A strain of *Candida auris* cultured in a petri dish at CDC

Candida auris Infection control measures in HA Hospital

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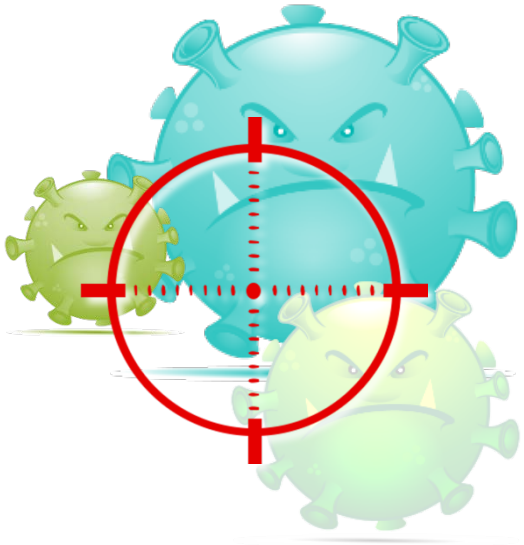
12 August 2019

Objectives

* What do we know about C auris?
* How to prevent transmission of C auris in hospital ?



Date Collected: 24/07/2019 16:53
Date Arrived: 24/07/2019 20:13
Specimen:- MID-STREAM URINE

Microscopy : Large numbers of WBC seen (> 100,000 cell/ml)
RBC not seen
Epithelial cells not seen
Yeast-like organism present

Routine culture :-

Organism 1 : Yeast isolated

Date Collected: 24/07/2019 06:50
Date Arrived: 24/07/2019 11:44
Specimen:- CATHETER URINE

Microscopy : WBC not seen
RBC not seen
Epithelial cells not seen
Yeast-like organism present

Routine culture :-

Organism 1 : Candida albicans isolated

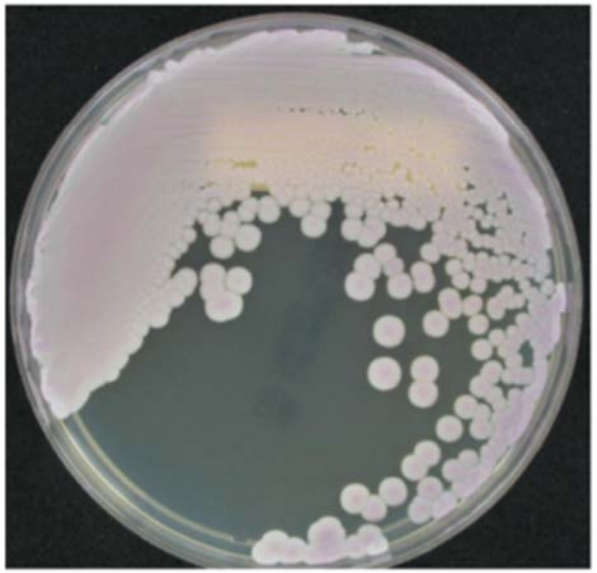
Importance of C auris

Multidrug resistant

* In US, about 90% of *C. auris* isolates have been resistant to fluconazole, about 30% have been resistant to amphotericin B, and less than 5% have been resistant to echinocandins

Difficult to identified

* Speciation not routinely performed for non-sterile specimens e.g. urine
* Often misidentifed as other Candida e.g. *Candida haemulonii, Candida famata, Candida lusitania etc.*
* Matrix-assisted laser desorption/ionization time-of-flight (MALDI-TOF) with updated data base can correctly differentiate *C. auris* from other *Candida* species



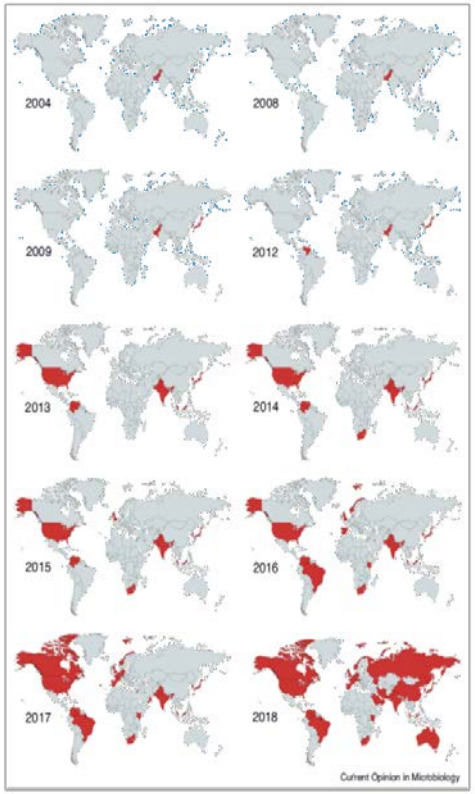
C. auris

Importance of C auris

Cause prolonged outbreak in healthcare setting

Country	Units	No of cases	Duration of outbreak	Mortality rate
Venezuela	NNU / NICU	18 BSI	15 months (Mar 12-Jul 13)	27.8%
UK (London)	CT ICU	50 (44% infection)	16 months (Apr 15 – Jul 16)	0%
UK (Oxford)	Neuro ICU	70 (10% infection)	32 months (Feb 15 – Aug 17)	20%
Spain	Surgical ICU	140 (41 BSI)	10 months (Apr 16 – Jan 17)	40%

Calvo B et al. First report of Candida auris in America: clinical and microbiological aspects of 18 episodes of candidemia. J Inf 2016;73(4):369–74
Schelenz S et al. First hospital outbreak of the globally emerging Candida auris in a European hospital. Antimicrob Resist Infect Control. 2016;5:35
Eyre DW et al. A Candida auris outbreak and its control in an intensive care setting. N Engl J Med. 2018;379(14):1322
Ruiz-Gaitan A et al. An outbreak due to Candida auris with prolonged colonisation and Candidaemia in a tertiary care European hospital. Mycoses. 2018;61(7):498–505



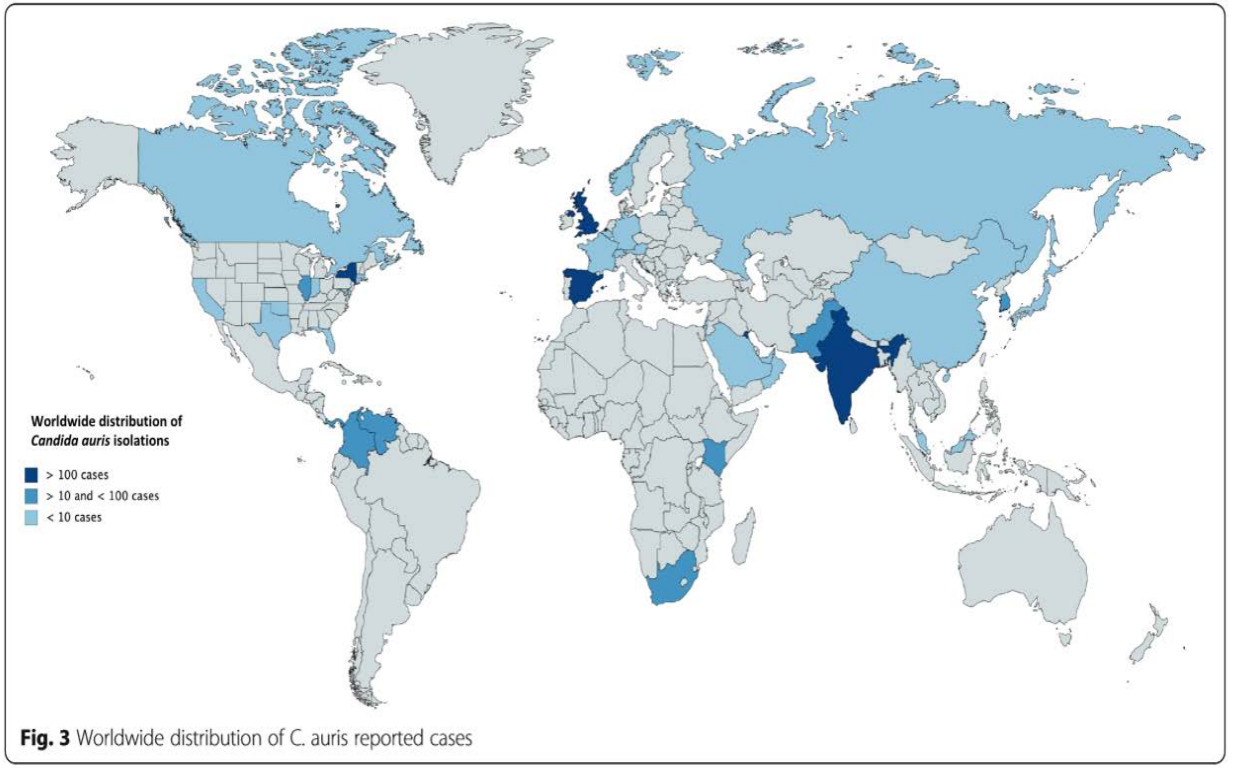


Fig. 3 Worldwide distribution of C. auris reported cases

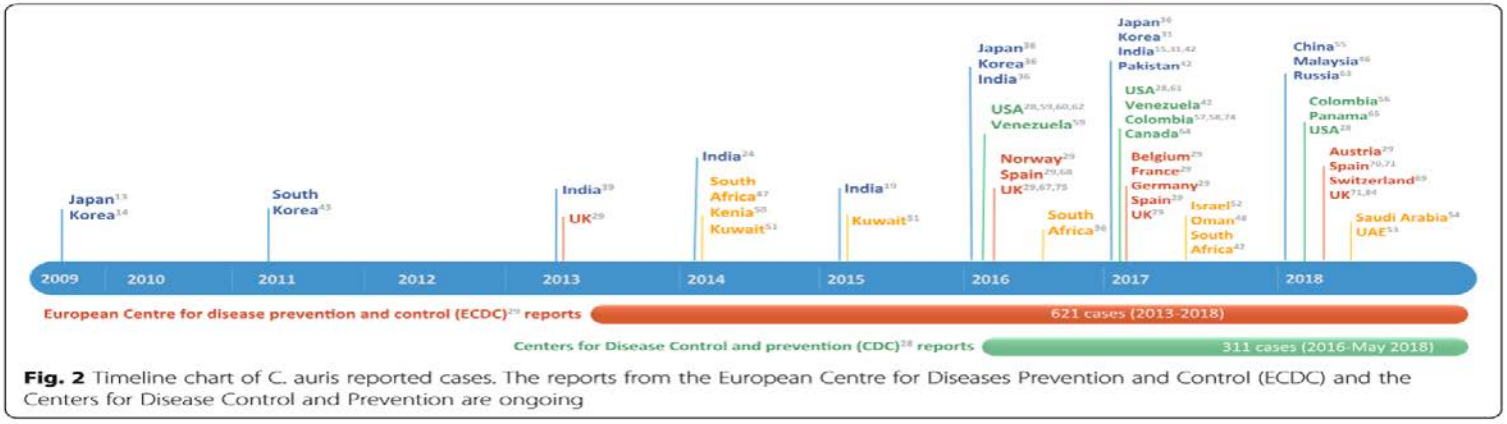


Fig. 2 Timeline chart of C. auris reported cases. The reports from the European Centre for Diseases Prevention and Control (ECDC) and the Centers for Disease Control and Prevention are ongoing

Rhodes J, Fisher MC. Global epidemiology of emerging Candida auris. Curr Opin Microbiol. 2019 Jul 3;52:84-89.
Cortegiani et al. Journal of Intensive Care (2018) 6:69

C auris infection

TABLE 3 *Candida* auris infection cases by disease type reported in the literature

Type of disease or location of isolation[b]	No. of cases (reference[s])
Candidemia	291 (3–5, 7, 8, 10, 12, 14–16, 26, 27, 57, 58, 70, 71)
Central venous catheter tip	2 (70)
CNS	1 (12)
ENT	21[a] (1, 17, 58, 70, 72)
Respiratory tract	18 (26, 27, 36, 70)
Urogenital system	17 (12, 27, 56)
Abdominal	13 (12, 27, 70)
Skin and soft tissue, including surgical wounds	12 (3, 10, 27, 70)
Bone	2 (12, 70)

[a]Two associated with otomastoiditis and 19 from ear swabs of patients with otitis externa.
[b]CNS, central nervous system; ENT, ear, nose, and throat.

Anna Jeffery-Smith et al. *Candida auris*: a Review of the Literature. Clin Microb Rev 2018; 31(1): e00029-17

Multidrug resistant

Table 2 Select studies describing the frequency of antifungal resistance among *Candida auris* isolates

Country, study setting (years)	Sample size	Frequency of resistance to select antifungals							Reference
		Fluconazole (%)	Voriconazole (%)	Echinocandin (%)	Amphotericin B (%)	Flucytosine (%)	≥2 drug classes	≥3 drug classes	
India, 10 acute care hospitals (2009–2017); clinical isolates	350	90.3	14.9	2.0	7.8	16.0	25.1	2.0	[70]
USA, multistate survey (2013–2017); clinical and surveillance isolates	99	88.9	–	6.1	33.3	–	39.4	–	[6]
Columbia, outbreaks in 4 hospitals (2015–2016); clinical, surveillance, and environmental isolates[a]	85	12.9	0	0	30.6	–	0	0	[39]
UK, single-center outbreak (2015–2017); clinical and surveillance isolates	79[b]	100	97.5	0	17.7	0	17.7	0	[52•]
Multination survey (2008–2015), clinical isolates	54	92.6	53.7	7.4	35.2	5.6	40.7	3.7	[4]
USA, single region outbreak (2016–2017); clinical isolates	51	98.0	–	0	29.4	–	25.5	0	[51]

Resistance to azoles (90%), amphoterin B (30%) Echinocandin (5%)

GM Snyder & BS Wright The Epidemiology and Prevention of Candida auris Curr Infect Dis 2019;21:19

Mortality

* An Indian study reported case-fatality rates for *C. auris* bloodstream infections of 33% for all patients and 57% for the subgroup of patients admitted to intensive care unit, but these rates might be attributable to the severity of underlying diseases in these patients
* In the UK outbreak in RBH, no fatalities could be directly attributed to *C. auris* infection
* In the Neuroscience ICU outbreak in Oxford, 90-day mortality was 20% (13 of 64) in case and 20% (44 of 221) in control respectively (P = 1.00)
* In a recent in vitro study, the pathogenicity of the most virulent *C auris* strains was comparable to that of *C. albicans*

Chowdhary, A., et al., New clonal strain of *Candida auris*, Delhi, India. Emerg Infect Dis, 2013. 19(10): p. 1670-3
Schelenz et al. First hospital outbreak of the globally emerging Candida auris in a European hospital. Antimicrobial Resistance and Infection Control (2016) 5:35
David W. Eyre etal. A *Candida auris* Outbreak and Its Control in an Intensive Care Setting N Engl J Med 2018;379:1322-31

Risk factors for infection

Admission to a facility with *C. auris* cases
Broad-spectrum antibiotic and antifungal use
Concomitant conditions: recent surgery, parenteral nutrition
Intensive care unit admission
Invasive devices: central venous catheters, indwelling urinary catheters

* C. auris BSI mainly affected patients with severe underlying diseases and immunosuppression e.g. diabetes mellitus, chronic kidney disease, HIV, solid tumours and haematological malignancies
* Neonates have also been affected
* **Devices associated** -- central venous and urinary catheters, surgery and admission to **intensive care units**
* Treatment with systemic antifungals prior to C. auris infection has also been reported for a proportion of patients – highlight the importance of antifungal stewardship
* Transmission from donor in a lung transplant recipient reported

Anna Jeffery-Smith et al. *Candida auris*: a Review of the Literature. Clin Microb Rev 2018; 31(1): e00029-17
Azar MM et al Donor-derived transmission of Candida auris during lung transplantation. Clin Infect Dis 2017;65:1040 –1042
Graham M. Snyder1 & Sharon B. Wright The Epidemiology and Prevention of Candida auris Curr Infect Dis 2019;21:19

Risk factors

Table 1. Selected concurrent medical conditions and medical interventions for 51 persons with *Candida auris* infection, New York, USA, 2013–2017

Characteristic	No. (%) persons
Concurrent condition	
Respiratory insufficiency requiring support	33 (65)
Mechanical ventilation at time of diagnosis	17 (33)
Neurologic disease*	24 (47)
Diabetes	18 (35)
Malignancies	11 (22)
Colon cancer	5 (10)
End-stage renal disease	8 (16)
Hemodialysis	7 (14)
Kidney transplant	1 (2)
Decubitus ulcers	10 (20)
Otitis with complications	2 (4)
Medical interventions	
Hemodialysis	7 (14)
Central venous catheter within 7 d before first positive culture for *C. auris*	31 (61)
Gastrostomy tube at time of diagnosis	27 (53)
Receipt of systemic antifungal medication within 90 d before first culture positive for *C. auris*	25 (49)
Receipt of systemic antibiotics within 14 d before first culture positive for *C. auris*	42 (82)

*Includes seizure disorder (n = 8), cerebrovascular accident (n = 7), dementia (n = 4), anoxic brain injury (n = 3), spinal cord injury (n = 2), and 1 case each of Parkinson's disease, multiple sclerosis, Huntington's disease, Guillain-Barré syndrome, traumatic brain injury, pituitary tumor, and neuropathy.

Eleanor Adams et al. *Candida auris* in Healthcare Facilities, New York, USA, 2013–2017
Emerg Infect Dis 2018; 24:1816 DOI: https://doi.org/10.3201/eid2410.180649

Co-carriage with CPE

* 3/5 case in Oman were co-colonized with carbapenem-resistant KPNE and one with SMAL
* All (3/3) cases in Singapore series were co-colonized with CPE(NDM-1 and OXA-232)
* Given the substantial overlap in factors associated with C. auris carriage and CPE, facilities should screening of C auris when patients have colonization with carbapenemase-producing Gram-negative bacteria (CDC 2019)

Al-Siyabi T et al. First report of Candida auris in Oman: clinical and microbiological description of five candidemia cases. J Inf Secur 2017;75(4):373–6. https://doi.org/10.1016/j.jinf.2017.05.016
Tan YE, Tan AL. Arrival of Candida auris fungus in Singapore: report of the first 3 cases. Ann Acad Med Singap. 2018;47(7):260–2.

Colonization

* Contact with patients known to harbor *C. auris* or their environment is known risk factor
  * Contact time as little as 4 h
  * Invasive infections acquired within 48 h of admission to ICU
* *C. auris* has been detected at multiple body sites, including nares, groin, axilla, rectum and urine
* The median duration of carriage was 61 - 82 days in an UK outbreak
* Prolonged carriage for 3 months or more in spite of initial negative screens and echinocandin treatment
* need for **multiple screens** with ongoing patient isolation after treatment and upon readmission to health care facilities

Anna Jeffery-Smith et al. *Candida auris*: a Review of the Literature. Clin Microb Rev 2018; 31(1): e00029-17
David W. Eyre et al. A *Candida auris* Outbreak and Its Control in an Intensive Care Setting N Engl J Med 2018;379:1322-31. DOI: 10.1056/NEJMoa1714373

Long term colonization was common

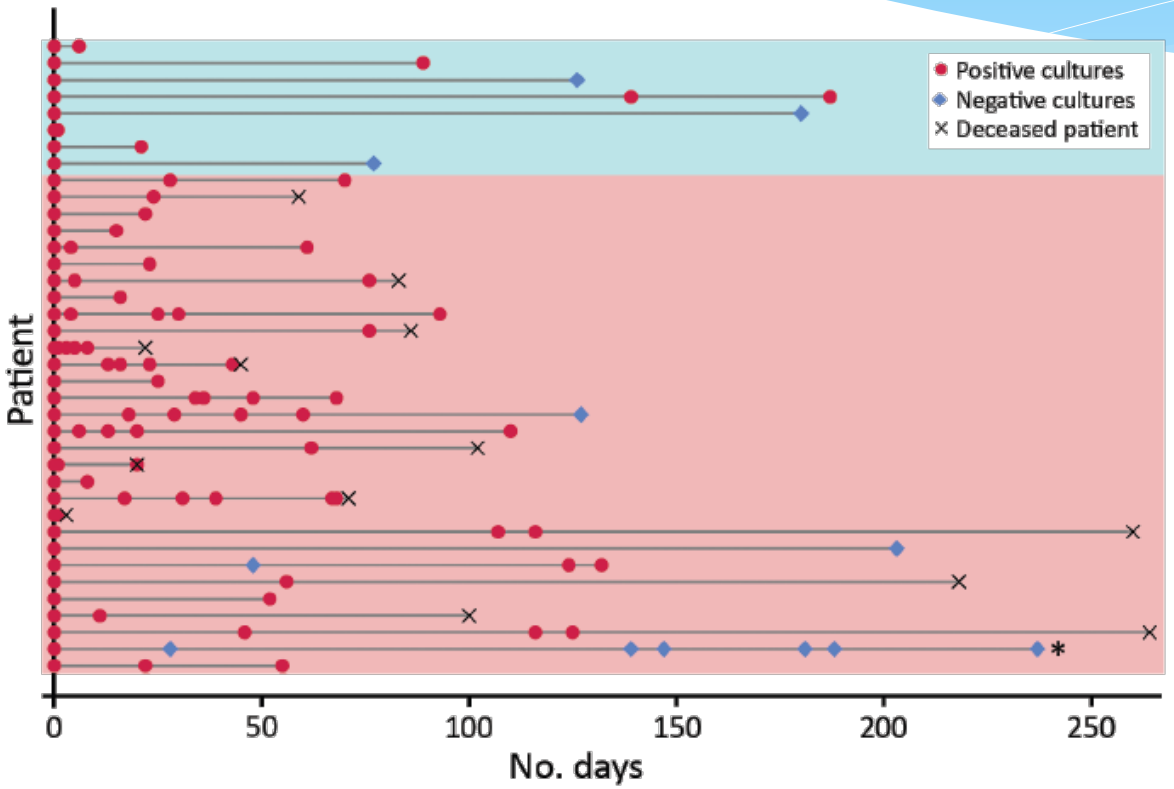


Figure 3. Long-term Candida auris colonization of clinical and screening case-patients, New York, USA, 2013–2017. Each patient for whom follow-up cultures were performed is represented by a horizontal line. The bottom 30 lines (pink shading) indicate clinical case-patients; the top 8 (blue shading) indicate screening case-patients. Follow-up cultures were collected from a variety of sites, typically axilla and groin and often nares, rectum, urine, and wounds. Persons were considered free of colonization with C. auris and eligible for removal of contact precautions when 2 sets of surveillance cultures at multiple sites, taken at least 1 week apart, were negative; only 1 person indicated on the figure (second from bottom) met this criterion.

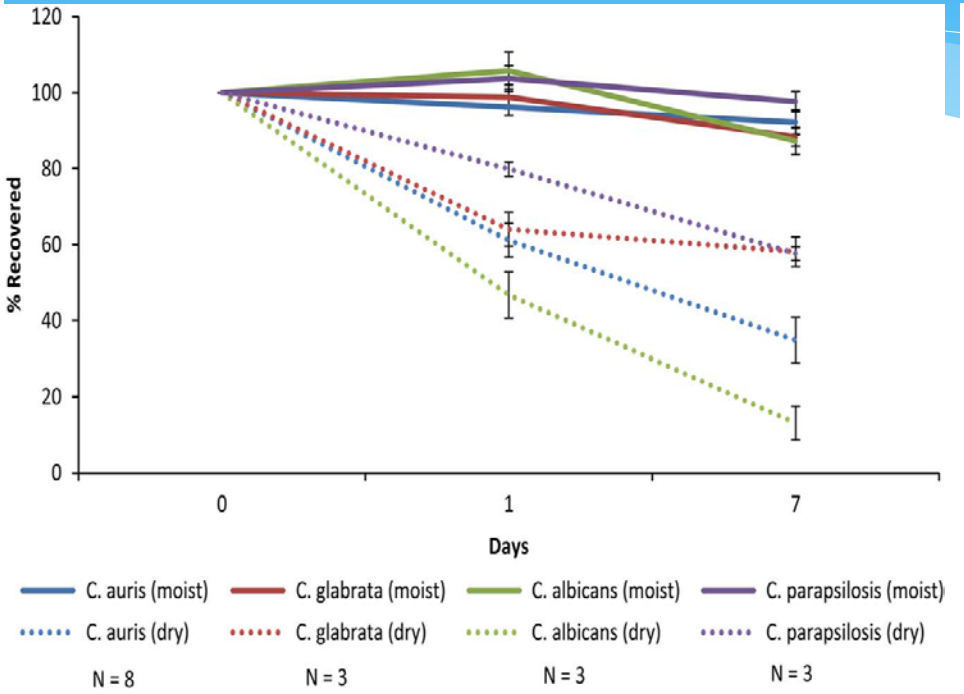
Eleanor Adams et al. *Candida auris* in Healthcare Facilities, New York, USA, 2013–2017
Emerg Infect Dis 2018; 24:1816 DOI: https://doi.org/10.3201/eid2410.180649

Site of colonization

* no studies on sampling sites exist for *C. auris* to determine those with highest yield
* early cases were sampled from multiple body sites (including nares, ears, oropharynx, axilla, groin, and rectum)
* Approximately 90% of cases were positive by **axilla or groin swab**
* Nares was the second most commonly positive body site
* Screening of epidemiologically-linked patients with a composite swab of the bilateral axillae and groin is recommended; additional body sites, including nares, may be sampled if feasible.

Tsay S et al. Approach to the Investigation and Management of Patients With Candida auris, an Emerging Multidrug-Resistant Yeast. Clin Infect Dis. 2018;66(2):306-11.

Prolonged Survival in environment



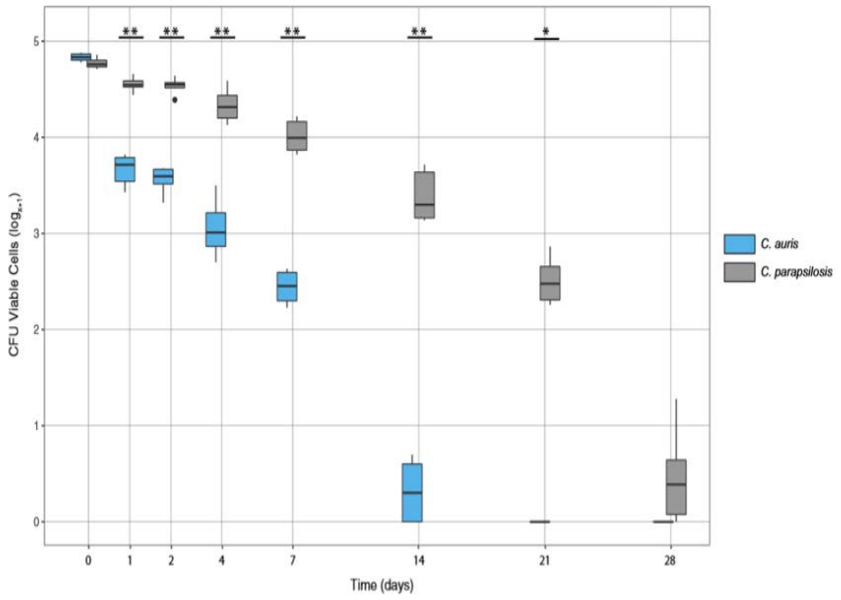


FIG 1 The log transformed recovery of viable *C. auris* (blue) and *C. parapsilosis* (gray) at each time point as determined by culture. The middle bar within each box represents the median; the top and bottom of the box represent the 75th and 25th quartiles, respectively, and dark circles represent outliers. A single asterisk indicates $P < 0.05$ and double asterisk indicates $P < 0.001$ between *C. auris* and *C. parapsilosis* for each time point.

C auris survived on moist or dry surfaces for 7 days
Exhibited a greater propensity to survive on surfaces than *C albicans*

C auris survive for at least 14 days on plastic surface

Piedrahita et al. Environmental Surfaces in Healthcare Facilities are a Potential Source for Transmission of Candida auris and Other Candida Species Infect Control Hosp Epidemiol 2017;38:1107–1109

Welsh et al. Survival, persistence and isolation of the emerging multidrug-resistant pathogenic yeast C auris on plastic healthcare surface J Clin Microb 55;2996-3005

Environmental Contamination

Table 2. Environmental contamination with *Candida auris* in healthcare facilities, New York, USA, 2013–2017*

Category, object or surface	No. samples	Positive by culture, no. (%)	Positive by PCR and negative by culture, no. (%)	Negative by culture and PCR, no. (%)
Near-patient surfaces and objects in rooms				
Bedside/over bed table	44	2 (5)	2 (5)	40 (91)
Bed rail	49	7 (14)	5 (10)	37 (76)
TV remote/call button	36	2 (6)	2 (6)	32 (89)
IV poles	21	5 (24)	1 (5)	15 (71)
Bed	17	4 (24)	0	13 (77)
Privacy curtain	6	2 (33)	0	4 (67)
Miscellaneous other†	5	0	1 (20)	4 (80)
Total	178	22 (12)	11 (6)	145 (82)
Other surfaces and objects in rooms				
Door knob/handle	36	1 (3)	1 (3)	34 (94)
Sink	27	1 (4)	2 (7)	24 (89)
Window	22	3 (14)	1 (5)	18 (82)
Floor	17	4 (24)	0	13 (77)
Furniture	27	3 (11)	0	24 (89)
Window curtain	11	3 (27)	0	8 (73)
Light switch	9	0	0	9 (100)
Closet	6	0	0	6 (100)
Wall	4	1 (25)	0	3 (75)
Bathroom	4	1 (25)	0	3 (75)
Countertop	4	1 (25)	0	3 (75)
Toilet	4	0	0	4 (100)
Miscellaneous other‡	16	2 (13)	0	14 (88)
Total	187	20 (21)	4 (2)	163 (87)
Equipment in room				
Ventilator/respiratory equipment	12	1 (8)	0	11 (92)
Pump	4	0	0	4 (100)
Miscellaneous other§	19	4 (21)	0	15 (79)
Total	35	5 (14)	0	30 (86)
Equipment outside of room				
Clean supply cart	51	1 (2)	0	50 (98)
Ventilator/respiratory equipment	45	1 (2)	0	44 (98)
Vital sign machine	21	3 (14)	1 (5)	17 (81)
Normothermia system (e.g., Bair hugger)	20	1 (5)	0	19 (95)
Computer workstation	20	0	0	20 (100)
Thermometer	14	1 (7)	1 (7)	12 (86)
PPE/isolation cart/box	12	1 (8)	1 (8)	10 (83)
Lift/scale	11	2 (18)	0	9 (82)
Glucometer	11	0	0	11 (100)
Housekeeping cart	9	0	1 (11)	8 (89)
Dialysis equipment	7	1 (14)	0	6 (86)
Suction canister	6	1 (17)	0	5 (83)
Ultrasonography equipment	4	0	0	4 (100)
Miscellaneous other¶	29	1 (3)	0	28 (97)
Total	260	13 (5)	4 (2)	243 (94)

*A total of 660 samples were collected from surfaces, objects, and equipment in the rooms of *C. auris* case-patients and from mobile equipment outside the rooms on the affected nursing units. In addition, 62 samples from surfaces within the nursing units but outside the patient rooms and 23 samples from outside the affected nursing units were negative by culture and PCR. The location of 36 samples could not be ascertained; 2 were positive by culture. PPE, personal protective equipment; TV, television.
†PCR positive from light cord.
‡Cultures positive from handrail and phone.
§Cultures positive from glucometers (n = 2), vital signs machine, and stretcher.
¶Culture positive from bedpan flusher.

* 62 / 781 (8%) of samples were positive (in 15/20 facilities)
* High yield items include iv poles, beds, privacy curtain, window curtains and floor

Eleanor Adams et al. *Candida auris* in Healthcare Facilities, New York, USA, 2013–2017 Emerg Infect Dis 2018; 24:1816
DOI: https://doi.org/10.3201/eid2410.180649

Table 1. *Candida auris*-positive Environmental Samples Collected From Colombian Medical Facilities

Hospital	Zone 1 (Positive/Total)	Zone 2 (Positive/Total)	Zone 3 (Positive/Total)	Zone 4 (Positive/Total)	Total
A	7/20	5/22	0/20	0/6	12/68 (18%)
B	0/28	0/23	0/15	0/41	0/107 (0)
C	0/12	1/10	1/7	0/30	2/59 (3%)
D	7/25	5/21	6/16	5/26	23/88 (26%)
Total	14/85 (16%)	11/76 (14%)	7/58 (12%)	5/103 (5%)	37/322 (11%)

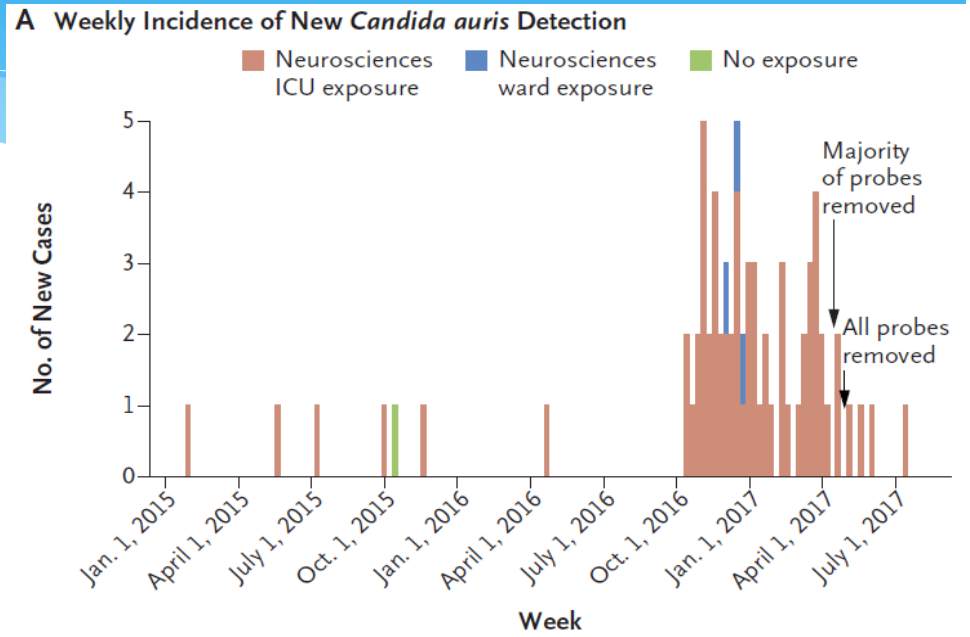
"Positive" indicates environmental samples from which *Candida auris* was isolated, and "total" indicates the number of samples collected.

Zone	Definitions	Examples of items
Zone 1	Patient bed and the adjacent environment, including floors and items in contact with the bed	bedrails, pillows, catheters
Zone 2	surfaces near zone 1 with infrequent patient contact but frequent healthcare worker contact	medical devices (eg, cardiac monitors, ventilators)
Zone 3	Surface with little to no patient contact and infrequent healthcare worker contact	windows, cabinets, floors further than the immediate vicinity of the patient bed
Zone 4	surfaces in a bathroom adjacent to the patient room hallway items	toilet and sink, stretchers, mobile storage cabinets, cleaning equipment

Patricia Escandon et al. Molecular Epidemiology of *Candida auris* in Colombia Reveals a Highly Related, Countrywide Colonization With Regional Patterns in Amphotericin B Resistance Clin Infect Dis 2019;68(1):15–21

Contamination of Equipment

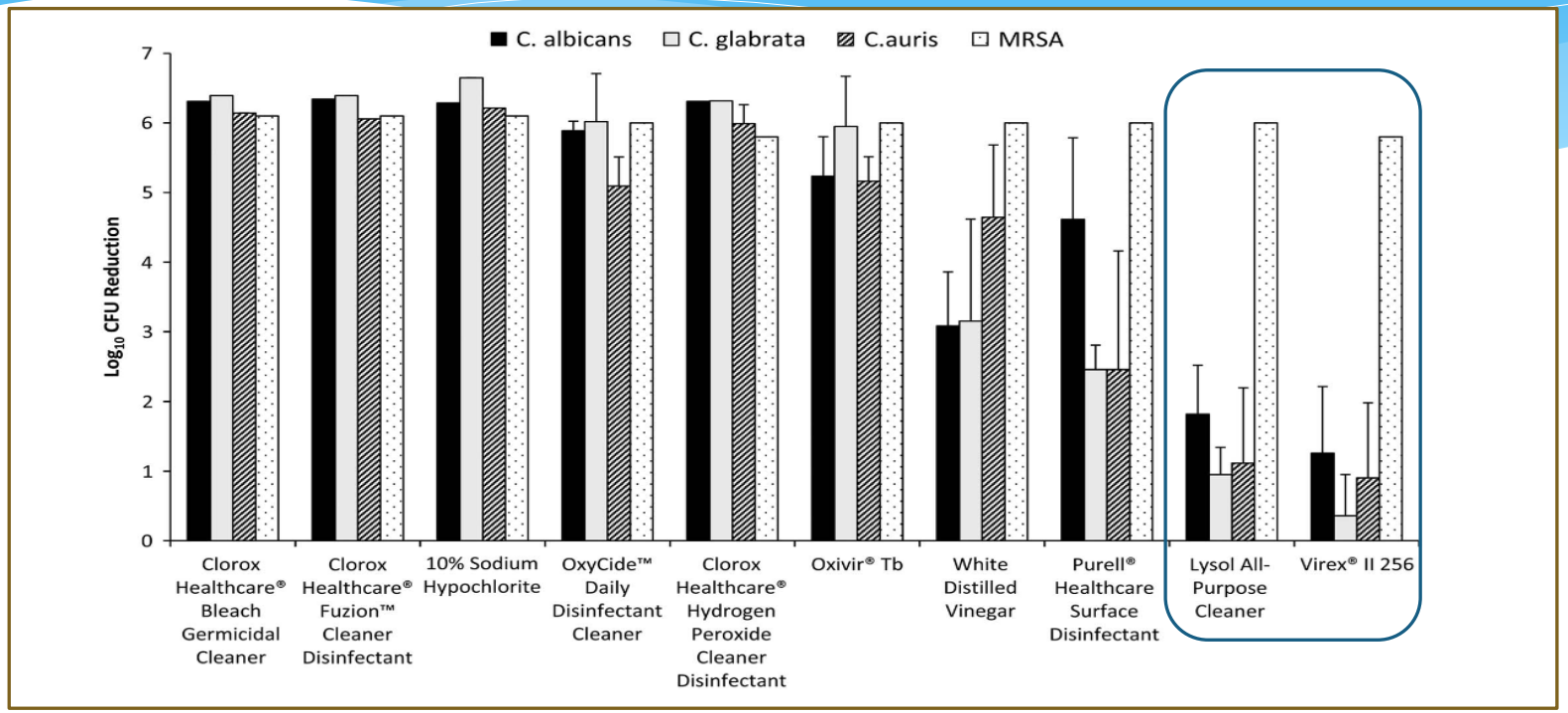
- Single center outbreak in Neuro ICU involving 70 patients over 2 years
- C *auris* rarely detected in general environment but found in temp probe, a pulse oximeter and a patient hoist
- Transmission attributable to the use of axillary temperature probe (OR 6.8 p<0.001)
- New cases was reduced only after removal of probes



Skin surface temperature probe

David W. Eyre etal. A *Candida auris* Outbreak and Its Control in an Intensive Care Setting N Engl J Med 2018;379:1322-31. DOI: 10.1056/NEJMoa1714373

Effectiveness of disinfectants against Candida auris



Sodium hypochlorite, peracetic acid and hydrogen peroxide are effective
2 QACS disinfectants are ineffective

Cadnum, J. L.et al. (2017b). Effectiveness of disinfectants against Candida auris and other Candida species. Infect. Control Hosp. Epidemiol. 38, 1240–1243

Effectiveness of surface disinfectants

Effective

* Chlorine ≥1000 ppm
* hydrogen peroxide 1.4%
* Alcohols
* Peracetic acid

Ineffective:

* Quaternary ammonium compounds

TABLE 2 | Surface disinfectants tested against *C. auris*.

Disinfectant	Concentrations tested (contact time in minutes)	Effective	Level of evidence	Comments	Reference
Chlorine	0.39% (1), 0.65% (1), 0.825% (1), 1% (10), 2% (10), 1000 ppm (3, 5, 180, 1800), 10000 ppm (3, 180, 1800)	Yes	Good	Most extensively studied. Can cause ocular irritation, or oropharyngeal, esophageal, and gastric burns. Can corrode metals at concentrations > 500 ppm.	Abdolrasouli et al., 2017; Biswal et al., 2017; Cadnum et al., 2017b; Moore et al., 2017
Hydrogen peroxide	8 g/m^3 (?), 1.4% (1)	Yes	Moderate		Abdolrasouli et al., 2017; Cadnum et al., 2017b
Hydrogen peroxide+silver nitrate	11% (60)	Yes	Low		Biswal et al., 2017
Phenolics	5% (?)	Yes	Low	Not FDA-approved for use as high-level disinfectant but can be used to preclean before terminal sterilization.	Biswal et al., 2017
Glutaraldehyde	2% (20)	Yes	Low	Expensive and toxic. Should be used for medical equipment cleaning.	Biswal et al., 2017
Alcohols	29.4% (0.5)	Yes	Low	Difficult to achieve prolonged contact time due to rapid evaporation. Flammable. May harden rubber and certain plastic tubing after prolonged and repeated use.	Cadnum et al., 2017b
Acetic acid	>5% (3)	No	Low		Cadnum et al., 2017b
Peracetic acid	2000 ppm (5, 10)	Yes	Low	For medical equipment cleaning. Can corrode certain metals.	Kean et al., 2018
Peracetic acid+hydrogen peroxide+acetic acid	1200 ppm/<1% (3)	Yes	Low		Cadnum et al., 2017b
Quaternary ammonium compounds	2% didecyldimethyl ammonium chloride (60), alkyl dimethyl ammonium chlorides (10), didecyldimethyl ammonium chloride/dimethylbenzyl ammonium chloride (10)	No	Low		Biswal et al., 2017; Cadnum et al., 2017b

Tsun et al. Candida auris: disinfectants and implications for infection control. Frontiers in Microbiology 2018;vol 9 p.726

Effectiveness of UV-C on C auris

Methods:

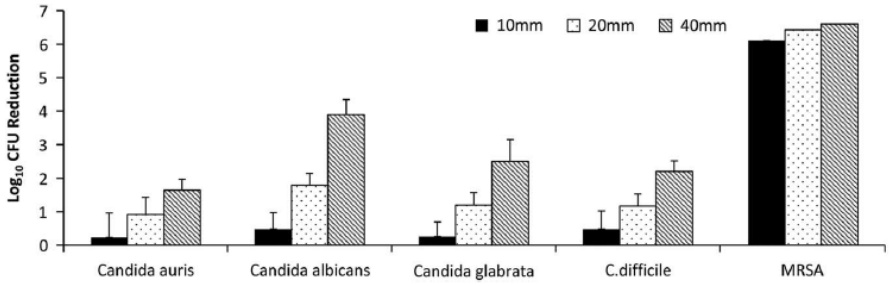
- UVC (Optimum) used at 5 ft for specified time; 10^6 CFU with 5% FCS applied to stainless-steel carriers

Results:

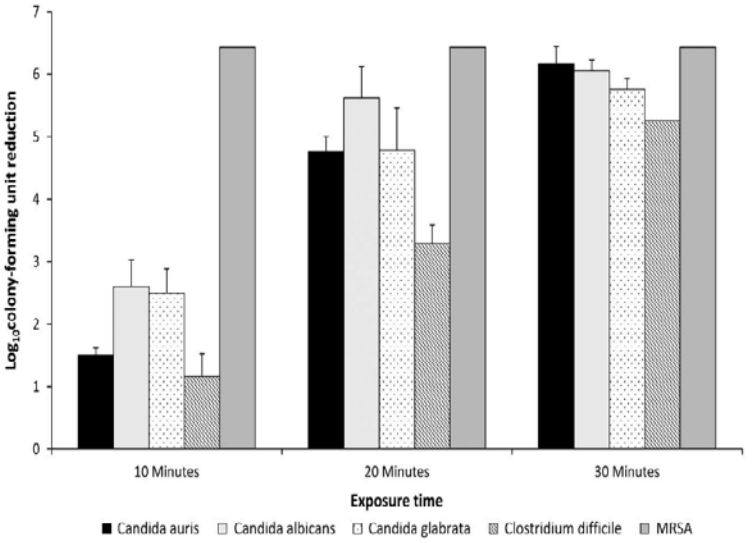
- *C. auris* less susceptible to UVC than other *Candida* spp.

Conclusion:

- Use *C. difficile* cycle time to inactivate *C. auris*



Exposure to UVC at 5 feet for 10 min



Exposure to 20mm disc at 5 feet

Cadnum JL et al. Relative resistance of the emerging fungal pathogen Candida auris and other Candida species to killing by ultraviolet light. Infect. Control Hosp. Epidemiol. 2018 39, 94–96. doi:10.1017/ice.2017.239

Environmental disinfection Guidelines

TABLE 1 | Recommendations from major world health organizations for infection control of *Candida auris*.

Health Organization	Environmental disinfection	Decolonization procedure	Hand hygiene procedure
Centers for Disease Control and Prevention	Daily and terminal cleaning with use of an EPA-registered hospital-grade disinfectant effective against *C. difficile* spores.	No recommendations.	Use alcohol-based hand sanitizer or hand washing with soap and water, before and after donning gloves.
Public Health England	Terminal cleaning with use of a hypochlorite at 1000 ppm. Equipment should be cleaned according to manufacturer's instructions.	No recommendations.	Hand washing with soap and water followed by alcohol-based hand sanitizer on dried hands, before and after donning gloves.
European Centre for Disease Prevention and Control	Terminal cleaning with disinfectants with certified antifungal activity.	No recommendations.	No recommendations.
Centre for Opportunistic, Tropical and Hospital Infections (South Africa)	Regular and terminal cleaning with chlorine-releasing agent at 1000 ppm. Consider hydrogen peroxide vapor in terminal cleaning, if feasible.	Not recommended due to limited evidence.	Hand washing with soap and water, especially with soiling, followed use of alcohol-based hand sanitizer.
Pan American Health Organization/World Health Organization	Daily and terminal cleaning with soap and water followed by 0.1% bleach. Clean, disinfect, or sterilize equipment and appliances as per the type of material, after use by the patient. Machine wash linens and clothes.	No recommendations.	No recommendations.

Tsun et al. Candida auris: disinfectants and implications for infection control. Frontiers in Microbiology 2018;vol 9 p.726

Nosocomial outbreak in Indian ICU

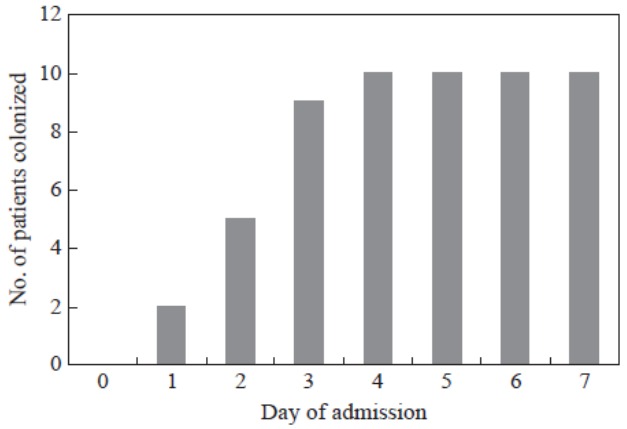


Figure 3. Time to *Candida auris* acquisition after intensive care unit admission.

Table I
Contamination of *Candida auris* on environmental samples and carriage on healthcare workers' hands

Samples	MICU	CCU	Trauma ICU	NSW
Environmental				
No. of samples	68	10	189	37
C. auris-positive samples	7	0	17	0
Handwash samples (HCWs)				
No. of samples	41	13	79	12
C. auris-positive samples	2	0	2	0

MICU, medical intensive care unit; CCU, cardiac care unit; ICU, intensive care unit; NSW, neurosurgical ward; HCW, healthcare worker.

24/305 (7.9%) environmental samples positive
Bed, ventilators, temperature probe and ECG leads

Table II
Colonization rate by *Candida auris* of different body sites

Site	Oral	Rectal	Axilla	Groin
Trauma ICU				
No. of samples	89	83	158	168
Growth of *C. auris*	4 (4.4%)	15 (18%)	62 (39.2%)	34 (20.2%)
MICU				
No. of samples	38	35	38	38
Growth of *C. auris*	6 (15.7%)	3 (8.5%)	10 (26.3%)	2 (5.2%)
Total	10/95 (10.5%)	18/118 (15.2%)	72/196 (36.7%)	36/206 (17.4%)

ICU, intensive care unit; MICU, medical intensive care unit.

M. Biswal et al. Controlling a possible outbreak of Candida auris infection: lessons learnt from multiple interventions J Hosp Infect 97 (2017) 363-370

Schelenz *et al. Antimicrobial Resistance and Infection Control* (2016) 5:35
DOI 10.1186/s13756-016-0132-5

Antimicrobial Resistance and Infection Control

RESEARCH Open Access

First hospital outbreak of the globally emerging *Candida auris* in a European hospital

Silke Schelenz[1,3*], Ferry Hagen[2], Johanna L. Rhodes[3], Alireza Abdolrasouli[3], Anuradha Chowdhary[4], Anne Hall[1], Lisa Ryan[1], Joanne Shackleton[1], Richard Trimlett[5], Jacques F. Meis[2,6], Darius Armstrong-James[1,3] and Matthew C. Fisher[3]

C auris outbreak in RBH

* 20 beds Cardiothoracic ICU
* 50 patients involve from Apr 15 –Jul 16
* 44 % (n = 22/50) of patients with possible or proven infection, 18 % (n = 9/50) with Candidemia
* contamination of the floor, trollies, radiators, windowsills, equipment, monitors, key pads and also one air sample
* cleaning / disinfection using sodium hypochlorite products 3 times per day and hydrogen peroxide vapour terminal disinfection

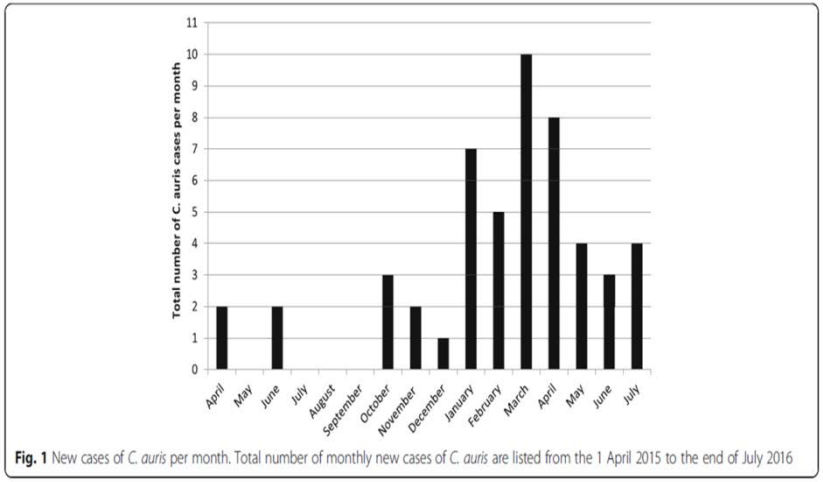


Fig. 1 New cases of *C. auris* per month. Total number of monthly new cases of *C. auris* are listed from the 1 April 2015 to the end of July 2016

Table 1 Clinical manifestations of *C. auris* in patients

Clinical manifestation of *C. auris* cases	Percent (total number)
Colonization only	56 % (*n* = 28/50)
Candidaemia episodes (one patient had two episodes)	18 % (*n* = 9/50)
Possible sternal wound infection (culture positive and clinical signs of infection)	6.3 % (*n* = 3/50)
Possible urinary catheter infection (culture positive before and after catheter change and response to antifungal treatment)	2 % (*n* = 1/50)
Possible vascular line tip infection (positive line tip culture treated empirically with antifungal agent)	14 % (*n* = 7/50)
Presumed invasive candidiasis of unknown focus of infection	4 % (*n* = 2*/50)

*one patient had a raised BDG of 303 pg/mL (normal range <60 pg/mL)

S Schelenz et al. First hospital outbreak of globally emerging Candida auris in a European hospital Antimicrob Resist and Infect Control 2016;5:35

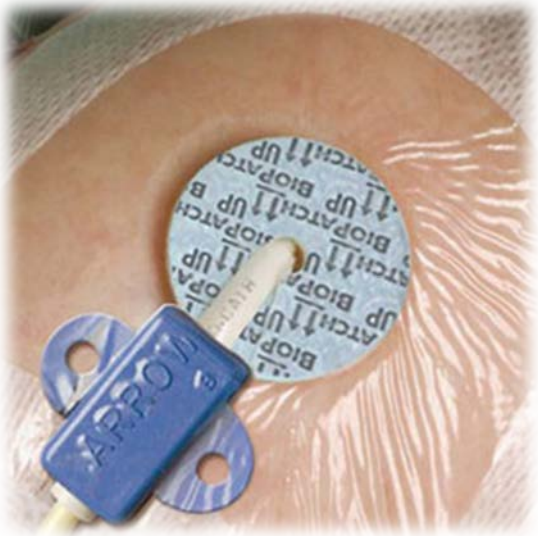
Outbreak control measures

* Close contact were screened: nose, axilla, groin, throat, rectum or faeces, CVC exit sites as well as urine, wounds, drains and respiratory specimens
* de-isolated after three consecutive negative screens and screened weekly thereafter until discharge. The latter was introduced as one patient became positive after three consecutive negative screens
* Only one out of 258 HCW screened C. auris positive nose swab who was successfully decolonized with chlorhexidine washes, nasal ointment and oral nystatin for 5 d (Staff reported a skin allergy to alcohol gel)

S Schelenz et al. First hospital outbreak of globally emerging Candida auris in a European hospital Antimicrob Resist and Infect Control 2016;5:35

Decolonization

* Patients were prescribed twice daily 2% chlorhexidine wipes or aqueous 4% chlorhexidine formulation
* Mouthwashing with 0.2% chlorhexidine or oral nystatin for those with oropharyngeal colonization
* Use of chlorhexidine impregnated patch at CVC exit site (BioPatch)



Public Health England

Protecting and improving the nation's health

Guidance for the laboratory investigation, management and infection prevention and control for cases of *Candida auris*

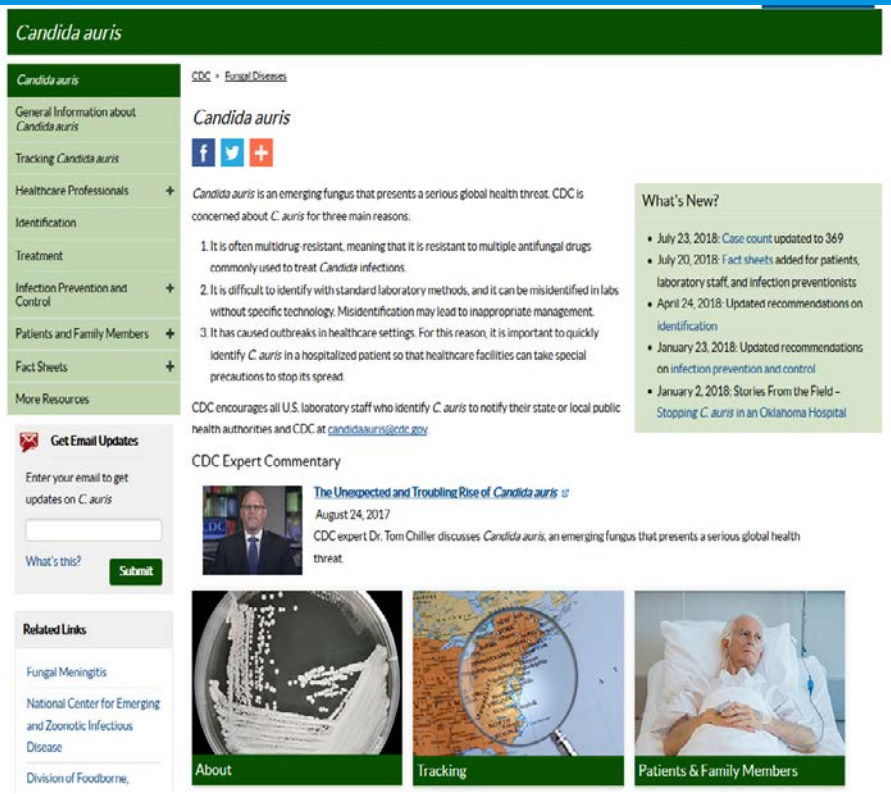
August 2017 v2.0

ecdc
EUROPEAN CENTRE FOR DISEASE PREVENTION AND CONTROL

RAPID RISK ASSESSMENT

Candida auris in healthcare settings – Europe

First update, 23 April 2018



Pan American Health Organization
World Health Organization
Americas

Epidemiological Alert

Candida auris outbreaks in health care services

3 October 2016

In light of reports of outbreaks of Candida *auris* associated with health care services in Latin America, the Pan American Health Organization / World Health Organization (PAHO / WHO) recommends Member States to establish the capacity for early detection and notification in order to enable the implementation of appropriate measures to prevent and control spread in communities and in health care services in the Americas.

Active surveillance screening in HA Hospitals

* patients who had history of hospitalization outside Hong Kong in the last 12 months AND currently admitted to high risk units, including **intensive care units, clinical oncology wards, hematology wards and bone marrow units**
* patients who have history of hospitalization in local hospital with ongoing outbreak
* Apply preemptive contact precautions until one set of screening is negative

CCIDER Guideline on Infection Control of C auris Jul 2019

Enhanced Laboratory diagnosis

* All *Candida* isolates obtained from a normally sterile site (e.g., bloodstream, cerebrospinal fluid) should be identified to the species level
* Speciate all Candida isolates from intensive care units
* If a case of *C auris* is identified, the hospital is advised to speciate all candida isolates from the affected ward for the subsequent four weeks

Starting from 12 Jul 2019, yeasts from all clinical specimens are identified down to species level for all HA hospitals as an interim precautionary measures

CCIDER Guideline on Infection Control of C auris Jul 2019

Infection control measures

* Single room isolation with contact precautions and designated equipment
* Adhere to **hand hygiene** stringently
* Environment should be disinfected at least twice daily using **1000ppm sodium hypochlorite solution**
* Use of disposable wipe preferred

CCIDER Guideline on Infection Control of C auris Jul 2019

Patient care equipment

* Dedicated non-critical equipment e.g. stethoscopes, blood pressure cuff
* If items must be shared, they should be properly disinfected after each patient use using 1000 ppm sodium hypochlorite solution
* Particular attention should be paid to cleaning of reusable equipment (e.g. pulse oximeters, thermometer probes, computers on wheels, ultrasound machines) from the bed space of an infected or colonized patient

Catheter care bundles

* strict adherence to central and peripheral catheter care bundles, urinary catheter care bundle and care of the tracheostomy site
* prompt removal of venous cannulas if there is any sign of infection
* high standards of aseptic technique when undertaking wound care

Public Health England (PHE). Guidance for the laboratory investigation, management and infection prevention and control for cases of *Candida auris.* August 2017 v2.0.

Terminal Disinfection

* Clean and disinfect the surfaces, **floor** and wall by 1,000 ppm sodium hypochlorite solution.
* Terminal room disinfection with hydrogen peroxide vapour or UVC room disinfector could also be considered
* Consider to discarding less expensive items that are difficult to decontaminate, or using single-patient use devices such as blood pressure cuffs
* Stocks of single use items in the immediate patient environment should be discarded

CCIDER Guideline on Infection Control of C auris Jul 2019

Screening of close contacts

* Screening should be performed in patients who shared the same room or **cubicle** as the infected or colonized patient within the **past one month**
* Screening should be **extended to whole ward in outbreak** situation
* Use a **pooled swab** of the patient's **nasal, axilla and groin**
* Apply empirical contact precautions until **three consecutive screens at least 24 hours apart** are negative

CCIDER Guideline on Infection Control of C auris Jul 2019

Discontinuation of isolation

* Discontinuation of isolation may be considered if there are two sets of negative screening cultures at least one week apart
* Screening sites include nasal, axilla and groin and previous positive culture sites e.g. urine, sputum
* The patient should not be on antifungal medication active against *C auris* for past one week and topical antiseptic e.g. chlorhexidine for past 48 hours
* Periodic screening e.g. weekly during the same hospital stay should be performed after isolated is discontinued
* Rescreening should be performed upon subsequent admission to determine the colonization status

CCIDER Guideline on Infection Control of C auris Jul 2019

Decolonization

* There are currently no data on the efficacy of decolonization for patients with *C. auris*, such as the use of chlorhexidine or topical antifungals
* Use of skin decontamination with chlorhexidine, mouth gargles with chlorhexidine, targeted topical management e.g. topical nystatin, chlorhexidine impregnated dressing at catheter exit sites may be considered in outbreak situation as advised by infection control team

CCIDER Guideline on Infection Control of C auris Jul 2019

Discharge and transfer

* When patients are transferred to other healthcare facilities, receiving facilities should be notified
* For confirmed cases discharged back to RCHE or RCHD, hospital ICT should notify ICB for assessment prior to discharge

出院須知

帶有耳念珠菌的患者對家人、同事或公眾的健康不會構成危險，因此無須在家中隔離，可參與正常社交生活，但仍須注意下列事項：

1. 保持良好的個人衛生，例如每天洗澡及更換衣服。衣服可與其他衣物按慣常方法一起清洗。
2. 注意手部衛生：經常用清水及稠液徹底清潔雙手，或用酒精搓手液揉搓雙手。
3. 傷口應用敷料妥善包紮，並於處理傷口前後清潔雙手。
4. 避免與別人共用個人物品，如毛巾、牙刷、剃鬚刀及衣物等。餐具可按慣常方法清洗。
5. 避免徒手直接接觸傷口、造口、引流或任何被身體分泌物污染之物件。如有需要，應先戴上手套，並於處理完畢後清潔雙手。
6. 保持環境衛生和物品清潔。例如可用 1 比 49 稀釋家用漂白水(即把 1 份 5.25% 漂白水與 49 份清水混和)定期消毒家具及環境設施。
7. 如出現感染徵狀，應立即找醫生診治。
8. 跟從醫生處方，正確使用抗生素 / 抗真菌素。

給病人及家屬指引

耳念珠菌

醫院管理局 HOSPITAL AUTHORITY

總感染控制主任辦事處

2019年6月

CMS alert and reporting

* Notify Centre for Health Protection (CHP) & CICO Office when *C. auris* is identified from clinical specimen of **one or more patients**
* Hospital ICT should tag *C. auris* cases in the on CMS alert as well as MDRO tagging system
* For discharged close contacts, CMS tagging should be done to remind the ward to perform screening and empirical contact precautions upon readmission. This tagging could be removed when patient has three consecutive negative screens or the patient is not readmitted for one year

Summary

Role of infected / colonized patients

* Propensity to colonized in skin >> GI tract
* Prolonged colonization for months
* Effective decolonization regime not available

Role of environment and equipment

* Prolonged survival in both dry and moist surface
* Relative resistance to surface disinfectant
* Up to 10% of environmental samples positive in some outbreak reports

Role of healthcare workers

* Colonization of healthcare workers are uncommon
* Transient hand carriage demonstrated → hand hygiene is prudent

Active surveillance screening for high risk patients and
enhanced laboratory surveillance are currently
the key measures to prevent transmission of C auris in Hong Kong