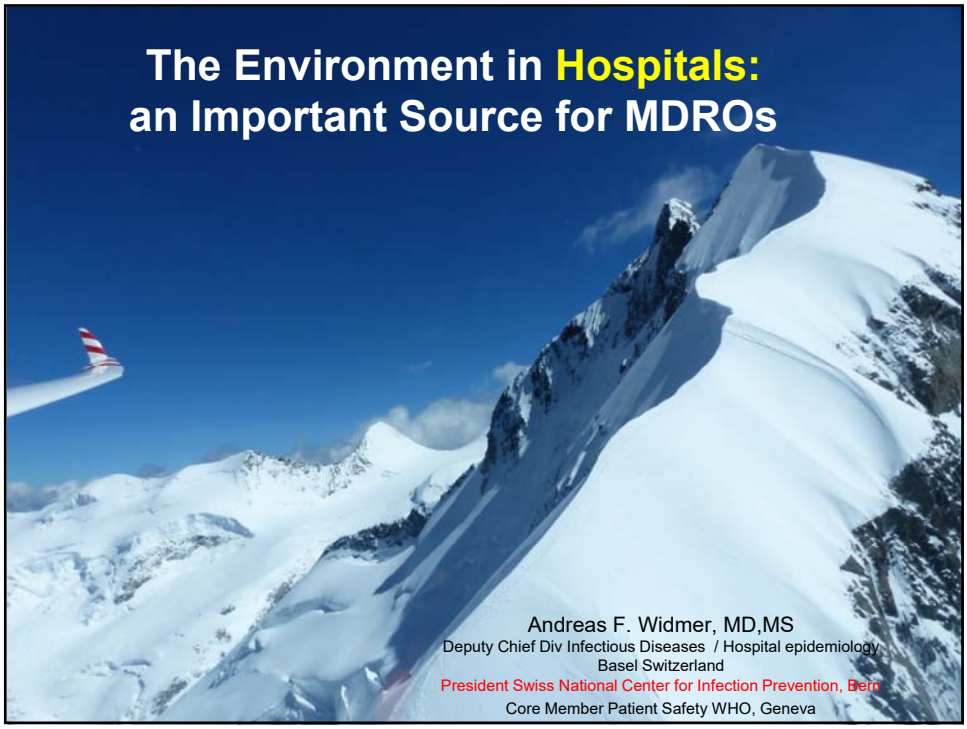


1

The Hospital Environment

A dangerous Area ?

- Surfaces
- Air
- Water
- Medical Devices

2

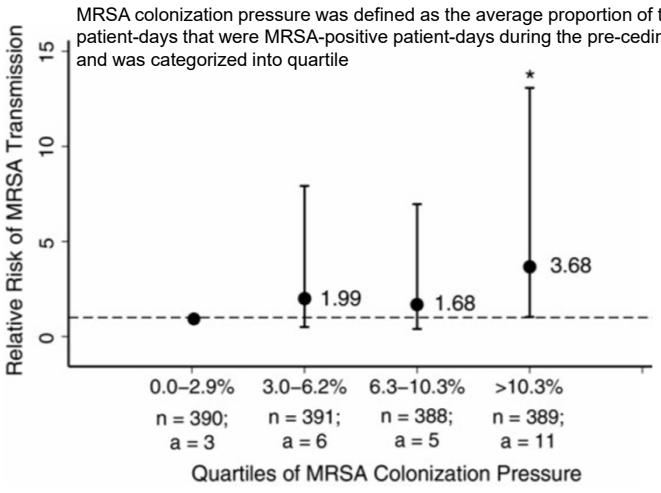
The Hospital Environment

A dangerous Area ?

- Surfaces
- Air
- Water
- Medical Devices

3

Relative risk of MRSA transmission by increasing quartiles of colonization pressure.



Popoola VO: Clinical Infectious Diseases 2013;57(10):1458â€“60

4

The previous point of view

"We conclude that organisms in the inanimate hospital environment contribute negligibly to endemic nosocomial infection and that routine microbiologic surveillance of the inanimate environment is not cost effective"

Maki DG et al.
N Engl J Med 1982;307:1562-1566.

«There is no evidence that environmental cleaning/disinfection has an impact on the incidence of nosocomial infection»

Wing-Hong Seto ICCAC 2007.

5

Environmental Surface Disinfection?

- ***1 – 2 hours after floor disinfection identical number of bacteria as prior to disinfection***

  [Ayliffe GAJ et al. BMJ 1966; 2: 442]

- ***"There is no difference in hospital-acquired infection rates when floors are cleaned with detergent vs. disinfectant"***

  [Rutala WA et al: J Hosp Infect 2001; 48 Suppl. A: 66]

6

Cross-over Aldehyd vs Glucoprotamin disinfection of Bone Marrow Transplant Unit. Recontamination after disinfection

Recontamination with enterococci within 0,5-2 hours

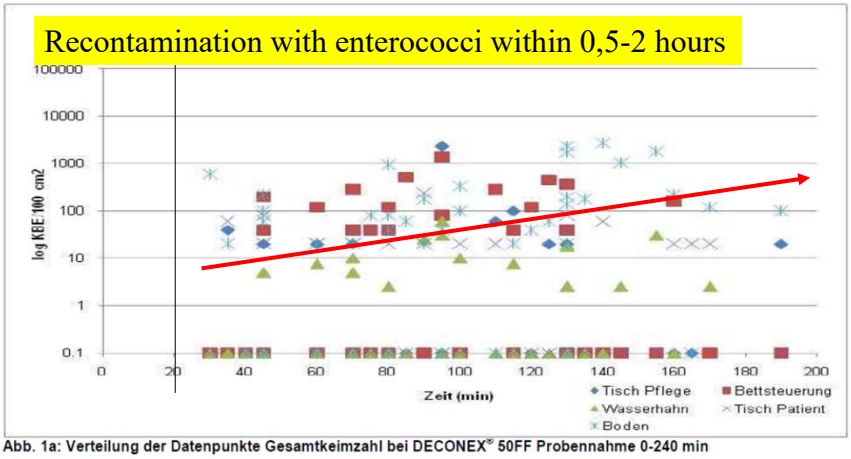


Abb. 1a: Verteilung der Datenpunkte Gesamtkeimzahl bei DECONEX® 50FF Probennahme 0-240 min

Meinke R. & Widmer AF. Infect Control Hosp Epidemiol. 2012 Nov;33(11):1077-80

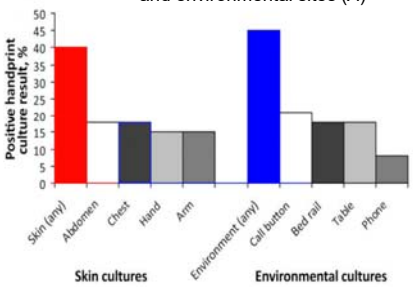
7

FREQUENCY OF ACQUISITION OF MRSA ON GLOVED HANDS AFTER CONTACT WITH SKIN AND ENVIRONMENTAL SITES

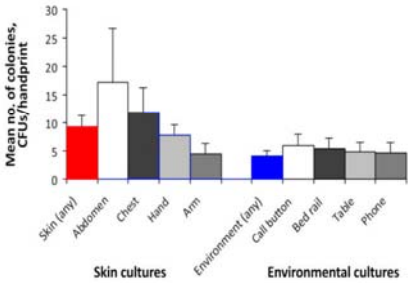
40 patients, MRSA carriers
hand contamination was equally likely after contact with commonly examined skin sites and commonly touched environmental surfaces in patient rooms (40% vs 45%)

No significant difference on contamination rates of gloved hands after contact with skin or environmental surfaces (40% vs 45%; p=0.59)

A % positive gloved hands after contact with skin and environmental sites (*A*)



B mean number of MRSA colonies acquired on hands (*B*).



Stiefel U, et al. ICHE 2011;32:185-187

8

Compliance with Protocols for Cleaning Disinfection Monitoring Cleaning Practices

- **1404 objects were evaluated before the intervention**
- **744 objects were evaluated after the intervention**
- **Proportion of objects cleaned**
  - **Before intervention: 47%**
  - **After interventions: 76 - 92%**
- **Technique improved in all hospitals ($p < 0.001$)**
- **Technique has been adopted in numerous hospitals and has led to improved cleaning practices**

Carling PC et al. Clin Infect Dis 2006;42:385
Carling PC et al. Infect Control Hosp Epidemiol 2008;29:1

Slide: adapted from Boyce J.

9

Enhanced terminal room disinfection and acquisition and infection caused by multidrug-resistant organisms and *C. difficile*

(the Benefits of Enhanced Terminal Room Disinfection study): a cluster-randomised, multicentre, crossover study

- 21`395 (69%) met all inclusion criteria of 31 226 patients were exposed;
  - 4`916 in the reference group (Quat)
  - 5'178 in the reference group (Quat) + UV group
  - 5'438 in the bleach group
  - 5863 in the bleach group + UV group.

- 115 patients had the primary outcome during 22 426 exposure days in the reference group (51·3 per 10 000 exposure days).
- **Reference vs Quat and UV** (n=76; 33·9 cases per 10 000 exposure days; RR 0·70(0·50–0·98; **p=0·036**).
- **bleach** (n=101; 41·6 cases per 10 000 exposure days; RR 0·85 (CI 0·69–1·04; p=0·116)
- **bleach and UV** (n=131; 45·6 cases per 10 000 exposure days; RR 0·91, 95% CI 0·76–1·09; p=0·303) among exposed patients.
- Incidence of *C. difficile* infection similar adding UV to cleaning with bleach (n=38 vs 36; 30·4 cases vs 31·6 cases per 10 000 exposure days; RR 1·0,(0·57–1·75; p=0·997).

Anderson DJ. Lancet.2017;389:805-14.

10

Risk for a new patient associated with the colonization status of the prior room occupant

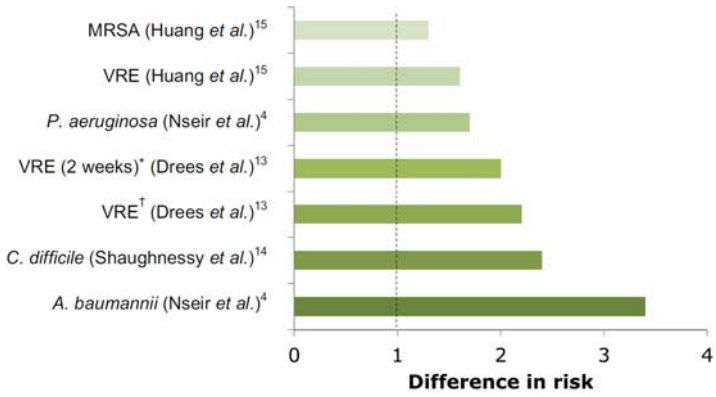


Chart showing the increased risk associated with the prior room occupant. The figures of difference in risk are unadjusted based on raw data. Several of the studies included adjusted measures of risk, but these were not included because of differences in study design. * Any patient infected or colonized with VRE in the two weeks prior to admission. y The immediate prior room occupant was known to be infected or colonized with VRE.

Otter JA Am J Infect Control 2013;41:S6-11.

11

American Journal of Infection Control 41 (2013) S12-S19

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Original research article

Does improving surface cleaning and disinfection reduce health care-associated infections?

Yes, it can

Curtis J. Donskey MD [a,b,*]

[a] Geriatric Research, Education, and Clinical Center, Cleveland Veterans Affairs Medical Center, Cleveland, OH
[b] Case Western Reserve University School of Medicine, Cleveland, OH

Key Words:
Environment
Cleaning
Transmission

Contaminated environmental surfaces provide an important potential source for transmission of health care-associated pathogens. In recent years, a variety of interventions have been shown to be effective in improving cleaning and disinfection of surfaces. This review examines the evidence that improving environmental disinfection can reduce health care-associated infections.

Published by Elsevier Inc. on behalf of the Association for Professionals in Infection Control and Epidemiology, Inc.

12

Correlation (Bioburden) of total CFU and numbers of clinically important Pathogen on Surfaces

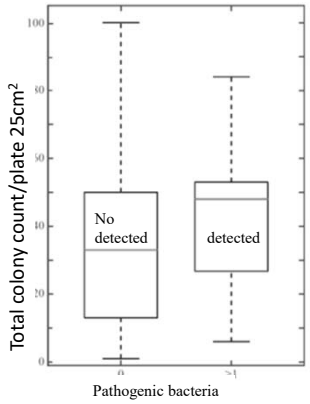
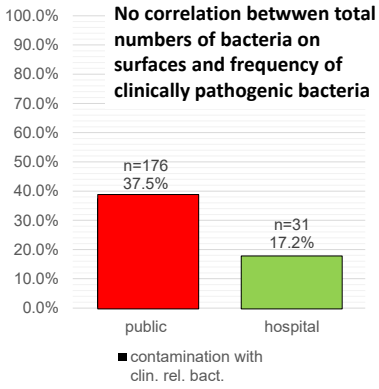


Figure 1. Total colony count (colony-forming units per plate) obtained from surfaces without the presence of pathogens of high clinical relevance (PHCR) and surfaces with at least one PHCR; no significant difference was found ($P = 0.67$).

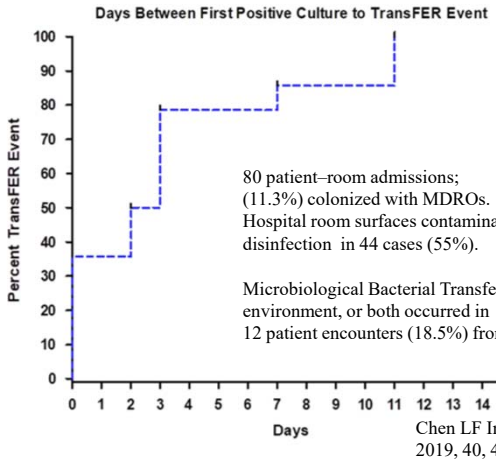


pathogens of high clinical relevance (PHCR) definition issued by CDC

Widmer FC. J Hosp Infect. 2019 Feb;101(2):240-244

13

Time from first positive bacterial culture from any source to documented transfer of clonally identical bacteria between patients and room surfaces.



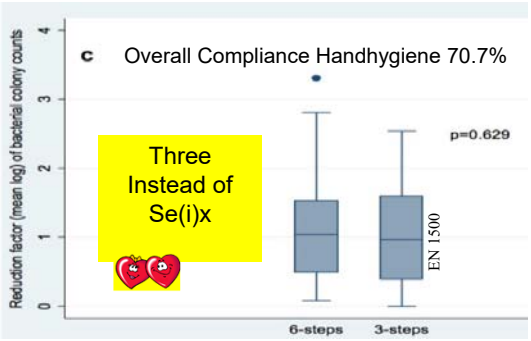
80 patient–room admissions;
(11.3%) colonized with MDROs.
Hospital room surfaces contaminated with MDROs despite terminal disinfection in 44 cases (55%).

Microbiological Bacterial Transfer events either to the patient, the environment, or both occurred in
12 patient encounters (18.5%) from the microbiologically evaluable cohort.

Chen LF Infection Control & Hospital Epidemiology 2019, 40, 47–52. doi: 10.1017/ice.2018.275

14

Simplifying the WHO protocol: 3 steps versus 6 steps for performance of hand hygiene (HH) a cluster-randomized clinical trial (n=2'923 HH indications)



Compliance with technique (direct supervision)
51.7% (595/1151) 3 steps
12.7% (116/915) 6 steps (p<0.001)

Tschudin-Sutter & Widmer AF. Clin Infect Dis. 2018 Nov 3., https://doi.org/10.1093/cid/ciy948

15

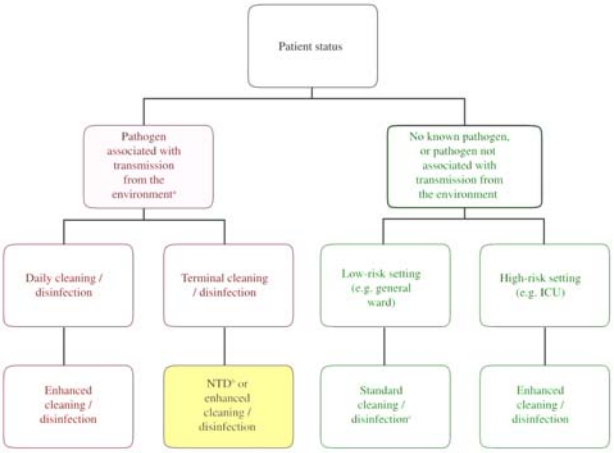
What is on that keyboard? Detecting hidden Environmental Reservoirs during a *C. difficile* outbreak NAP1/027

- **20 of 87 (23%) surfaces cultured outside of patient rooms contaminated with toxin-producing *C difficile*.**
- 9 of 29 (31%) surfaces in **physician** areas were contaminated,
  - 2 of 6 (33%) telephone keypads
  - **5 of 19 (26%) desktop computers**
  - 2 of 2 doorknobs.
- 1 of 10 (10%) surfaces in **nursing** areas were contaminated,
  - 0 of 2 telephones
  - **1 of 4 (25%) desktop computers**
  - 0 of 2 doorknobs.
- 9 (21%) of portable **medical equipment** were contaminated
  - 0 of 1 ultrasound machines
  - 1 of 5 (20%) pulse oximeter finger probes,
  - **3 of 9 (33%) portable computers**
  - 2 of 13 (15%) medication carts
  - 3 of 11 (27%) medication bar code scanners.

Dumford DM. Am J Infect Control. 2009 Feb;37(1):15-9.

16

Proposed algorhithm for environmental disinfection



Uvc or H_2O_2

Key pathogens associated with contamination of the environment include

- *C. difficile*
- VRE
- MRSA
- *A. baumannii*,
- MDR-*P. aeruginosa*
- Norovirus.

All NTD systems are applied **after** a cleaning step to ensure that surfaces are free from visible contamination, which is unacceptable to subsequent patients and will reduce the efficacy of the NTD disinfection.

There is limited equivocal evidence that enhanced cleaning/disinfection in a low-risk general ward setting can reduce the spread of pathogens.

Otter JA. J Hosp Infect. 2013 Jan;83(1):1-13.

17

INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY DECEMBER 2011, VOL. 32, NO. 12

ORIGINAL ARTICLE

Emergence of Glutaraldehyde-Resistant *Pseudomonas aeruginosa*

Sarah Tschudin-Sutter, MD;[1] Reno Frei, MD;[2] Günter Kampf, MD;[3,4] Michael Tamm, MD;[5] Eric Pflimlin, RN;[6] Manuel Battegay, MD;[1] Andreas Franz Widmer, MD, MSc[1]

OBJECTIVE. In November 2009, routine sampling of endoscopes performed to monitor the effectiveness of the endoscope-cleaning procedure at our hospital detected *Pseudomonas aeruginosa*. Herein we report the results of the subsequent investigation.

DESIGN AND METHODS. The investigation included environmental samples for source investigation, molecular analysis by pulsed-field gel electrophoresis (PFGE) to reveal the identity of the strains, determination of the bactericidal activity of the glutaraldehyde-based disinfectant used for automated endoscope reprocessing. In addition, patient charts was analyzed by medical chart review, and incidence rates of clinical samples with *P. aeruginosa* were compared.

SETTING. The University Hospital of Basel is an 855-bed tertiary care center in Basel, Switzerland. Approximately 1,700 flexible bronchoscopic, 2,500 gastroscopic, 1,400 colonoscopic, 160 endoscopic retrograde cholangiopancreatographic, and 140 endosonographic procedures are performed annually.

RESULTS. *P. aeruginosa* was detected in samples obtained from endoscopes in November 2009 for the first time since the initiation of surveillance in 2006. It was found in the rinsing water and in the drain of 1 of the 2 automated endoscope reprocessors. PFGE revealed 2 distinct *P. aeruginosa* strains, one in each reprocessor. The glutaraldehyde-based disinfectant showed no activity against the 2 pseudo-outbreak strains when used in the recommended concentration under standard conditions. After medical chart review, 6 patients with lower respiratory tract and bloodstream infections were identified as having a possible epidemiological link to the pseudo-outbreak strain.

CONCLUSIONS. This is the first description of a pseudo-outbreak caused by *P. aeruginosa* with reduced susceptibility to an aldehyde-based disinfectant routinely used in the automated processing of endoscopes.

Infect Control Hosp Epidemiol 2011;32(12):1173-1178

Emergence of resistance also to Disinfectants

18

The Hospital Environment

A dangerous Area ?

- Surfaces
- Air
- Water
- Medical Devices

19

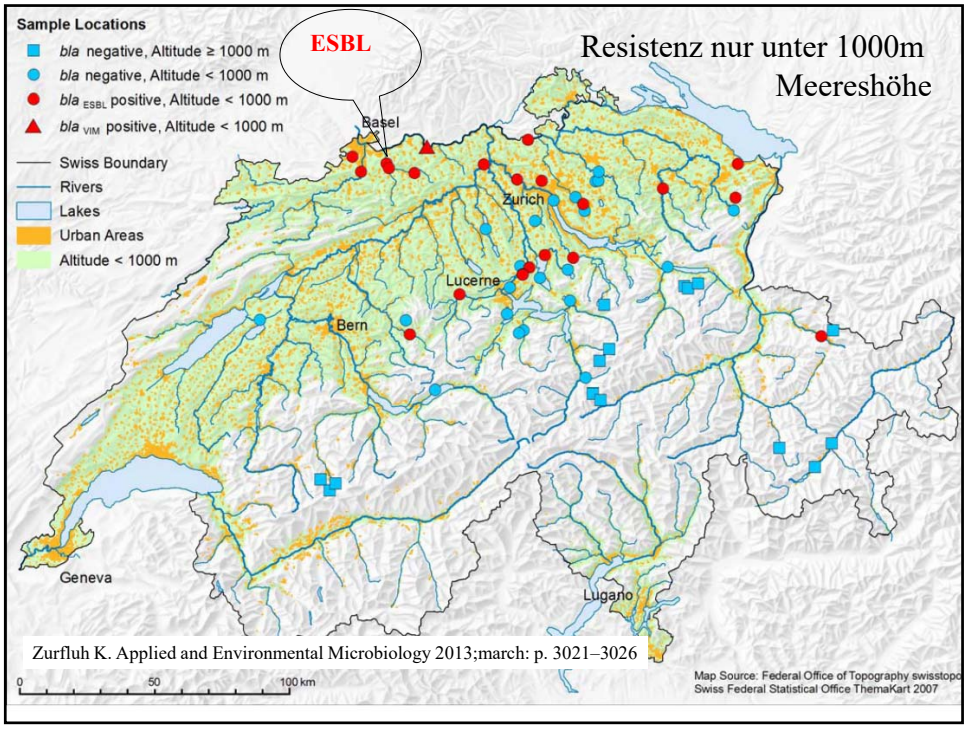
Water Reservoirs Containing Carbapenem-Resistant Organisms in Hospitals

Water Reservoir	Studies, No. (N = 32)	References
Drains/drainage systems	17	Peña et al [35], Kotsanas et al [26], La Forgia et al [28], Betteridge et al [7], Leitner et al [20], Wendel et al [29], Breathnach et al [21], Leung et al [24], Snitkin et al [22], Tofteland et al [32], Vergara-López et al [33], Yomoda et al [9], Stjarne Aspelund et al [12], Odom et al [11], Knoester et al [25], Landelle et al [37], Seara et al [34]
Sink surfaces	14	Betteridge et al [7], Wendel et al [29], Knoester et al [25], Podnos et al [23], Wang et al [27], Biswal et al [8], Hong et al [30], Bukholm et al [31], Kouda et al [38], Landelle et al [37], Dewi et al [10], Kaiser et al [13], Ito et al [14], Leung et al [24]
Faucets	8	Odom et al [11], Knoester et al [25], Majumdar et al [17], Pitten et al [36], Hong et al [30], Bukholm et al [31], Alter et al [15], Leung et al [24]
Water	3	Knoester et al [25], Ambrogi et al [18], Bukholm et al [31]
Inflatable hair wash basin	2	Wendel et al [29], Knoester et al [25]
Sensor mixer taps	1	Durojaiye et al [16]
Water/tea dispenser	2	Wong et al [19], Ito et al [14]
Shower/shower equipment	3	Betteridge et al [7], Leung et al [24], Seara et al [34]
Toilet bowl/brush	2	Breathnach et al [21], Kouda et al [38]

*Some studies had multiple water reservoirs, so categories are not mutually exclusive.

Kizny Gordon AE et al. Clin Infect Dis. 2017 May 15;64(10):1435-1444.

20



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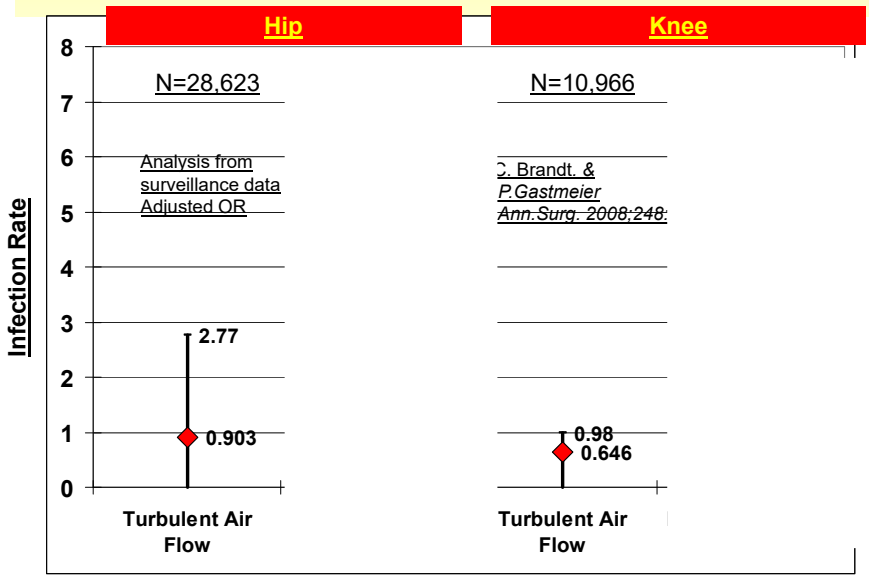
The Hospital Environment

A dangerous Area ?

- Surfaces
- Air
- Water
- Medical Devices

22

Incidence of Surgical Site Infections by Type of Air quality in the OR: Standard vs Laminar Air Flow



23

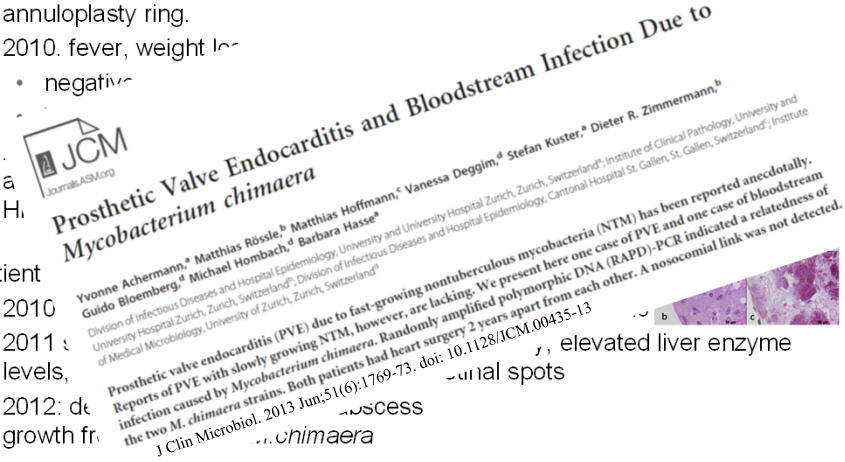
M.chimaera: The beginning of the Outbreak 2008/2010

Patient 1

- 2008, aortic and mitral reconstruction w
  annuloplasty ring.
- 2010. fever, weight l
  - negati
- a
  H

Patient

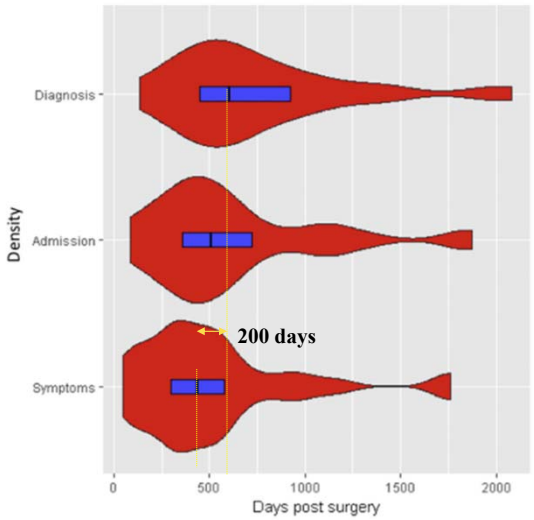
- 2010
- 2011 s
  levels,
- 2012: d
  growth fr


JCM
Journals.ASM.org
Prosthetic Valve Endocarditis and Bloodstream Infection Due to *Mycobacterium chimaera*
Yvonne Achermann,[a] Matthias Rössle,[b] Matthias Hoffmann,[c] Vanessa Deggim,[d] Stefan Kuster,[a] Dieter R. Zimmermann,[b] Guido Bloemberg,[d] Michael Hombach,[d] Barbara Hasse[a]
Division of Infectious Diseases and Hospital Epidemiology, University and University Hospital Zurich, Zurich, Switzerland[a]; Institute of Clinical Pathology, University and University Hospital Zurich, Zurich, Switzerland[b]; Division of Infectious Diseases and Hospital Epidemiology, Cantonal Hospital St. Gallen, St. Gallen, Switzerland[c]; Institute of Medical Microbiology, University of Zurich, Zurich, Switzerland[d]
Prosthetic valve endocarditis (PVE) due to fast-growing nontuberculous mycobacteria (NTM) has been reported anecdotally. Reports of PVE with slowly growing NTM, however, are lacking. We present here one case of PVE and one case of bloodstream infection caused by *Mycobacterium chimaera*. Randomly amplified polymorphic DNA (RAPD)-PCR indicated a relatedness of the two *M. chimaera* strains. Both patients had heart surgery 2 years apart from each other. A nosocomial link was not detected.
J Clin Microbiol. 2013 Jun;51(6):1769-73. doi: 10.1128/JCM.00435-13

, elevated liver enzyme
nal spots
bscess
chimaera

24

M.chimaera: long-incubation time
Summary of 30 patients

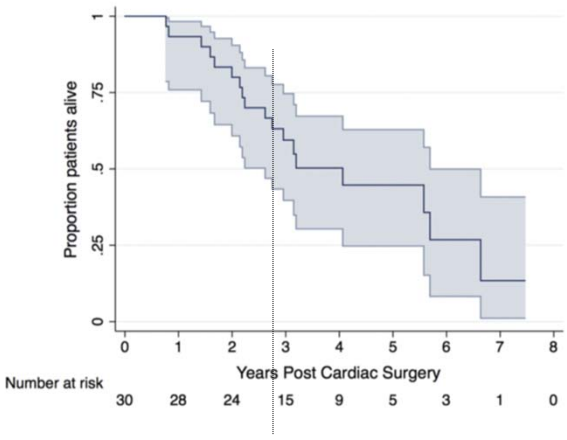


Violin plot demonstrating the distribution of times between cardiac surgery and the development of symptoms, hospital admission and diagnosis of Mycobacte-rium chimaera infection. Plots comprise a symmetrical kernel-density plot (red) showing the full distribution of times with a superimposed boxplot (blue)

Scriven JE. Clin Microbiol Infect. 2018 Nov;24(11):1164-1170. doi: 10.1016/j.cmi.2018.04.027

25

Survival after cardiac surgery for patients diagnosed with *Mycobacterium chimaera* infection



Incidence
1.100 to 1:1000

Mortality 50%

Scriven JE. Clin Microbiol Infect. 2018 Nov;24(11):1164-1170. doi: 10.1016/j.cmi.2018.04.027

26

Different Technologies among HCU Products

TABLE 2. Technical Data for the Different Heater-Cooler Units (HCUs)[a]

	3T HCU	HCU30	HCU40
Ventilator for compressor			
Maximum power, W	95	46	55
Rotational speed, rpm	1,500–1,550	Max. 1,550	Max. 2,950
Diameter propeller, mm	300	1 × 254	2 × 200
Ventilator for electronics			
Maximum power, W	1.4	1.1	…
Rotational speed, rpm	2,600	Max. 3,900	…
Diameter propeller, mm	75	60	…
Functions/Maintenance			
Standby water temperature	≈20° C (ambient temperature)	2–4°C	2–4°C
Disinfecting agent[b]	Peracetic acid	None, thermodisinfection at 90°C	Sodium hypochl
Recommended disinfection interval[b]	Every 2nd week	Weekly	Weekly
Automated reminder for disinfection	No	No	Yes

[a]Provided by the manufacturers.
[b]By the end of the study, May 2017.

Kuehl R & Widmer AF. Infect Control Hosp Epidemiol 2018;39:834–840

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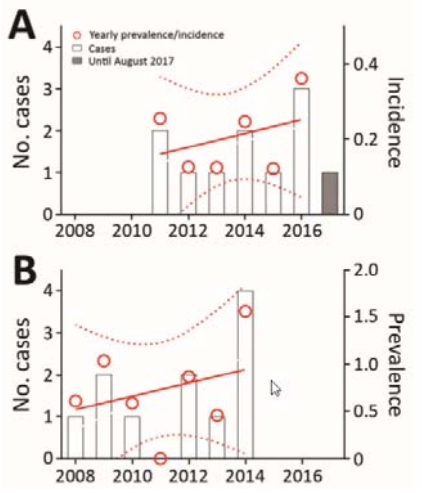
EMERGING INFECTIOUS DISEASES
CDC
Mycobacteria
March 2018

Global Health Estimate of Invasive *Mycobacterium chimaera* Infections Associated with Heater–Cooler Devices in Cardiac Surgery



Global Health Estimate

Based on Prevalence:
(10 major market countries for valve replacement)
150–300 cases / year

Based on Incidence:
(European Union)
70–130 cases / year

2019: approx. 120 cases reported

Reporting bias estimated: 1:10

Rami Sommerstein, Barbara Hasse, Jonas Marschall, Hugo Sax, Michele Genoni, Matthias Schlegel, Andreas F. Widmer,

28

Evidence that *Mycobacterium chimaera* aerosols penetrate laminar airflow and result in infections at the surgical field

- the airflow from the unit could be shown to breach the laminar flow using smoke testing, which correlated with increased particle counts and the detection of *M chimaera* (settle plates) in the operating field, up to 5 m from the heater-cooler unit
- In conclusion, **laminar flow might be insufficient to protect** against microbial aerosols generated in an airflow such as from the heater-cooler unit exhaust fan, and in this particular outbreak
  microbial air contamination is indeed strongly implicated as the source of surgical site infection..
- **Walker JT. Lancet Infect Dis. 2017 Oct;17(10):1019. doi: 10.1016/S1473-3099(17)30519-4**

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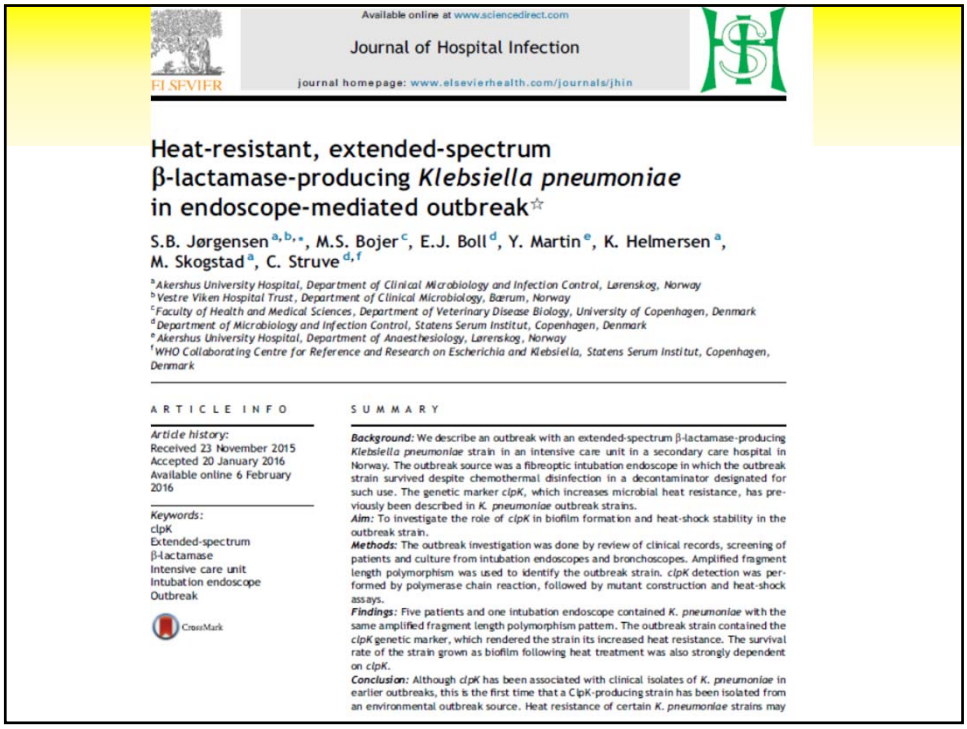
The Hospital Environment

A dangerous Area ?

- Surfaces
- Air
- Water
- Medical Devices

30



Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevierhealth.com/journals/jhin

Heat-resistant, extended-spectrum β-lactamase-producing *Klebsiella pneumoniae* in endoscope-mediated outbreak☆

S.B. Jørgensen[a,b,*], M.S. Bojer[c], E.J. Boll[d], Y. Martin[e], K. Helmersen[a], M. Skogstad[a], C. Struve[d,f]

[a] Akershus University Hospital, Department of Clinical Microbiology and Infection Control, Lørenskog, Norway
[b] Vestre Viken Hospital Trust, Department of Clinical Microbiology, Bærum, Norway
[c] Faculty of Health and Medical Sciences, Department of Veterinary Disease Biology, University of Copenhagen, Denmark
[d] Department of Microbiology and Infection Control, Statens Serum Institut, Copenhagen, Denmark
[e] Akershus University Hospital, Department of Anaesthesiology, Lørenskog, Norway
[f] WHO Collaborating Centre for Reference and Research on Escherichia and Klebsiella, Statens Serum Institut, Copenhagen, Denmark

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Keywords:
clpK
Extended-spectrum
β-lactamase
Intensive care unit
Intubation endoscope
Outbreak

SUMMARY

Background: We describe an outbreak with an extended-spectrum β-lactamase-producing *Klebsiella pneumoniae* strain in an intensive care unit in a secondary care hospital in Norway. The outbreak source was a fibreoptic intubation endoscope in which the outbreak strain survived despite chemothermal disinfection in a decontaminator designated for such use. The genetic marker *clpK*, which increases microbial heat resistance, has previously been described in *K. pneumoniae* outbreak strains.
Aim: To investigate the role of *clpK* in biofilm formation and heat-shock stability in the outbreak strain.
Methods: The outbreak investigation was done by review of clinical records, screening of patients and culture from intubation endoscopes and bronchoscopes. Amplified fragment length polymorphism was used to identify the outbreak strain. *clpK* detection was performed by polymerase chain reaction, followed by mutant construction and heat-shock assays.
Findings: Five patients and one intubation endoscope contained *K. pneumoniae* with the same amplified fragment length polymorphism pattern. The outbreak strain contained the *clpK* genetic marker, which rendered the strain its increased heat resistance. The survival rate of the strain grown as biofilm following heat treatment was also strongly dependent on *clpK*.
Conclusion: Although *clpK* has been associated with clinical isolates of *K. pneumoniae* in earlier outbreaks, this is the first time that a ClpK-producing strain has been isolated from an environmental outbreak source. Heat resistance of certain *K. pneumoniae* strains may

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Pathogens Associated With a Fomite, Transmission Mechanism, and Infection Prevention Recommendations in Moderate to High Significance Categories of Healthcare-Associated Outbreaks

Fomite	Pathogen	Transmission	Significance[a]	Prevention/Control
Hand soap/ sanitizer dispenser	*Enterobacter, Pseudomonas, Serratia*	Contact	Moderate	Use disposable dispenser, antiseptic with greater bactericidal activity (eg, chlorhexidine) and/or alcohol-based handrub, use antimicrobial at recommended concentration
Humidifier	*Acinetobacter, Acremonium, Burkholderia, Klebsiella, Legionella, Mycobacterium, Pseudomonas, Stenotrophomonas*	Inhalation, airborne	High	Avoid use of humidifier when possible, use sterile water, disinfect between use
Nebulizer	*Burkholderia, Legionella, Pseudomonas, Staphylococci*	Inhalation, contact, airborne	High	Avoid sharing multidose medications between patients, use sterile water, disinfect device between use
Pressure transducer	*Pseudomonas, Serratia*	Contact	Moderate	Disinfect pressure transducer between patients, use disposable dome, adhere to aseptic technique
Stethoscope	*Acinetobacter, Klebsiella, Pseudomonas*	Contact	Moderate	Prudent to disinfect between patients
Suction apparatus	*Acinetobacter, Enterobacter, Klebsiella, Pseudomonas, Salmonella, Serratia, Staphylococcus, Stenotrophomonas*	Contact, droplet	High	Avoid backflow, avoid aerosolization, disinfect suction apparatus properly
Thermometer	*Clostridium, Enterobacter, Enterococcus, Klebsiella*	Contact	High	Proper disinfection between uses of thermometer, use single-use disposable thermometer when available
Ultrasound probe	*Burkholderia, Enterobacter, Mycobacterium, Pseudomonas, Salmonella, Serratia, Staphylococcus*	Contact	High	Low-level disinfect for surface probes and high-level disinfect for endocavitary probes between patients; label gel bottles and use sterile gels if available

[a]Clinical significance for outbreaks via a fomite was categorized as low (≤3 outbreaks), moderate (4–6 outbreaks), and high (≥7 outbreaks).

Kanamori H, Rutala WA, & Weber DJ. Clin Infect Dis. 2017 Oct 15;65(8):1412-1419. doi: 10.1093/cid/cix462.

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Pathogens Associated With a Fomite in Low Significance Category of Healthcare-Associated Outbreaks

Fomite	Pathogen
Atomizer	*Alcaligenes, Achromobacter*
Breast pump	*Acinetobacter, Serratia*
Computer keyboard/ mobile phone/tablet	*Acinetobacter, Chryseobacterium, Clostridium, Enterococcus, Pseudomonas, Staphylococcus*
Electrocardiography/ lead wire	*Enterococcus, Serratia*
Enteral feed	*Salmonella, Serratia*
Medical chart	*Acinetobacter, Escherichia, Klebsiella, Staphylococcus, Streptococcus*
Shaving razor	*Klebsiella, Microsporum, Serratia*
Tourniquet/ exsanguinator	*Acinetobacter, Enterococcus, Candida, Staphylococcus, Proteus*
Toys	*Bacillus, Micrococcus, Pseudomonas, Staphylococcus, Stenotrophomonas, Streptococcus*
Measuring cup/auto-mated urine analyzer	*Pseudomonas, Shewanella*
Wheelchairs	*Acinetobacter, Pseudomonas, Staphylococcus*

Kanamori H, Rutala WA, & Weber DJ. Clin Infect Dis. 2017 Oct 15;65(8):1412-1419. doi: 10.1093/cid/cix462.

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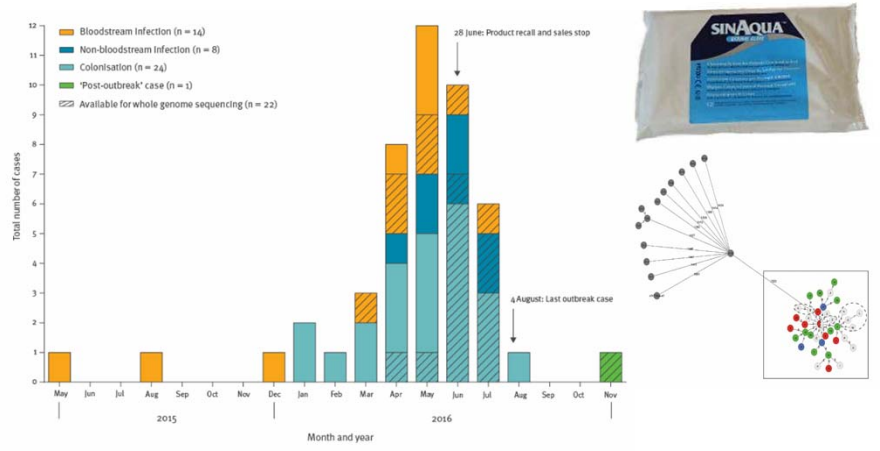
Outbreak mit *Burkholderia cepacia* complex durch kontaminierte Waschtücher «Sinaqua Dermal» in der Schweiz



Sommerstein R &Marschall J. Euro Surveill. 2017 Dec;22(49)

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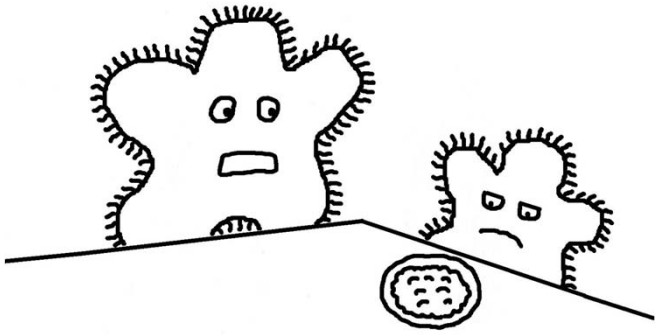
The End

Bundesamt
für Gesundheit



"But Timmy, you have to eat your antibiotics, or you'll never become a big and strong bacteria."

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SWISSNOSO
Sginf
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ANRESIS

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