Candida auris: What makes it unique among *Candida* spp.?

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Outline

- Epidemiology
- Infection control and prevention
- Microbiology
- Clinical characteristics
- Management

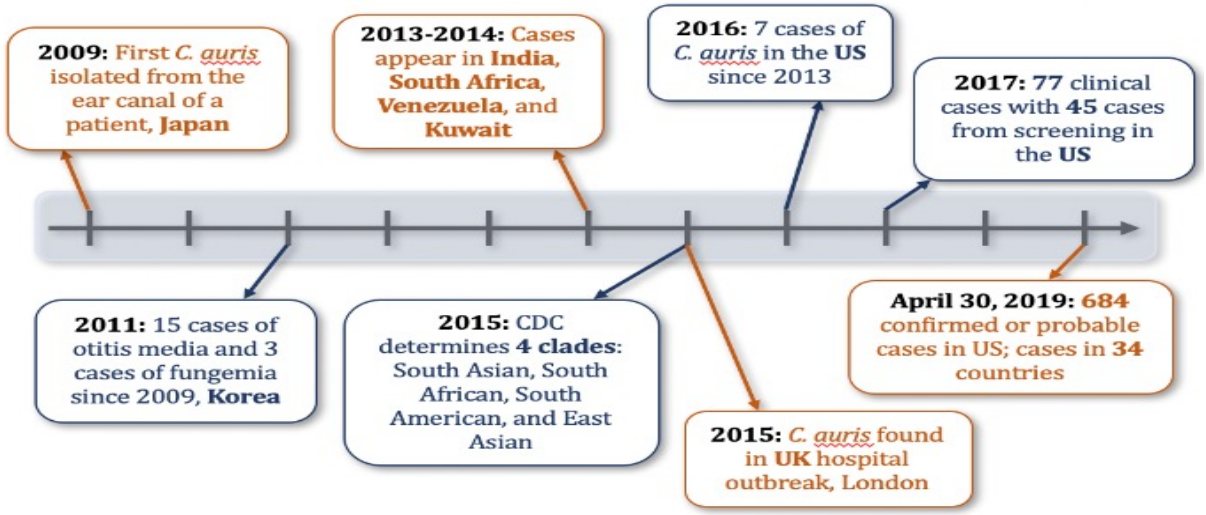
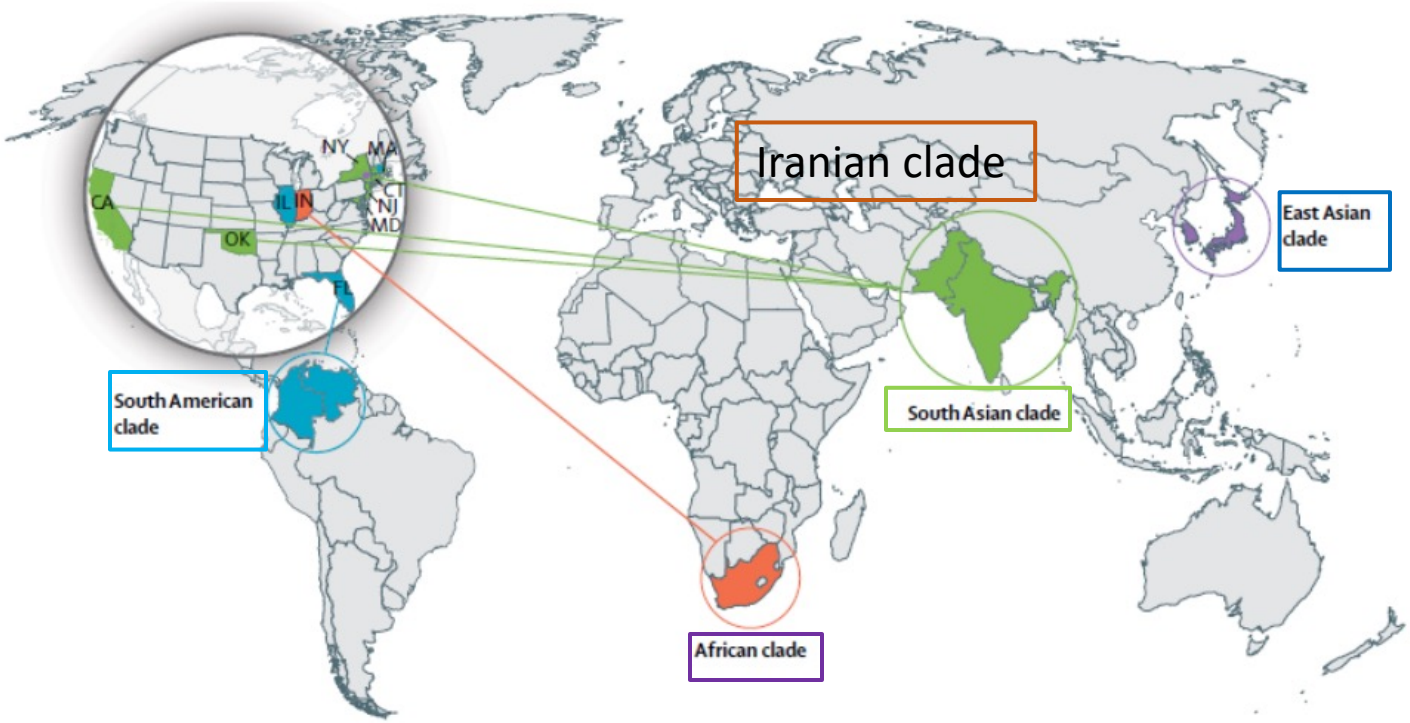
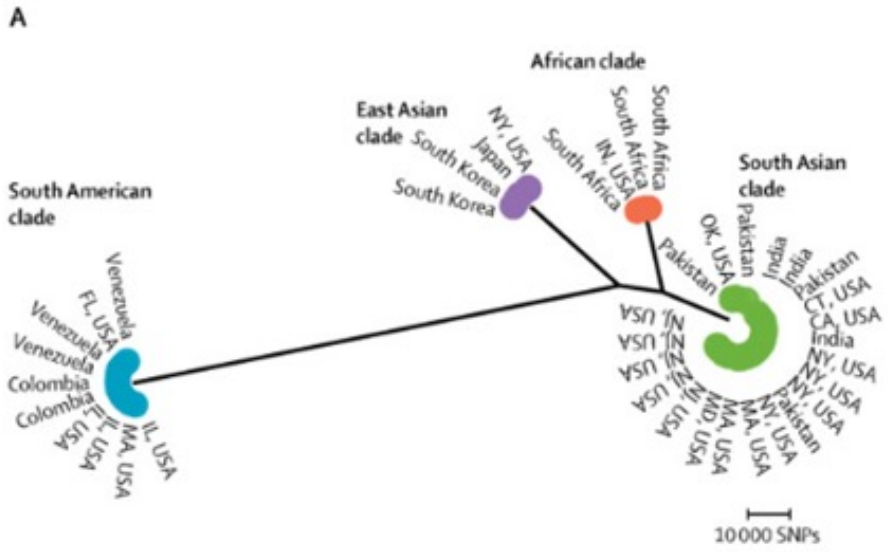
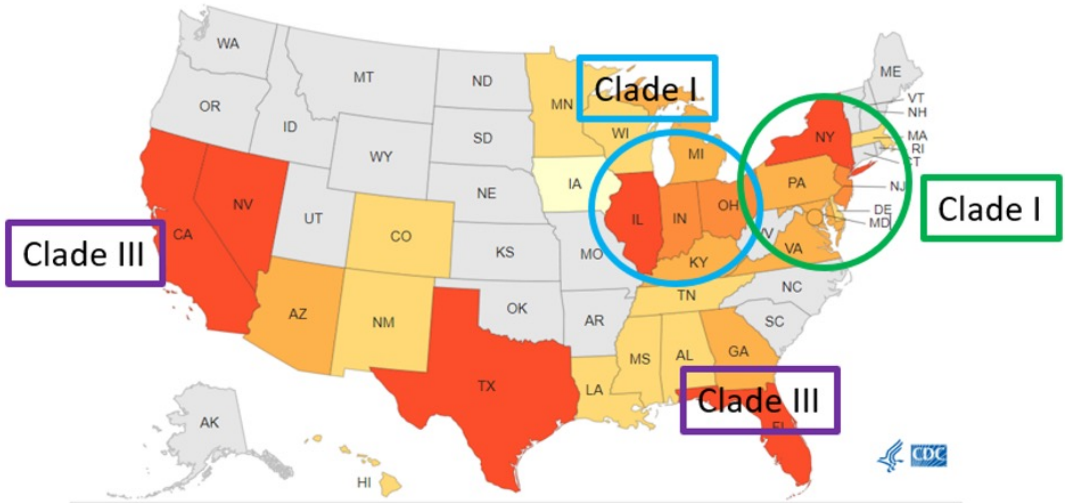


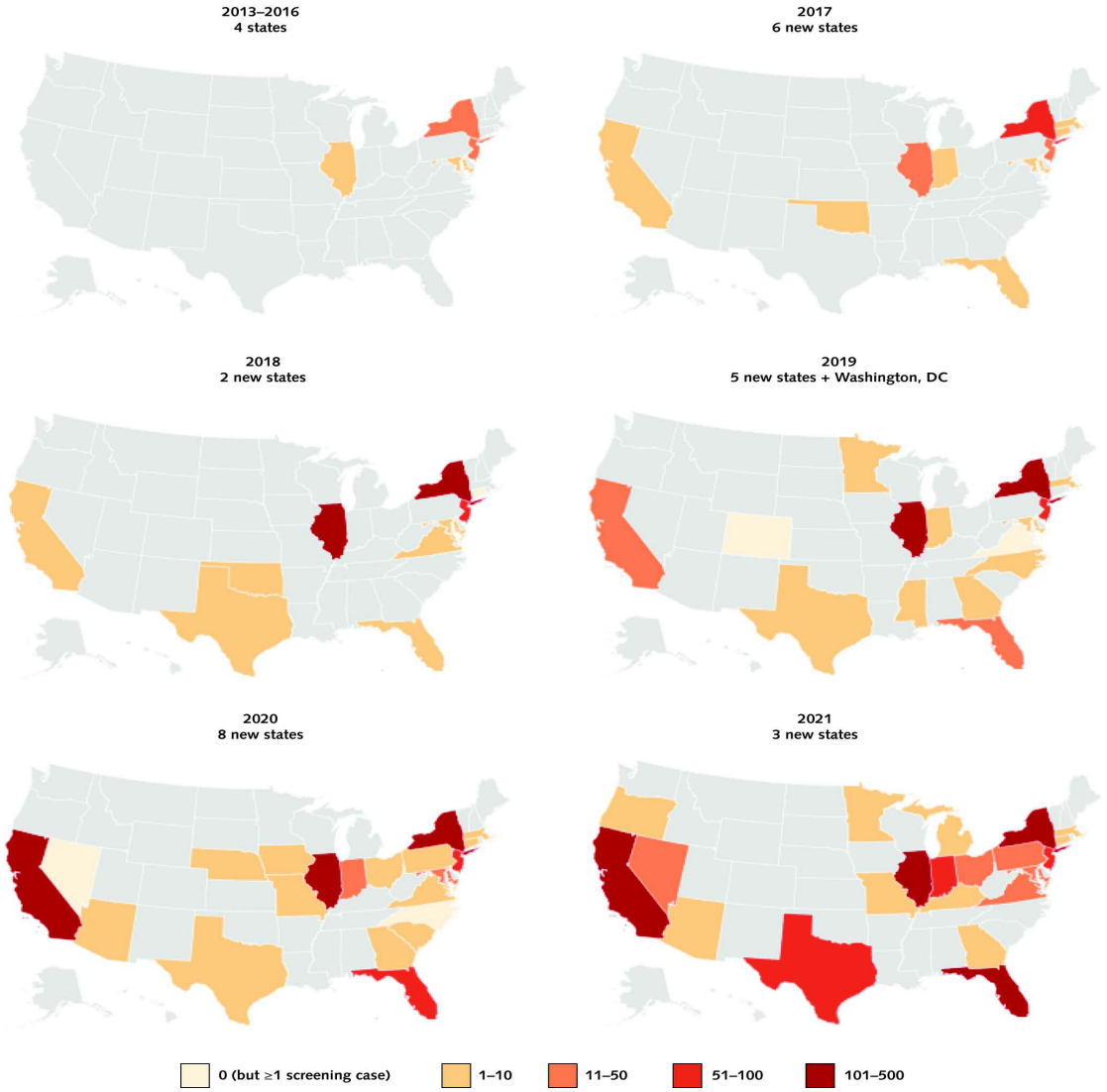
Figure 1. A timeline of the spread of Candida auris. Image courtesy L. Leung.





Chow et al. Lancet Infect Dis 2018;18:1377





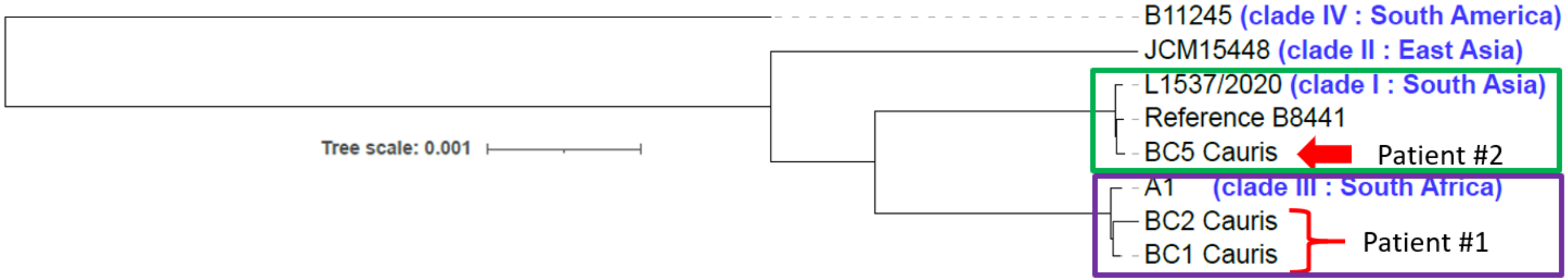
South American strain—Florida, Illinois, Massachusetts

African strain—California, Florida, Indiana

South Asian strain—California, Connecticut, Florida, Maryland, New York, New Jersey, Oklahoma

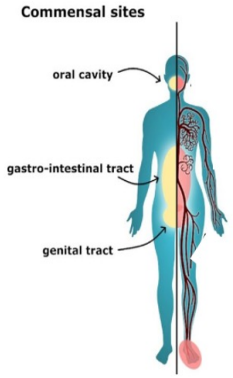
East Asian strain—Florida, New York

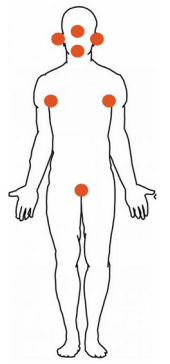
Ann Intern Med. 2023; 176(4):489-495. doi:10.7326/M22-3469


B11245 (clade IV : South America)
JCM15448 (clade II : East Asia)
L1537/2020 (clade I : South Asia)
Reference B8441
BC5 Cauris
Patient #2
A1 (clade III : South Africa)
BC2 Cauris
BC1 Cauris
Patient #1
Tree scale: 0.001

Behaviors observed with *C. auris* set it apart from other *Candida* species

	Candida albicans	*Candida auris*
Colonization site Portal of entry	Host endogenous flora (GI tract)	Acquisition from another person
Persistence on skin	Not observed (except *C. parapsilosis*)	Predilection for skin, particularly the axilla and groin Stick and stay
Tolerance to growth on high temp	Grows poorly at >37C	Grows best at 42C
Tolerance to growth in NaCl (sweats)	NaCl sensitive	NaCl tolerant
Hardy in environment		Stick and stay (~*Candida parapsilosis*)
Propensity for nosocomial outbreaks	Rare	Common



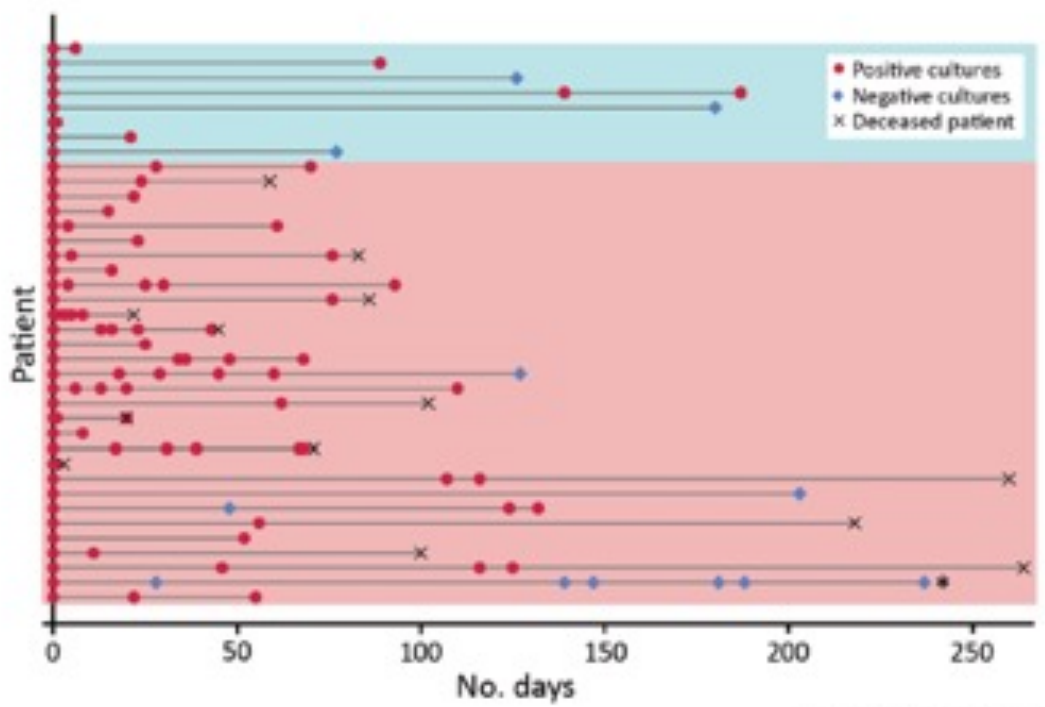


C. auris can **spread between patients** in healthcare facilities and cause **outbreaks**

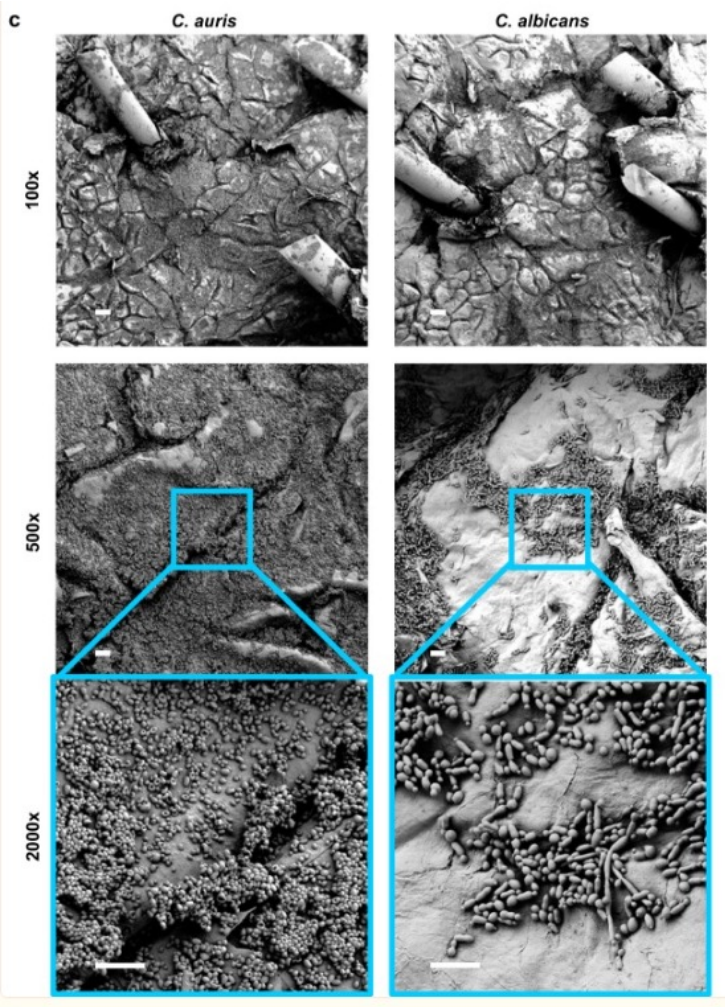
	Candida albicans	*Candida auris*
Healthcare setting	Acute care	Post-acute or chronic care High-acuity patients
Host	Opportunistic infection (immunocompromised, neutropenia, disrupted gut integrity, etc)	Prolonged health care High-acuity post-acute care facilities Invasive devices (respirators, trach, etc)
Risk factors	Central venous catheters GI surgery **Neutropenia** Multiple antibacterial agents	Central venous catheters **MDR bacterial infections** Multiple antibacterial agents Prior antifungals
Previous colonization		MDR bacteria *Candida auris*
Defense system	PMN is major defense mechanism	**Immune evasion (PMN phagocytosis and killing)**

Factors contributing to transmission

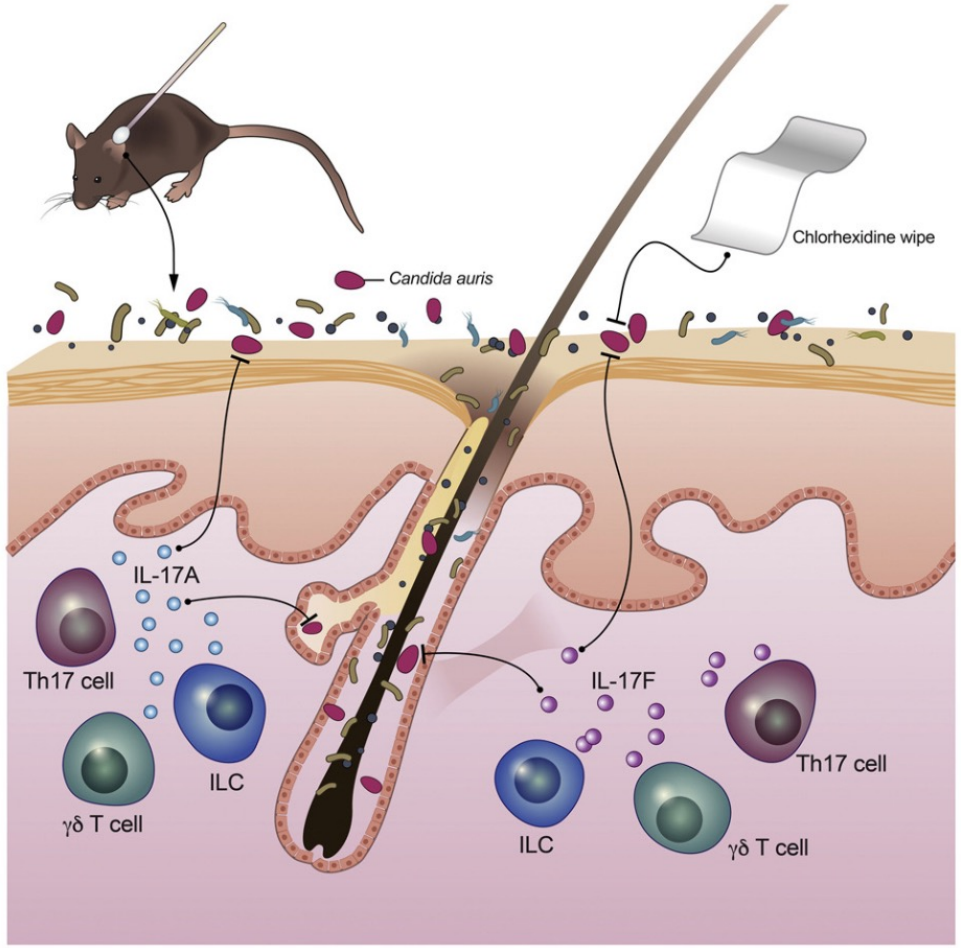
- **Colonize skin** and may persist for ≥200 days
- **Persist in the hospital environment**



Adams et al. EID 2018;24(10): 1816-1824



Horton MV et al. mSphere 2020; 5:e00910-9



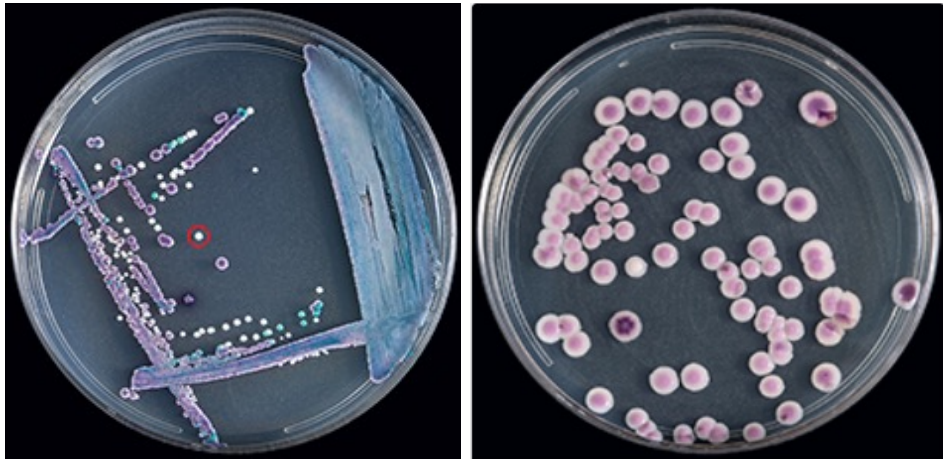
- *C. auris* establishes long-term residence within the skin tissue compartment (hair follicle).
- Clades of *C. auris* differ in their abilities to colonize murine skin, mirroring epidemiologic findings.

Huang X et al. Cell Host Microbe 2021:29:210-21

Identification can be difficult

SDA (Sabouraud Dextrose Agar)

Candida auris	
Growth	within 3 days
Temperature	25 – 42° C
Colony	Smooth and glistening White to grey Entire margin



CHROMagar Candida (not *C. auris* specific)

CHROMagar Candida PLUS (*C. auris* specific)

- Light blue with a blue halo
- Occasional false-positives with closely related species (*C. vulturna, C pseudohaemulonii*)

Phenotypic characteristics are not sufficient for identification

VITEK (2YST, 2 XL)

Misidentifications:
Candida haemulonii, *Candida duobushaemulonii*, *Candida* spp., and *Candida auris* from African and East Asian clades

BD Phoenix

Misidentifications:
Candida haemulonii, *Candida catenulata*, *Candida* spp.

API 20C

Misidentifications:
Rhodotorula glutinis, *Candida sake*, *Saccharomyces kluyveri*, *Saccharomyces cerevisiae*, *Candida* spp.

Candida auris **ID:**

BIOCHEMICAL SYSTEMS

MicroScan, MicroScan AutoScan, Microscan Walkaway

Misidentifications:
Candida famata, *Candida guilliermondii*, *Candida lusitaniae*, *Candida parapsilosis*, *Candida* spp., *Rhodotorula rubra*

RapiID Yeast Plus

Misidentifications:
Candida parapsilosis, *Candida* spp.

Proteomic Identification

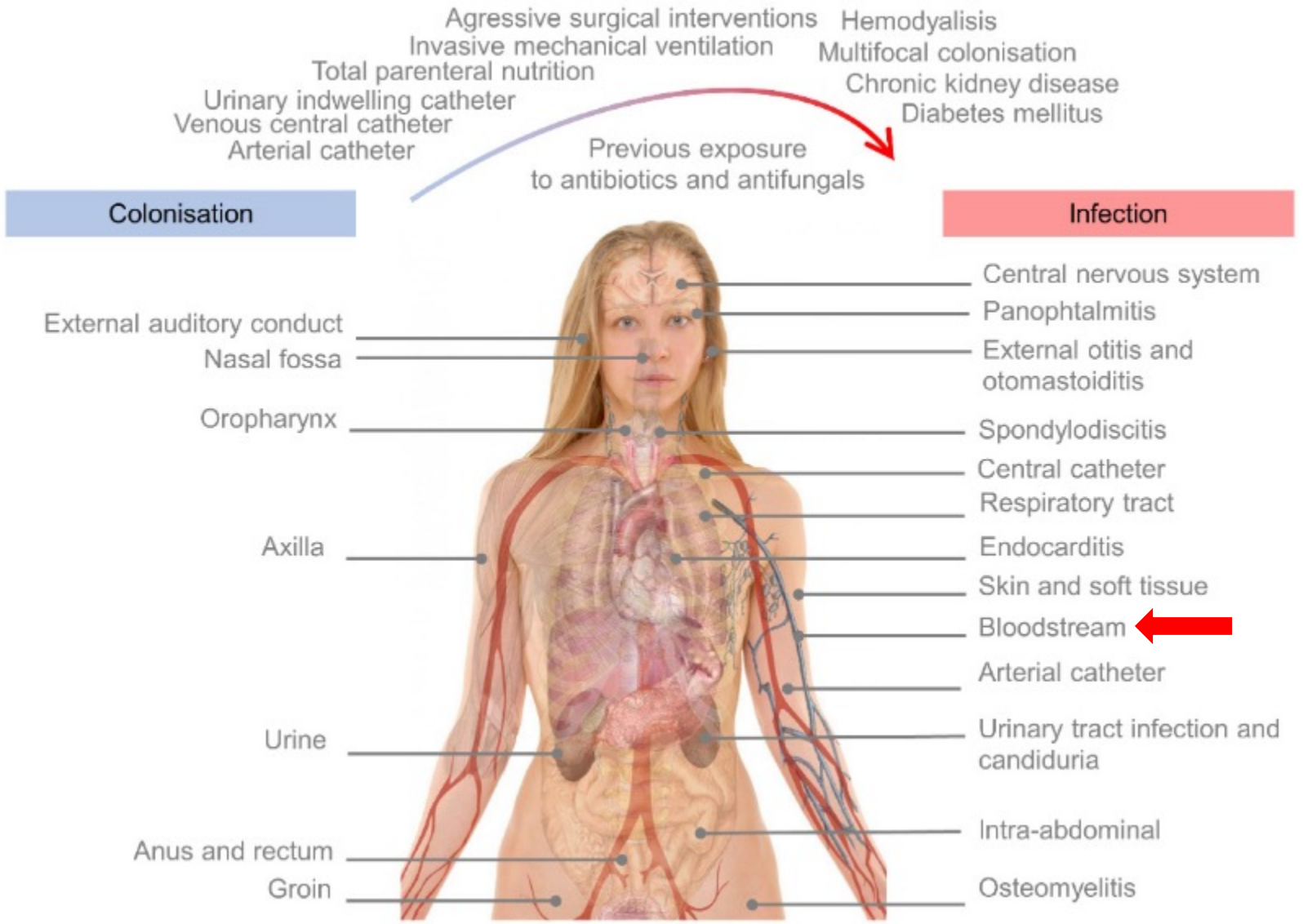
Bruker Biotyper
CA Library Claim 4

Vitek MS
IVD v3.2

Candida auris well represented in MALDI-TOF database libraries and reliably identified

Cernakova L et al. Int J Mol Sci 2021;22(9):4470

Figure 2. Schema representing the most common colonisation, invasive infection sites, and risk factors for deep-seated infections in patients colonised by *C. auris*.

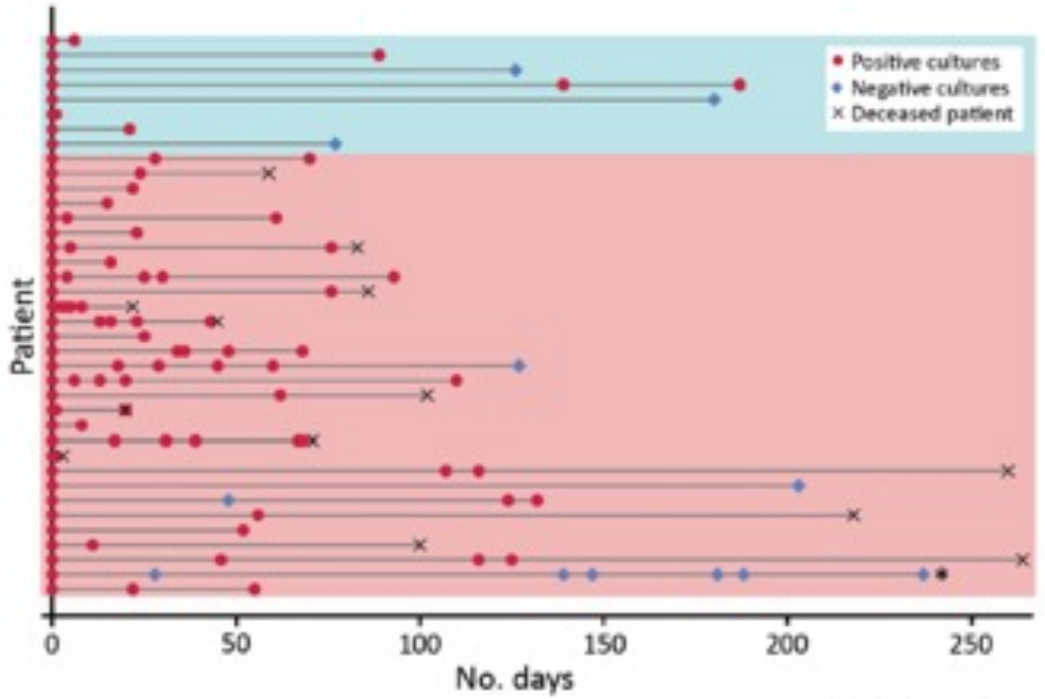


Infection Prevention – Precaution

Table 2
Infection prevention and infection control recommendations of the CDC and PHE[1,2]

	Center for Disease Control and Prevention	Public Health England
Precautions	Single room with standard and contact precautions including gown, gloves, and hand hygiene practices. To the extent possible, minimize the number of staff who care for the *C. auris* patient. If there are multiple *C auris* cases in a facility, consider cohorting staff caring for these patients	Single room, with *ensuite* facilities when possible, with standard precautions including gloves, aprons, and hand hygiene practices. If a patient needs to be taken out of the room to theatre, procedures should be scheduled as last case of the day and environmental cleaning should be performed afterwards

Infection Prevention – Duration of contact duration

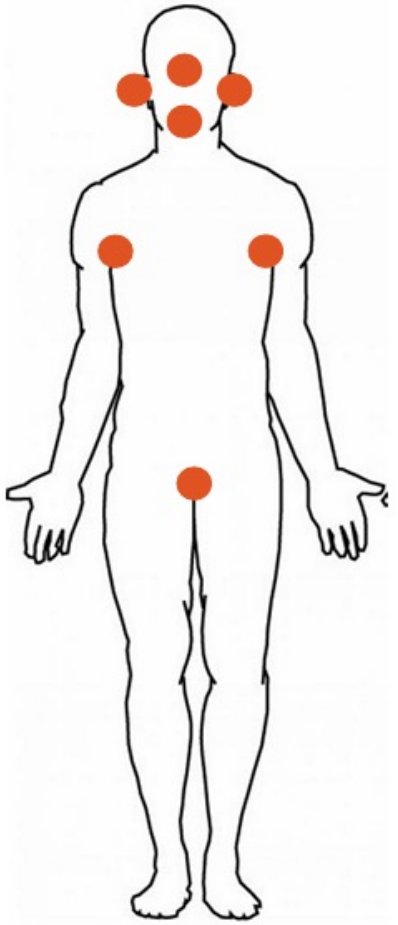


Adams et al. EID 2018;24(10): 1816-1824

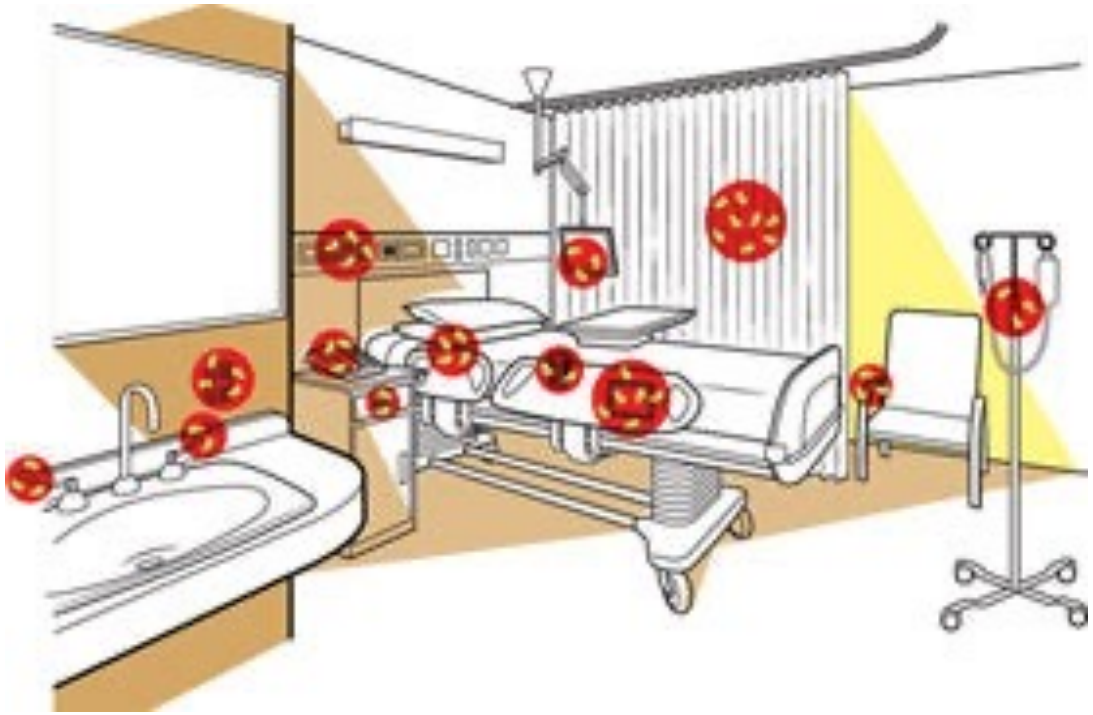
- INDEFINITELY!!

Infection Prevention – Surveillance screening

- Target screening:
  - Patients with contact with another patient with *C. auris* infection or colonization
  - Transferred from a facility with *C. auris* cases
    - Especially those require high-level of care (ventilator-dependent)



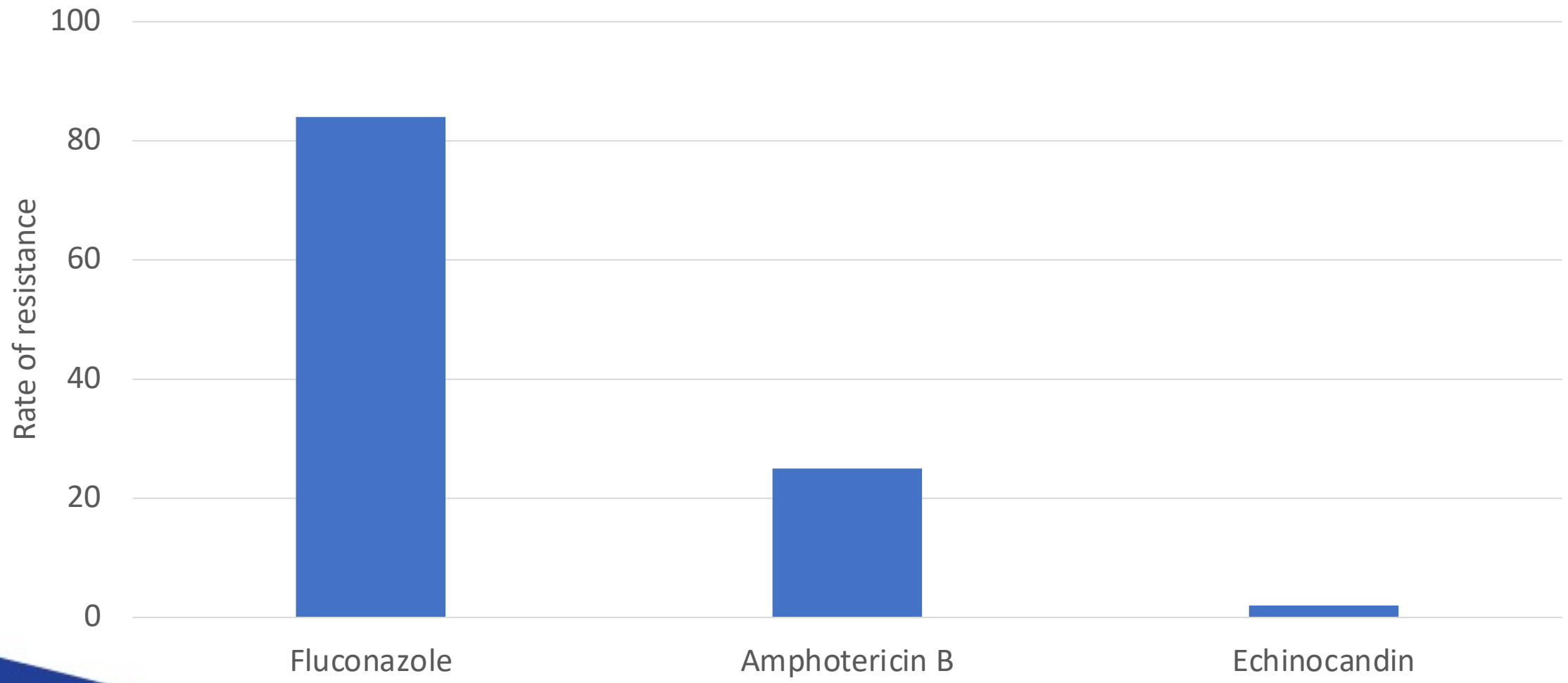
Infection Prevention – Environmental disinfection



List P: Antimicrobial Products Registered with EPA for Claims Against Candida Auris

Registration	Active Ingredient	Product Brand Name	Company	Contact Time (minutes)	Formulation Type	Surface Types	Use sites
10324-214	Hydrogen Peroxide and Paracetic Acid	Maguard 5626	Mason Chemical Company	2	Dilutable	Hard Nonporous (HN)	Hospital; Institutional; Residential
1677-226	Hydrogen Peroxide, Paracetic Acid and Octoanoic Acid	Virasept	Ecolab Inc.	4	Ready to Use	Hard Nonporous (HN)	Hospital; Institutional
1677-237	Hydrogen Peroxide and Paracetic Acid	Oxycide™ Daily Disinfectant Cleaner	Ecolab Inc.	3	Dilutable	Hard Nonporous (HN)	Hospital; Institutional
1677-262	Dodecylbenzenesulfonic Acid	Disinfectant 1 Spray	Ecolab Inc.	1	Ready to Use	Hard Nonporous (HN)	Hospital; Institutional
1677-263	Dodecylbenzenesulfonic Acid	Disinfectant 1 Wipe	Ecolab Inc.	1.25	Ready to Use/Wipe	Hard Nonporous (HN)	Hospital; Institutional
37549-1	Sodium Hypochlorite	Micro-Kill Bleach Germicidal Bleach Wipes	Medline Industries Inc.	2	Ready to Use/Wipe	Hard Nonporous (HN)	Hospital; Institutional; Residential
37549-2	Sodium Hypochlorite	Micro-Kill Bleach Solution	Medline Industries, LP	2	Ready to Use	Hard Nonporous (HN)	Hospital; Institutional; Residential
46781-12	Isopropyl Alcohol and Quaternary Ammonium	Cavicide 1	Metrex Research	1	Ready to Use	Hard Nonporous (HN)	Hospital; Institutional; Residential
46781-13	Isopropyl Alcohol and Quaternary Ammonium	CaviWipes 1	Metrex Research	1	Ready to Use/Wipe	Hard Nonporous (HN)	Hospital; Institutional; Residential
46781-14	Sodium Hypochlorite	CaviWipes Bleach	Metrex Research	3	Ready to Use/Wipe	Hard Nonporous (HN)	Hospital; Institutional; Residential

Antifungal resistance is common



- > 40% are multi-drug resistant

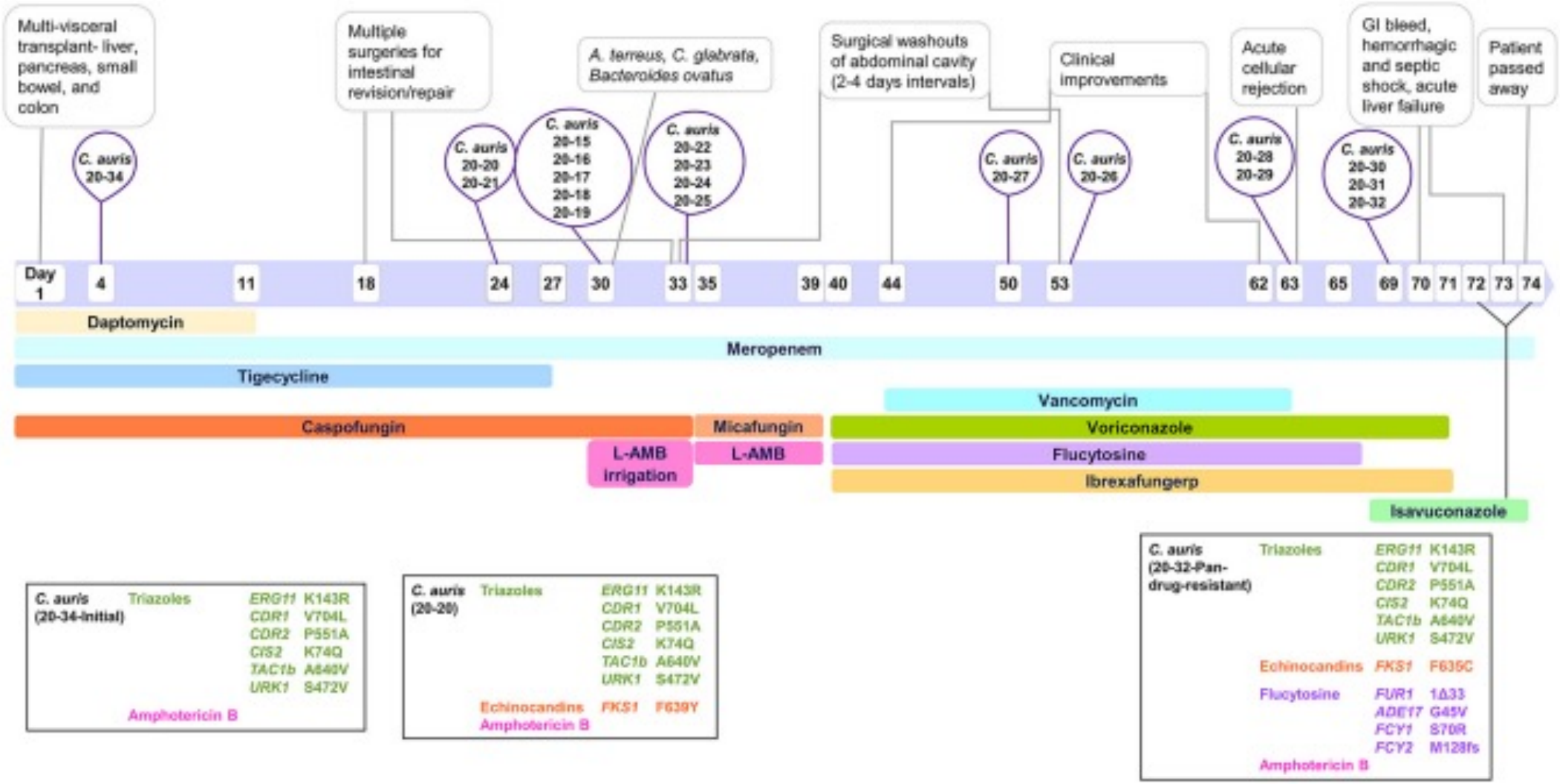
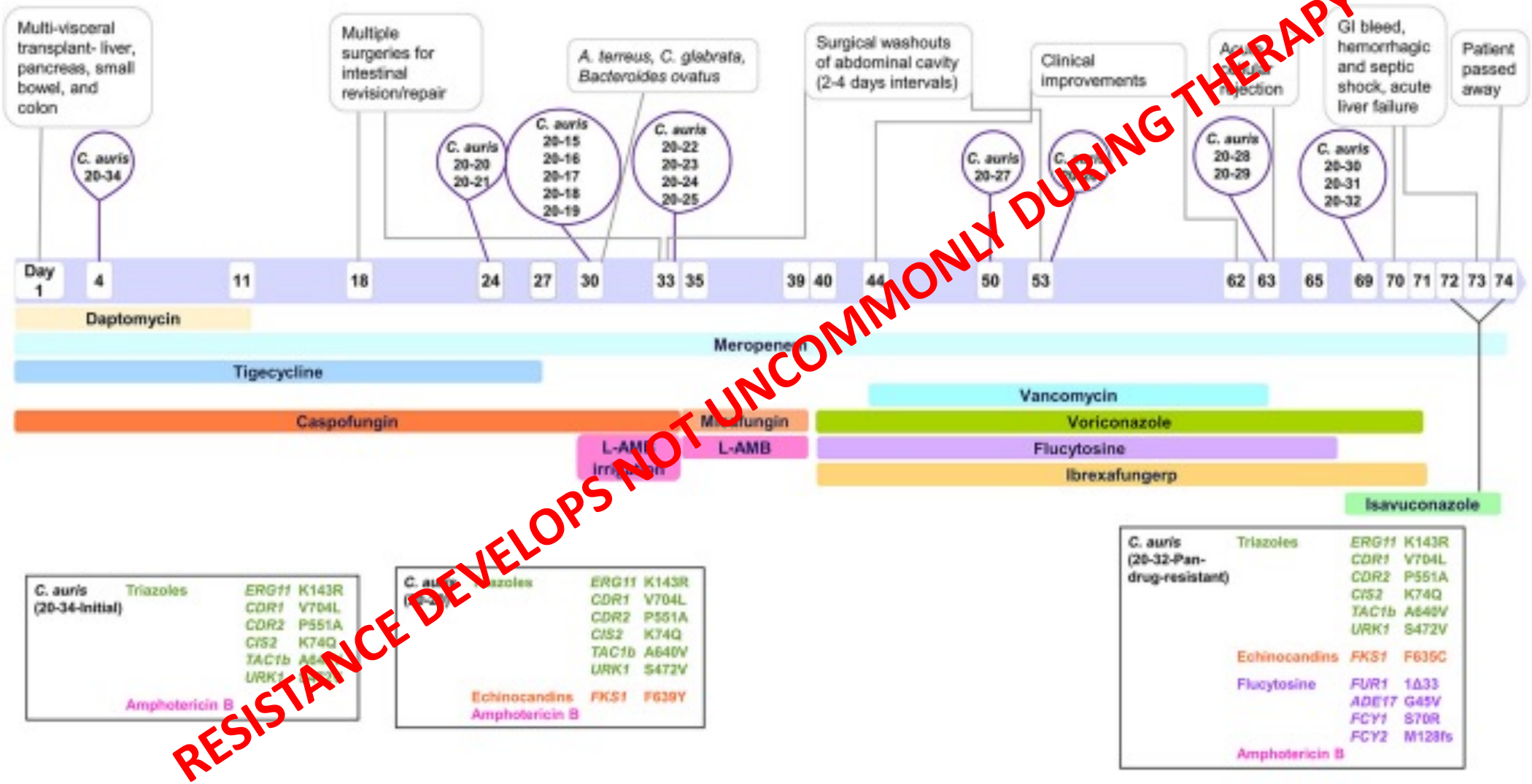


FIG 1 A timeline of the clinical course of the patient. *Candida auris* isolations at different intervals, including pan-drug-resistant isolates recovered on hospital day 72 are shown. Also highlighted are antimicrobial drugs and duration, major complications, and other pathogens encountered in the patient.

Jacobs S et al. AAC 2022;66:1-14



RESISTANCE DEVELOPS NOT UNCOMMONLY DURING THERAPY

FIG 1 A timeline of the clinical course of the patient. *Candida auris* isolations at different intervals, including pan-drug-resistant isolates recovered on hospital day 72 are shown. Also highlighted are antimicrobial drugs and duration, major complications, and other pathogens encountered in the patient.

Jacobs S et al. AAC 2022;66:1-14

Notes from the Field

Transmission of Pan-Resistant and Echinocandin-Resistant *Candida auris* in Health Care Facilities — Texas and the District of Columbia, January–April 2021

Meghan Lyman, MD[1]; Kaitlin Forsberg, MPH[1]; Jacqueline Reuben, MHS[2]; Thi Dang, MPH[3]; Rebecca Free, MD[1]; Emma E. Seagle, MPH[1]; D. Joseph Sexton, PhD[1]; Elizabeth Soda, MD[4]; Heather Jones, DNP[4]; Daryl Hawkins, MSN[2]; Adonna Anderson, MSN[2]; Julie Bassett, MPH[3]; Shawn R. Lockhart, PhD[1]; Enyinnaya Merengwa, MD, DrPH[3]; Preetha Iyengar, MD[2]; Brendan R. Jackson, MD[1]; Tom Chiller, MD[1]

Morbidity and Mortality Weekly Report

DC – 101 isolates (Jan-April 2021)

- 3 skin colonization pan-drug resistant (PDR) isolates
- Facilities: Long-term care for severely ill patients

Tx – 22 isolates

- 2 PDR and 5 resistant to both azole and echinocandins
- Facilities in same city: LR-AC (2), 3 ST AC and 2 at both
- 5 colonization and 3 clinical isolates

No previous echinocandin exposure

Transmission of PDR or echinocandin-resistant *C. auris* in US healthcare

The New York Times

Deadly Fungus Spread Rapidly During the Pandemic, C.D.C. Says

Candida auris, a drug-resistant fungus that health officials hoped to contain is now in more than half the 50 states, according to a new research paper.

First line antifungal

- Echinocandin (beware of emerging ECH-resistance)
- Source control (remove lines)

Monitor clinical improvement

Persistent culture ≥7d

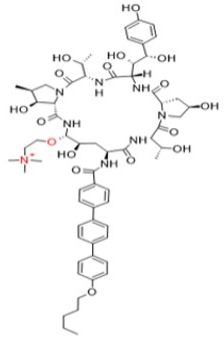
- Check antifungal MIC
- Consider switching to or adding L-AmB (5 mg/kg)

Pan-drug resistance

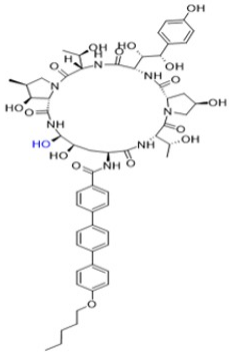
- Call AMP – Expanded access with novel agents on pipeline

Outcome

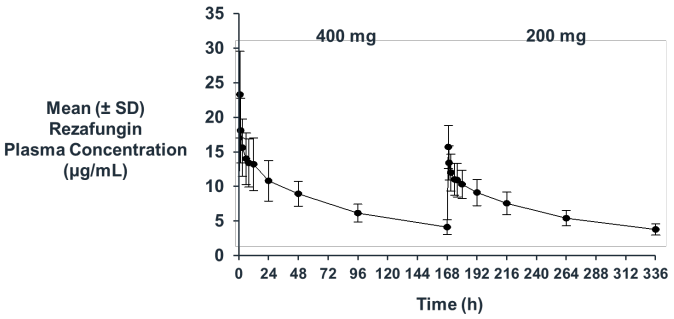
	Candida albicans and other spp	*Candida auris*
Mortality	30%	39%
Microbiologic persistence	32%	42%
Microbiologic recurrence	4%	12%
Hospitalization stay	10 days	31 days

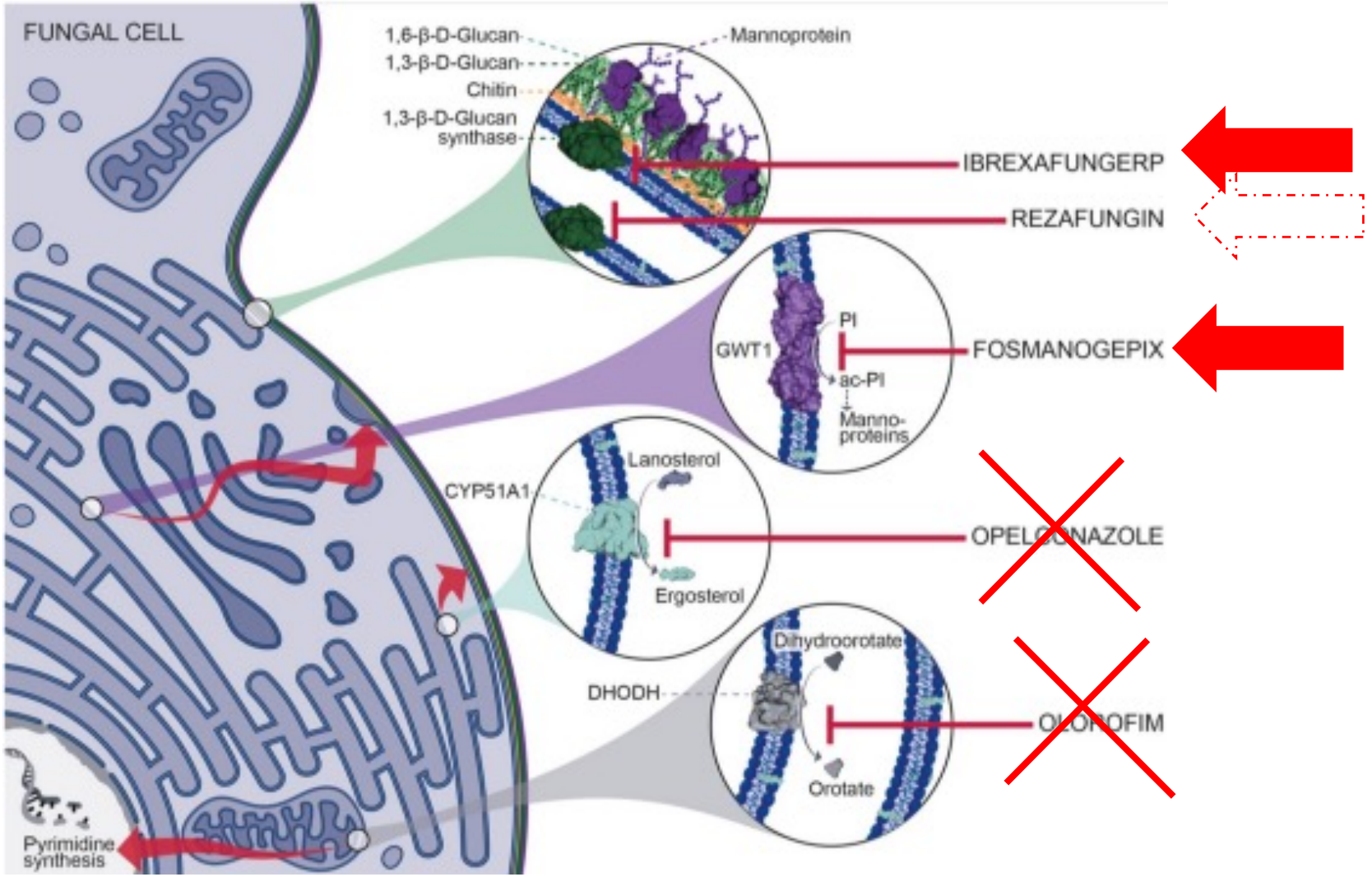


Rezafungin



Anidulafungin





Hoenig M et al. Drugs 2021;81:1703-29