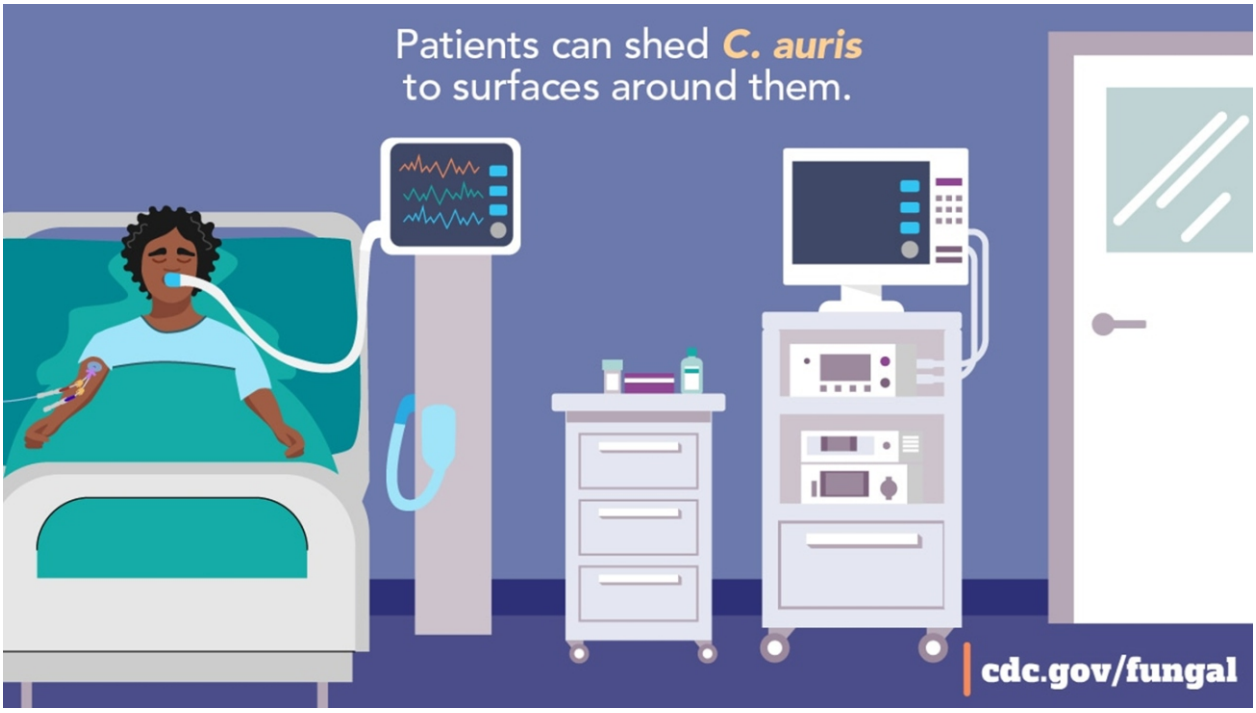
Visual communication and educational materials are powerful tools for effectively conveying complex information in a clear, engaging, and accessible manner. By combining such visuals understanding, retention, and recall of key messages can be enhanced. Well-designed materials not only improve knowledge transfer but also encourage behavior change and adherence to best practices.






Not all disinfectants are effective against C. auris. Check the Environmental Protection Agency's (EPA) List P for a current list of approved hospital-grade disinfectants.
cdc.gov/fungal


C. auris mostly affects patients requiring complex medical care, including patients with invasive medical devices like breathing tubes, feeding tubes, or ventilators.
cdc.gov/fungal


Patients can shed C. auris
to surfaces around them.
cdc.gov/fungal

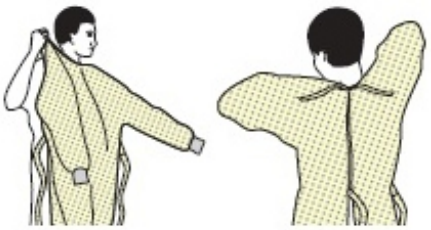

5 Moments for
HAND HYGIENE
1 BEFORE TOUCHING A PATIENT
2 BEFORE A PROCEDURE
3 AFTER A PROCEDURE OR BODY FLUID EXPOSURE RISK
4 AFTER TOUCHING A PATIENT
5 AFTER TOUCHING A PATIENT'S SURROUNDINGS

SEQUENCE FOR PUTTING ON PERSONAL PROTECTIVE EQUIPMENT (PPE)

The type of PPE used will vary based on the level of precautions required, such as standard and contact, droplet or airborne infection isolation precautions. The procedure for putting on and removing PPE should be tailored to the specific type of PPE.

1. GOWN

- Fully cover torso from neck to knees, arms to end of wrists, and wrap around the back
- Fasten in back of neck and waist



2. MASK OR RESPIRATOR

- Secure ties or elastic bands at middle of head and neck
- Fit flexible band to nose bridge
- Fit snug to face and below chin
- Fit-check respirator

3. GOGGLES OR FACE SHIELD

- Place over face and eyes and adjust to fit

4. GLOVES

- Extend to cover wrist of isolation gown

USE SAFE WORK PRACTICES TO PROTECT YOURSELF AND LIMIT THE SPREAD OF CONTAMINATION

- Keep hands away from face
- Limit surfaces touched
- Change gloves when torn or heavily contaminated
- Perform hand hygiene

HOW TO SAFELY REMOVE PERSONAL PROTECTIVE EQUIPMENT (PPE) EXAMPLE 1

There are a variety of ways to safely remove PPE without contaminating your clothing, skin, or mucous membranes with potentially infectious materials. Here is one example. **Remove all PPE before exiting the patient room** except a respirator, if worn. Remove the respirator **after** leaving the patient room and closing the door. Remove PPE in the following sequence:

1. GLOVES

- Outside of gloves are contaminated!
- If your hands get contaminated during glove removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Using a gloved hand, grasp the palm area of the other gloved hand and peel off first glove
- Hold removed glove in gloved hand
- Slide fingers of ungloved hand under remaining glove at wrist and peel off second glove over first glove
- Discard gloves in a waste container

2. GOGGLES OR FACE SHIELD

- Outside of goggles or face shield are contaminated!
- If your hands get contaminated during goggle or face shield removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Remove goggles or face shield from the back by lifting head band or ear pieces
- If the item is reusable, place in designated receptacle for reprocessing. Otherwise, discard in a waste container

3. GOWN

- Gown front and sleeves are contaminated!
- If your hands get contaminated during gown removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Unfasten gown ties, taking care that sleeves don't contact your body when reaching for ties
- Pull gown away from neck and shoulders, touching inside of gown only
- Turn gown inside out
- Fold or roll into a bundle and discard in a waste container

4. MASK OR RESPIRATOR

- Front of mask/respirator is contaminated — DO NOT TOUCH!
- If your hands get contaminated during mask/respirator removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Grasp bottom ties or elastics of the mask/respirator, then the ones at the top, and remove without touching the front
- Discard in a waste container

5. WASH HANDS OR USE AN ALCOHOL-BASED HAND SANITIZER IMMEDIATELY AFTER REMOVING ALL PPE

PERFORM HAND HYGIENE BETWEEN STEPS IF HANDS BECOME CONTAMINATED AND IMMEDIATELY AFTER REMOVING ALL PPE

CS250672-E

When To Think **Fungus**

Of the 1-5 million types of fungi, **a few hundred can make people sick.**

cdc.gov/fungal

Think Fungus

Diagnostic tests keep antifungals working their best.

cdc.gov/fungal

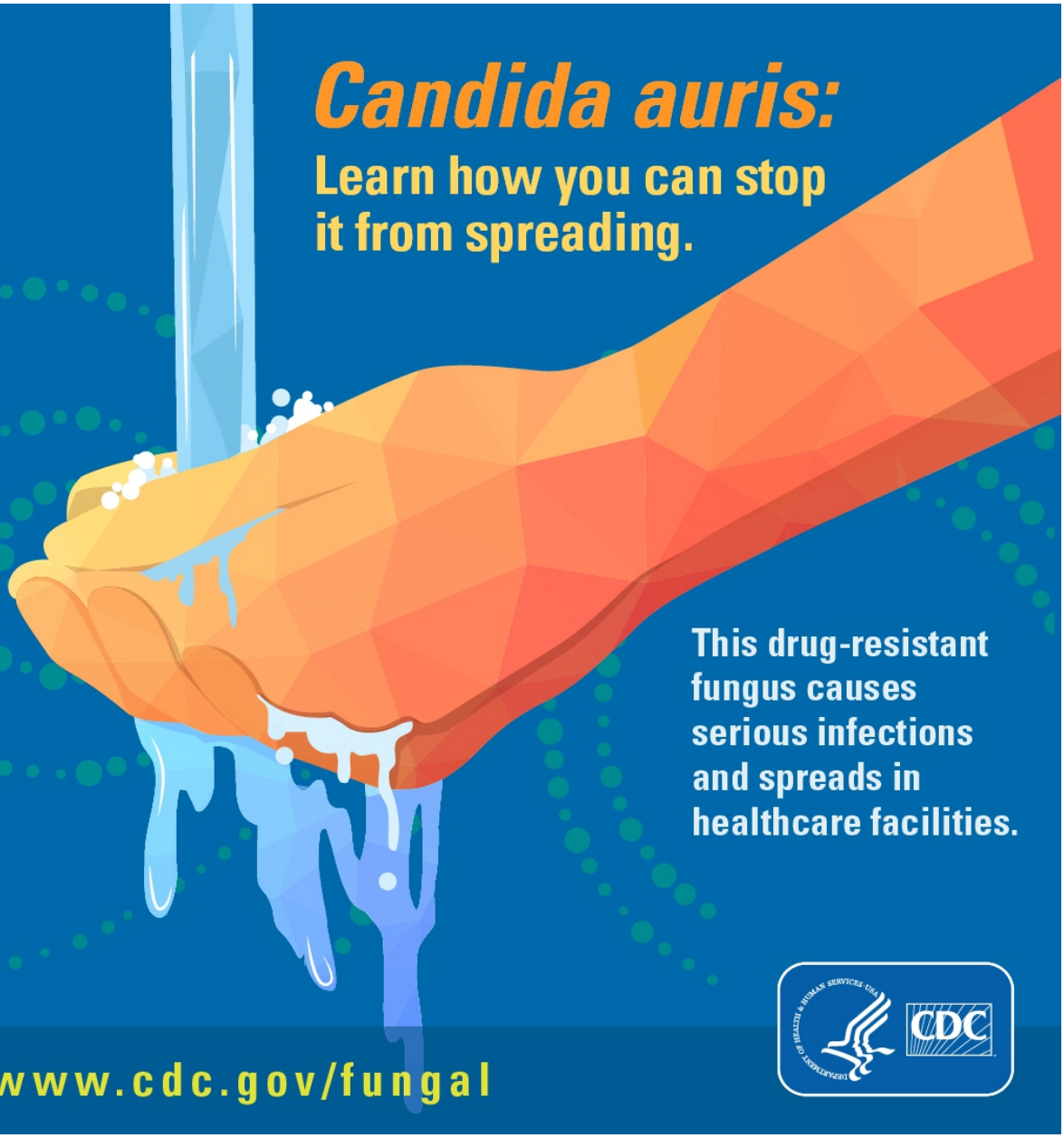
The Future of **Fungal Infections**

Disease-causing fungi are spreading and emerging with climate and environmental changes.

cdc.gov/fungal

Candida auris:

Learn how you can stop it from spreading.



This drug-resistant fungus causes serious infections and spreads in healthcare facilities.

www.cdc.gov/fungal

CEOH
CENTER FOR ENVIRONMENTAL & OCCUPATIONAL HEALTH

NATIONAL FUNGAL DISEASE SURVEILLANCE SYSTEM

CEOH - NIH