UNIVERSIDAD EL BOSQUE

Vigilada Mineducación

SIMPOSIO INTERNACIONAL EN RESISTENCIA BACTERIANA "DIAGNOSTIC STEWARDSHIP" Y CONTROL DE LAS INFECCIONES

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Best Practices in Disinfection of Noncritical Surfaces in the Healthcare Setting: A Bundle Approach

Skin Antisepsis: CHG Treatment and Skin Site Prep

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DISCLOSURES 2020-2021

Consultations

PDI (Professional Disposable International)

HonorariaPDI

 Acknowledgement: Some CHG slides from Dr. Emily E. Sickbert-Bennett, Ms. Shelley Summerlin-Long

www.disinfectionandsterilization.org

Sources of Healthcare-Associated Pathogens

Weinstein RA. Am J Med 1991:91 (suppl 3B):179S

- Endogenous flora (SSI, UTI, CLABSI): 40-60%
- Exogenous: 20-40% (e.g., cross-infection via contaminated hands [staff, visitors])
- Other (environment): 20%
 - Medical devices
 - Contact with environmental surfaces (direct and indirect contact)

Our Responsibility to the Future

Institute Practices that Prevent All Infectious Disease Transmission via Environment

Environmental Contamination Leads to HAIs

Weber, Kanamori, Rutala. Curr Op Infect Dis 2016:29:424-431



- Evidence environment contributes
 Role-MRSA, VRE, *C. difficile*
- Surfaces are contaminated-~25%
- EIP survive days, weeks, months
- Contact with surfaces results in hand contamination
- Disinfection reduces contamination
- Disinfection (daily) reduces HAIs
- Rooms not adequately cleaned

Admission to Room Previously Occupied by Patient C/I with Epidemiologically Important Pathogen



- Results in the newly admitted patient having an increased risk of acquiring that pathogen by 39-353%
- For example, increased risk for *C. difficile* is 235% (11.0% vs 4.6%)
- Exposure to contaminated rooms confers a 5-6 fold increase in odds of infection, hospitals must adopt proven methods for reducing environmental contamination (Cohen et al. ICHE. 2018;39:541-546)

Acquisition of EIP on Hands of Healthcare Providers after Contact with Contaminated Environmental Sites and Transfer to Other Patients



Acquisition of EIP on Hands of Patient after Contact with Contaminated Environmental Sites and Transfers EIP to Eyes/Nose/Mouth



Best Practices in Disinfection of Noncritical Surfaces in the Healthcare Setting: A Bundle Approach

A set of evidence-based practices, generally 3-5, that when performed collectively and reliably have been proven to improve patient outcomes Best Practices in Disinfection of Noncritical Surfaces in the Healthcare Setting: A Bundle Approach

NL Havill AJIC 2013;41:S26-30; Rutala, Weber. AJIC 2019

- A Bundle Approach to Surface Disinfection
- Develop policies and procedures
- Select cleaning and disinfecting products
- Educate staff-environmental services and nursing
- Monitor compliance (thoroughness of cleaning, product use) and feedback
- Implement "no touch" room decontamination technology and monitor compliance

KEY PATHOGENS WHERE ENVIRONMENTIAL SURFACES PLAY A ROLE IN TRANSMISSION

- MRSA
- VRE
- Acinetobacter spp.
- Clostridium difficile
- Norovirus
- Rotavirus
- SARS

ENVIRONMENTAL CONTAMINATION ENDEMIC AND EPIDEMIC MRSA

	Outbreak	Endemic				Site estimated mean§
	Rampling et al [∞] *	Boyce et al48*	Sexton et al⁵¹†	Lemmen et al ^{so*} ‡	French et al ^{64*}	
Floor	9%	50-55%	44-60%	24%		34.5%
Bed linen		38-54%	44%	34%		41%
Patient gown		40-53%		34%		40.5%
Overbed table		18-42%	64-67%	24%		40%
Blood pressure cuff	13%	25-33%				21%
Bed or siderails	5%	1-30%	44-60%	21%	43%	27%
Bathroom door handle		8-24%		12%¶		14%
Infusion pump button	13%	7–18%		30%		19%
Room door handle	11%	4–8%		23%	59%	21.5%
Furniture	11%		44-59%	19%		27%
Flat surfaces	7%		32-38%			21.5%
Sink taps or basin fitting				14%	33%	23.5%
Average quoted**	11%	27%	49%	25%	74%	37%

Dancer SJ et al. Lancet ID 2008;8(2):101-13

ENVIRONMENTAL SURVIVAL OF KEY PATHOGENS ON HOSPITAL SURFACES

Pathogen	Survival Time
S. aureus (including MRSA)	7 days to >12 months
Enterococcus spp. (including VRE)	5 days to >46 months
Acinetobacter spp.	3 days to 11 months
Clostridium difficile (spores)	>5 months
Norovirus (and feline calicivirus)	8 hours to >2 weeks
Pseudomonas aeruginosa	6 hours to 16 months
Klebsiella spp.	2 hours to >30 months

Adapted from Hota B, et al. Clin Infect Dis 2004;39:1182-9 and Kramer A, et al. BMC Infectious Diseases 2006;6:130

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

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



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

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Major article

Kev Words.

Ceaning

Environment

Transmission

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

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> 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. Copyright © 2013 by the Association for Professionals in Infection Control and Epidemiology, Inc. Published by Elsevier (nc. All rights reserved.

Contaminated environmental surfaces provide an important potential source for transmission of many health care associated pathogens.¹⁶ These include *Clostridium dif cile*, methicillin resistant infected with health care associated pathogens shed organisms onto their skin, clothing bedding, and nearby environmental surfaces.¹² In addition to surfaces in rooms, portable equipment

Environmental Disinfection Interventions

Donskey CJ. Am J Infect Control 2013;41:S12

- Cleaning product substitutions
- Improvements in the effectiveness of cleaning and disinfection practices
 - Education
 - Audit and feedback
 - Addition of housekeeping personnel or specialized cleaning staff
- Automated technologies
- Conclusion: Improvements in environmental disinfection may prevent transmission of pathogens and reduce HAIs

ENVIRONMENTAL CONTAMINATION LEADS TO HAIs

- There is increasing evidence to support the contribution of the environment to disease transmission
- This supports comprehensive disinfecting regimens (goal is not sterilization) to reduce the risk of acquiring a pathogen from the healthcare environment/equipment

Disinfection of Noncritical Surfaces Bundle

NL Havill AJIC 2013;41:S26-30

- Develop policies and procedures
- Select cleaning and disinfecting products
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Disinfection of Noncritical Surfaces Bundle

Develop policies and procedures

- Standardize C/D patient rooms and pieces of equipment throughout the hospital
- All touchable hand contact surfaces wiped with disinfection daily, when spills occur and when the surfaces are visibly soiled.
- All noncritical medical devices should be disinfected daily and when soiled
- Clean and disinfectant sink and toilet
- Damp mop floor with disinfectant-detergent
- If disinfectant prepared on-site, document correct concentration
- Address treatment time/contact time for wipes and liquid disinfectants (e.g., treatment time for wipes is the kill time and includes a wet time via wiping as well as the undisturbed time).

REVIEW THE "BEST" PRACTICES FOR CLEANING AND DISINFECTING

Cleaning and disinfecting is one-step with disinfectantdetergent. No pre-cleaning necessary unless spill or gross contamination. In many cases "best" practices not scientifically determined.

Blood Pressure Cuff Non-Critical Patient Care Item





C Healthwise, Incorporated

Surface Disinfection Noncritical Patient Care Rutala, Weber, HICPAC. CDC 2008. <u>www.cdc.gov</u>

- Disinfecting Noncritical Patient-Care Items
 - Process noncritical patient-care equipment with a EPAregistered disinfectant at the proper use dilution and a contact time of at least 1 min. Category IB
 - Ensure that the frequency for disinfecting noncritical patientcare surfaces be done minimally when visibly soiled and on a regular basis (such as after each patient use or once daily or once weekly). Category IB



Surface Disinfection Environmental Surfaces Rutala, Weber, HICPAC. CDC 2008. <u>www.cdc.gov</u>

- Disinfecting Environmental Surfaces in HCF
 - Disinfect (or clean) housekeeping surfaces (e.g., floors, tabletops) on a regular basis (e.g., daily, three times per week), when spills occur, and when these surfaces are visibly soiled. *Category IB*

Use disinfectant for housekeeping purposes where: uncertainty exists as to the nature of the soil on the surfaces (blood vs dirt); or where uncertainty exists regarding the presence of multi-drug resistant organisms on such surfaces. Category II

It appears that not only is disinfectant use important but how often is important

Daily disinfection vs clean when soiled

Daily Disinfection of High-Touch Surfaces Kundrapu et al. ICHE 2012;33:1039

Daily disinfection of high-touch surfaces (vs cleaned when soiled) with sporicidal disinfectant (PA) in rooms of patients with CDI and MRSA reduced acquisition of pathogens on hands after contact with surfaces and of hands caring for the patient. Daily disinfection less hand

contamination.



FIGURE 1. Effect of daily disinfection of high-touch environmental surfaces on acquisition of *Clostridium difficile* and methicillin-resistant Staphylococcus awress (MRSA) on gloved hands of investigators after contact with the surfaces. A, Percentage of positive *C*, difficile cultures; *B*, mean number of *C*. difficile colony-forming units acquired; *C*, percentage of positive MRSA cultures; *D*, mean number of MRSA colony-forming units acquired; *C*, percentage of positive MRSA cultures; *D*, mean number of MRSA colony-forming units acquired.

Use of a Daily Disinfectant Cleaner Instead of a Daily Cleaner Reduced HAI Rates

Alfa et al. AJIC 2015.43:141-146

- Method: Improved hydrogen peroxide disposable wipe was used once per day for all high-touch surfaces to replace cleaner
- Result: When cleaning compliance was ≥ 80%, there was a significant reduction in cases/10,000 patient days for MRSA, VRE and *C. difficile*
- Conclusion: Daily use of disinfectant applied to environmental surfaces with a 80% compliance was superior to a cleaner because it resulted in significantly reduced rates of HAIs caused by *C. difficile*, MRSA, VRE

EVIDENCE THAT ALL TOUCHABLE ROOM SURFACES ARE EQUALLY CONTAMINATED

TABLE 1.Precleaning and Postcleaning Bacterial Load Mea-surements for High-, Medium-, and Low-Touch Surfaces

Mean CFUs/RODAC (95% CI)

Surface (no. of samples)	Precleaning	Postcleaning
High (n = 40)	71.9 (46.5–97.3)	9.6 (3.8–15.4)
Medium $(n = 42)$	44.2 (28.1–60.2)	9.3 (1.2–17.5)
Low $(n = 37)$	56.7 (34.2–79.2)	5.7 (2.01–9.4)

NOTE. CFU, colony-forming unit; CI, confidence interval.

Number of culture sites and prevalence of contamination with nosocomial pathogens in intensive care units (N=523)

Ward	Culture sites ^a					
	HCWs' hands	Surfaces distant from patients	Surfaces close to patients	Prevalence of contamination		
Α	3/10 (30%)	0/22 (0%)	6/25 (24.0%)	9/57 (15.8%)		
В	2/9 (22.2%)	4/19 (21.1%)	5/48 (10.4%)	11/76 (14.5%)		
С	2/10 (20%)	2/26 (7.7%)	7/49 (14.3%)	11/85 (12.9%)		
D	1/9 (11.1%)	2/24 (18.2%)	7/45 (15.6%)	10/78 (12.8%)		
E	0/5 (0%)	4/22 (18.2%)	3/30 (10%)	7/57 (12.3%)		
F	1/10 (10%)	0/11 (0%)	4/31 (12.9%)	5/52 (9.6%)		
G	0/3 (0%)	2/14 (14.3%)	0/20 (0%)	2/37 (5.4%)		
Н	1/10 (10%)	0/16 (0%)	1/55 (1.8%)	2/81 (2.5%)		
Total	10/66 (15.2%)	14/154 (9.1%)	33/303 (10.9%)	57/523 (10.9%)		

Willi I, Mayre A, Kreidl P, et al. JHI 2018;98:90-95

HCW, healthcare worker.

^a Number of contaminated samples/number of samples obtained.

Huslage K, Rutala W, Gergen M, Sickbert-Bennett S, Weber D ICHE 2013;34:211-2

ALL "TOUCHABLE" (HAND CONTACT) SURFACES SHOULD BE WIPED WITH DISINFECTANT

"High touch" objects only recently defined (no significant differences in microbial contamination of different surfaces) and "high risk" objects not epidemiologically defined. Cleaning and disinfecting is one-step with disinfectant-detergent. No pre-cleaning necessary unless spill or gross contamination.

Evaluation of Hospital Floors as a Potential Source of Pathogen Dissemination

Koganti et al. ICHE 2016. 37:1374; Deshpande et al. AJIC 2017. 45:336.

- Effective disinfection of contaminated surfaces is essential to prevent transmission of epidemiologically-important pathogens
- Efforts to improve disinfection focuses on touched surfaces
- Although floors contaminated, limited attention because not frequently touched
- Floors are a potential source of transmission because often contacted by objects that are then touched by hands (e.g., shoes, socks)
- Non-slip socks contaminated with MRSA, VRE (Mahida, J Hosp Infect. 2016;94:273



Recovery of Nonpathogenic Viruses from Surfaces and Patients on Days 1, 2, and 3 After Inoculation of Floor Near Bed

Koganti et al. ICHE 2016. 37:1374

Variable	Day 1 (% Positive)	Day 2 (% Positive)	Day 3 (% Positive)
Patient Hands	40	63	43
Patient Footwear	100	100	86
High-touch surface <3ft	58	62	77
High-touch surface >3ft	40	68	34
Personal items	50	44	50
Adjacent room floor	NA	100	80
Adjacent room environment	NA	40	11
Nursing station	53	47	63
Portable equipment	33	23	100

Surfaces <3ft included bedrail, call button, telephone, tray table, etc; surfaces >3ft included side table, chair, IV pole, etc; personal-cell phones, books, clothing, wheelchairs; nurses station included computer keyboard, mouse, etc

Recovery of Nonpathogenic Viruses from Surfaces and Patients on Days 1, 2, and 3 After Inoculation of Floor Near Bed Koganti et al. ICHE 2016. 37:1374

- Found that a nonpathogenic virus inoculated onto floors in hospital rooms disseminated rapidly to the footwear and hands of patients and to high-touch surfaces in the room
- The virus was also frequently found on high-touch surfaces in adjacent rooms and nursing stations
- Contamination in adjacent rooms in the nursing station suggest HCP contributed to dissemination after acquiring the virus during contact with surfaces or patients
- Studies needed to determine if floors are source of transmission

Disinfection of Noncritical Surfaces Bundle

NL Havill AJIC 2013;41:S26-30

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Science of Cleaning and Disinfection

Rutala, Weber, HICPAC. November 2008. www.cdc.gov

- Cleaning-removes organisms/organic matter
- Disinfection-inactivates organisms

Effectiveness of Different Methods of Surface Disinfection for MRSA Rutala, Gergen, Weber. Unpublished data.

Technique (with cotton)	MRSA Log ₁₀ Reduction (QUAT)
Saturated cloth	4.41
Spray (10s) and wipe	4.41
Spray, wipe, spray (1m), wipe	4.41
Spray	4.41
Spray, wipe, spray (until dry)	4.41
Disposable wipe with QUAT	4.55
Control: detergent	2.88

Effective Surface Decontamination

Product and Practice = Perfection

Effective Surface Decontamination

Product and **Practice** = **Perfection**

PROPERTIES OF AN IDEAL DISINFECTANT

Rutala, Weber. Infect Control Hosp Epidemiol. 2014;35:855-865

- Broad spectrum-wide antimicrobial spectrum
- Fast acting-should produce a rapid kill
- Remains Wet-meet listed kill/contact times with a single application
- Not affected by environmental factors-active in the presence of organic matter
- Nontoxic-not irritating to user
- Surface compatibility-should not corrode instruments and metallic surfaces
- Persistence-should have sustained antimicrobial activity
- Easy to use
- Acceptable odor
- Economical-cost should not be prohibitively high
- Soluble (in water) and stable (in concentrate and use dilution)
- Cleaner (good cleaning properties) and nonflammable

Environmental Disinfection Interventions Donskey CJ. Am J Infect Control 2013;41:S12

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MOST PREVALENT PATHOGENS CAUSING HAI

Rutala, Weber. Infect Control Hosp Epidemiol. 2014;35:855-865; Weiner et al ICHE 2016;37:1288

- Most prevent pathogens causing HAI (easy to kill)
 - *E. coli* (15.4%)
 - **S.** aureus (11.8%)
 - Klebsiella (7.7%)
 - Coag neg Staph (7.7%)
 - **E.** faecalis (7.4%)
 - P. aeruginosa (7.3%)
 - **C.** albicans (6.7%)
 - Enterobacter sp. (4.2%)
 - **E. faecium** (3.7%)

- Common causes of outbreaks and ward closures (relatively hard to kill)
 - C. difficile spores
 - Norovirus
 - Rotavirus
 - Adenovirus

Microbiological Disinfectant Hierarchy Rutala WA, Weber DJ, HICPAC. www.cdc.gov



LOW-LEVEL DISINFECTION FOR NONCRITICAL EQUIPMENT AND SURFACES

Rutala, Weber. Infect Control Hosp Epidemiol. 2014;35:855-865; Rutala, Weber, AJIC 2019;47:A96-A105

Exposure time <u>></u> 1 min				
Germicide	Use Concentration			
Ethyl or isopropyl alcohol	70-90%			
Chlorine	100ppm (1:500 dilution)			
Phenolic	UD			
lodophor	UD			
Quaternary ammonium (QUAT)	UD			
QUAT with alcohol	RTU			
Improved hydrogen peroxide (HP)	0.5%, 1.4%			
PA with HP, HP, chlorine (C. difficile	e) UD			

UD=Manufacturer's recommended use dilution; others in development/testing-electrolyzed water; polymeric guanidine; cold-air atmospheric pressure plasma (Boyce Antimicrob Res IC 2016. 5:10)

C. difficile EPA-Registered Products

- List K: EPA's Registered Antimicrobials Products Effective Against C. difficile spores, April 2014
- http://www.epa.gov/oppad001/list_k_clostridium.pdf
- Most registered products are chlorine-based, some HP/PA-based, one 4% HP

NL Havill AJIC 2013;41:S26-30

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- Develop policies and procedures
 - Environmental cleaning and disinfection is an integral part of preventing transmission of pathogens
 - In addition to identifying products and procedures, ensure standardization of cleaning throughout the hospital
 - Some units utilize ES to clean pieces of equipment (e.g., vital sign machines, IV pumps); some units use patient equipment, and some units utilize nursing staff.
 - Multidisciplinary group to create a standardized plan for cleaning patient rooms and pieces of patient equipment throughout the hospital

NL Havill AJIC 2013;41:S26-30

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Effective Surface Decontamination

Product and Practice = Perfection

Thoroughness of Environmental Cleaning Carling et al. ECCMID, Milan, Italy, May 2011



Practice* NOT Product

*surfaces not wiped

MONITORING THE EFFECTIVENESS OF CLEANING

Cooper et al. AJIC 2007;35:338

- Visual assessment-not a reliable indicator of surface cleanliness
- ATP bioluminescence-measures organic debris (each unit has own reading scale, <250-500 RLU)
- Microbiological methods-<2.5CFUs/cm²-pass; can be costly and pathogen specific
- Fluorescent marker-transparent, easily cleaned, environmentally stable marking solution that fluoresces when exposed to an ultraviolet light (applied by IP unbeknown to EVS, after EVS cleaning, markings are reassessed)

TARGET ENHANCED



TERMINAL ROOM CLEANING: DEMONSTRATION OF IMPROVED CLEANING

- Evaluated cleaning before and after an intervention to improve cleaning
- 36 US acute care hospitals
- Assessed cleaning using a fluorescent dye
- Interventions
 - Increased education of environmental service workers
 - Feedback to environmental service workers
- †Regularly change "dotted" items to
 prevent targeting objects





Carling PC, et al. ICHE 2008;29:1035-41

Percentage of Surfaces Clean by Different Measurement Methods

Rutala, Kanamori, Gergen, Sickbert-Bennett, Huslage, Weber. APIC Poster 2017.

Fluorescent marker is a useful tool in determining how thoroughly a surface is wiped and mimics the microbiological data better than ATP



Scatterplot of ATP Levels (less than 5000 RLUs) and Standard Aerobic Counts (CFU/Rodac)

Rutala, Kanamori, Gergen, Sickbert-Bennett, Huslage, Weber. APIC 2017



There was no statistical correlation between ATP levels and standard aerobic plate counts.

ALL "TOUCHABLE" (HAND CONTACT) SURFACES SHOULD BE WIPED WITH DISINFECTANT

"High touch" objects only recently defined (no significant differences in microbial contamination of different surfaces) and "high risk" objects not epidemiologically defined.

MICROBIAL BURDEN ON ROOM SURFACES AS A FUNCTION OF FREQUENCY OF TOUCHING

Surface	Prior to Cleaning	Post Cleaning (mean)
	Mean CFU/RODAC (95% CI)	Mean CFU/RODAC (95% CI)
High	71.9 (46.5-97.3)	9.6
Medium	44.2 (28.1-60.2)	9.3
Low	56.7 (34.2-79.2)	5.7

- The level of microbial contamination of room surfaces is similar regardless of how often they are touched both before and after cleaning
- Therefore, all surfaces that are touched must be cleaned and disinfected

Huslage K, Rutala WA, Weber DJ. ICHE. 2013;34:211-212

Future Methods to Ensure Thoroughness

Future May Have Methods to Ensure Thoroughness Such as Colorized Disinfectant

Kang et al. J Hosp Infect 2017

Colorized disinfection – contact time compliance



o min

2 min

4 min

- Color-fading time matched to disinfectant contact time --> enforces compliance
- Provides real-time feedback when disinfection is complete
- Trains staff on importance of contact time as they use the product

Colorized disinfection – improved coverage



- Increased visibility when disinfecting surfaces, fewer missed spots
- Real-time quality control that allows staff to monitor thoroughness of cleaning

NL Havill AJIC 2013;41:S26-30

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These interventions (effective surface disinfection, thoroughness indicators) not enough to achieve consistent and high rates of cleaning/disinfection

No Touch

(supplements but do not replace surface cleaning/disinfection)

"NO TOUCH" APPROACHES TO ROOM DECONTAMINATION

(UV/VHP~20 microbicidal studies, 12 HAI reduction studies; will not discuss technology with limited data) Weber, Kanamori, Rutala. Curr Op Infect Dis 2016;29:424-431; Weber, Rutala et al. AJIC; 2016:44: e77-e84; Anderson et al. Lancet 2017;389:805-14; Anderson et al. Lancet Infect Dis 2018;June 2018.



Enhanced Disinfection Leading to Reduction of Microbial Contamination and a Decrease in Patient Col/Infection

Anderson et al. Lancet 2017;289:805; Rutala et al. ICHE In press.

	Standard Method	Enhanced method		
	Quat	Quat/UV	Bleach	Bleach/UV
EIP (mean CFU per room)ª	60.8	3.4	11.7	6.3
Reduction (%)		94	81	90
Colonization/Infection (rate)ª	2.3	1.5	1.9	2.2
Reduction (%)		35	17	4

All enhanced disinfection technologies were significantly superior to Quat alone in reducing EIPs. Comparing the best strategy with the worst strategy (i.e., Quat vs Quat/UV) revealed that a reduction of 94% in EIP (60.8 vs 3.4) led to a 35% decrease in colonization/infection (2.3% vs 1.5%). Our data demonstrated that a decrease in room contamination was associated with a decrease in patient colonization/infection. First study which quantitatively described the entire pathway whereby improved disinfection decreases microbial contamination which in-turn reduced patient colonization/infection. This technology ("no touch"-e.g., UV/HP) should be used (capital equipment budget) for terminal room disinfection (e.g., after discharge of patients on Contact Precautions).

NL Havill AJIC 2013;41:S26-30

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Skin Antisepsis: CHG Treatment and Skin Site Preparation

- Skin Antisepsis
 - Pre-operative
 - Surgical site
- CHG Bathing/Treatment



SSI: Primary Risk Factors

- Endogenous microorganisms
 - Skin-dwelling microorganisms
 - Most common source
 - S aureus most common isolate
 - Fecal flora (gnr) when incisions are near the perineum or groin
- Exogenous microorganisms
 - Surgical personnel (members of surgical team)
 - OR environment (including air)
 - All tools, instruments, and materials
Why are we doing this?



Why are we doing this?



SSI: Preoperative Issues Modifiable Risks

Glucose control-in diabetic patients

Preoperative CHG shower

Appropriate hair removal

Hand hygiene

Skin antisepsis

Antimicrobial prophylaxis

Normothermia-hypo higher risks

Mangram AJ, et al. *Infect Control Hosp Epidemiol*. 1999;20(4):250-278. 5 Million lives. Institute for Healthcare Improvement. Available at: http://ihi.org/IHI/Programs/Campaign/Campaign.htm. Accessed on February 8, 2007.

Skin Antisepsis: CHG Treatment and Skin Site Preparation

- Skin Antisepsis
 - Pre-operative
 - Surgical site
- CHG Bathing/Treatment

Normal Skin Micro-Flora

Numbers of bacteria that colonize different parts of the body



Numbers per square centimeter of skin surface (cfu/cm²). Counts on hands range from 3.9x10⁴ to 4.6x10⁶.

Microbial Ecology of Skin Surface

- Scalp 6.0 Log₁₀ cfu/cm²
- Axilla 5.5 Log₁₀ cfu/cm²
- Abdomen 4.3 Log₁₀ cfu/cm²
- Forearm $4.0 \text{ Log}_{10} \text{ cfu/cm}^2$
- Hands 4.0-6.6 Log₁₀ cfu/cm²
- Perineum 7.0-11.0 Log₁₀ cfu/cm²

Surgical Microbiology Research Laboratory 2008 – Medical College of Wisconsin

Skin Antisepsis: CHG Treatment and Skin Site Preparation

- Skin Antisepsis
 - Pre-operative
 - Surgical site
- CHG Bathing/Treatment

4% Chlorhexidine Gluconate (CHG) Shower -Mean Skin Surface Concentration (N=60)



Edmiston et al, J Am Coll Surg 2008;207:233-239

EUNIC HEALTH CARE

Surgical Site Infection Initiative

Pre-Operative CHG Treatment (Wipes)

Training Materials February 2020

Why are we doing this?

- Studies have shown decreases in surgical site infections with the introduction of a pre-operative antiseptic bathing/treatment protocol.^{1,2}
- To gain the maximum antiseptic effect of chlorhexidine gluconate (CHG), adequate amounts must be maintained on the skin.³
- The average CHG concentration is higher with cloths vs. liquid soap (65.4 vs 20.8 ppm).⁴

Who will receive a CHG Treatment?

- Patients should receive a CHG treatment the night-before and the day-of surgery.
 - Exclude patients having surgery above the neck (eye, dental, etc.) or having non-surgical procedures performed in the OR or other procedural area (bronchoscopy, GI endoscopy, etc.)
- Inpatients will receive both treatments on the unit where they are housed.
 - The day-of treatment should be given within the 6 hours before surgery.
- Patients arriving from home for surgery will receive day-of treatment in Pre-op.

How do we apply the wipes? (Adults)





Apply wipes to dry skin - Patient may feel sticky for about 2 minutes -Do not rinse off - Do not apply lotion - Do not flush wipes

Skin Antisepsis: CHG Treatment and Skin Site Preparation

- Skin Antisepsis
 - Pre-operative
 - Surgical site
- CHG Treatment/Bathing

Surgical Site Preparation

- Alcohol-containing preparation (e.g., CHG-alcohol, iodophor-alcohol)
 - SHEA
- Alcohol-containing antiseptic solution containing CHG
 WHO

Skin Antisepsis: CHG Treatment and Skin Site Preparation

- Skin Antisepsis
 - Pre-operative
 - Surgical site
- CHG Treatment/Bathing

CHG Treatment /Bathing Prevents Infection, Reduces Skin Burden and Environmental Contamination Donskey C. AJIC 2016;44:e17

- Patients C/I with healthcare pathogens on their skin
- Such contamination may lead to infection when factors such as devices, catheters and wounds provide a route for pathogens on skin to reach sterile sites.
- Skin contamination may also contribute to transmission due to environmental shedding and transfer to hands of personnel
- Strong rationale for efforts to reduce the burden of pathogens on skin

CHG Treatment/Bathing Prevents Infection, Reduces Skin Burden and Environmental Contamination

Donskey C. AJIC 2016;44:e17

Decreased skin contamination, hand contamination, environmental contamination and reduced VREs in ICU. Vernon et al. Arch Intern Med 2006;166:306-312



Fig 1. Effect of daily chlorhexidine bathing on skin and environmental contamination and acquisition of vancomycin-resistant enterococci (VRE).

CHG Treatment Prevents Infection, Reduces Skin Burden and Environmental Contamination

Donskey C. AJIC 2016;44:e17

12 of 14 (86%) studies, CHG was associated with a significant reduction in C/I

Effect of chlorhexidine gluconate (CHG) bathing on colonization and infection with pathogens

Study	Setting	Chlorhexidine formulation	Design	Outcomes
7	Medical intensive care unit	2% chlorhexidine gluconate (CHG)-impregnated cloths	Quasiexperimental	Decreased vancomycin-resistant enterococci on patients' skin, health care workers' hands, and environment Reduced acquisition of vancomycin-resistant enterococci
				colonization
11	Medical intensive care unit	4% CHG solution	Quasiexperimental	Decreased Acinetobacter baumannii skin colonization and bloodstream infections
10	2 Medical intensive care unit wards	2% CHG-impregnated cloths	2 arm crossover trial	Decreased primary bloodstream infections
6	Medical intensive care unit	2% CHG-impregnated cloths	Quasiexperimental	Decreased central line-associated bloodstream infections and blood culture contamination
12	6 Intensive care units in 4 hospitals	2% CHG-impregnated cloths	Quasiexperimental	Decreased acquisition of methicillin-resistant Staphylococcus aureus and vancomycin-resistant enterococci
				Decreased vancomycin-resistant enterococci bacteremia
17	Long-term acute care	2% CHG solution	Quasiexperimental	Decreased central line-associated bloodstream infection
	hospital		-	No change in ventilator-associated pneumonia
9	2 Intensive care units	4% CHG solution plus chlorhexidine acetate powder to groin, axilla, and skin folds	Quasiexperimental	Decreased acquisition of methicillin-resistant <i>S aureus</i> (non-qacA/B strains)
14	Trauma intensive care unit	2% CHG-impregnated cloths	Quasiexperimental	Decreased methicillin-resistant <i>S aureus</i> and <i>Acinetobacter</i> spp colonization
				Decreased central line-associated bloodstream infection
19	Surgical intensive care unit	2% CHG-impregnated cloths	Quasiexperimental	No decrease in central line-associated bloodstream infection
13	Trauma center intensive care unit	2% CHG-impregnated cloths	Quasiexperimental	Decreased central line-associated bloodstream infection
16	4 Medical wards	2% CHG-impregnated cloths	Quasiexperimental	Decreased methicillin-resistant <i>S aureus</i> and vancomycin-resistant enterococci infections
21	II and the Local La	40% CHC as had a second to the sharehold as	0	No change in <i>Clostriatum atgiccie</i> infections
21	Hospital-wide	4% CHG solution applied as bed bath or	Quasiexperimental	Decreased C difficue infections
		shower daily or 3 times per week		No change in other hospital-associated infections
8	Oncology patients	2% CHG-impregnated cloths	Quasiexperimental	Colonization of vancomycin-resistant enterococci colonization
15	4 Long-term acute care hospitals	2% CHG-impregnated cloths	Stepped wedge bundle	Decreased Klebsiella pneumoniae carbapenemase-producing enterobacteriaceae colonization and infection, all-cause bacteremia, and blood culture contamination

Table 1

Impact of CHG Treatment/Bathing on HA Bloodstream Infections

Musuuza et al. BMC Infect Disd 2019;19:416

The incidence rate of BSI was reduced by ~40% (26 studies)

		Events,	Events,
Study	IRR (95% CI)	CHG	Comparator
Camus 2005	0.20 (0.02, 1.69)	1/1991	5/1961
Bleasdale 2007	0.39 (0.18, 0.86)	9/2210	22/2119
Borer 2007	0.16 (0.04, 0.70)	2/1600	15/1923
Gould 2007 🔶	0.68 (0.56, 0.82)	171/6664	264/6899
Climo 2009	0.34 (0.18, 0.62)	14/15472	41/1522
Holder 2009	1.00 (0.22, 4.47)	2/3333	12/20000
Munoz-Price 2009	0.40 (0.26, 0.63)	29/7632	59/6210
Popovich 2009	0.13 (0.03, 0.54)	2/5610	19/6728
Dixon 2010	0.28 (0.12, 0.64)	7/3148	27/3346
Evans 2010	0.25 (0.08, 0.76)	4/1904	15/1785
Popovich 2010	1.14 (0.59, 2.18)	17/5799	19/7366
Kassakian 2011	0.96 (0.31, 2.98)	6/36185	6/34800
Montecalvo 2012	0.66 (0.43, 1.04)	25/6466	85/14556
Climo 2013	0.72 (0.57, 0.92)	119/24902	165/24983
Huang 2013 +	0.59 (0.52, 0.68)	356/101603	412/69668
Martínez-Reséndez 2014	0.55 (0.35, 0.85)	25/3125	84/5684
Popp 2014	0.15 (0.01, 3.07)	0/277	2/203
Cassir 2015	0.50 (0.25, 0.97)	12/1344	28/1546
Hayden 2015	0.68 (0.63, 0.74)	870/114070	2004/178516
Noto 2015	0.92 (0.70, 1.20)	100/19231	117/20689
Abboud 2016	0.59 (0.27, 1.31)	14/28914	11/13508
Amirov 2016	0.25 (0.03, 2.03)	1/10000	7/17500
Boonyasiri 2016	1.27 (0.23, 6.86)	2/202	4/512
Swan 2016	0.21 (0.01, 4.27)	0/952	2/976
Duszyńska 2017	0.32 (0.14, 0.71)	8/1157	23/1050
Overall (I-squared = 50.3%, p = 0.002)	0.59 (0.52, 0.68)		

CHG Treatment/Bathing Prevents Infection, Reduces Skin Burden and Environmental Contamination

Donskey C. AJIC 2016;44:e17

Guiding principle of infection prevention is effective implementation of interventions requires monitoring of compliance of staff with feedback on performance. Measuring CHG on skin a means to monitor

effectiveness





CHG Treatment/Bathing Prevents Infection, Reduces Skin Burden and Environmental Contamination

Donskey C. AJIC 2016;44:e17

- Growing body of evidence has accumulated suggesting that CHG treatment/bathing may be a beneficial strategy to prevent C/I with healthcare pathogens
- Reduction in skin carriage may reduce dissemination of pathogens to the environment and hands of personnel
- This practice is now becoming routine, particularly in ICUs
- To optimize bathing in real-world settings, need to develop strategies to monitor compliance

Tips for Success

- Use daily on:
 - ✓ ICUs
 - ✓ Step down
 - Oncology units (adults and pediatrics)
- Educate caregivers about the importance of daily CHG treatment in reducing infections
- Document "chlorhexidine treatment (not bath)" as given or refused (under daily cares/hygiene)
- Dispose of wipes in the trash can

Best Practices in Disinfection of Noncritical Surfaces in the Healthcare Setting: A Bundle Approach

Skin Antisepsis: CHG Treatment and Skin Site Prep

Best Practices in Disinfection of Noncritical Surfaces in the Healthcare Setting: A Bundle Approach NL Havill AJIC 2013;41:S26-30; Rutala, Weber. AJIC 2019

- MRSA, VRE, C. difficile, MDR-Acinetobacter comprise a growing reservoir of epidemiologically important pathogens that have an environmental mode of transmission
- Implement evidence-based practices for surface disinfection
 - Evidence-based policies
 - Ensure use of safe and effective (against emerging pathogens such as C. auris and CRE) low-level disinfectants
 - Ensure thoroughness of cleaning (new thoroughness technology)
- Use "no touch" room decontamination technology proven to reduce microbial contamination on surfaces and reduction of HAIs at terminal/discharge cleaning

Contraindications

Don't use wipes if patient has:

- S CHG allergy € CHG allerg
- S radiation treatment that day
- S Thiotepa chemotherapy (follow same protocol as with CHG liquid)

Avoid:

- S areas with rashes, moderate or severe burns, severe skin breakdown or open wounds
- S head and face
- Solutions from home. Many lotions deactivate CHG especially nice smelling lotions
- S rinsing off − These are no-rinse wipes (Still encourage hand washing)

Don't:

- ◎ put wipes in with the soap & water bath the wipes won't work
- S put wipes in the microwave or blanket warmer
- S flush in the toilet
- S use for Foley care Follow urinary pericare policy

Skin Antisepsis: CHG Treatment and Skin Site Preparation

- Surgical Site Preparation
 - Pre-operative-shower or CHG wipes (night before, morning)
 - Current evidence favors the use of alcohol-containing solutions, often containing CHG or povidone-iodine, for surgical site preparation
- CHG Bathing/Treatment
 - Growing body of evidence has accumulated suggesting that CHG bathing/treatment may be a beneficial strategy to prevent C/I with healthcare pathogens

THANK YOU! www.disinfectionandsterilization.org

