

# Emerging Issues in Infection Prevention

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# Emerging Zoonosis

You notice an increased in Gr. B *Streptococcal* infection in your province. All cases represent as severe infections. Which of the following animal may be a reservoir for this infection?

- A) Crab
- B) Shellfish
- C) Freshwater fish
- D) Snail
- E) No animal reservoir for this infection

Clinical Infectious Diseases

SUPPLEMENT ARTICLE

IDSAA  
Infectious Diseases Society of America

hivma  
HIV Medicine Association

1000000

## 2015 Epidemic of Severe *Streptococcus agalactiae* Sequence Type 283 Infections in Singapore Associated With the Consumption of Raw Freshwater Fish: A Detailed Analysis of Clinical, Epidemiological, and Bacterial Sequencing Data

Shirin Kalimuddin,<sup>1,2</sup> Swaine L. Chen,<sup>2,3,4</sup> Cindy T. K. Liu,<sup>5,6</sup> Tse Hsien Koh,<sup>7</sup> Thean Yen Tan,<sup>8</sup> Michelle Kam,<sup>9</sup> Christopher W. Wong,<sup>2</sup> Kurosh S. Meherishahi,<sup>1</sup> Man Ling Chan,<sup>1</sup> Lee Ching Ng,<sup>1</sup> Wen Ying Tang,<sup>1</sup> Hishamuddin Badaruddin,<sup>10</sup> Jeannette Teo,<sup>11</sup> Anucha Apisarnthanarak,<sup>12</sup> Nontra Suwastanak,<sup>13,14</sup> Margaret Ip,<sup>15</sup> Matthew T. G. Holden,<sup>16</sup> Li Yang Han,<sup>17</sup> and Timothy Barkham<sup>2</sup> for the Singapore Group B *Streptococcus* Consortium

**Background.** *Streptococcus agalactiae* (group B *Streptococcus* [GBS]) has not been described as a foodborne pathogen. However, in 2015, a large outbreak of severe invasive sequence type (ST) 283 GBS infections in adults epidemiologically linked to the consumption of raw freshwater fish occurred in Singapore. We attempted to determine the scale of the outbreak, define the clinical spectrum of disease, and link the outbreak to contaminated fish.

**Methods.** Time-series analysis was performed on microbiology laboratory data. Food handlers and fishmongers were screened for enteric carriage of GBS. A retrospective cohort study was conducted to assess differences in demographic and clinical characteristics of patients with invasive ST283 and non-ST283 infections. Whole-genome sequencing was performed on human and fish ST283 isolates from Singapore, Thailand, and Hong Kong.

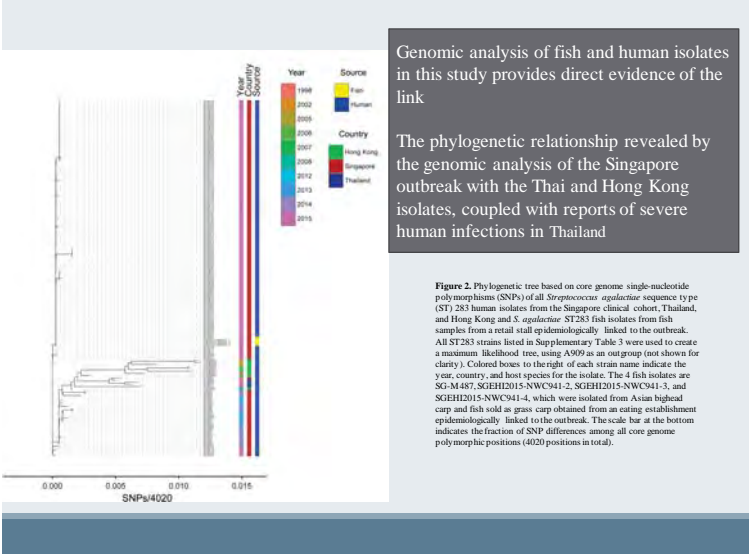
**Results.** The outbreak was estimated to have started in late January 2015. Within the study cohort of 408 patients, ST283 accounted for 35.8% of cases. Patients with ST283 infection were younger and had fewer comorbidities but were more likely to develop meningococcal sepsis, septic arthritis, and spinal infection. Of 82 food handlers and fishmongers screened, none carried ST283. Culture of 43 fish samples yielded 13 ST283-positive samples. Phylogenomic analysis of 161 ST283 isolates from humans and fish revealed they formed a tight clade distinguished by 93 single-nucleotide polymorphisms.

**Conclusions.** ST283 is a zoonotic GBS clone associated with farmed freshwater fish, capable of causing severe disease in humans. It caused a large foodborne outbreak in Singapore and poses both a regional and potentially more widespread threat.

**Keywords.** outbreak; *Streptococcus agalactiae*; group B streptococcus; foodborne; zoonosis.

Table 1. Demographic, Clinical, and Microbiological Characteristics of the Study Population

Variable	ST283 (n = 146)	Non-ST283 GBS (n = 262)	P Value
Median (IQR) urea, mmol/L	5.30 (3.53–8.30)	8.45 (5.00–14.85)	<.001
Median (IQR) CRP mg/L	211.0 (113.0–318.8)	124.0 (22.05–213.60)	<.001
Median (IQR) procalcitonin, µg/L	6.00 (2.00–27.34)	3.70 (0.93–14.27)	.096
GBS serotype			NA
III	146 (100)	44 (16.9)	
IIa	---	38 (14.6)	
IIb	---	17 (6.5)	
II	---	35 (13.5)	
IV	---	1 (0.4)	
V	---	55 (21.2)	
VI	---	58 (22.3)	
VII	---	12 (4.6)	
Clinical syndrome			
Bacteremia without specific focus	33 (22.3)	61 (23.5)	.903
Meningitis/ meningoen­cephalitis	29 (19.9)	0 (0.0)	<.001
Endocarditis (native valve)	15 (10.3)	13 (5.0)	.064
Endovascular infection <sup>a</sup>	1 (0.7)	2 (0.8)	1.000
Endophthalmitis	6 (4.1)	3 (1.1)	.075
Pneumonia	1 (0.7)	3 (1.1)	1.000
Skin and soft tissue infection	27 (18.5)	110 (42.0)	<.001
Native joint septic arthritis	44 (30.1)	13 (5.0)	<.001
Prosthetic joint septic arthritis	1 (0.7)	1 (0.4)	1.000
Spinal infection <sup>b</sup>	12 (8.2)	5 (1.9)	.005
Lower urinary tract infection	5 (3.4)	31 (11.8)	.007
Upper urinary tract infection <sup>c</sup>	8 (5.5)	12 (4.6)	.870
Hepatobiliary infection	1 (0.7)	2 (0.8)	1.000
Inpatient mortality	5 (3.4)	25 (9.5)	.038



It comes with  
Water

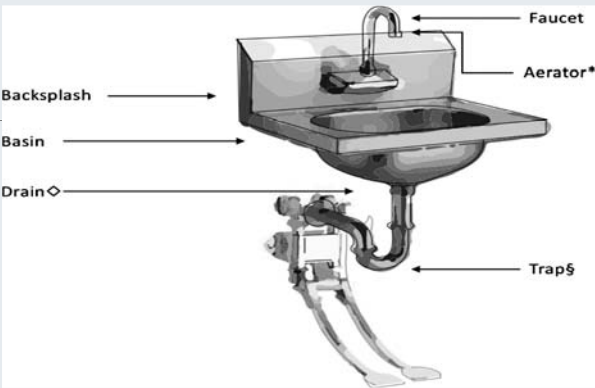


Fig.1 Anatomy of a hospital sink and associated nomenclature.  
\*Flowmodulator; §U-bend/P-trap/S-trap/Siphon; ◇outlet/strainer;  
imagecourtesy of Bryan Graham Huck



## Characterizations of handwashing sink activities in a single hospital medical intensive care unit

M. Grabowski<sup>a</sup>, J.M. Lobo<sup>a</sup>, B. Gunnell<sup>b</sup>, K. Enfield<sup>c</sup>, R. Carpenter<sup>d</sup>, L. Barnes<sup>e</sup>, A.J. Mathers<sup>f,\*,1</sup>

- Handwashing was only 4% (224 out of 5614) of total behaviours
- 56 activities were categorized where a variety of nutrients, which could promote microbial growth, were disposed of in the sink

**4% OF SINK USE FOR HAND WASHING! THUS RE-THINKING WASTE MANAGEMENT!**

HAND HYGIENE → ALCOHOL-BASED HAND RUB

**HOWEVER, FOCUS ON:**

DISCARDING DETERGENT AND DIS-INFECTANT

DISCARDING OF BIOLOGICAL WASTE

DISCARDING OF DRUGS, INFUSION FLUID AND ANTIBIOTICS

## Spread from the Sink to the Patient: *In Situ* Study Using Green Fluorescent Protein (GFP)-Expressing *Escherichia coli* To Model Bacterial Dispersion from Hand-Washing Sink-Trap Reservoirs

April 2017, Volume 83, Issue 8, e13327–16  
Applied and Environmental Microbiology  
Shireen Kotay,<sup>a</sup> Weidong Chai,<sup>a</sup> William Guilford,<sup>b</sup> Katie Barry,<sup>a</sup> Amy J. Mathers<sup>a,c</sup>

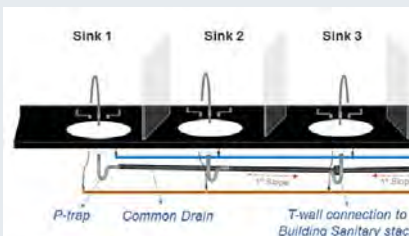
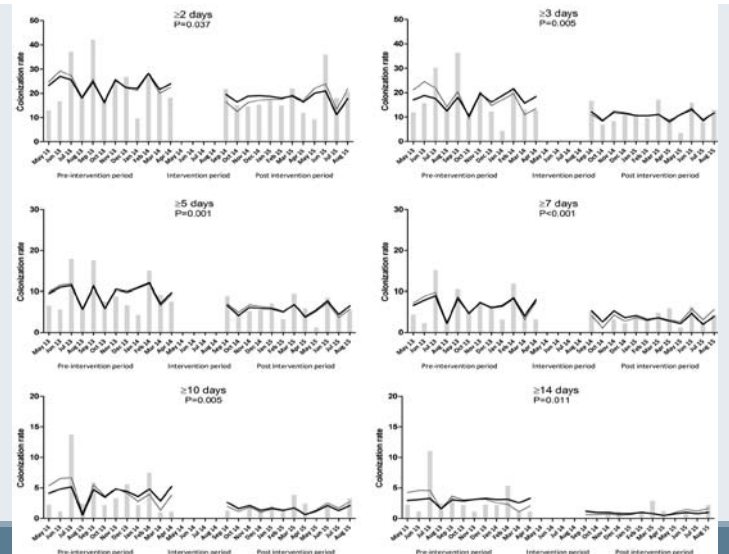
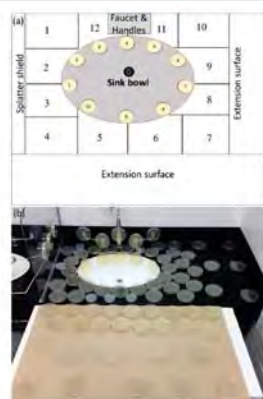
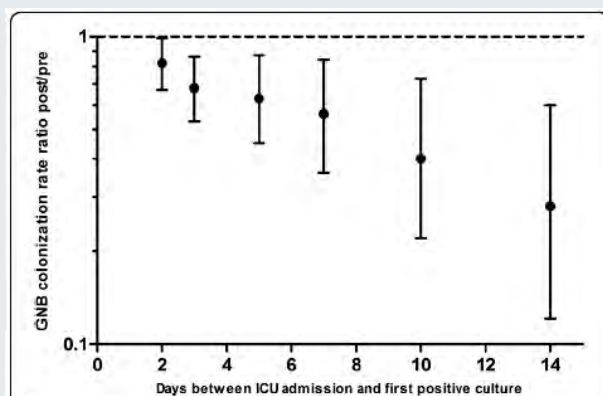


FIG 4 Layout of the sink gallery comprising the 5 sink modules and





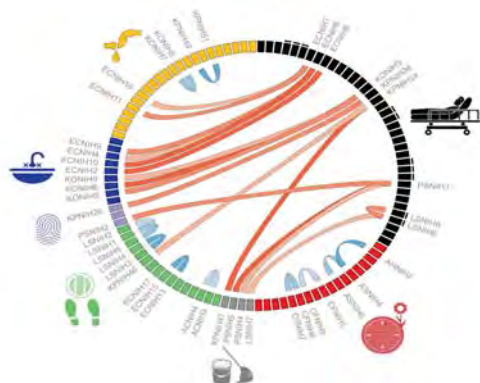
**Fig. 3** Colonization rate ratios related to ICU-LOS. Legend: Colonization rate ratios (with 95%CI) were calculated to investigate the effect of ICU-LOS on the effect of the intervention. GNB identified in ICU patients with a length of stay of  $\geq 2$ ,  $\geq 3$ ,  $\geq 5$ ,  $\geq 7$ ,  $\geq 10$  or  $\geq 14$  days after ICU admission were analyzed

**Table 1** 'Water-free' patient care activities

Patient care-related action	New method with 'water-free' working
Gloves and gowns	Universal gloving and gowning (pre- and post-intervention period)
Hand washing after visual contamination	'Quick & Clean', (Alpheios B.V., Heerlen, The Netherlands) wipes to remove extensive contamination from hands. Followed by disinfection with alcohol-based hand rub
Medication preparation	Dissolving of medication in bottled water (SPA reine, Spa, Belgium)
Drinks	Bottled water (SPA reine, Spa, Belgium)
Canula care	Disposable materials
Hair washing	Rinse-free shampoo cap (Comfort Personal cleansing products, USA)
Washing	Moistened disposable wash gloves, (D-care, Houten, The Netherlands)
Dental care	Bottled (SPA reine, Spa, Belgium)
Shaving	Electric shaving, or with warm bottled water (SPA reine, Spa, Belgium)

## Genomic Analysis of Hospital Plumbing Reveals Diverse Reservoir of Bacterial Plasmids Conferring Carbapenem Resistance

Rebecca A. Weingarten,<sup>a</sup> Ryan C. Johnson,<sup>a</sup> Sean Conlan,<sup>b</sup> Amanda M. Ramsburg,<sup>a</sup> John P. Dekker,<sup>a</sup> Anna F. Lau,<sup>a</sup> Pavel Khil,<sup>a</sup> Robin T. Odom,<sup>a</sup> Clay Deming,<sup>b</sup> Morgan Park,<sup>a</sup> Pamela J. Thomas,<sup>a</sup> NISC Comparative Sequencing Program,<sup>a</sup> David K. Henderson,<sup>a</sup> Tara N. Palmore,<sup>a</sup> Julia A. Segre,<sup>b</sup> Karen M. Frank<sup>a</sup>



## Oral Care with CHG

# Did your hospital implement CHG bath and CHG mouth care?

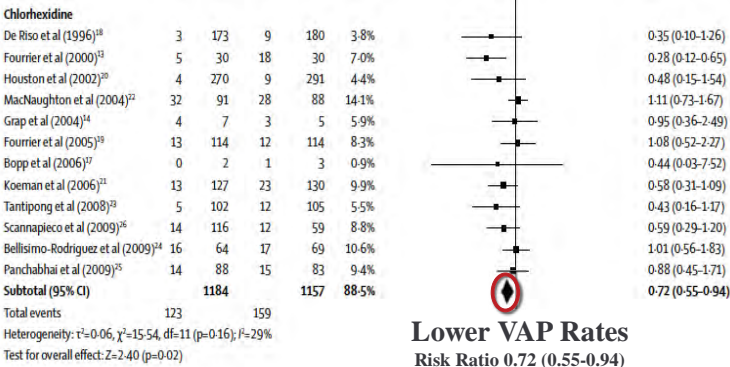
- A) Yes
- B) No
- C) Not sure

# Did you notice higher mortality on the group with CHG bath or CHG mouth care?

Variable	CHG bath	CHG mouth care
A)	Y	Y
B)	Y	N
C)	N	Y
D)	N	N

# Oral Care with Chlorhexidine

Meta-analysis of Randomized Studies: lower VAP rates



VAP Prevention Studies are at High Risk for Bias

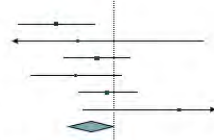
Especially Open Label studies



# Open Label vs Double Blind Studies

## Open Label Randomized Controlled Trials:

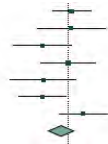
Open-label Studies					
Fourrier et al, <sup>20</sup> 2000	5	30	18	30	0.28 (0.12-0.65)
Bopp et al, <sup>22</sup> 2006	0	2	1	3	0.44 (0.03-7.52)
Jafari et al, <sup>19</sup> 2007	9	40	13	40	0.69 (0.33-1.43)
Tantipong et al, <sup>24</sup> 2008	5	102	12	105	0.43 (0.16-1.17)
Panchabhai et al, <sup>26</sup> 2009	14	88	15	83	0.88 (0.45-1.71)
Berry et al, <sup>28</sup> 2011	4	71	1	78	4.39 (0.50-38.39)
Subtotal	37	333	60	339	0.61 (0.35-1.04)



Lower VAP Rates!  
RR 0.61 (0.35-1.04)

## Double-Blind Randomized Controlled Trials:














Double-blind Studies					
Macnaughton et al, <sup>18</sup> 2004	32	91	28	88	1.11 (0.73-1.67)
Fourrier et al, <sup>21</sup> 2005	13	114	12	114	1.08 (0.52-2.27)
Koeman et al, <sup>23</sup> 2006	13	127	23	130	0.58 (0.31-1.09)
Bellissimo-Rodrigues et al, <sup>25</sup> 2009	16	64	17	69	1.01 (0.56-1.83)
Scannapieco et al, <sup>27</sup> 2009	14	116	12	59	0.59 (0.29-1.20)
Ozaka et al, <sup>30</sup> 2012	12	32	22	34	0.58 (0.35-0.97)
Meinberg et al, <sup>23</sup> 2012	18	28	11	24	1.40 (0.84-2.35)
Subtotal	118	572	125	518	0.88 (0.66-1.16)



No Difference!  
RR 0.88 (0.66-1.16)

JAMA Internal Med 2014;174:751

# Mortality


Study or Subgroup	Chlorhexidine		Control		Risk Ratio (95% CI)	<div><div><div><div><div></div><div></div></div><div></div><div></div></div><div>Favors Chlorhexidine</div><div>Favors Control</div></div></div>	Weight, %
	Events	Patients	Events	Patients			
<b>Non-Cardiac Surgery Studies</b>							
Open-label Studies							
Fourrier et al, <sup>20</sup> 2000	3	30	7	30	0.43 (0.12-1.50)		1.0
Tantipong et al, <sup>24</sup> 2008	36	102	37	105	1.00 (0.69-1.45)		12.1
Panchabhai et al, <sup>26</sup> 2009	64	88	51	83	1.18 (0.96-1.46)		36.3
Subtotal	103	220	95	218	1.06 (0.80-1.41)		49.5
Double-blind Studies							
Macnaughton et al, <sup>18</sup> 2004	36	91	33	88	1.05 (0.73-1.53)		12.0
Fourrier et al, <sup>21</sup> 2005	31	114	24	114	1.29 (0.81-2.06)		7.6
Koeman et al, <sup>23</sup> 2006	49	127	39	130	1.29 (0.91-1.81)		14.1
Scannapieco et al, <sup>27</sup> 2009	16	97	8	49	1.01 (0.46-2.20)		2.7
Ozaka et al, <sup>30</sup> 2012	19	32	20	34	1.01 (0.68-1.51)		10.2
Meinberg et al, <sup>29</sup> 2012	13	28	9	24	1.24 (0.65-2.38)		3.9
Subtotal	164	489	133	439	1.15 (0.96-1.38)		50.5
<b>Total</b>	<b>267</b>	<b>709</b>	<b>228</b>	<b>657</b>	<b>1.13 (0.99-1.29)</b>		<b>100.0</b>
<b>All Studies</b>							
<b>Total</b>	<b>283</b>	<b>1637</b>	<b>247</b>	<b>1597</b>	<b>1.13 (0.99-1.28)</b>		<b>100.0</b>

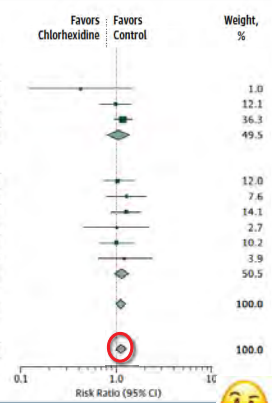
0.1

1.0

10

Risk Ratio (95% CI)





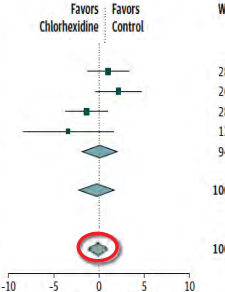
JAMA Internal Med 2014;174:751-761

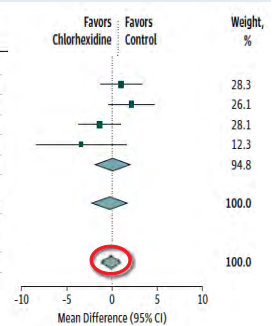
Trend to Higher Mortality!  
RR 1.13 (0.99 to 1.28)

Need to look at objective outcomes

## Randomized trials of oral care with chlorhexidine vs control solution

### Duration of Mechanical Ventilation

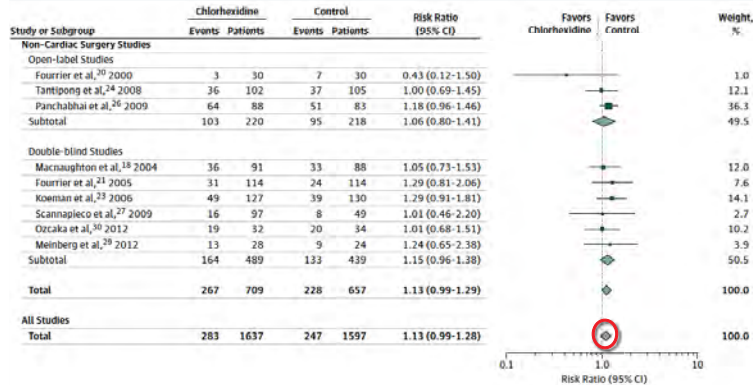
Study or Subgroup	Chlorhexidine		Control		Mean Difference (95% CI)		Weight, %
	Mean (SD)	Total	Mean (SD)	Total			
<b>Double-blind Studies</b>							
Fourrier et al, <sup>21</sup> 2005	11.7 (8.7)	114	10.6 (8.7)	114	1.10 (-1.16 to 3.36)	28.3	
Koeman et al, <sup>23</sup> 2006	9.2 (12)	127	7 (8.1)	130	2.20 (-0.31 to 4.71)	26.1	
Scannapieco et al, <sup>27</sup> 2009	8.4 (5.2)	50	9.7 (6.3)	49	-1.30 (-3.58 to 0.98)	28.1	
Ozaka et al, <sup>30</sup> 2012	9 (8.3)	32	12.3 (11.9)	34	-3.30 (-8.23 to 1.63)	12.3	
Subtotal		323		327	0.13 (-1.90 to 2.17)	94.8	
<b>Total</b>		<b>353</b>		<b>357</b>	<b>-0.15 (-2.18 to 1.89)</b>	<b>100.0</b>	
<b>All Studies</b>							
<b>Total</b>		<b>838</b>		<b>826</b>	<b>0.01 (-1.12 to 1.14)</b>	<b>100.0</b>	



No Difference!  
Mean Difference 0.01 days (-1.12 to 1.14)

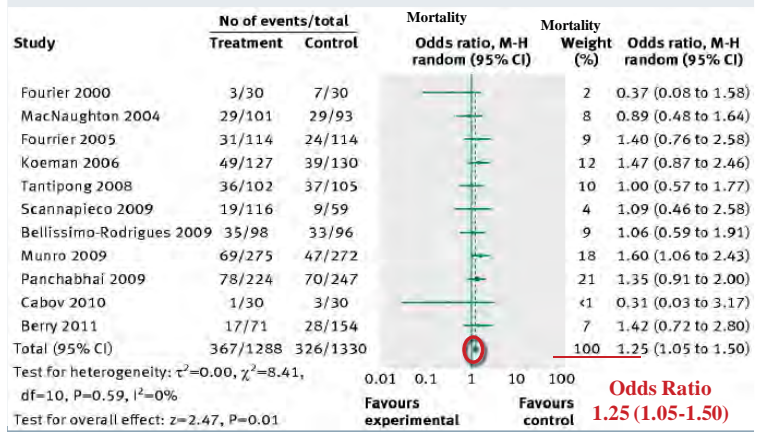
JAMA Internal Med 2014;174:751-761

## Mortality



JAMA Internal Med 2014;174:751-761

## Significantly Higher Mortality



BMJ 2014;348:g2197

## Oral Ulcers Associated with 2% Chlorhexidine



Bleeding Ulcer



White Plaques

Intensive Care Med 2016;42:620-621

## Oral Ulcers Associated with 2% Chlorhexidine



Bleeding Mouth



Dry Tongue, Aphthous Lesions

Intensive Care Med 2016;42:620-621

## Case Reports of Allergies and Anaphylaxis

## ORIGINAL ARTICLE

## ANAPHYLAXIS

### Standardized testing with chlorhexidine in perioperative allergy – a large single-centre evaluation

M. S. Opstrup<sup>1,2</sup>, H.-J. Malling<sup>2</sup>, M. Kræigaard<sup>2</sup>, H. Mosbech<sup>2</sup>, P. S. Skov<sup>2</sup>, L. K. Poulsen<sup>2</sup> & L. H. Garvey<sup>2</sup>

<sup>1</sup>National Allergy Research Centre, Copenhagen University Hospital Gentofte; <sup>2</sup>Allergy Clinic, Danish Anaesthesia Allergy Centre, Copenhagen University Hospital Gentofte, Gentofte, Denmark.

1972 *Acetivibrio* April 1981, 43, 1200-1205

**Supplementary materials**

ACTA AGRICULTURICA SCANDINAVICA  
1999, 49, 277

### Case Report

### Anaphylactic reactions in anaesthetised patients – four cases of chlorhexidine allergy

L. H. GARDY, J. BMOJTIMESON<sup>2</sup> and E. HOSAL<sup>2</sup>

Department of Psychiatry and Behavioral Science, University of California, San Francisco, CA

**9% of perioperative allergic reactions attributed to chlorhexidine**

### Case reports of anaphylaxis

*Allergy* 2014;69(10):1390-1396  
*Acta Anaesthesiol Scand* 2001;45:1290-1294

## Case Reports of ARDS following Aspiration

## Chlorhexidine Gluconate Ingestion Resulting in fatal Respiratory Distress Syndrome

Kiyotaka Hirata PhD

Department of Pharmacy, Nippon Medical School Hospital, 1-1-5  
Sendagi Bunkyo-ku, Tokyo, 113-8603, Japan

Akira Kurokawa MD

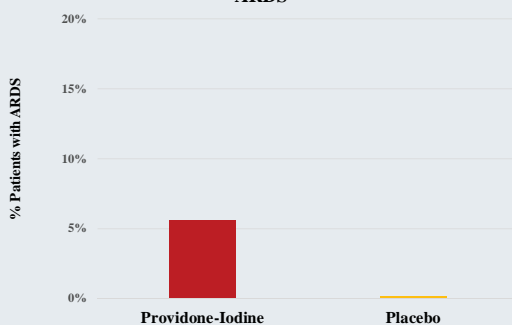
Department of Emergency and Critical Care Medicine, Nippon Medical School, Tama  
Nagayama Hospital, 1-1-5 Sendagi, Bunkyo-ku, Tokyo, 113-8603, Japan

Vet Hum Toxicol 2002;44:89-91

## Randomized controlled trial of providone-iodine vs placebo to prevent VAP

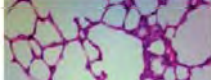
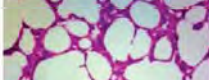




### Aspiration of Oral Antiseptics and ARDS

## ARDS



*Crit Care Med* 2014;42:1-8

## Chlorhexidine Instillation into Rat Lungs

	Control	0.02% CHG	0.20% CHG
After 24 hours			
After 7 days			

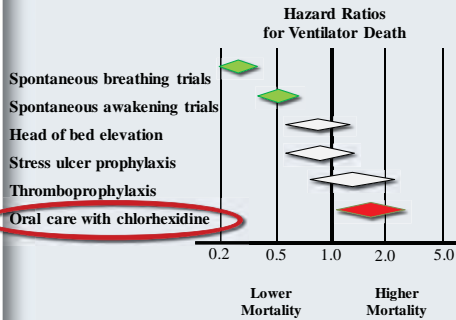
Human and Experimental Toxicology 2011;30:1795-1803



# Independent Signal

Retrospective cohort analysis  
5,539 patients on mechanical ventilation

adjusted for comorbidities, severity of illness,  
contraindications, etc.



JAMA Internal Med 2016;176:1277-1283

## ATB Prophylaxis for ESBL Carriage

Which ATB do you use to prevent SSI in ESBL-carriage who had contaminated abdominal surgery?

A Cefazolin

B Cefoxitin

C Piperacillin-tazobactam

D Ertapenem

## GLOBAL GUIDELINES FOR THE PREVENTION OF SURGICAL SITE INFECTION



### 4.3 Screening for extended-spectrum beta-lactamase colonization and the impact on surgical antibiotic prophylaxis

#### Recommendation

The panel decided not to formulate a recommendation due to the lack of evidence.

### 4.2 Decolonization with mupirocin ointment with or without chlorhexidine gluconate body wash for the prevention of *Staphylococcus aureus* infection in nasal carriers undergoing surgery

#### Recommendations

1. The panel recommends that patients undergoing cardiothoracic and orthopaedic surgery with known nasal carriage of *S. aureus* should receive perioperative intranasal applications of mupirocin 2% ointment with or without a combination of CHG body wash. (Strong recommendation, moderate quality of evidence)
2. The panel suggests considering to treat also patients with known nasal carriage of *S. aureus* undergoing other types of surgery with perioperative intranasal applications of mupirocin 2% ointment with or without a combination of CHG body wash. (Conditional recommendation, moderate quality of evidence)

Carriage of Extended-spectrum Beta-lactamase-producing Enterobacteriaceae and the Risk of Surgical Site Infection After Colorectal Surgery: A Prospective Cohort Study

Bianna Dubinsky-Pertsov,<sup>1,2</sup> Elizabeth Temkin,<sup>1</sup> Stephan Harbarth,<sup>3</sup> Carolina Fankhauser-Rodriguez,<sup>3</sup> Biljana Carevic,<sup>4</sup> Ivana Radovanovic,<sup>4</sup> Frederic Ris,<sup>4</sup> Yehuda Kariv,<sup>5</sup> Nicolas G. Buchs,<sup>6</sup> Eduardo Schiffer,<sup>7</sup> Shimeit Cohen Percia,<sup>8</sup> Amir Nutman,<sup>3,2</sup> Noga Fallach,<sup>4</sup> Joseph Klausner,<sup>1,2</sup> and Yehuda Carmeli<sup>1,2</sup>, for the R-GNOSIS WP4 Study Group

Table 3. Pathogens Causing Surgical Site Infections (SSI) in Patients With SSI Confirmed by Culture

	ESBL-PE Carriers	ESBL-PE non-carriers
ESBL-producing	0	0
ESBL-nonproducing	3	1
Other Enterobacteriaceae		
ESBL-producing	0	1
ESBL-nonproducing	0	5
Enterococcus spp.	9	8
Pseudomonas aeruginosa	3	3
Staphylococcus aureus	3	7
Amisobes	0	1
Other	7	4

**Results.** A total of 3600 patients were screened for ESBL-PE; 13.8% were carriers. SSIs occurred in 55/220 carriers (24.8%) and 49/440 noncarriers (11.1%,  $P < .001$ ). In multivariable analysis, ESBL-PE carriage more than doubled the risk of SSI (odds ratio [OR], 2.36; 95% confidence interval [CI], 1.50–3.71). Carriers had higher risk of deep SSI (OR, 2.25; 95% CI, 1.27–3.99). SSI caused by ESBL-PE occurred in 7.2% of carriers and 1.6% of noncarriers (OR, 4.23; 95% CI, 1.70–10.56).

Personalized Ertapenem Prophylaxis for Carriers of Extended-spectrum  $\beta$ -Lactamase-producing Enterobacteriaceae Undergoing Colorectal Surgery

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<sup>1</sup>National Center for Infection Control and Antibiotic Resistance, Tel-Aviv Sourasky Medical Center, and <sup>2</sup>Sackler Faculty of Medicine, Tel-Aviv University, Israel; <sup>3</sup>Infection Control Program, Geneva University Hospitals and Faculty of Medicine, World Health Organization Collaborating Center, Switzerland; <sup>4</sup>Department of Hospital Epidemiology, Clinical Center of Serbia, Belgrade; <sup>5</sup>Department of Surgery, Geneva University Hospitals and Faculty of Medicine, Switzerland; <sup>6</sup>Department of Surgery, Tel-Aviv Sourasky Medical Center, Israel; and <sup>7</sup>Department of Anesthesiology, Geneva University Hospitals and Faculty of Medicine, Switzerland

**Background.** Carriers of extended-spectrum  $\beta$ -lactamase-producing Enterobacteriaceae (ESBL-PE) who receive cephalosporin-based prophylaxis have twice the risk of surgical site infection (SSI) following colorectal surgery as noncarriers. We tested whether ESBL-PE screening and personalized prophylaxis with ertapenem reduces SSI risk among carriers.

**Methods.** We conducted a prospective nonrandomized, nonblinded, interventional study in 3 hospitals in Israel, Switzerland, and Serbia. Patients were screened for ESBL-PE carriage before elective colorectal surgery. During the baseline phase, departmental guidelines advised prophylaxis with a cephalosporin plus metronidazole. In the intervention phase, guidelines were changed for ESBL-PE carriers to receive ertapenem. The primary outcome was any type of SSI within 30 days. We calculated adjusted risk differences (ARDs) following logistic regression.

**Results.** The intention-to-treat analysis compared 209 ESBL-PE carriers in the baseline phase to 269 in the intervention phase. SSI rates were 21.5% and 17.5%, respectively (ARD, –4.7% [95% confidence interval (CI), –11.8% to 2.4%]). Unplanned crossover was high (15%), so to assess efficacy we performed an as-treated analysis comparing 247 patients who received cephalosporin-based prophylaxis with 221 who received ertapenem. SSI rates were 22.7% and 15.8%, respectively (ARD, –7.7% [95% CI, –14.6% to –0.8%]), and rates of SSI caused by ESBL-PE were 6.5% and 0.9%, respectively (ARD, –5.6% [95% CI, –8.9% to –2.3%]). There was no significant difference in the rate of deep SSI. The number needed to treat to prevent 1 SSI in ESBL-PE carriers was 13.

**Conclusions.** Screening for ESBL-PE carriage before colorectal surgery and personalizing prophylaxis for carriers is efficacious in reducing SSI.

Table 3. Pathogens Causing Surgical Site Infection (SSI) in Extended-spectrum  $\beta$ -Lactamase-producing Enterobacteriaceae Carriers With Culture-confirmed SSI, by Study Phase\*

Pathogen	Baseline Phase (n = 31)	Intervention Phase (n = 23)
Enterobacteriaceae		
ESBL-producing	0	0
ESBL-nonproducing	2	2
Proteus spp.		
ESBL-producing	0	1
ESBL-nonproducing	0	0
Enterococcus spp.	13	7
Pseudomonas aeruginosa	3	5
Staphylococcus aureus	8	3
Other	6	7

In conclusion, our study provides evidence for screening patients for ESBL-PE carriage before elective colorectal surgery and personalizing antibiotic prophylaxis for patients who screen positive. Routine use of ertapenem prophylaxis for all patients should be discouraged because of the risk of resistance.

Incidence and Risk Factors for Multidrug-Resistance Organisms (MDROs) Colonization among Patients Undergoing Elective Orthopedic Surgery at Thammasat University Hospital

Sirikun Umpunthong,<sup>1</sup> Anucha Apisarnthanasak,<sup>2</sup> Pojane Srimanot,<sup>3</sup> Thana Khawcharoenporn,<sup>4</sup> Chayanin Aungthong,<sup>5</sup> Narisara, Mungkomkaew,<sup>6</sup> Pansache Damronglerd,<sup>7</sup> Sasiuch Rujjanavech,<sup>8</sup> Nuntira Suwattarat<sup>9</sup>

**Results:** Of 384 swabs tested from 96 patients (median age, 58 years), 31 rectal swabs (31/96, 32.3%) and 7 groin swabs (7/96, 7.3%) were identified as ESBL-producing *E. coli*. Seven patients (7.3%) had diagnosed with SSIs. A higher rate of SSIs was found among patients with ESBL-E. coli colonization (6/31, 19.4%) compared to patient without ESBL-E. coli colonization (1/65, 1.5%;  $P = 0.004$ , OR 15.36, 95%CI 1.7–356.3). In multivariate logistic regression analysis, SSIs was significantly associated with ESBL-E. coli colonization ( $P = 0.009$ , adjusted OR 18.29, 95% CI 2.05–162.99). In addition, in multivariate logistic regression analysis, ESBL-E. coli is a significantly risk factor associated with SSIs (6/7, 85.7%,  $P = 0.014$ , adjusted OR 16.53, 95% CI 1.78–153.44).

**Conclusions**

- We found a high incidence of ESBL-E. coli colonization and rate of SSI in patient with preoperative antibiotic prophylaxis.
- ESBL-E. coli colonization is an independent risk factor associated with SSI.
- Further screening and antibiotic prophylaxis modification is considered in endemic region especially for MDRO carriers.

**Methods**

**Study design:** Prospective cohort study.

**Study site:** Thammasat University Hospital.

**Study population:** Patients undergoing elective orthopedic surgery.

**Study protocol:** Patients were screened for MDRO colonization using rectal and groin swabs. MDRO colonization was confirmed by culture and PCR.

**Statistical analysis:** Descriptive statistics were used to describe the study population. Chi-square test was used to compare the incidence of SSIs between patients with and without ESBL-E. coli colonization. Multivariate logistic regression analysis was used to identify risk factors for SSIs.

# ESBL colonization among Abdominal Surgery

- 360 patients were prospective followed after abdominal surgery (clean contaminated surgery, contaminated surgery, dirty surgery)
- 129 patients (36%) had detected ESBL colonization and 49 patients (13.6%) developed surgical site infections.
- ESBL colonization was associated with surgical site infections (aOR = 2.4), but due to non-ESBL microorganisms (e.g., *S. aureus*, *Streptococcus* spp, *Pseudomonas aeruginosa*, non-ESBL *E. coli*)
- ESBL colonization was associated with deep surgical site infections (aOR = 4.9) due to ESBL producing microorganisms.
- No clear association between carbapenem pre-operative and reduction of surgical site infection among ESBL colonizers.

Apisarnthanarak A, et al. ICHE (in press)

Table 2: Microbial characterization of surgical site infections (SSI) among 360 patients who underwent pre-operative enteric screening for extended-spectrum beta lactamase (ESBL)-producing Enterobacteriaceae.

Microorganisms	Preoperative colonization with ESBL-producing Enterobacteriaceae (N = 40)	No colonization with ESBL-producing Enterobacteriaceae (N = 11)
<b>Superficial SSI (N = 41)</b>		
Gram-positive pathogen (N = 15)		
<i>Staphylococcus aureus</i> (N = 10)	7 (15)	3 (27)
<i>Streptococcus</i> spp. (N = 5)	3 (8)	2 (18)
Gram-negative pathogen (N = 26)		
Non-ESBL producing enterobacteriaceae (N = 16)	13 (32)	3 (27)
<i>Pseudomonas aeruginosa</i> (N = 6)	5 (13)	1 (9)
No pathogen detected (N = 4)	3 (8)	1 (9)
<b>Deep SSI and organ space infection (N = 10)</b>		
Non-ESBL producing enterobacteriaceae (N = 2)	0 (0)	2 (18)
ESBL-producing enterobacteriaceae (N = 8)	8 (20)	0 (0)

Note: no (%), unless indicated otherwise; 4 patients who developed superficial SSIs had negative culture results

Apisarnthanarak A, et al. ICHE (in press)

# Changing in Spalding Classification

## ENDOSCOPE REPROCESSING: CHALLENGES

NDM-Producing *E. coli* Associated ERCP

NDM-producing *E.coli* recovered from elevator channel (elevator channel orients catheters, guide wires and accessories into the endoscope visual field; crevices difficult to access with cleaning brush and may impede effective reprocessing)



MMWR 2014;62:1051; Epstein et al. JAMA 2014;312:1447-1455

## DISINFECTION AND STERILIZATION

EH Spaulding believed that how an object will be disinfected depended on the object's intended use

- **CRITICAL** - objects which enter normally sterile tissue or the vascular system or through which blood flows should be sterile
- **SEMICRITICAL** - objects that touch mucous membranes or skin that is not intact require a disinfection process (high-level disinfection[HLD]) that kills all microorganisms except for high numbers of bacterial spores
- **NONCRITICAL** - objects that touch only intact skin require low-level disinfection

## High-Level Disinfection = No Margin of Safety

0 margin of safety

Microbial contamination  $10^7$ - $10^{10}$ :

compliant with cleaning can reduce contamination up to  $10^4$   
and to HLD guidelines can reduce contamination up to  $10^6$

## RECENT DUODENOSCOPE-RELATED OUTBREAKS OF MRDO WITHOUT REPROCESSING BREACHES

MDRO	Resistance	No. Pts (infected)	Propagated Outbreak	Positive Scope(s)	Molecular Link	Reference
<i>K. pneumoniae</i>	CRE (bla <sub>oxa-232</sub> )	15 (8)	No	No	PCR*	Kim S, 2016
<i>E. coli</i> (Amp C)	CRE (bla <sub>cmg-2</sub> )	35	No	Yes (2)	PCR*, PFGE	Wendorf KA, 2015
<i>K. pneumoniae</i>	CRE (bla <sub>oxa-48</sub> )	12	Yes	No	PCR*, PFGE	Kola A, 2015
<i>K. pneumoniae</i>	CRE (bla <sub>KPC</sub> )	?	No	Yes (3)	PCR*, PFGE, WGS	Marsh J, 2015
<i>E. coli</i>	CRE (NDM)	39	Yes	Yes	PFGE	Epstein L, 2015
<i>P. aeruginosa</i>	VIM-2	22	Yes	Yes	Yes	Verfaillie C, 2015
<i>E. coli</i>	NDM-1	3 (3)	No	No	Not done	Smith Z, 2015.
<i>K. pneumoniae</i>	CRE (bla <sub>KPC-2SHV</sub> )	13	Yes	Yes	PCR*, PFGE	Carbonne A, 2010

PCR\*, PCR for resistance gene; CRE, carbapenem-resistant enterobacteriaceae; WGS, whole genome sequencing

## DISINFECTION AND STERILIZATION

EH Spaulding believed that how an object will be disinfected depended on the object's intended use (modified).

- **CRITICAL** - objects which directly or secondarily (i.e., via a mucous membrane such as duodenoscope, cystoscope, bronchoscope) enter normally sterile tissue or the vascular system or through which blood flows should be **sterile**.
- **HLD (6-log<sub>10</sub> reduction) vs Sterilization (12-log<sub>10</sub> reduction=SAL 10-6)**
- **SEMICRITICAL** - objects that touch mucous membranes or skin that is not intact require a disinfection process (**high-level disinfection [HLD]**) that kills all microorganisms but high numbers of bacterial spores.
- **NONCRITICAL** -objects that touch only intact skin require **low-level disinfection**.

Rutala, Weber. Am J Infect Control. 2016;44:e1-e6; Rutala, Weber ICHE. 2015;36:643



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# Thank you!

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## Practical Surveillance Issues

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Does the number of central catheterization impact your CLABSI rates in your hospital?

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A) Yes

B) No

C) Not sure

D) Don't care

Does the number of catheter lumens impact your CLABSI rate in your hospital?

---

A) Yes

B) No

C) Not sure

D) Don't care

## The Effect of Multiple Concurrent Central Venous Catheters (CVC) on Central Line-associated Bloodstream Infections (CLA-BSIs)

- Study design: Case-control study. 197 case-patients and 201 control subjects with a CVC inserted during tertiary care hospitalization from January 1, 2008 to December 31, 2010.
- Results: Patients with multiple CVCs (n=78) had a **4.2 (95% CI, 2.2-8.4) times greater risk of CLA-BSI** compared with patients with 1 CVC after adjusting for CLA-BSI risk factors.
- Conclusion: Multiple CVCs is an independent risk factor for CLA-BSI even after adjusting for severity of illness.

Concannon C., et al. Intensive Care Med 2016;42:1418-26.

Dose the number of intravascular catheters a patient has impact your CLA-BSI rate?--YES

## Do Multi-lumen Central Venous Catheters (CVCs) Increase Risk for Catheter-related Bloodstream Infection (CRI)?

- Study design: During 1 year, all CVCs inserted in patients admitted for visceral, orthopedic or urologic surgery at two hospitals in Switzerland were followed prospectively for CRI
- Results: **Each additional lumen increased the risk of CRI (HR = 4.4; 95% CI: 2.5-7.7; p <0.001).**
- Conclusion: Number of lumens and site of access were independent risk factors for CRI. The use of catheters with multiple lumens should be restricted as far as possible.

Templeton A, et al., Infection 2008;36:32-7

Dose the number of catheter lumens a patient has impact your CLA-BSI rate?--YES

### **Do Number of Lumens or Parenteral Nutrition Increase Central Line-associated Bloodstream Infection (CLA-BSI) Risk ?**

- Study design: A CLA-BSI rate was calculated for all subclavian catheters inserted during a 12-month period.
- Results: The single lumen and triple lumen infection rates were 1.2% (8/645) and 6.9% (34/495), respectively. Within this group, 11.8% (28/237) of the catheters used for total parenteral nutrition (TPN) were infected, whereas 1.6% (14/903) of the non-TPN catheters were infected. Of patients receiving total parental nutrition through a triple lumen catheter, 14.5% (25/172) became infected, whereas 4.6% (3/65) of the patients receiving total parental nutrition through a single lumen catheter became infected.
- Conclusion: The CLA-BSI risk was approximately three times greater for patients receiving total parental nutrition through a triple lumen catheter..

Yeung C. et al., Infection control and Hospital Epi 1988;9:154-8.

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**Dose what you infuse  
through the  
Intravascular catheter  
Impact your CLA-BSI  
rate?--YES**

### **Needleless Connectors vs. Stopcocks**

- Study design: The microbial contamination rate associated with three-way stopcocks (S) was compared to a needleless connector (NC). Fifty cardiothoracic surgery patients with a central venous catheter (CVC) were randomly assigned to S/NC. Before/after manipulation, 70% isopropyl alcohol disinfection was used
- Results: The internal surfaces of 20/200 (10%) S were contaminated vs. 1/193 (0.5%) NC (P<0.0001).
- Conclusion: The use of a NC reduces the internal microbial contamination rate of CVC luer compared with S.

Casey AL, et al. J Hosp Infect 2007;65:212-8

### **Contamination and Catheter-related Infection Vary By Needleless Connector (NC) Design**

Effective disinfection of a NC is influenced by several factors including:

1. Ability to clean the NC surface;
2. The amount and position of grooves or gaps present; and
3. The roughness or smoothness of the septum.

Jarvis W. Infection Control Today. 2010;14:1-3

## Disinfection of Needleless Connectors (NCs)

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- Menyhey found 20/30 (67%) NCs disinfected with 70% alcohol for 3-5 seconds resulted in transmission of contaminants.
- Kaler found 15 second scrub disinfection with 70% alcohol of alcoholic chlorhexidine eliminated all organisms.
- Ruschman found that 60 second scrub disinfection with 70% alcohol eliminated all microorganisms

Menygay S. Z. and Maki D.G. AJIC. 2008;36:s174-e1.  
Kaler W. and Chinn R. JAVA 2007;12140-142.  
Ruschman K. L. and Fulton J.s. JIN 1993;16:304-308.

## Disinfection of Needleless Connectors (NCs)

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- Rupp found a 5 second alcohol disinfection was effective.
- Smith found that alcohol disinfection contact time of 10/12/15 seconds was adequate, but 5 and 8 seconds were inadequate.
- Simmons found 3/10/15 seconds failed to completely eliminate contaminants.  
**Bottom line:** The disinfectant, application method, and time required to disinfect needleless connectors varies by their design. Manufacturers should provide the data for adequate disinfection of their specific needleless connector(s).

Rupp M. E., et. Al., ICHE. 2012;33:661-665.  
Smith J. S., et. Al., JAVA 2012;17:137-143.  
Simmons S., et. Al., Critical Care Nursing Quarterly. 2011;34:31-35.

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**Dose the number of manipulations and type of needleless connector (and method of disinfection) used impact your CLA-BSI rate?-- YES**

## Uncontrolled Confounders

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Thus, studies show that the following factors are confounding variables in the calculation of catheter-related infection rates. Without control of these factors, current rate estimates--- including SIRs---may be invalid.

- Type of catheter
- Skin antiseptic
- Anatomic location of catheter insertion
- Number of catheters
- Number of catheter lumens
- Impregnated vs. non-impregnated catheter
- Number of manipulations
- Type of infusions (parenteral nutrition, chemotherapy)
- Type and design of your needleless connector



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# Thank you!

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# Do we really have to use SIR?

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## Do you use SIR (Standardized Infection Ratio) to measure your HAIs

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- A) Yes
- B) No
- C) I do not know what is SIR
- D) Don't care

## What is a standardized infection ratio (SIR)?

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- The standardized infection ratio (SIR) is a summary measure used to track HAIs at a national, state, or local level over time
- The SIR adjusts for patients of varying risk within each facility
- It is a summary statistic widely used in public health
- In HAI data analysis, the SIR compares the actual number of HAIs reported with the baseline U.S. experience

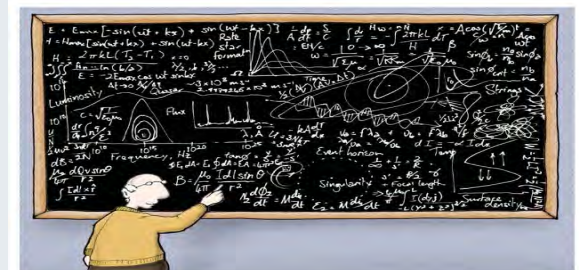
## I was just getting used to rates, why the SIR?

More sensitive for low denominators

Ability to combine data

Useful for predicting state and national rates

## OK , I'm no statistician what's all this mumbo jumbo about?



The SIR

In simple terms- you are compared to the average of a referent population adjusted for risk. In this case it is a historical control.

## Let's take a closer look

Hospital A :

Type of ICU	Number of Infections	Line days	My rate	NHSN Mean
Med/ Surg	1	865	1.1	2.1
SICU	0	1000	0	2.8
CTICU	2	1065	1.8	1.1
MICU	2	1000	2.0	2.1

## Turned into SIR

How do we get the expected?

Type of ICU	Number of Infections	Line days	My rate	NHSN Mean
Med/ Surg	1	865	1.1	2.1
SICU	0	1000	0	2.8
CTICU	2	948	2.1	1.1
MICU	2	1000	2.0	2.1

*Med Surg*  $2.1 / 1000 \times 865 = 0.95$   
*SICU*  $2.8 / 1000 \times 1000 = 2.8$   
*CTICU*  $1.1 / 1000 \times 948 = 0.93$   
*MICU*  $2.1 / 1000 \times 1000 = 2.1$

## The SIR

Type of ICU	Number of infections	Number expected	SIR Observed/expected	P VALUE
Med/ Surg	1	0.95	1.05	
SICU	0	2.8	0	
CTICU	2	0.93	2.1	
MICU	2	2.1	0.95	
	5	6.78	0.7	

SIR is less than 1

## Simply Put

A SIR of **1.0** means the observed number of infections is equal to the number of expected infections.

A SIR **above 1.0** means that the infection rate is higher than that found in the "standard population." For HAI reports, the standard population comes from data reported by the hundreds of U.S. hospitals that use the NHSN system. The difference above 1.0 is the percentage by which the infection rate exceeds that of the standard population.

A SIR **below 1.0** means the infection rate is lower than that of the standard population. The difference below 1.0 is the percentage by which the infection rate is lower than that experienced by the standard population.

Number of infections observed in that period

Org ID	Location	Summary Yr/Half	Months	infcount	Number Expected	Central Line Days	SIR	SIR p-value	95% Confidence Interval
10018	22ICU	2009H1	1	0	1.036	314	0.00		
10018	71ICU	2009H1	3	4	2.205	1575	1.81	0.1816	0.620 4.151
10018	ICU	2009H1	3	2	1.785	850	1.12	0.5327	0.199 3.527
10018	S-ICU	2009H1	3	3	1.564	680	1.92	0.2074	0.523 4.958

CLDs observed that in period

## Statistical Significance

•If the P value is less than .05 then your rates are different than the national average

•If the confidence level does not overlap 1, then your rates are different than the national average.

## States with Mandatory HAI Laws

State	No of Facilities Reporting	Observed	Predicted	95% CI for SIR			Graphic Representation of SIR <sub>i</sub>		
				SIR	Lower	Upper	0	1.0	2.0
Colorado	50	64	94.25	0.68	0.52	0.87			
Connecticut <sup>1</sup>	30	65	69.46	0.94	0.72	1.19			
Delaware	8	20	33.84	0.59	0.36	0.91			
Illinois	140	301	333.46	0.90	0.80	1.01			
Maryland <sup>1</sup>	48	234	179.95	1.30	1.14	1.48			
Massachusetts	70	124	211.44	0.59	0.49	0.70			
New Hampshire	24	13	22.93	0.57	0.34	0.90			
New Jersey	72	183	222.97	0.82	0.71	0.95			
New York <sup>1</sup>	182	604	610.22	0.99	0.91	1.07			
Oklahoma	48	59	118.95	0.50	0.38	0.64			
Oregon	37	50	82.21	0.61	0.45	0.80			
Pennsylvania	204	818	1,176.83	0.70	0.65	0.74			
South Carolina <sup>1</sup>	63	183	158.11	1.16	1.00	1.34			
Tennessee <sup>1</sup>	72	282	245.99	1.15	1.02	1.29			
Vermont	8	3	10.99	0.27	0.07	0.71			
Virginia	76	161	193.81	0.83	0.71	0.97			
Washington	62	86	148.07	0.58	0.47	0.72			
US-all	1,538	4,615	5,618.75	0.82	0.80	0.85			

<sup>1</sup> Presence of mandate to report CLABSI to the state health department using NHCSS as of June 30, 2009

<sup>2</sup> Solid diamond=SIR =1.0, solid X=SIR >1.0, open circle=SIR not different than 1.0

<sup>3</sup> State health department self-reported the completion of any validation study of NHCSS data (studies conducted on 2008 data).

## The SIR

PROS	CONS
Surgical risk adjustment is a significant improvement	Risk adjustment still suboptimal – especially with CLABSI data
Consistent with other types of data such as mortality	Not designed to compare 1 institution to another- only to compare with national average
Advantages with rare events	Potential problems with ranking ,etc
	Overall rates can cloud the big picture

How do you clean your hospital?

Do your hospital have protocol and checklist for audit ENV cleaning?

Variables	Protocol	Checklist
A)	Yes	Yes
B)	Yes	No
C)	No	Yes
D)	No	No



## What methods do you use to audit ENV cleaning practice?

- A) ATP test
- B) Fluorescence marking
- C) Microbiological culture
- D) Visual Inspection

## Do you use the same product to disinfect EIDs (SARS, MERS, C. auris)?

- A) Yes
- B) No
- C) Not sure

### National Survey of Environmental Cleaning and Disinfection in Hospitals in Thailand

Anucha Apisarnthanasak, MD<sup>1</sup>, David J. Weber, MD, MPH<sup>1,2</sup>, David Ratz, MS<sup>3</sup>, Sanjay Saint, MD, MPH<sup>1,4</sup>, Thana Khawcharoenporn, MD, MS<sup>3</sup>, M. Todd Greene, PhD, MPH<sup>1,4</sup>

More than 90% of Thai hospitals surveyed reported implementing environmental cleaning and disinfection (ECD) protocols. Hospital epidemiologist presence was associated with the existence of an ECD checklist ( $P= .01$ ) and of ECD auditing ( $P= .001$ ), while good and excellent hospital administrative support were associated with better adherence to ECD protocols ( $P< .001$ ) and ECD checklists ( $P= .003$ ).

*Infect Control Hosp Epidemiol* 2017;138:1230–1233

TABLE 1. Hospital Characteristics, Policy, Practice, and Barriers to Implementing Environmental Cleaning/Disinfection (ECD) Policies

Characteristics	No. (%) <sup>a</sup>
Type of ownership	
Private	44 (20.8)
Government owned	148 (69.8)
Military	20 (9.4)
Total number of acute-care hospital beds (including ICU)	345.9 ± 468.8
Affiliated with medical school	111 (52.4)
Facility has infectious diseases specialist(s)	108 (50.9)
Facility has environmental health and safety/services	130 (61.3)
Involved in HAI collaborative	105 (49.5)
Overall support of infection control program is	135 (63.7)
good/excellent	
Facility has hospital epidemiologist	83 (39.2)
Total FTEs for all infection preventionists	3.5 ± 3.4
Lead infection preventionist certified in infection control	196 (92.5)
How does your facility obtain environmental services?	
Internal employees	65 (20.7)
Contract service with an external company	40 (18.9)
Both internal employees and contract services	105 (49.5)
Facility implements ECD protocol	192 (90.6)
Facility has ECD checklist	117 (55.2)
Facility has a mechanism to audit ECD practices	92 (43.4)
Method used to audit ECD practices <sup>b</sup>	
ATP or bioluminescent testing	9 (9.8)
Fluorescent marking	13 (14.1)
Microbiological monitoring	52 (57.1)
Visual inspection for cleanliness	60 (65.9)
Barrier for effectively implementing ECD protocol <sup>b</sup>	
Staffing concerns	168 (79.3)
Time constraints	124 (58.5)
Lack of resources or funding	128 (60.4)
Facility culture	139 (65.6)
Inadequate education provided to staff	160 (75.5)
Uncertainty regarding which cleaning and disinfecting products to use	121 (57.1)

## EFFICACY OF ANTISEPTICS AND DISINFECTANTS AGAINST *C. AURIS*

•Study design: In vitro study of germicide efficacy against *C. auris* and *C. albicans*

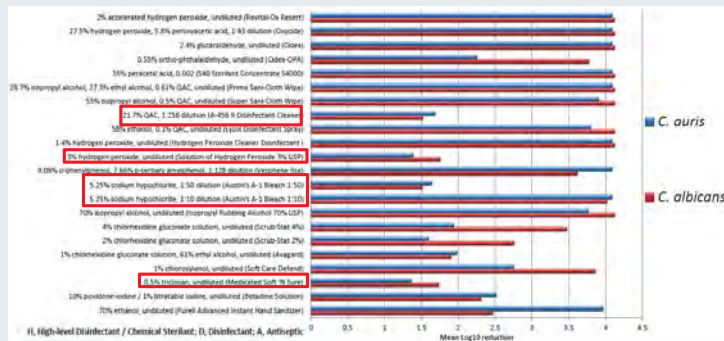
•Method: Disc-based quantitative carrier test with an inoculum of  $\sim 10^6$  organisms with 5% fetal calf serum and 1 minute exposure time at room temperature (challenging test conditions)

•Results:

- Study demonstrated  $\geq 3$ -log<sub>10</sub> reduction (12/22, 55%) and 2-log<sub>10</sub> reduction (15/22, 68%) for *C. auris*
- *C. auris* was less susceptible to 0.55% ortho-phthalaldehyde, 2% chlorhexidine, 4% chlorhexidine, and 1% chloroxenol compared to *C. albicans*.
- *C. auris* was more susceptible to 70% ethanol, compared to *C. albicans*.
- Several germicides (21.7% QAC [1:256 dilution], 3% hydrogen peroxide, 5.25% sodium hypochlorite [1:50 dilution], 0.5% triclosan) had  $< 2$ -log<sub>10</sub> reduction for both *C. auris* and *C. albicans*

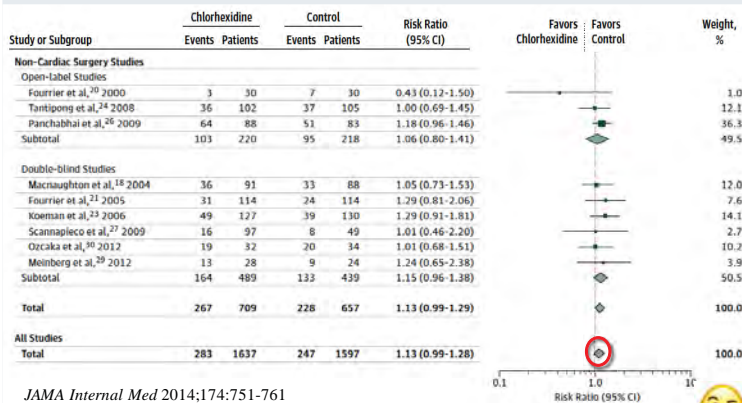
Rutala WA, Sickbert-Bennett E, Weber D, et al. Unpublished

# EFFICACY OF ANTISEPTICS AND DISINFECTANTS AGAINST *C. AURIS*



Thank you!

## Mortality



## About the Recognition Award

### What is APSIC Safe Surgery?

APSiC Safe Surgery is a team of people (Surgical team, Infection Control, Critical care team) that promotes collaboration and use of guidelines as well as best practices to deliver quality surgical care for those served.

At APSIC and 3M, we define a hospital as a Centre of Excellence when it fulfils all of the strategic criteria including:

- Delivers the highest level of patient safety and quality patient outcome
- Committed to ensuring dedicated surgical site infection (SSI) control teams to undertake SSI surveillance
- Takes on a leadership role and follows the recommendations of APSIC Guidelines for Prevention of SSI
- Implements quality improvement projects to achieve significant reduction in surgical site infections

The hospital identified as a Centre of Excellence will be invited to the next APSIC International Congress to receive the APSIC Safe Surgery Award.

