EMERGING PATHOGENS: ENVIRONMENTAL SURVIVAL AND TRANSMISSION, GERMICIDAL ACTIVITY AND CONTROL MEASURES

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Disclosures: Consultant to Germitec, PDI, Merck, Pfizer

TOPICS TO BE DISCUSSED: EMERGING PATHOGENS REVIEWED

- Topics
  - Key information on each pathogen for the Infection Preventionist
  - Environmental transmission and survival
  - Susceptibility of each pathogen to antiseptics and disinfectants
- Viruses: Ebola, MERS CoV
- Bacteria: Carbapenemase-producting *Enterobacteriaceae* (CRE)
- Fungi: *Candida auris*

Decreasing Order of Resistance of Microorganisms to Disinfectants/Sterilants

Most Resistant



Most Susceptible

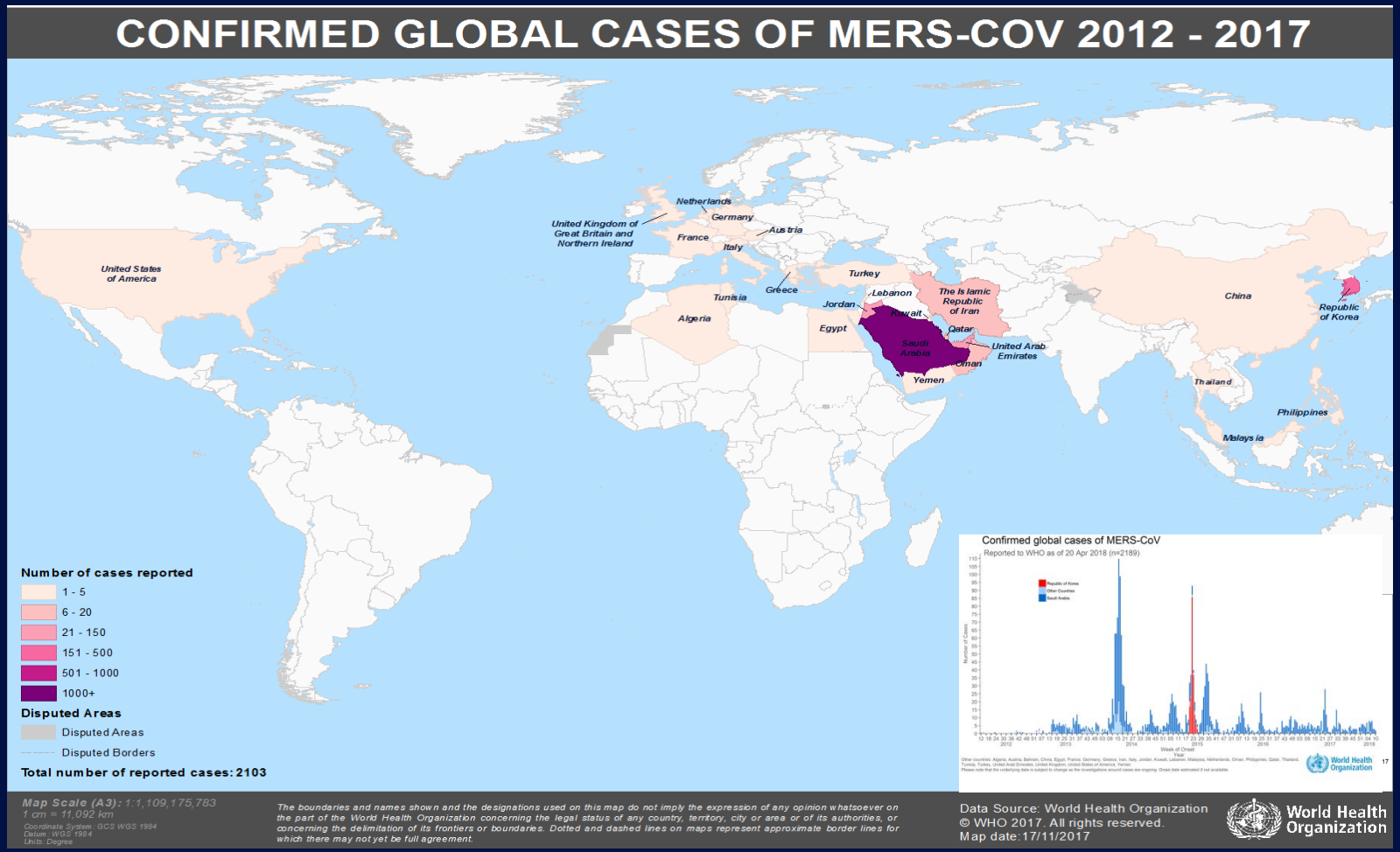
Prions
Bacterial spores (*C. difficile*)
Protozoal oocysts
Helminth eggs
Mycobacteria
Small, non-enveloped viruses (norovirus)
Protozoal cysts
Fungal spores
Gram-negative bacilli (CRE)
Vegetative fungi and algae (*Candida*)
Large, non-enveloped viruses
Gram-positive bacteria (MRSA, VRE)
Enveloped viruses (MERS-CoV)

MERS-CoV: HISTORY

- Microbiology
  - MERS is a viral respiratory disease caused by a novel coronavirus, identified 2012
  - Reservoir: Dromedary camels
- Epidemiology
  - As of April 2018, a total of 2,206 lab-confirmed cases of MERS had been reported globally from 27 countries; majority of cases from Saudi Arabia (1,831) ; 2 imported cases in US in May 2014
  - Case-fatality rate: 35.8% (deaths = 787)
  - Number of hospital-acquired cases has dropped significantly since 2015 (due to improved infection control and prevention)
  - No differences in demographic and epidemiological characteristics of recent cases
  - No sustained human-to-human transmission; however, limited non-sustained human-to-human transmission in health care facilities
  - Outbreaks in Saudi Arabia, UAE, and Korea

http://www.who.int/emergencies/mers-cov/en/

OUTBREAK CURVE AND COUNTRIES INVOLVED, MERS-CoV, WHO



MERS-CoV: INFECTION PREVENTION ISSUES

- Pathogen: Family *Coronaviridae* (RNA virus, enveloped)
- Endemic location: Middle East (reservoir: camels, bats)
- Transmission: Person-to-person (superspreaders); direct, indirect?*, airborne?*
- Incubation period: ~ 5 days (range, 2-15 days)
- Infectivity (rho): 0.3-1.3 (infectious period, 1-11 days of illness)
- Biosafety level: 3
- Isolation: Contact, airborne (N95 plus eye protection)
- Hospital outbreaks: Well described (HCP at high risk)
- Environmental control^: Standard cleaning and disinfection procedures using an EPA-registered disinfectant (use product with MERS-CoV or coronavirus label claim)

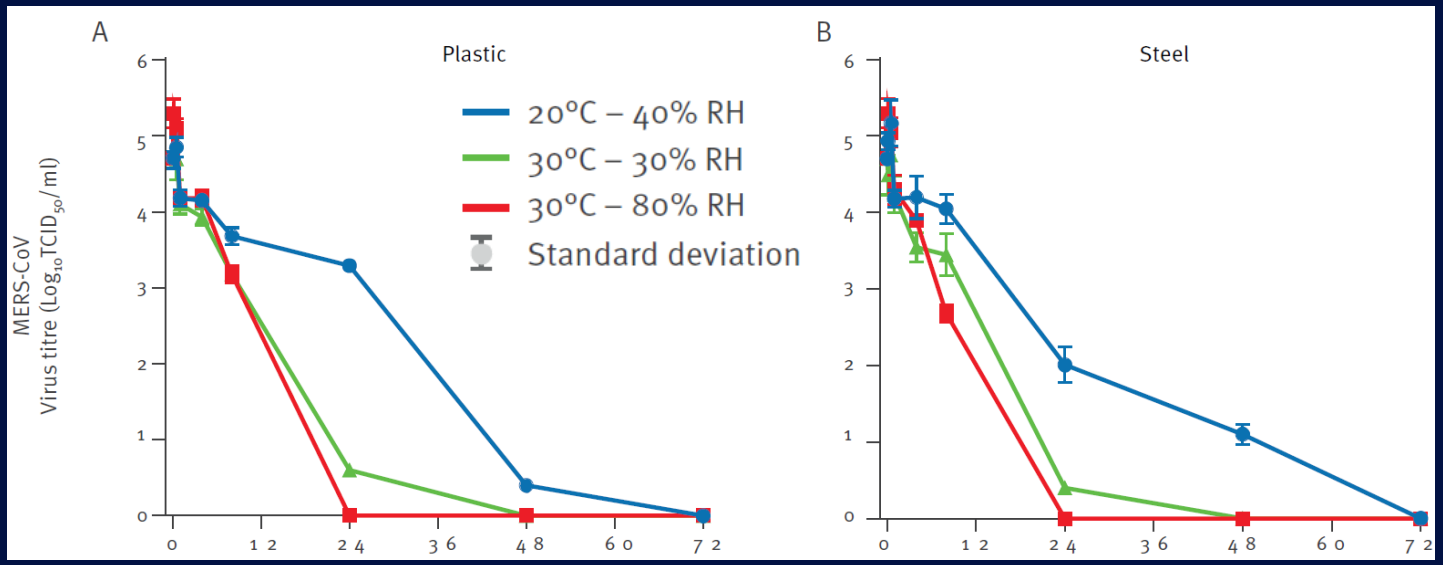
Weber DJ, et al. AJIC 2016;44:e91-e100

^https://www.cdc.gov/coronavirus/mers/infection-prevention-control.html

*Provides evidence for transmission via environment/air; Majumder M, et al. Trans R Soc Trop Med Hyg 2017;111:261-269

MERS-CoV: ENVIRONMENTAL SURVIVAL

- Goal: Assess stability of MERS-CoV on surfaces
- Results:
  - Plastic, 20ºC, 40% RH; $t_{½}$ = 0.95 hrs: steel, 20ºC, 40% RH; t½ = 0.94 hrs
  - MERS-CoV was more stable at low temperature/low humidity conditions and could still be recovered after 48 hours. During aerosolization of MERS-CoV, no decrease in stability was observed at 20°C – 40% RH.



van Doremalen N, et al. Eurosurveillance 2013l18L20590

MERS-CoV: ENVIRONMENTAL CONTAMINATION (KOREA)

Swab Site	PCR Results (Positivity Percent, %)	Culture Results (Positivity Percent, %)
Bed sheet	3/15 (20.0)	1/15 (6.7)
Bedrails	4/15 (26.7)	1/15 (6.7)
Bed tables	2/5 (40.0)	0/5 (0.0)
Bed controllers	5/15 (33.3)	0/15 (0.0)
Shelves	0/14 (0.0)	0/14 (0.0)
Door buttons	1/10 (10.0)	0/10 (0.0)
Bathroom door knobs	1/10 (10.0)	0/10 (0.0)
Patient room floor	0/7 (0.0)	0/7 (0.0)
Patient monitor buttons	0/5 (0.0)	0/5 (0.0)
Thermometers	1/5 (20.0)	0/5 (0.0)
IV fluid hangers	5/14 (35.7)	2/14 (14.3)
Portable X-rays	1/5 (20.0)	0/5 (0.0)
Computed radiography cassette	1/1 (100.0)	1/1 (100.0)
Anteroom floors	2/14 (14.3)	0/14 (0.0)
Anteroom tables	3/7 (42.8)	1/7 (14.3)
Entrances of air-ventilating equipment	1/6 (16.7)	0/6 (0.0)

Bin SY, et al. Clin Infect Dis 2016;62:755-60.

Patient Data	Environmental Data		
MERS-CoV PCR Results	Environmental Sampling	RT-PCR From Samples	RT-PCR From Viral Culture
(+) at the time of sampling	Air sampling[b]	2/2	1/2
	Fomites swab	4/6	2/6
	Fixed-structure swab	7/13	2/13
(+) at the time of sampling	Air sampling[b]	2/2	2/2
	Fomites swab	4/4	3/4
	Fixed-structure swab	12/12	5/12
	Fixed-structure swab	1/5	0/5
(–) at the time of sampling	Air sampling[d]	3/3[c]	1/3
	Fomites swab	5/6	2/6
	Fixed-structure swab	8/17	0/17
	Fixed-structure swab	1/5	1/5

Dim S-H, et al. Clin Infect Dis 2016l63L363-9

EFFICACY ANTISEPTICS AND DISINFECTANTS AGAINST HCoV 229E

Antiseptic/ Disinfectant	Concentration (%)	HCoV 229E	Type B-Coxsackievirus	Type 5-Adenovirus
Sodium hypochlorite	0.01	No	No	No
	0.10	Yes	No	No
	0.50	Yes	Yes	Yes
Povidone-iodine	10 (1% available iodine)	Yes	No	No
Ethanol	70	Yes	No	Yes
N-alkyl-dimethybenzyl chloride	0.04	No	No	No
Chlorhexidine gluconate	0.05	Yes	No	Yes

Efficacy validated if reduction in viral titers $\geq$3-$\log_{10}$ after 1 min contact time
Efficacy of phenolics varied depending on agent and additives

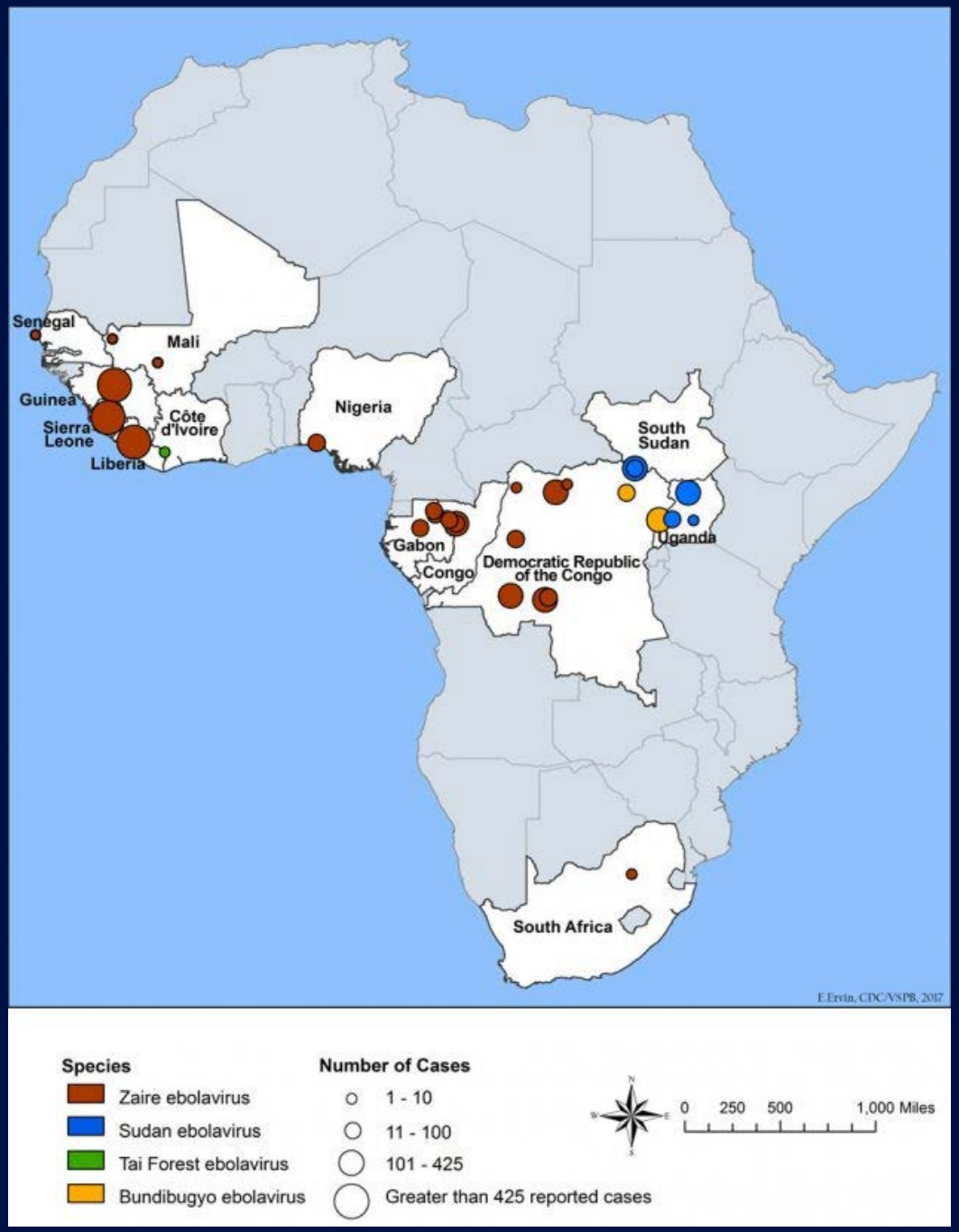
Geller C, et al. Viruses 2012;4:3044-3068.

EBOLA VIRUS DISEASE (EBV): HISTORY

- Microbiology
  - EBV is a hemorrhagic severe systemic disease first reported from DRC in 1976
  - Reservoir: African fruit bats?
- Epidemiology
  - Multiple outbreaks since 1976 in Africa; largest 2014-16 in West Africa with >28,600 cases (~800 HCP infected)
  - Ongoing outbreak in DRC (town, Bikoro)
  - Case-fatality rate: ~50% (range, 25% to 90%)
  - Transmission: Only while index case is symptomatic; no transmission via food (except bushmeat) or insects
    - Ebola virus can persist in certain body fluids after recovery: semen, breast milk, ocular fluid, and CSF

http://www.who.int/emergencies/mers-cov/en/

EBOLA VIRUS DISEASE DISTRIBUTION MAP: CASES OF EBV IN AFRICA SINCE 1976



https://www.cdc.gov/vhf/ebola/history/distribution-map.html

INFECTION PREVENTION ISSUES

- Pathogen: Family *Filovirdae* (RNA virus, enveloped)
- Endemic location: West and Central Africa (reservoir: bats?)
- Transmission :Person-to-person, direct (blood or body fluids) and indirect (contaminated needles/syringes); sexual (semen); zoonotic (nonhuman primates, bats)
- Incubation period: 6-12 (range, 2-21)
- Infectivity (rho): 1.5-2.0 (infectious period; 6-12 days, range 2-21)
- Biosafety level: 4
- Isolation: Contact (full body protection, no exposed surfaces), N95, eye protection
- Hospital outbreaks: Well described (HCP at high risk)
- Environmental control: Dedicated (preferably) disposable equipment (sterilize reusable equipment), use EPA disinfectant with non-enveloped virus claim

Weber DJ, et al. AJIC 2016;44:e91-e100

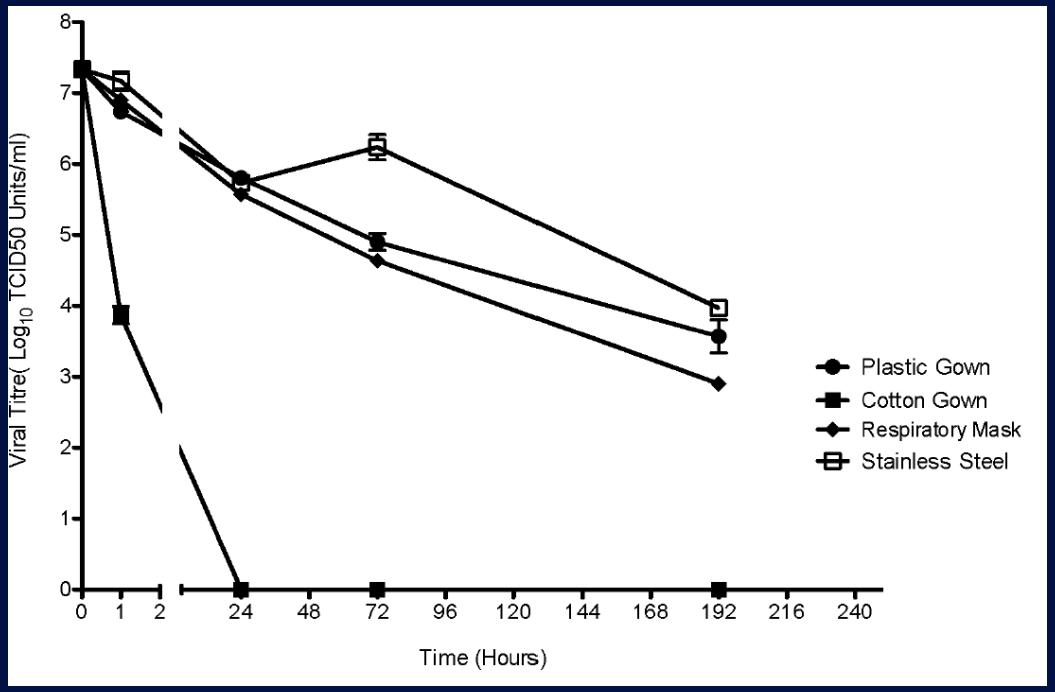
ENVIRONMENTAL CONTAMINATION, EBOLA TREATMENT CENTER, SIERRA LEONE, DETECTION OF RNA

Swab Location	Positive swab samples/Total
Patient personal effects	1/5
Patient clothing	2/5
Patient blanket	1/3
Patient's mattress	4/8
Floor with body fluids next to patient	1/4
Floor with no visible contamination next to patient	1/8
Head of bed rail	2/8
Biological waste buckets	2/4
IV bags and tubing	1/5
Urine catheter bag assembly	2/5

Sites negative for Ebola: Patient food/water, towel , toys; foot of bed rail, curtains, chairs; all general ward surfaces

Poliquin P, et al. JID 2016;214(S3):S145-52

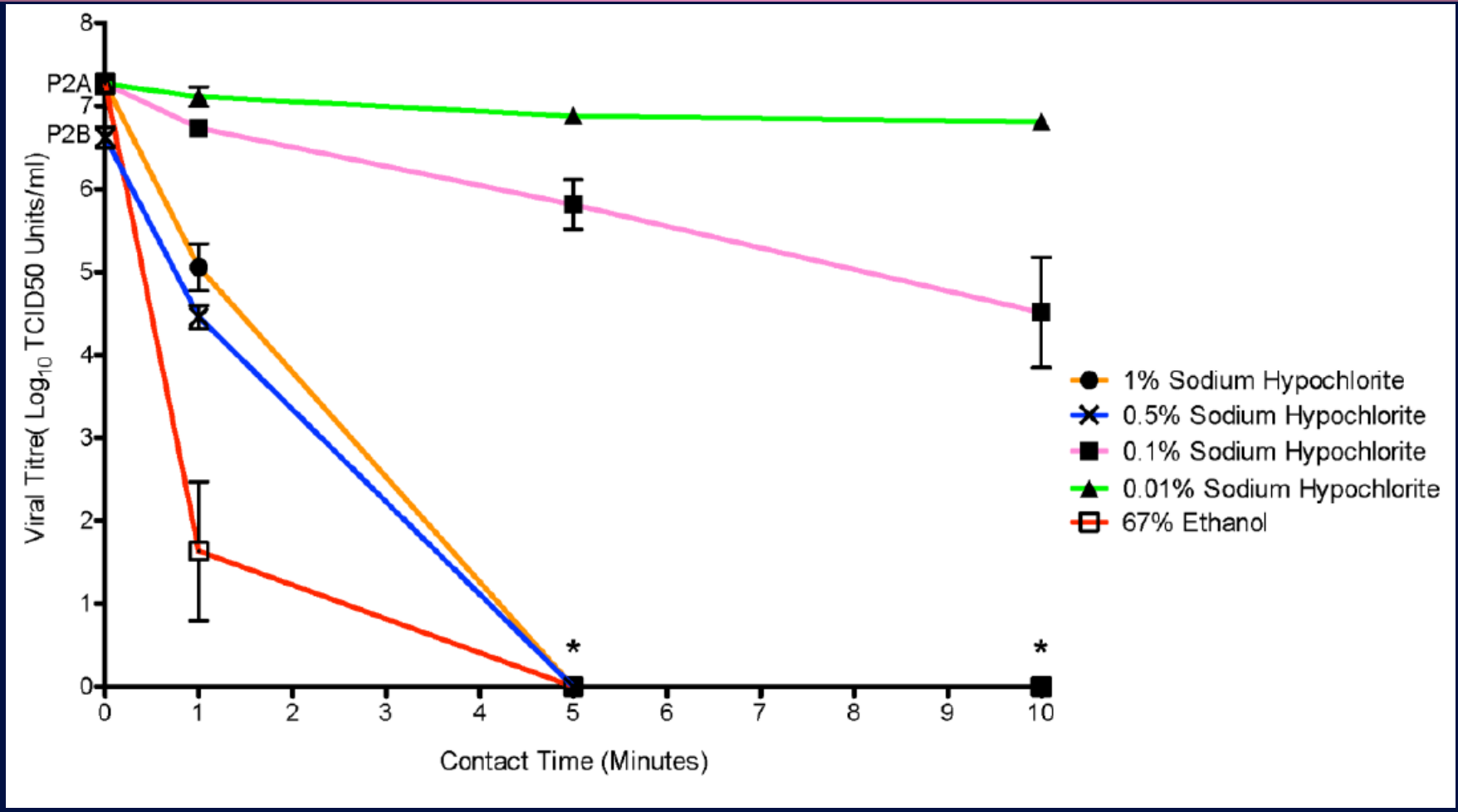
SURVIVAL OF EBOLA VIRUS (Makona varient)



Cook BW, et al
Viruses 2015;7:1975-1986

Tested Surface	Decay Constant (κ)/1 Hour	Decay Constant (κ)/24 Hours	R^2	One-Log Reduction ($TCID_{50}$/mL)	Time (Hours)	Four-Log Reduction ($TCID_{50}$/mL)	Time (Hours)
Plastic Gown	0.0117	0.28	0.96	6.3	24	3.3	285
Cotton Gown	0.6395	15.35	0.99	6.3	0.24	3.3	1.24
Stainless Steel	0.0091	0.22	0.90	6.3	30	3.3	365
Respiratory Mask	0.0113	0.27	0.97	6.3	20	3.3	147

SUSCEPTIBILITY OF EBOLA VIRUS TO ANTISEPTICS AND DISINFECTANTS



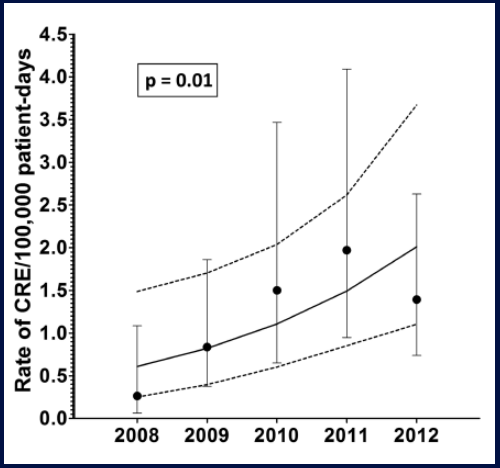
Cook BW, et al Viruses 2015;7:1975-1986

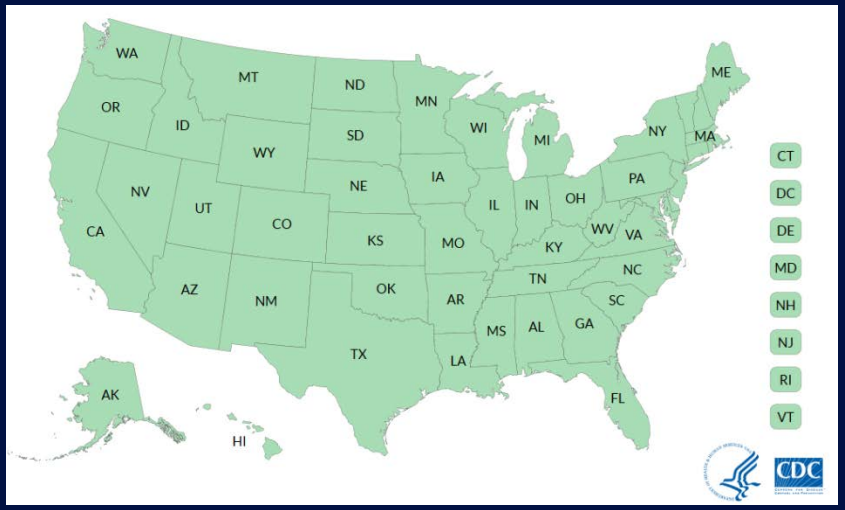
CRE: INFECTION PREVENTION

- Definition (CDC): Carbapenem-resistant *Enterobacteriaceae* (CRE) are resistant to imipenem, meropenem, doripenem, or ertapenem OR documentation that the isolate possess a carbapenemase.
  - This is a phenotypic definition (i.e., based on the antibiotic susceptibility pattern of the organism) and it includes bacteria that are not susceptible to carbapenems via more than one type of mechanism including enzymatic destruction of antibiotics and alterations in the bacteria's cell membrane (e.g., porin mutations)
- Associated with antibiotic failures and higher mortality rate
- Control: Contact isolation; Prevalence surveys for colonization may be indicated

CRE Trend Line, DICON

Anderson D, et al
ICHE 2014; 35:978-83





KPC-CRE

CRE: FREQUENCY OF ENVIRONMENTAL CONTAMINATION

TABLE 1. Contamination on Surfaces in Rooms Housing a Patient with CRE

Room Site Cultured (No.)	CRE Positive, No. (%)[a]	CRE, mean CFU (range)[b]
Bed rail (15)	2 (13.3)	45 (43–47)
Overbed table (15)	1 (6.7)	3
Chair #1 arm (12)	0 (0.0)	...
Sink (15)	2 (13.3)	14.5 (11–18)
Toilet (11)	2 (18.2)	7 (4–10)
Bathroom floor (10)	1 (10.0)	5
Supply cart (11)	1 (9.1)	2
Linen hamper (12)	0 (0.0)	...
Mobile computer (3)	0 (0.0)	...
Chair #2 arm (3)	0 (0.0)	...
Bedside table (3)	0 (0.0)	...
Toilet cabinet (4)	0 (0.0)	...
Floor outside toilet cabinet (4)	1 (25.0)	2
Ventilator counter (1)	0 (0.0)	...
Total (119)[c]	10 (8.4)	5.1 (2–47)

CFU, colony forming units; CRE, carbapenem-resistant *Enterobacteriaceae*.

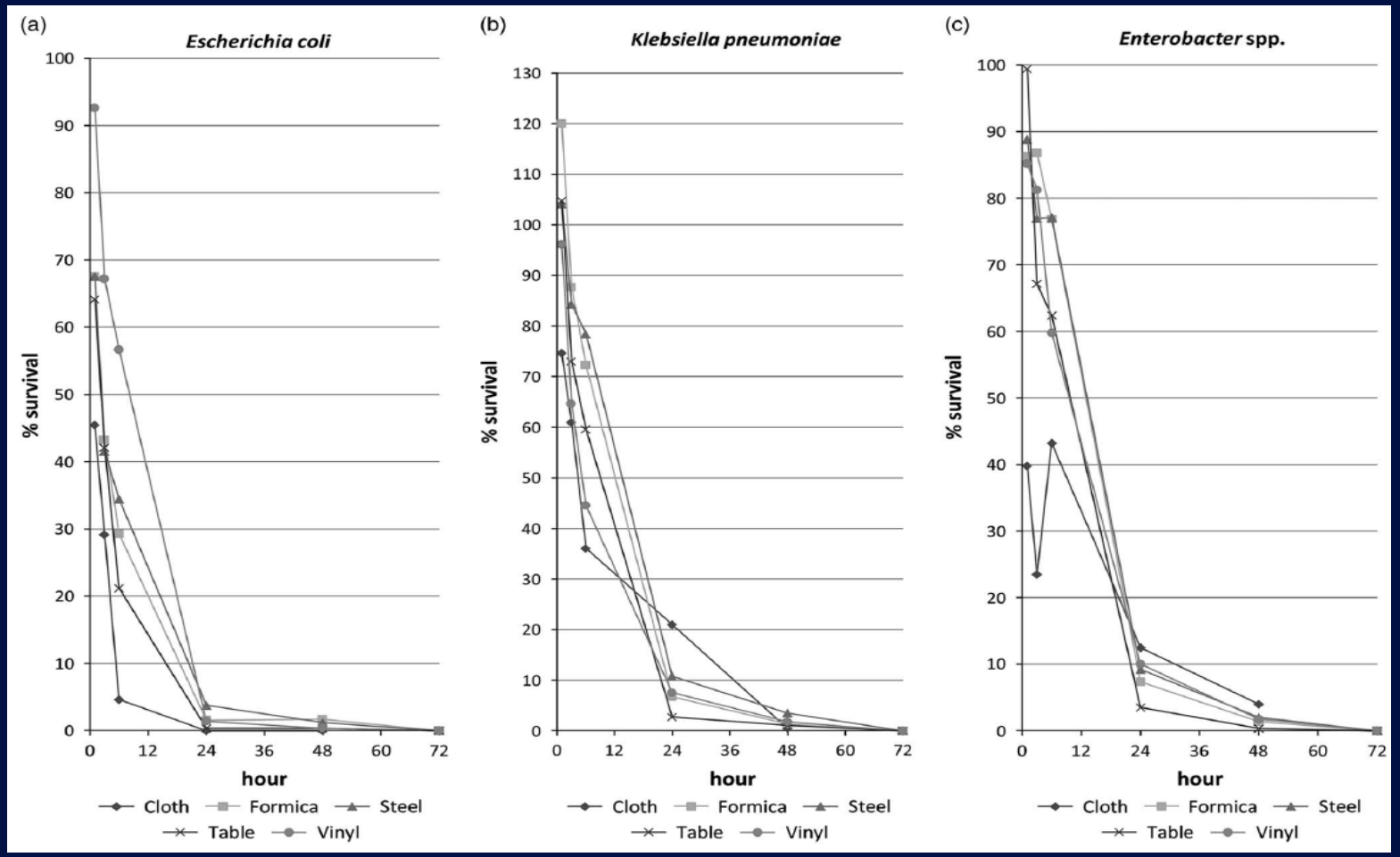
[a]Considered positive if ≥1 of the 5 Rodac plates had positive growth (ie, area sampled = 120 cm^2).

[b]Mean and range calculated only for CRE culture positive sites.

[c]For one site cultured, technical difficulties prevented assessing growth. Thus total was 119 sites instead of 120 sites.

Weber DJ, Rutala WA, et al. ICHE 2015;36:590-593

CRE: SURVIVAL ON ENVIRONMENTAL SUFACES



Weber DJ, Rutala WA, et al. ICHE 2015;36:590-593

TABLE 1 Efficacy of 21 germicides against carbapenem/colistin-resistant *Enterobacteriaceae* using a quantitative carrier test method

Germicide name	Manufacturer, location	Active ingredient	Formulation tested	Classification	Efficacy (mean $\log_{10}$ reduction) with[a]: KPC *E. coli*	KPC *K. pneumoniae*	KPC *E. cloacae*	MCR-1 *E. coli*
Purell Advanced instant hand sanitizer	GOJO, Akron, OH	70% ethanol	Undiluted	Antiseptic	4.6	3.5	4.1	4.2
Betadine solution	Purdue Products L.P., Stamford, CT	10% povidone-iodine/1% titratable iodine	Undiluted	Antiseptic	3.4	2.9	3.5	3.9
Medicated Soft "N Sure	Steris Corp., St. Louis, MO	0.5% triclosan	Undiluted	Antiseptic/handwash	2.3	2.9	3.3	3.8
Soft Care Defend	Diversey, Inc., Charlotte, NC	1% chloroxylenol	Undiluted	Antiseptic/handwash	4.3	3.7	4.5	4.4
Avagard	3 M, St. Paul, MN	1% chlorhexidine gluconate solution, 61% ethyl alcohol	Undiluted	Antiseptic/surgical hand scrub	2.6	3.8	3.7	1.8
Scrub-Stat 2%	Ecolab, St. Paul, MN	2% chlorhexidine gluconate solution	Undiluted	Antiseptic/surgical hand scrub/handwash	3.4	3.5	3.4	4.1
Scrub-Stat 4%	Ecolab, St. Paul, MN	4% chlorhexidine gluconate solution	Undiluted	Antiseptic/surgical hand scrub/handwash	3.1	4.0	3.5	4.4
Isopropyl rubbing alcohol 70% USP	Medichoice, Mechanicsville, VA	70% isopropyl alcohol	Undiluted	Antiseptics/disinfectant	4.6	4.0	4.9	4.4
Austin's A-1 bleach 1:10	James Austin Company, Mars, PA	5.25% sodium hypochlorite	1:10 dilution	Disinfectant	4.9	5.6	5.9	4.4
Austin's A-1 Bleach 1:50	James Austin Company, Mars, PA	5.25% sodium hypochlorite	1:50 dilution	Disinfectant	4.9	3.5	3.4	4.4
Vesphene IIse	Steris Corp., St. Louis, MO	9.09% *o*-phenylphenol, 7.66% *p*-tertiary amylphenol	1:128 dilution	Disinfectant	4.9	5.6	5.8	4.4
Solution of hydrogen peroxide 3% USP	Medichoice, Mechanicsville, VA	3% hydrogen peroxide	Undiluted	Disinfectant	2.2	3.5	3.2	1.7
Hydrogen peroxide cleaner disinfectant	Clorox Company, Oakland, CA	1.4% hydrogen peroxide	Undiluted	Disinfectant	4.9	5.6	5.8	4.4
Lysol disinfectant spray	Reckitt Benckiser, Parsippany, NJ	58% ethanol, 0.1% QAC[b]	Undiluted	Disinfectant	4.9	5.6	5.8	4.4
A-456 II disinfectant cleaner	Ecolab, St. Paul, MN	21.7% QAC[c]	1:256 dilution	Disinfectant	4.9	3.5	4.7	4.4
Super Sani-Cloth wipe	PDI, Orangeburg, NY	55% isopropyl alcohol, 0.5% QAC[d]	Undiluted[f]	Disinfectant	4.9	5.2	5.8	4.4
Prime Sani-Cloth wipe	PDI, Orangeburg, NY	28.7% isopropyl alcohol, 27.3% ethyl alcohol, 0.61% QAC[e]	Undiluted[f]	Disinfectant	4.8	5.6	5.9	4.4
S40 Sterilant concentrate S4000	Steris Corp., Mentor, OH	35% peracetic acid	0.20%	High-level disinfectant/ chemical sterilant	4.9	5.6	5.8	4.4
Cidex OPA	Advanced Steril. Prod., Irvine, CA	0.55% ortho-phthalaldehyde	Undiluted	High-level disinfectant/ chemical sterilant	2.4	4.8	3.4	2.0
Cidex	Advanced Steril. Prod., Irvine, CA	2.4% glutaraldehyde	Undiluted	High-level disinfectant/ chemical sterilant	4.9	5.6	5.8	4.4
Oxycide	Ecolab, St. Paul, MN	27.5% hydrogen peroxide, 5.8% peroxyacetic acid	1:43 dilution	High-level disinfectant/ chemical sterilant	4.9	5.6	5.8	4.4
Revital-Ox Resert	Steris Corp., Mentor, OH	2% accelerated hydrogen peroxide	Undiluted	High-level disinfectant/ chemical sterilant	5.2	5.9	5.8	4.4

[a]Test condition of 10^6 test organisms with 5% FCS and 1 min contact time.

[b]QAC (quaternary ammonium compounds): alkyl (C_{14} 50%, C_{12} 40%, C_{16} 10%) dimethyl benzyl ammonium saccharinate 0.1%.

[c]QAC: octyl decyl dimethyl ammonium chloride 6.51%, dioctyl dimethyl ammonium chloride 2.604%, didecyl dimethyl ammonium chloride 3.906%, alkyl (C_{14} 50%, C_{12} 40%, C_{16} 10%) dimethyl benzyl ammonium chloride 8.68%.

[d]QAC: *n*-alkyl (C_{12} 68%, C_{14} 32%) dimethyl ethyl benzyl ammonium chlorides 0.25%, *n*-alkyl (C_{14} 60%, C_{16} 30%, C_{12} 5%, C_{18} 5%) dimethyl benzyl ammonium chloride 0.25%.

[e]QAC: didecyl dimethyl ammonium chloride 0.61%.

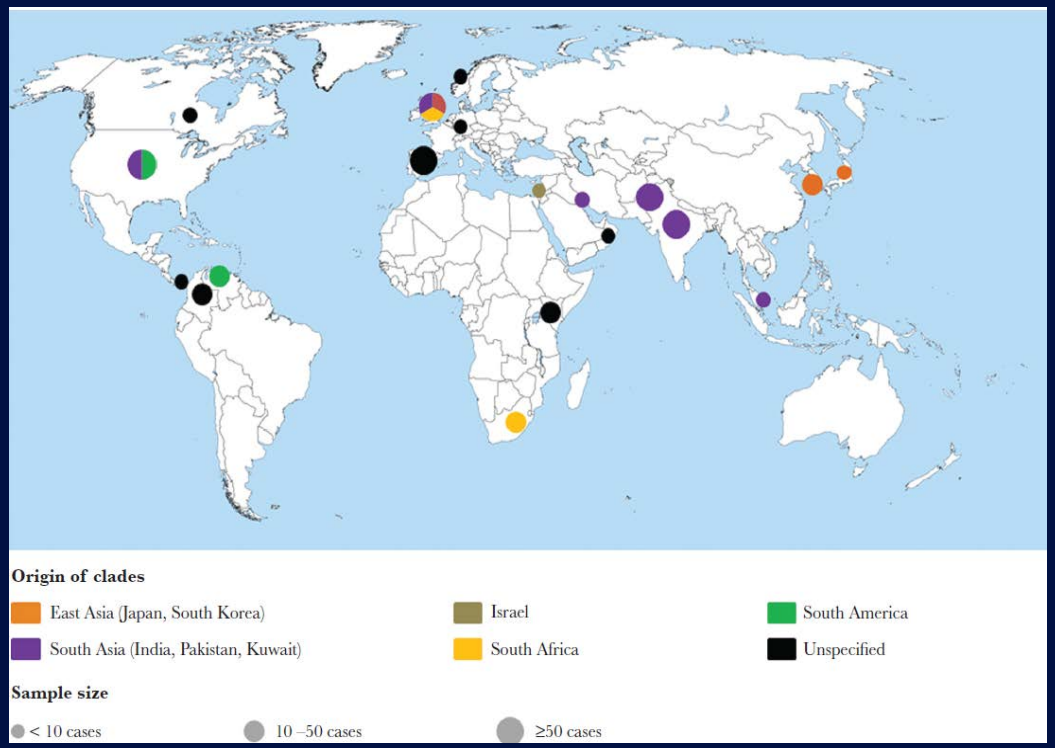
[f]Extract from cloth. We did not quantify QAC adhering to the cloth that is used to apply that particular germicide and may release smaller amounts of active QAC (17), but our data were not affected by this possibility because the extract was tested.

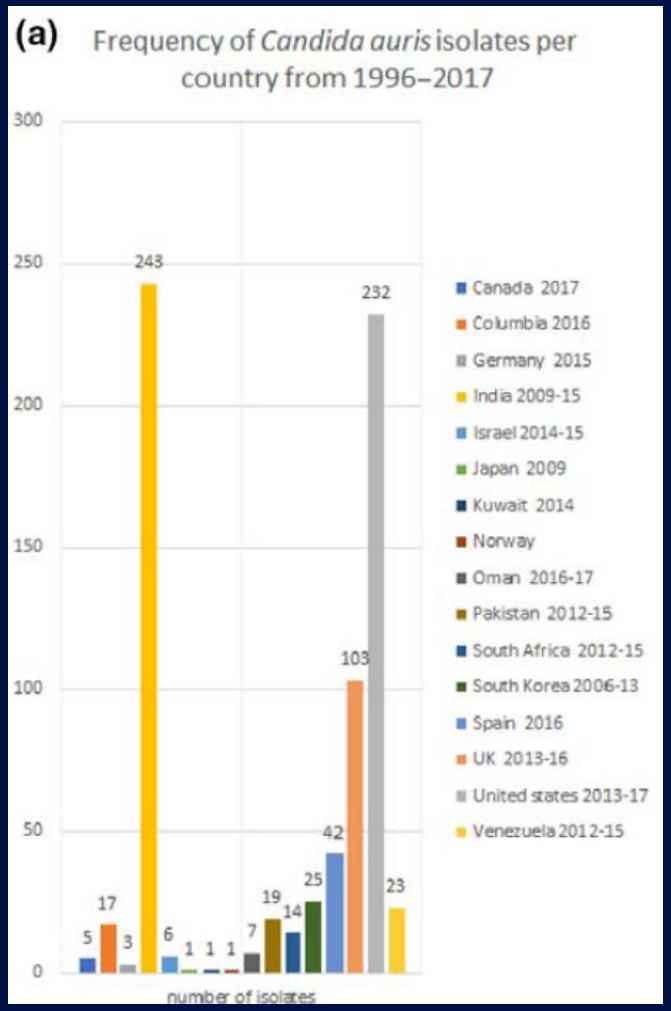
Kanamori H, Rutala W, Gergen M, Sickbert-Bennett E, Weber D. AAC 2018 (In press)

CANDIDA AURIS: HISTORY

- First identified as a new species in 2009 from the external ear canal of a Japanese patient
- Microbiology
  - Cannot be identified by commercial methods for yeast identification
  - Usually resistant to fluconazole, often resistant to amphotericin B, exhibits reduced susceptibility to voriconazole and itraconazole; resistance may develop on therapy
- Epidemiology
  - Transmission: Person-to-person (direct and indirect via environment); also via donor derived lung transplant (Azar 2017)
  - Most commonly clinical syndromes: fungemia, otologic infections
  - Nosocomial outbreaks have been reported in a number of countries
  - Risk factors for infection: immunosuppression, co-morbidities, central lines, Foley catheters, recent surgery, parental nutrition, broad spectrum antibiotics, ICU care, and residence in a skilled nursing home
  - Mortality (fungemia): 28%-66% (Sears 2017)

GEOGRAPHICAL DISTRIBUTION OF *CANDIDA AURIS*

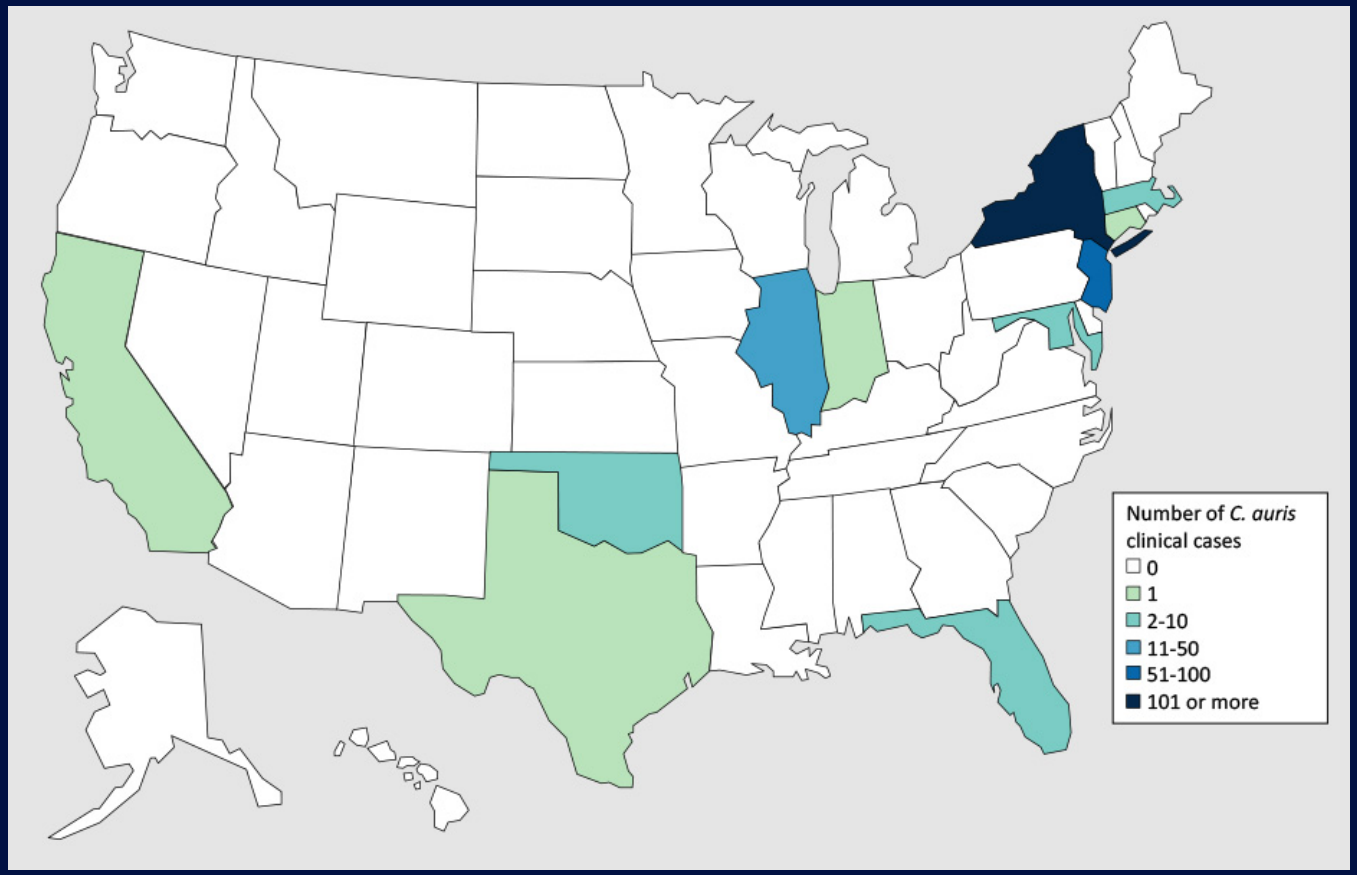




Lamoth Fl Kontoyiannis DP. J Infect Dis 2018;217:516-520.
Sekyere JO. Microbiologyopen. 2018 Jan 1 (Epub ahead of print

C. AURIS, CLINICAL CASES, US

(as of 30 April 2018)



Confirmed cases = 279

Probable cases = 29

Colonized = 517

States = 11

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

TRANSMISSION AND PERSISTENCE OF *CANDIDA AURIS*

- Colonization of patients
  - Colonization of patients is common; multiple sites involved (Biswal 2017)
- Role of HCP
  - HCP may be colonized; uncommon (Schelenz 2017)
  - HCP hands may transiently carry *C. auris* (Biswal 2017)
- Role of environment
  - Environmental contamination common (Lesho 2018, Biswal 2017, Schelenz 2017, Valladhaneni 2016): mattresses, furniture, sinks, and medical equipment
  - Prolonged environmental survival on environmental surfaces; >14 days (Piedrahita 2017, Welsh 2017)
  - Prolonged survival (>7 days) on contaminated bedding (Biswal 2017)

NOSOOCOMIAL OUTBREAK OF *C. auris*

(Biswal M, et al. JHI 2017;97:363-370)

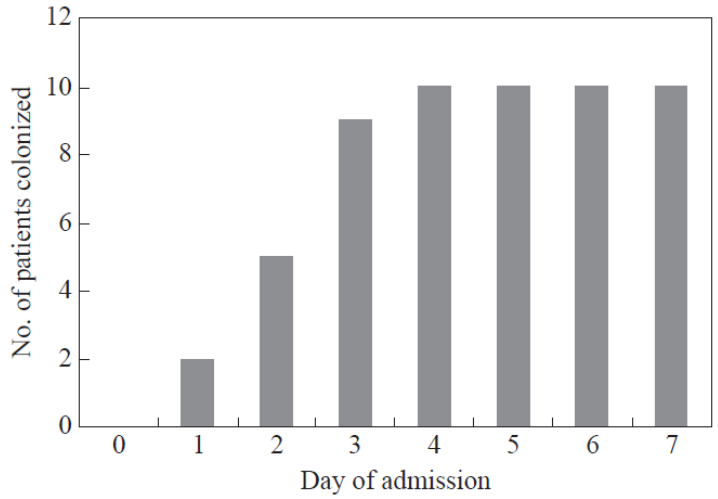


Figure 3. Time to *Candida auris* acquisition after intensive care unit admission.

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

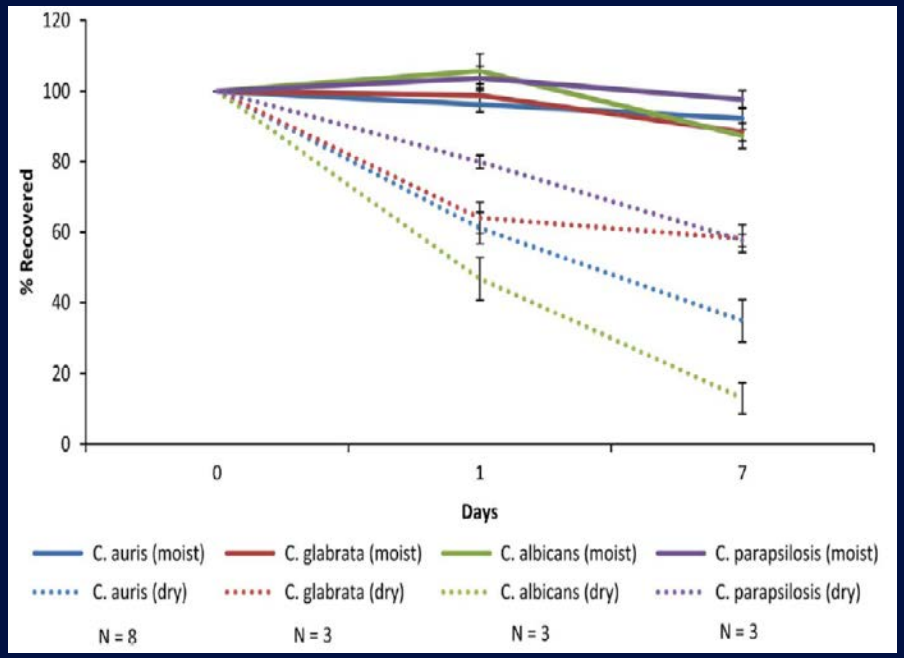
MICU, medical intensive care unit; CCU, cardiac care unit; ICU, intensive care unit; NSW, neurosurgical ward; HCW, healthcare worker.

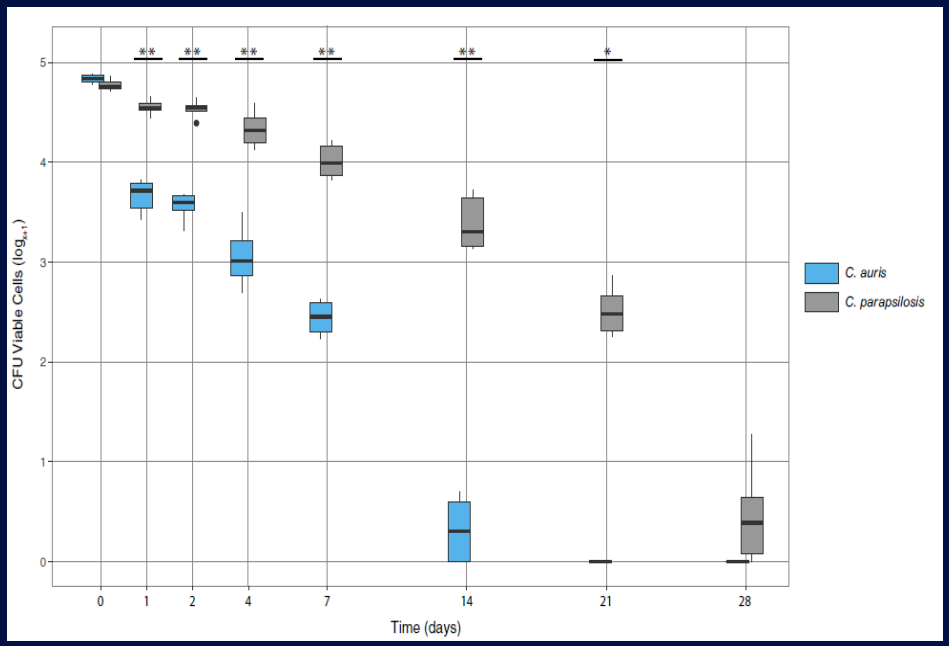
Colonization rate by *Candida auris* of different body sites

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.

ENVIRONMENTAL SURVIVAL OF *CANDIDA AURIS*

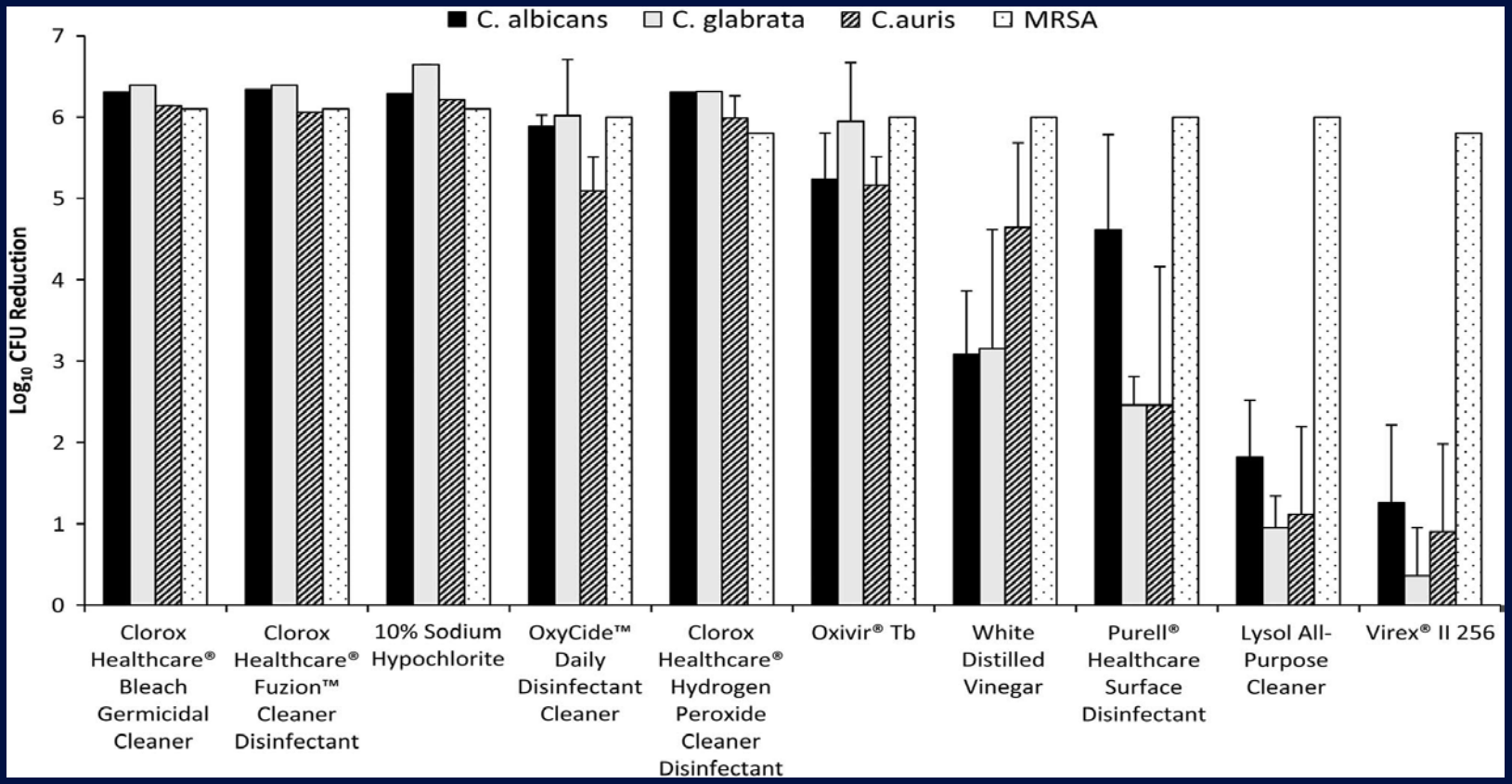




Piedrahita C, et al. ICHE 2017;38:1107-1109

Welsh RM, et al. J Clin Microbiol 2017;55:2996-3005

CANDIDA AURIS: SUSCEPTIBILITY TO DISINFECTANTS



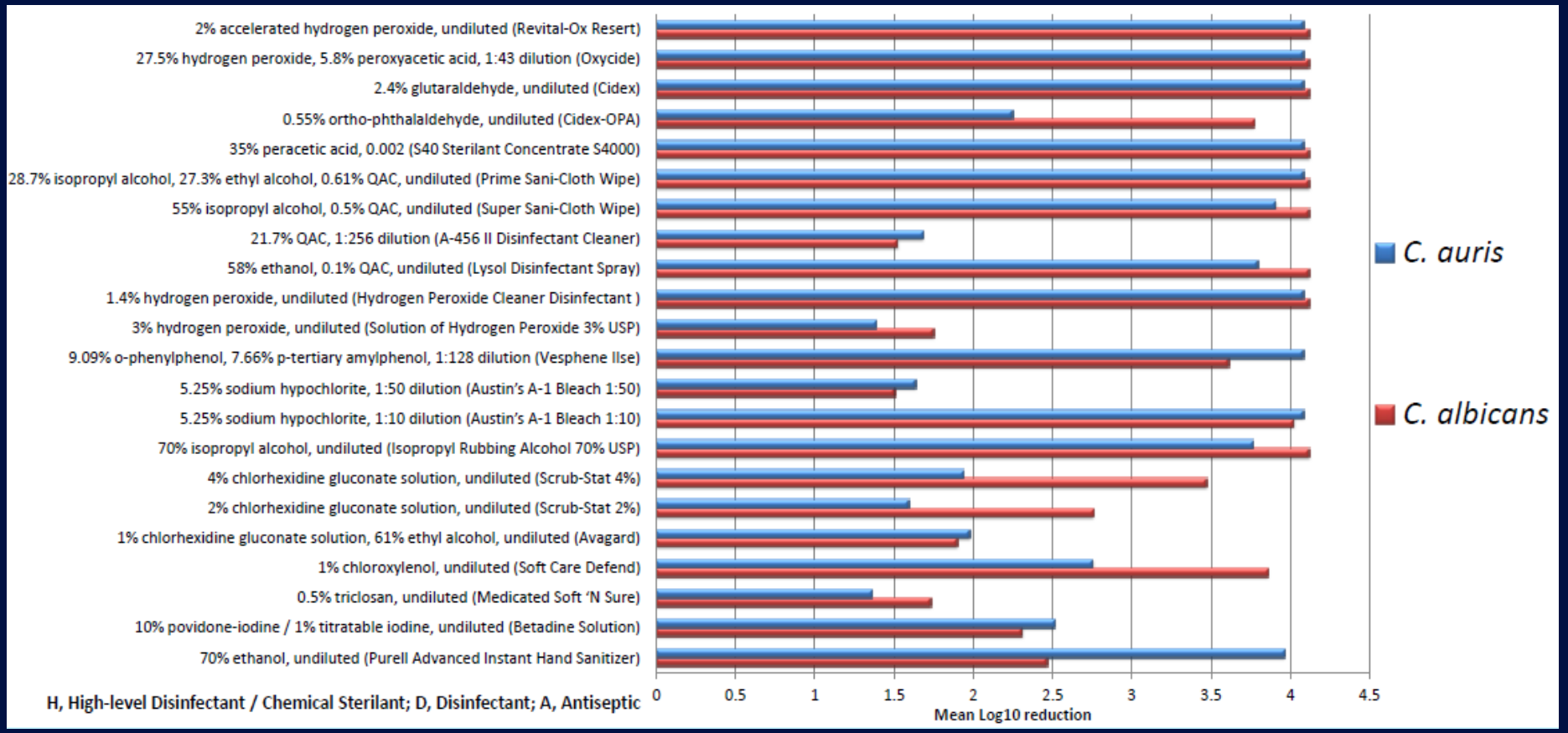
In laboratory testing, sporicidal and improved hydrogen peroxide disinfectants were highly effective against *C. auris, C. glabrata*, and *C. albicans*. The widely used quaternary ammonium disinfectants exhibited relatively poor activity against all of the *Candida* species. Cadnum et al. ICHE 2017;38:1240

EFFICACY OF ANTISEPTICS AND DISINFECTANTS AGAINST *C. AURIS*

- Study design: In vitro study of germicide efficacy against *C. auris* and *C. albicans*
- Method: Disc-based quantitative carrier test with an inoculum of ~10^6 organisms with 5% fetal calf serum and 1 minute exposure time at room temperature (challenging test conditions)
- Results:
  - Study demonstrated $\geq$3-$\log_{10}$ reduction (12/22, 55%) and 2-$\log_{10}$ reduction (15/22, 68%) for *C. auris*
  - *C. auris* was less susceptible to 0.55% ortho-phthalaldehyde, 2% chlorhexidine, 4% chlorhexidine, and 1% chloroxylenol compared to *C. albicans*.
  - *C. auris* was more susceptible to 70% ethanol, compared to *C. albicans*.
  - Several germicides (21.7% QAC] 3% hydrogen peroxide, 5.25% sodium hypochlorite [1:50 dilution], 0.5% triclosan) had <2-$\log_{10}$ reduction for both *C. auris* and *C. albicans*

Rutala WA, Sickbert-Bennett E, Weber D, et al. Unpublished

EFFICACY OF ANTISEPTICS AND DISINFECTANTS AGAINST *C. AURIS*



EFFICACY OF ANTISEPTICS AND DISINFECTANTS AGAINST *C. AURIS*

- Effectiveness of surface disinfectants (level of evidence)
  - Effective: Chlorine ≥1000 ppm (good); hydrogen peroxide 1.4% (moderate); phenolics 5%? (low); alcohols 29.4% (low); peracetic acid 2000 ppm (low)
  - Ineffective: Quats - 2% didecyldimethyl ammonium chloride; alkyl dimethyl ammonium chlorides; didecyldimethyl ammonium chloride/dimethylbenzyl ammonium chloride

TABLE 3 | Antiseptics tested against *C. auris*.

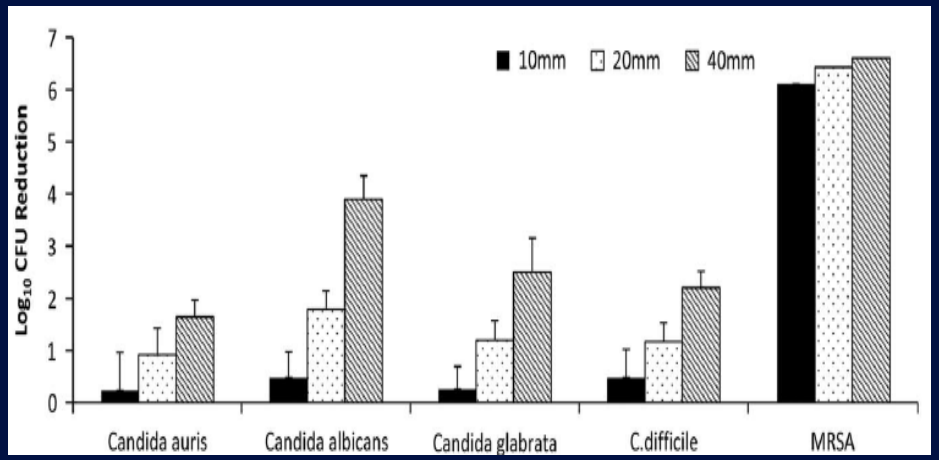
Disinfectant	Concentrations tested (contact time in minutes used)	Effective	Level of Evidence	Comments	Reference
Chlorhexidine gluconate	<0.02% (1440), 0.5% (0.5), 2% (2), 4% (3, 180, 1800)	Yes	Good	Most studied antiseptic. Limited clinical evaluation.	Schelenz et al., 2016; Abdolrasouli et al., 2017; Moore et al., 2017; Sherry et al., 2017
Chlorhexidine gluconate in isopropyl alcohol	2%/70% (2)	Yes	Low	*In vitro* testing only.	Moore et al., 2017
Povidone-iodine	10% (2, 3, 180, 1800)	Yes	Moderate	*In vitro* testing only.	Abdolrasouli et al., 2017; Moore et al., 2017;
Alcohol	70%	Yes	Low	Limited clinical evaluation.	Biswal et al., 2017

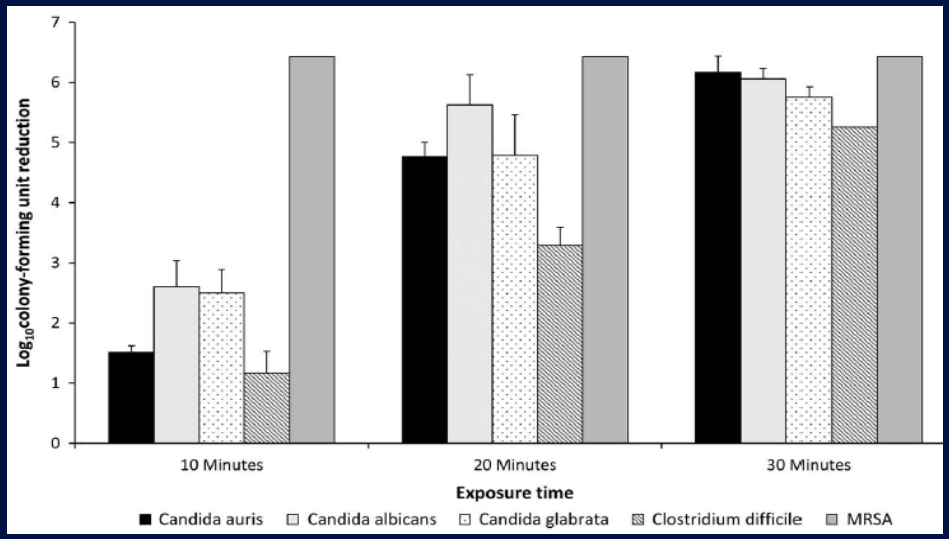
Ku TSN, et al. Frontiers in Microbiol 2018;9:726

EFFICACY OF UVC TO INACTIVATE *C. AURIS*

- Goal: Assess inactivation by UVC
- 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 (data) to inactivate *C. auris*

Cadnum JL, et al. ICHE 2018;39:94-96





C. AURIS: INFECTION PREVENTION

- Place patients in a single room using standard and contact isolation
- Emphasize hand hygiene
- Screen roommates; consider point prevalence surveys (swab patient's axilla and groin)
- Flag patient in case of re-admission
- Environmental infection control
  - EVS should use proper PPE
  - Monitor cleaning practices
  - Avoid quaternary ammonia products for surface disinfection; use a disinfectant EPA registered against *C. difficile* (Like K)

https://www.cdc.gov/fungal/candida-auris/c-auris-infection-control.html#disinfection

CONCLUSIONS

- MERS-CoV
  - Environmental contamination: Yes (low frequency)
  - Environmental survival: Hours
  - Environmental transmission: Probable
  - Antisepsis and disinfection: Standard
- Ebola
  - Environmental contamination: Yes (Frequent)
  - Environmental survival: Hours to days
  - Environmental transmission: Yes
  - Antisepsis and disinfection: Standard

CONCLUSIONS

- CRE
  - Environmental contamination: Yes (low frequency)
  - Environmental survival: Hours
  - Environmental transmission: Yes
  - Antisepsis and disinfection: Standard
- *C. auris*
  - Environmental contamination: Yes (frequent)
  - Environmental survival: Hours to days
  - Environmental transmission: Yes
  - Antisepsis and disinfection: Standard antisepsis (CHG or EtOH); Avoid quaternary ammonium compounds for surface disinfection

THANK YOU!!

