APIC
2012 SAN ANTONIO, TX
JUNE 4-6

Annual Educational Conference & International Meeting

#APIC2012

DISINFECTANTS USED FOR SURFACE DISINFECTION AND NEW ROOM DECONTAMINATION TECHNOLOGY

William A. Rutala, PhD, MPH, CIC

Director, Hospital Epidemiology, Occupational Health and Safety;
Professor of Medicine and Director, Statewide Program for
Infection Control and Epidemiology

University of North Carolina at Chapel Hill, USA

DISCLOSURES

- Consultation
  - Advanced Sterilization Products, Clorox
- Honoraria (speaking)
  - Advanced Sterilization Products, 3M
- Grants
  - CDC

LECTURE OBJECTIVES

- Review the use of low-level disinfectants and the activity of disinfectants on key hospital pathogens
- Review "no touch" methods for room decontamination

LECTURE OBJECTIVES

- Review the use of low-level disinfectants and the activity of disinfectants on key hospital pathogens
- Review "no touch" methods for room decontamination

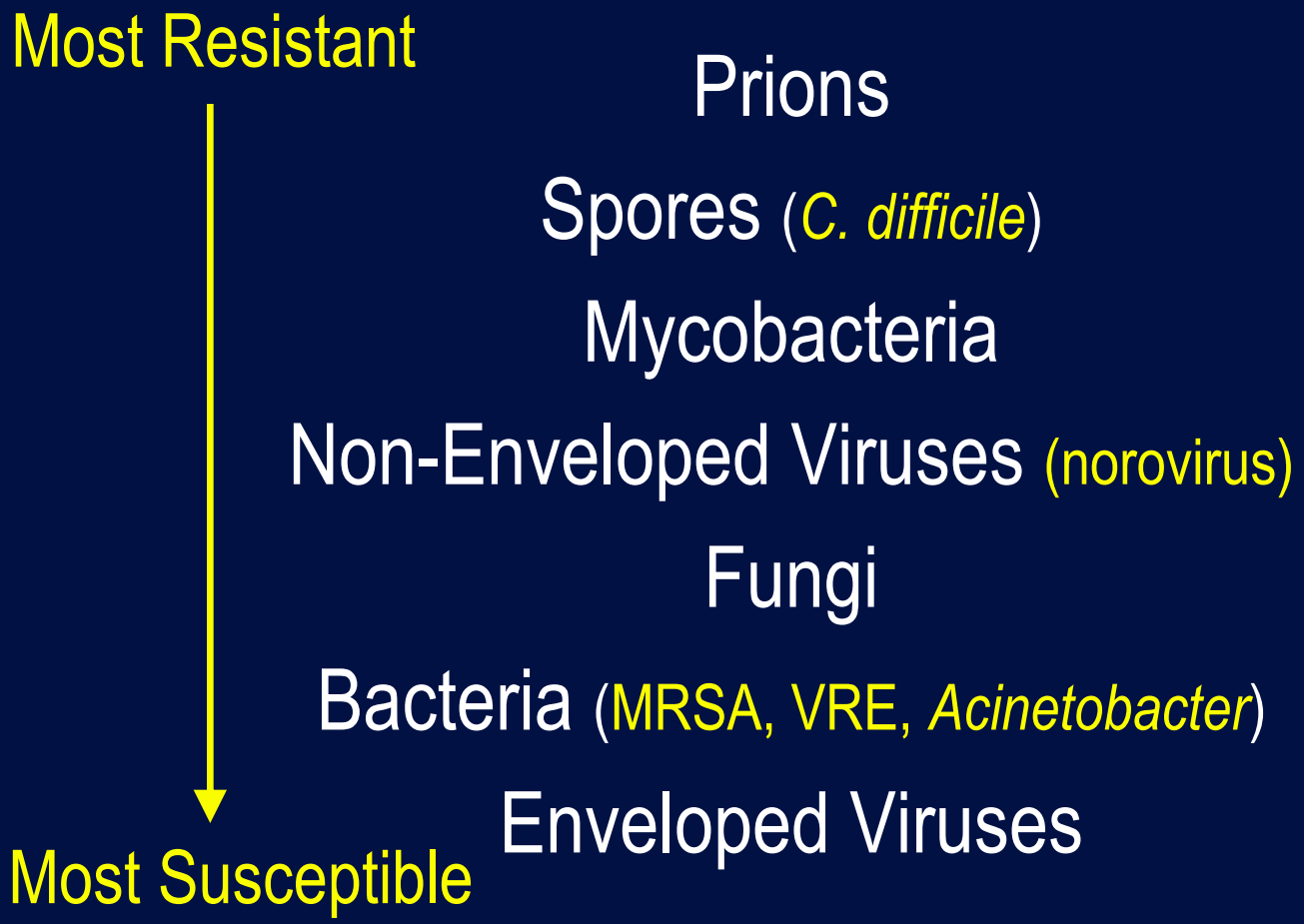
DISINFECTION AND STERILIZATION

- 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 but high numbers of bacterial spores**
  - **NONCRITICAL - objects that touch only intact skin require low-level disinfection**

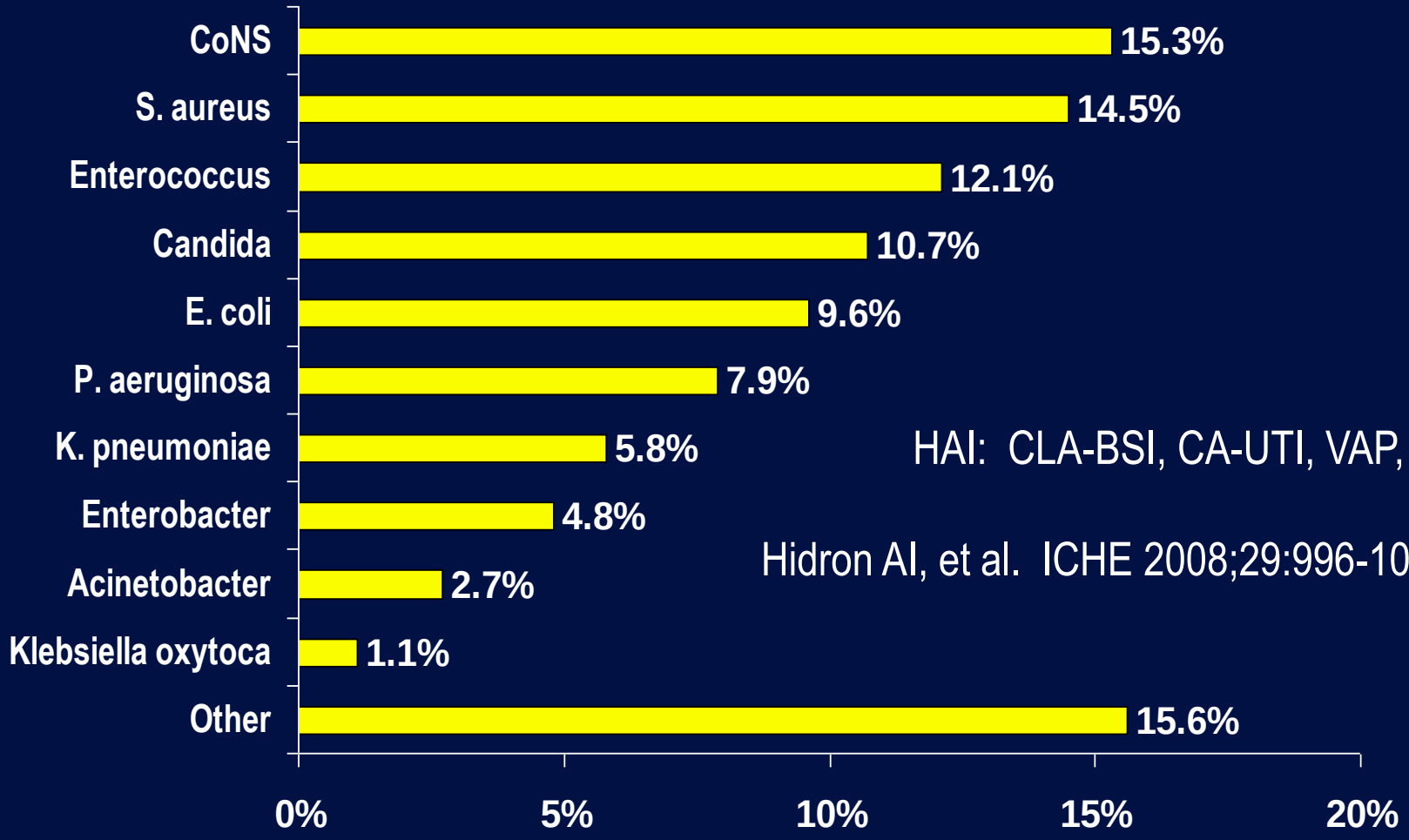
DISINFECTING NONCRITICAL PATIENT EQUIPMENT AND ENVIRONMENTAL SURFACES

Classification:	Noncritical objects will not come in contact with mucous membranes or skin that is not intact.
Object:	Can be expected to be contaminated with some microorganisms.
Level germicidal action:	Kill vegetative bacteria, fungi and lipid viruses.
Examples:	Bedpans; crutches; bed rails; EKG leads; bedside tables; walls, floors and furniture.
Method:	Low-level disinfection

Decreasing Order of Resistance of Microorganisms to Disinfectants/Sterilants



PATHOGENS ASSOCIATED WITH HAIs*: NHSN, 2006-2007



HAI: CLA-BSI, CA-UTI, VAP, SSI

Hidron AI, et al. ICHE 2008;29:996-1011

LOW-LEVEL DISINFECTION FOR NONCRITICAL EQUIPMENT AND SURFACES

Exposure time ≥ 1 min

Germicide	Use Concentration
Ethyl or isopropyl alcohol	70-90%
Chlorine	100ppm (1:500 dilution)
Phenolic	UD
Iodophor	UD
Quaternary ammonium	UD
Improved hydrogen peroxide	0.5%, 1.4%

UD=Manufacturer's recommended use dilution; if prepared on-site, document correct concentration at some frequency

CONTACT TIMES FOR SURFACE DISINFECTION

- Follow the EPA-registered contact times, ideally
  - Some products have achievable contact times for bacteria/viruses (30 seconds-2 minutes)
  - Other products have non-achievable contact times
- If use a product with non-achievable contact time
  - Use >1 minute (surface should appear visibly wet for 1 minute) based on CDC guideline and scientific literature
  - Prepare a risk assessment

  http://www.unc.edu/depts/spice/dis/SurfDisRiskAssess2011.pdf

EFFECTIVENESS OF DISINFECTANTS AGAINST MRSA AND VRE

TABLE 2
DISINFECTANT ACTIVITY AGAINST ANTIBIOTIC-SUSCEPTIBLE AND ANTIBIOTIC-RESISTANT BACTERIA

	Log_{10} Reductions							
	VSE		VRE		MSSA		MRSA	
Product	0.5 min	5 min	0.5 min	5 min	0.5 min	5 min	0.5 min	5 min
Vesphene IIse	>4.3	>4.3	>4.8	>4.8	>5.1	>5.1	>4.6	>4.6
Clorox	>5.4	>5.4	>4.9	>4.9	>5.0	>5.0	>4.6	>4.6
Lysol Disinfectant	>4.3	>4.3	>4.8	>4.8	>5.1	>5.1	>4.6	>4.6
Lysol Antibacterial	>5.5	>5.5	>5.5	>5.5	>5.1	>5.1	>4.6	>4.6
Vinegar	0.1	5.3	1.0	3.7	+1.1	+0.9	+0.6	2.3

Abbreviations: MRSA, methicillin-resistant *Staphylococcus aureus;* MSSA, methicillin-susceptible *S aureus;* VRE, vancomycin-resistant *Enterococcus;* VSE, vancomycin-susceptible *Enterococcus.* Data represent mean of two trials (n=2). Values preceded by ">" represent the limit of detection of the assay. Assays were conducted at a temperature of 20°C and a relative humidity of 45%. Results were calculated as the log of Nd/No, where Nd is the titer of bacteria surviving after exposure and No is the titer of the control.

Rutala WA, et al. *Infect Control Hosp Epidemiol* 2000;21:33-38.

DISINFECTION OF NONCRITICAL PATIENT-CARE DEVICES

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

- Process noncritical patient-care devices using a disinfectant and concentration of germicide as recommended in the Guideline (IB)
- Disinfect noncritical medical devices (e.g., blood pressure cuff) with an EPA-registered hospital disinfectant using the label's safety precautions and use directions. Most EPA-registered hospital disinfectants have a label contact time of 10 minutes but multiple scientific studies have demonstrated the efficacy of hospital disinfectants against pathogens with a contact time of at least 1 minute (IB)
- Ensure that, at a minimum noncritical patient-care devices are disinfected when visibly soiled and on a regular basis (e.g., once daily or weekly) (II)
- If dedicated, disposable devices are not available, disinfect noncritical patient-care equipment after using on a patient, who is on contact precautions before using this equipment on another patient (IB)

CLEANING AND DISINFECTION OF ENVIRONMENTAL SURFACES IN HEALTHCARE FACILITIES

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

- Clean housekeeping surfaces (e.g., floors, tabletops) on a regular basis, when spills occur, and when these surfaces are visibly soiled (II)
- Disinfect (or clean) environmental surfaces on a regular basis (e.g., daily, 3x per week) and when surfaces are visibly soiled (II)
- Follow manufacturers' instructions for proper use of disinfecting (or detergent) products – such as recommended use-dilution, material compatibility, storage, shelf-life, and safe use and disposal (II)
- Clean walls, blinds, and window curtains in patient-care areas when these surfaces are visibly contaminated or soiled (II)
- Prepare disinfecting (or detergent) solutions as needed and replace with fresh solution frequently (e.g., replace floor mopping solution every 3 patient rooms, change no less often than at 60-minute intervals) (IB)

REVIEW THE "BEST" PRACTICES FOR CLEANING AND DISINFECTING

Cleaning and disinfecting is one-step with disinfectant-detergent. No pre-cleaning necessary unless spill or gross contamination.

PROPERTIES OF AN IDEAL DISINFECTANT

Rutala, 1995. Modified from Molinari 1987.

- **Broad spectrum**-wide antimicrobial spectrum
- **Fast acting**-should produce a rapid kill
- **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
- Residual effect on treated surface-leave an antimicrobial film on treated surface
- **Easy to use**
- Odorless-pleasant or no odor
- Economical-cost should not be prohibitively high
- Soluble (in water) and stable (in concentrate and use dilution)
- Cleaner (good cleaning properties) and nonflammable

LOW-LEVEL DISINFECTION FOR NONCRITICAL EQUIPMENT AND SURFACES

Exposure time ≥ 1 min

Germicide	Use Concentration
Ethyl or isopropyl alcohol	70-90%
Chlorine	100ppm (1:500 dilution)
Phenolic	UD
Iodophor	UD
Quaternary ammonium	UD
Improved hydrogen peroxide	0.5%, 1.4%

UD=Manufacturer's recommended use dilution; if prepared on-site, document correct concentration at some frequency

IMPROVED HYDROGEN PEROXIDE SURFACE DISINFECTANT

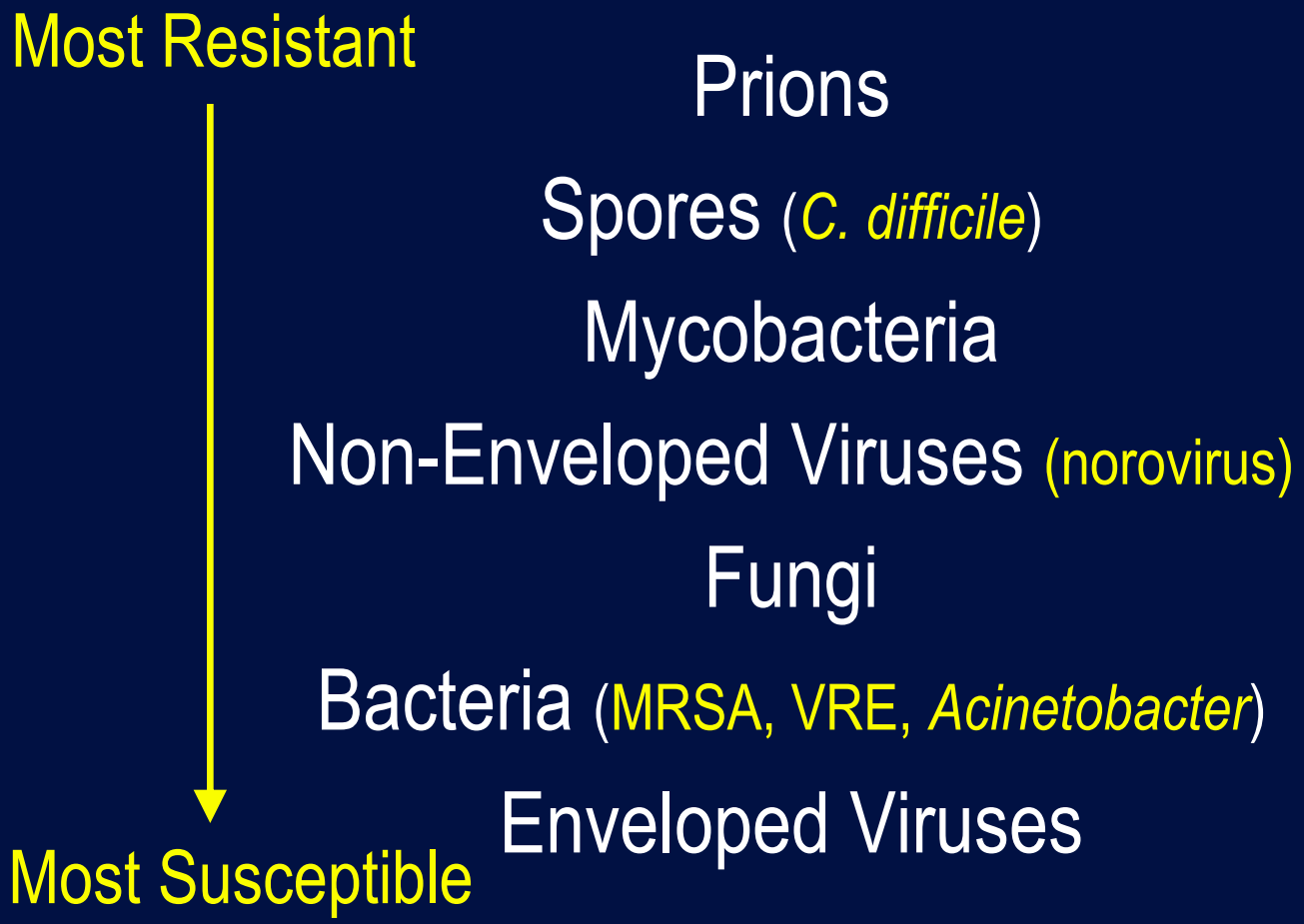
- Advantages
  - 30 sec -1 min bactericidal and virucidal claim (fastest non-bleach contact time)
  - 5 min mycobactericidal claim
  - Safe for workers (lowest EPA toxicity category, IV)
  - Benign for the environment; noncorrosive; surface compatible
  - One step cleaner-disinfectant
  - No harsh chemical odor
  - EPA registered (0.5% RTU, 1.4% RTU, wet wipe)
- Disadvantages
  - More expensive than QUAT

BACTERICIDAL ACTIVITY OF DISINFECTANTS (log_{10} reduction) WITH A CONTACT TIME OF 1m WITH/WITHOUT FCS. Rutala et al. ICHE. In press

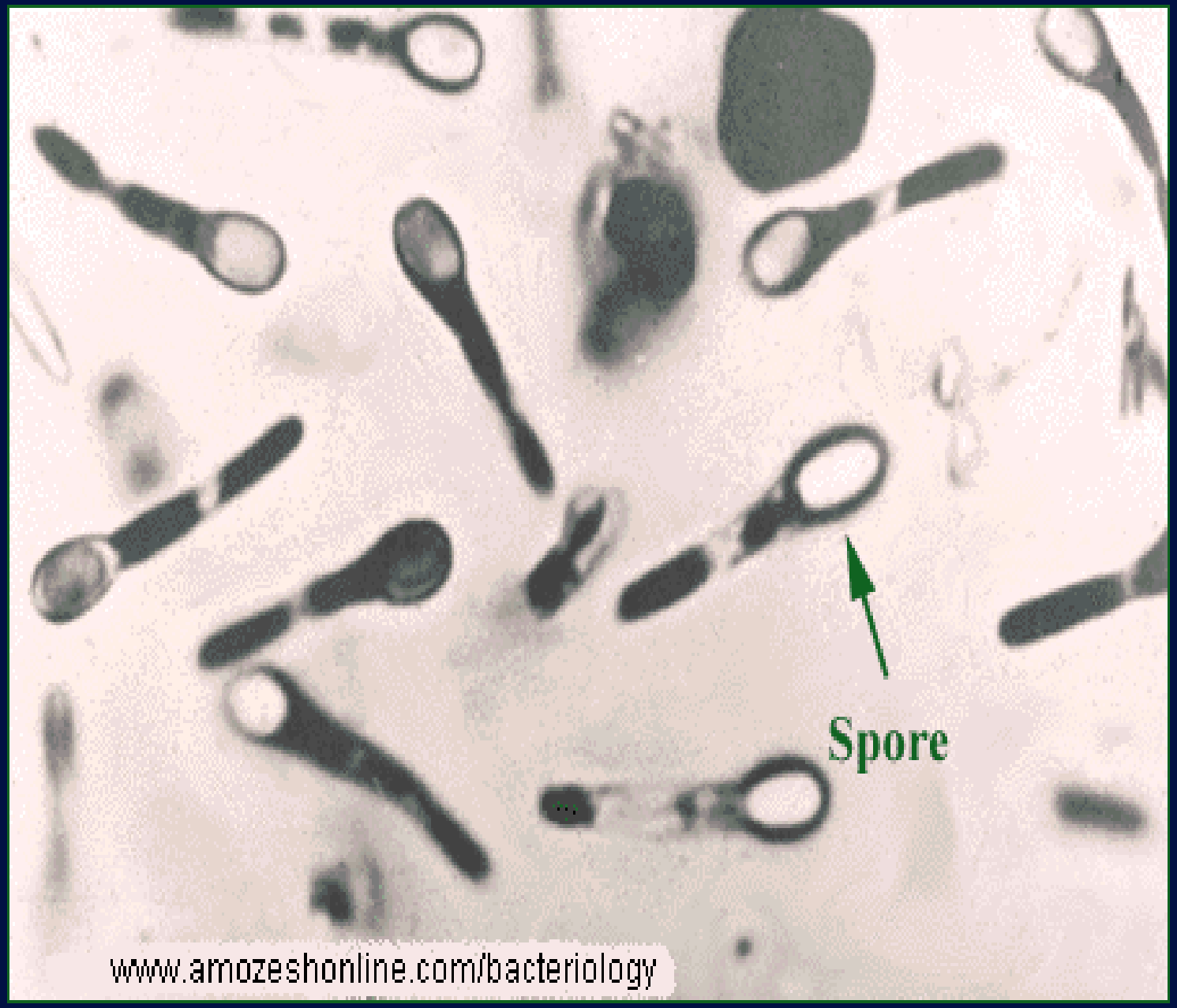
Improved hydrogen peroxide is significantly superior to standard HP at same concentration and superior or similar to the QUAT tested

Organism	Oxivir-0.5%	0.5% HP	Clorox HC HP Cleaner-Dis 1.4%	1.4% HP	3.0% HP	A456-II QUAT
MRSA	>6.6	<4.0	>6.5	<4.0	<4.0	5.5
VRE	>6.3	<3.6	>6.1	<3.6	<3.6	4.6
MDR-*Ab*	>6.8	<4.3	>6.7	<4.3	<4.3	>6.8
MRSA, FCS	>6.7	NT	>6.7	NT	<4.2	<4.2
VRE, FCS	>6.3	NT	>6.3	NT	<3.8	<3.8
MDR-*Ab*, FCS	>6.6	NT	>6.6	NT	<4.1	>6.6

Decreasing Order of Resistance of Microorganisms to Disinfectants/Sterilants



C. difficile spores



DISINFECTANTS

No measurable activity (1 *C. difficile* strain, J9; spores at 20 min)

- Vesphene (phenolic)
- 70% isopropyl alcohol
- 95% ethanol
- 3% hydrogen peroxide
- Clorox disinfecting spray (65% ethanol, 0.6% QUAT)
- Lysol II disinfecting spray (79% ethanol, 0.1% QUAT)
- TBQ (0.06% QUAT); QUAT may increase sporulation capacity- (Lancet 2000;356:1324)
- Novaplus (10% povidone iodine)
- Accel (0.5% hydrogen peroxide)

Rutala W, Weber D, et al. 2006

DISINFECTANTS AND ANTISEPSIS

C. difficile spores at 10 and 20 min, Rutala et al, 2006

- ~4 $\log_{10}$ reduction (3 *C. difficile* strains including BI-9)
  - Clorox, 1:10, ~6,000 ppm chlorine (but not 1:50)
  - Clorox Clean-up, ~19,100 ppm chlorine
  - Tilex, ~25,000 ppm chlorine
  - Steris 20 sterilant, 0.35% peracetic acid
  - Cidex, 2.4% glutaraldehyde
  - Cidex-OPA, 0.55% OPA
  - Wavicide, 2.65% glutaraldehyde
  - Aldahol, 3.4% glutaraldehyde and 26% alcohol

C. difficile CONTROL MEASURES

Orenstein et al. ICHE 2011;32:1137

- In units with high endemic *C. difficile* infection rates or in an outbreak setting, use dilute solutions of 5.25-6.15% sodium hypochlorite (e.g., 1:10 dilution of bleach) for routine disinfection. (Category II).
- We now use chlorine solution in all CDI rooms for routine daily and terminal cleaning (use to use QUAT in patient rooms with sporadic CDI). One application of an effective product covering all surfaces to allow a sufficient wetness for > 1 minute contact time. Chlorine solution normally takes 1-3 minutes to dry.
- For semicritical equipment, glutaraldehyde (20m), OPA (12m) and peracetic acid (12m) reliably kills *C. difficile* spores using normal exposure times

INACTIVATION OF MURINE AND HUMAN NOROVIRUES

Disinfectant, 1 min	MNV Log_{10} Reduction	HNV Log_{10} Reduction
70% Ethanol	>4 (3.3 at 15sec)	2
70% Isopropyl alcohol	4.2	2.2
65% Ethanol + QUAT	>2	3.6
79% Ethanol + QUAT	3.4	3.6
Chlorine (5,000ppm)	4	3
Chlorine (24,000ppm)	2.4	4.3
Phenolic, QUAT, Ag, 3% H_20_2	≤1	≤1 (2.1 QUAT)
0.5% Accel H_20_2	3.9	2.8

Rutala WA, Folan MP, Tallon LA, Lyman WH, Park GW, Sobsey MD, Weber DJ. 2007

GUIDELINE FOR THE PREVENTION OF NOROVIRUS OUTBREAKS IN HEALTHCARE, HICPAC, 2011

- Avoid exposure to vomitus or diarrhea. Place patients with suspected norovirus on Contact Precautions in a single room (IB)
  - Continue Precautions for at least 48 hours after symptom resolution (IB)
  - Use longer isolation times for patients with comorbidities (II) or <2 yrs (II)
- Consider minimizing patient movements within a ward (II)
  - Consider restricting movement outside the involved ward unless essential (II)
  - Consider closure of wards to new admissions (II)
- Exclude ill personnel (IB)
- During outbreaks, use soap and water for hand hygiene (IB)
- Clean and disinfect patient care areas and frequently touched surfaces during outbreaks 3x daily using EPA approved healthcare product (IB)
- Clean surfaces and patient equipment prior to disinfection. Use product with an EPA approved claim against norovirus (IC)

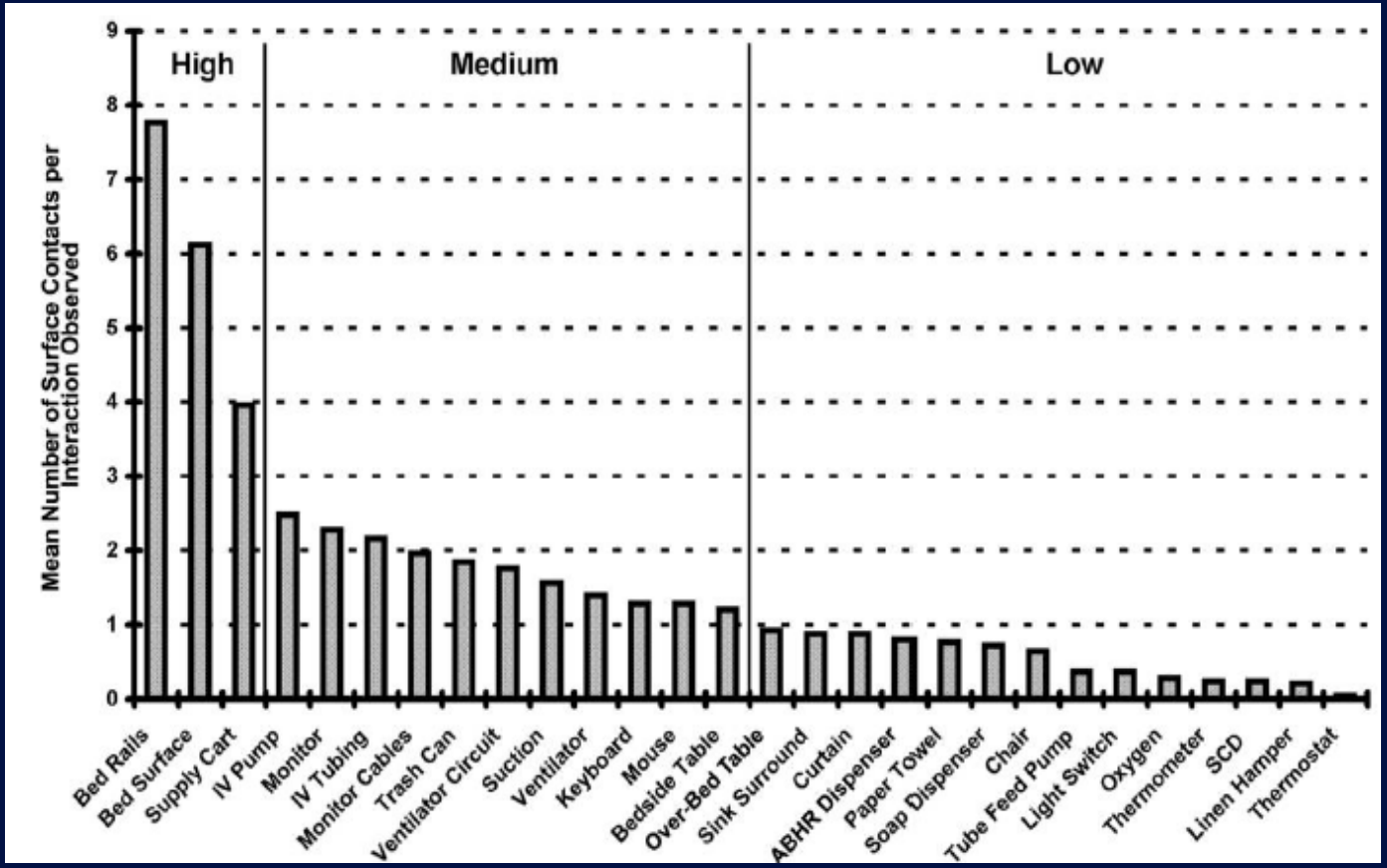
MacCannell T, et al. http://www.cdc.gov/hicpac/pdf/norovirus/Norovirus-Guideline-2011.pdf

SHOULD WE CONCENTRATE ON "HIGH TOUCH" OR "HIGH RISK" OBJECTS

No, not only "high risk" or "high touch" (all surfaces). "High touch" objects only recently defined and "high risk" objects not scientifically defined.

DEFINING HIGH TOUCH SURFACES

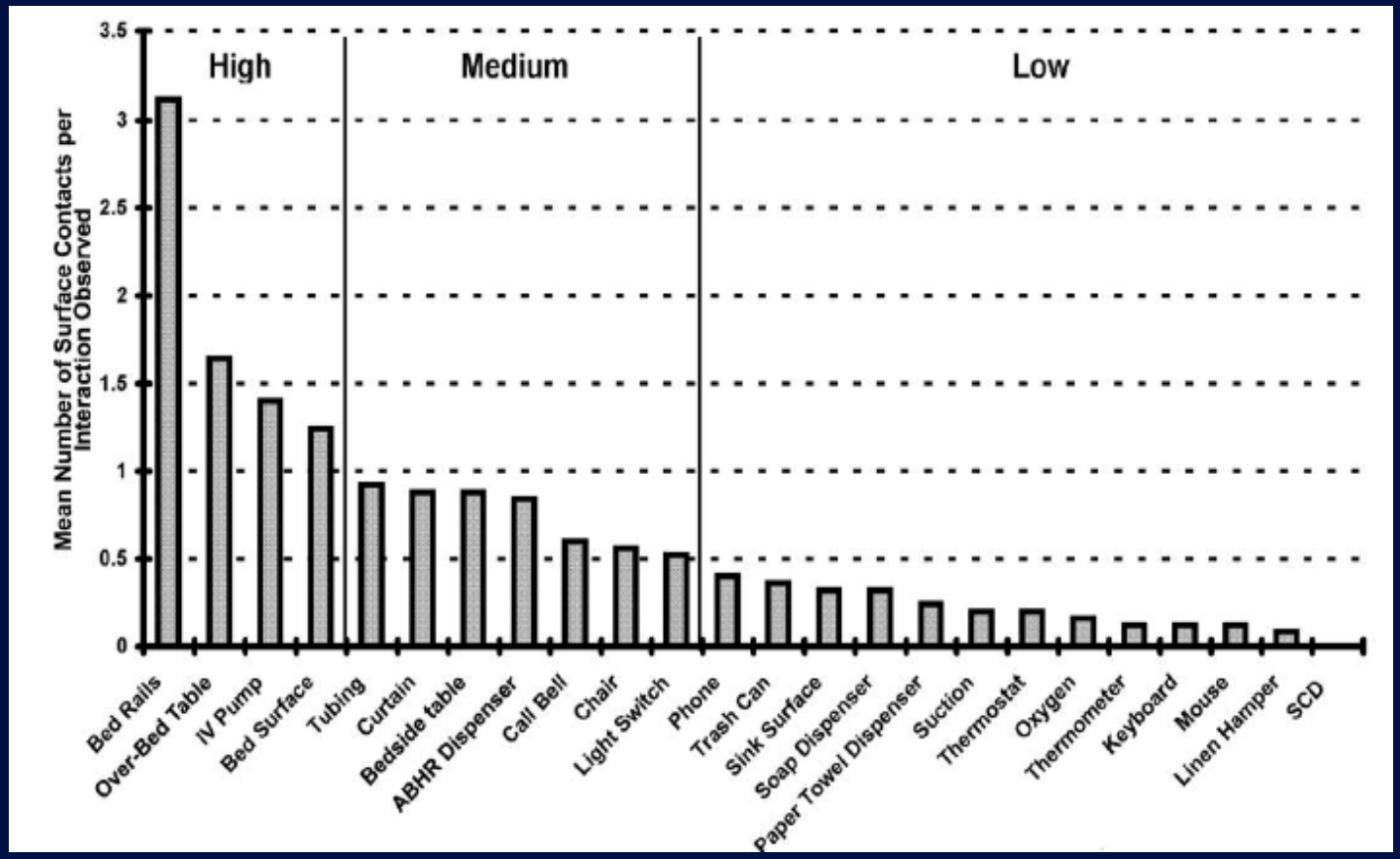
ICU



Huslage K, Rutala WA, Sickbert-Bennett E, Weber DJ. ICHE 2010;31:850-853

DEFINING HIGH TOUCH SURFACES

Non-ICU



Huslage K, Rutala WA, Sickbert-Bennett E, Weber DJ. ICHE 2010;31:850-853

Microbiologic Assessment of High, Medium and Low Touch Surfaces. Huslage, Rutala, Gergen, Weber. Unpublished 2012

No correlation between touch frequency and microbial contamination

Surface	Before Cleaning Mean CFU/Rodac	After Cleaning Mean CFU/Rodac	Significance
High	71.9 (CI 46.5-97.3)	9.6	High=Low High>Medium
Medium	44.2 (CI 28.1-60.2)	9.3	Medium=Low
Low	56.7 (CI 34.2-79.2)	5.7	

TABLE. Rates of Cleaning for 14 Types of High-Risk Objects

Object	Percentage cleaned		95% CI
	Mean ± SD	Range	
Sink	82 ± 12	57-97	77-88
Toilet seat	76 ± 18	40-98	68-84
Tray table	77 ± 15	53-100	71-84
Bedside table	64 ± 22	23-100	54-73
Toilet handle	60 ± 22	23-89	50-69
Side rail	60 ± 21	25-96	51-69
Call box	50 ± 19	9-90	42-58
Telephone	49 ± 16	18-86	42-56
Chair	48 ± 28	11-100	35-61
Toilet door knobs	28 ± 22	0-82	18-37
Toilet hand hold	28 ± 23	0-90	18-38
Bedpan cleaner	25 ± 18	0-79	17-33
Room door knobs	23 ± 19	2-73	15-31
Bathroom light switch	20 ± 21	0-81	11-30

NOTE. CI, confidence interval.

SHOULD WE CONCENTRATE ON "HIGH TOUCH" OR "HIGH RISK" OBJECTS

No, not only "high risk" or 'high touch" (all surfaces). "High touch" objects only recently defined and "high risk" objects not scientifically defined.

LECTURE OBJECTIVES

- Review the use of low-level disinfectants and the activity of disinfectants on key hospital pathogens
- Review "no touch" methods for room decontamination

NEW APPROACHES TO ROOM DECONTAMINATION

ROOM DECONTAMINATION UNITS

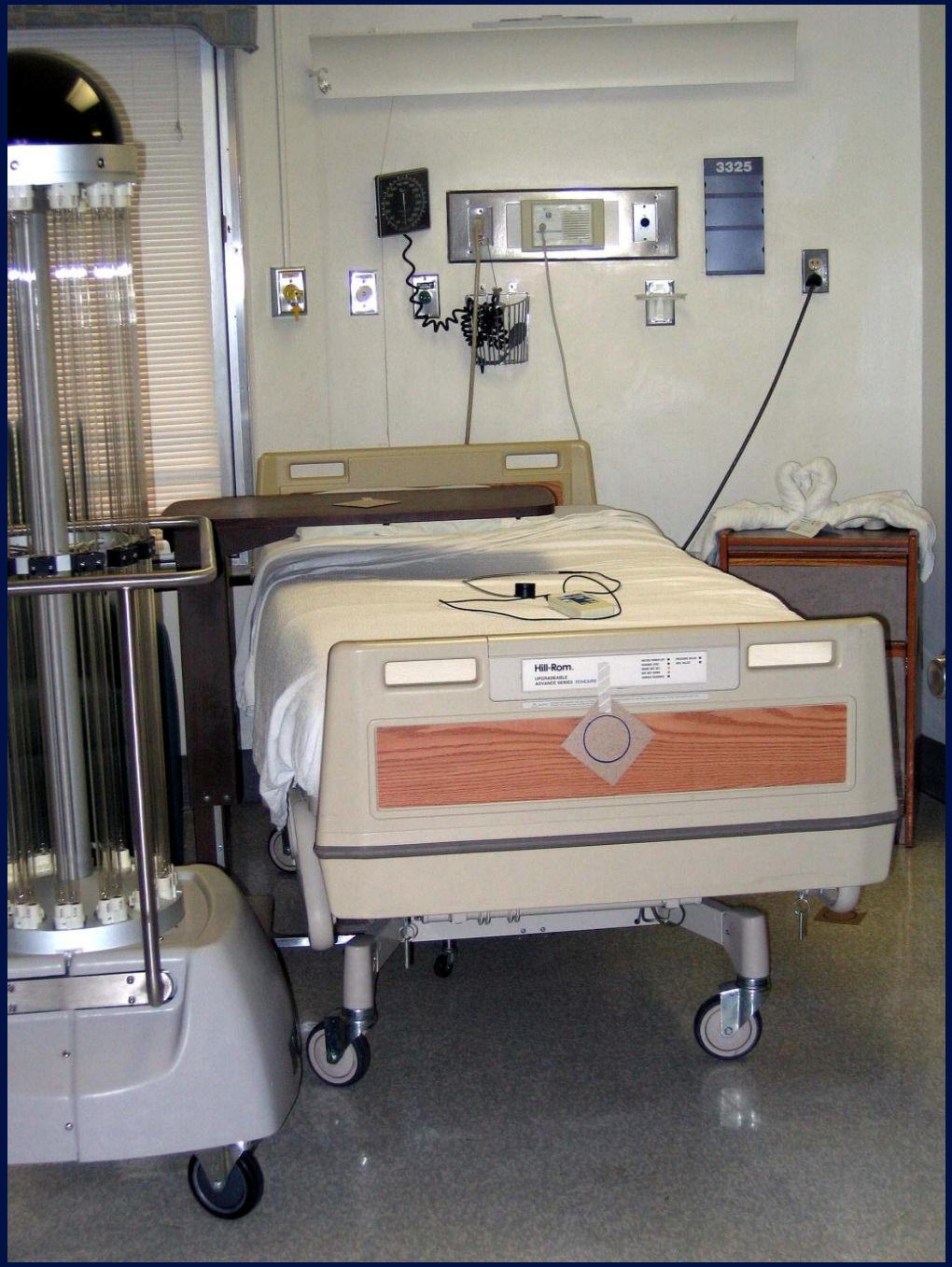
Rutala, Weber. ICHE. 2011;32:743

TABLE 1. Comparison of Room Decontamination Systems That Use UV Irradiation and Hydrogen Peroxide (HP)

	Sterinis	Steris	Bioquell	Tru-D
Abbreviation	DMHP (dry mist HP)	VHP (vaporized HP)	HPV (HP vapor)	UV-C
Active agent	Stenusil (5% HP, <50 ppm silver cations)	Vaprox (35% HP)	35% HP	UV-C irradiation at 254 nm
Application	Aerosol of active solution	Vapor, noncondensing	Vapor, condensing	UV irradiation, direct and reflected
Aeration (removal of active agent from enclosure)	Passive decomposition	Active catalytic conversion	Active catalytic conversion	Not necessary
Sporicidal efficacy	Single cycle does not inactivate *Bacillus atrophaeus* BIs; ~4-$\log_{10}$ reduction in *Clostridium difficile*[a] and incomplete inactivation in situ	Inactivation of *Geobacillus stearothermophilus* BIs	Inactivation of *G. stearothermophilus* BIs; >6-$\log_{10}$ reduction in *C. difficile*[a] in vitro and complete inactivation in situ	1.7–4-$\log_{10}$ reduction in *C. difficile*[a] in situ
Evidence of clinical impact	None published	None published	Significant reduction in the incidence of *C. difficile*	None published

NOTE. Adapted from Otter and Yezli.[18] BIs, biological indicators; VRE, vancomycin-resistant *Enterococcus*.

[a] All *C. difficile* experiments were done with *C. difficile* spores.


3325
Hill-Rom

UV Room Decontamination

- Fully automated, self calibrates, activated by hand-held remote
- Room ventilation does not need to be modified
- Uses UV-C (254 nm range) to decontaminate surfaces
- Measures UV reflected from walls, ceilings, floors or other treated areas and calculates the operation time to deliver the programmed lethal dose for pathogens.
- UV sensors determines and targets highly-shadowed areas to deliver measured dose of UV energy (12,000µWs/cm^2 bacteria)
- After UV dose delivered, will power-down and audibly notify the operator
- Reduces colony counts of pathogens by >99.9% within 20-25m

EFFECTIVENESS OF UV ROOM DECONTAMINATION

TABLE 1. UV-C Decontamination of Formica Surfaces in Patient Rooms Experimentally Contaminated with Methicillin-Resistant *Staphylococcus aureus* (MRSA), Vancomycin-Resistant *Enterococcus* (VRE), Multidrug-Resistant (MDR) *Acinetobacter baumannii*, and *Clostridium difficile* Spores

		UV-C line of sight						
		Total		Direct		Indirect		
Organism	Inoculum	No. of samples	Decontamination, $\log_{10}$ reduction, mean (95% CI)	No. of samples	Decontamination, $\log_{10}$ reduction, mean (95% CI)	No. of samples	Decontamination, $\log_{10}$ reduction, mean (95% CI)	*P*
MRSA	4.88 $\log_{10}$	50	3.94 (2.54–5.34)	10	4.31 (3.13–5.50)	40	3.85 (2.44–5.25)	.06
VRE	4.40 $\log_{10}$	47	3.46 (2.16–4.81)	15	3.90 (2.99–4.81)	32	3.25 (1.97–4.62)	.003
MDR *A. baumannii*	4.64 $\log_{10}$	47	3.88 (2.59–5.16)	10	4.21 (3.27–5.15)	37	3.79 (2.47–5.10)	.07
C. difficile spores	4.12 $\log_{10}$	45	2.79 (1.20–4.37)	10	4.04 (3.71–4.37)	35	2.43 (1.46–3.40)	<.001

Rutala WA, et al. Infect Control Hosp Epidemiol. 2010;31:1025-1029.

EFFECTIVENESS OF UV ROOM DECONTAMINATION

Nerandzic et al. BMC Infect Dis 2010;8:197

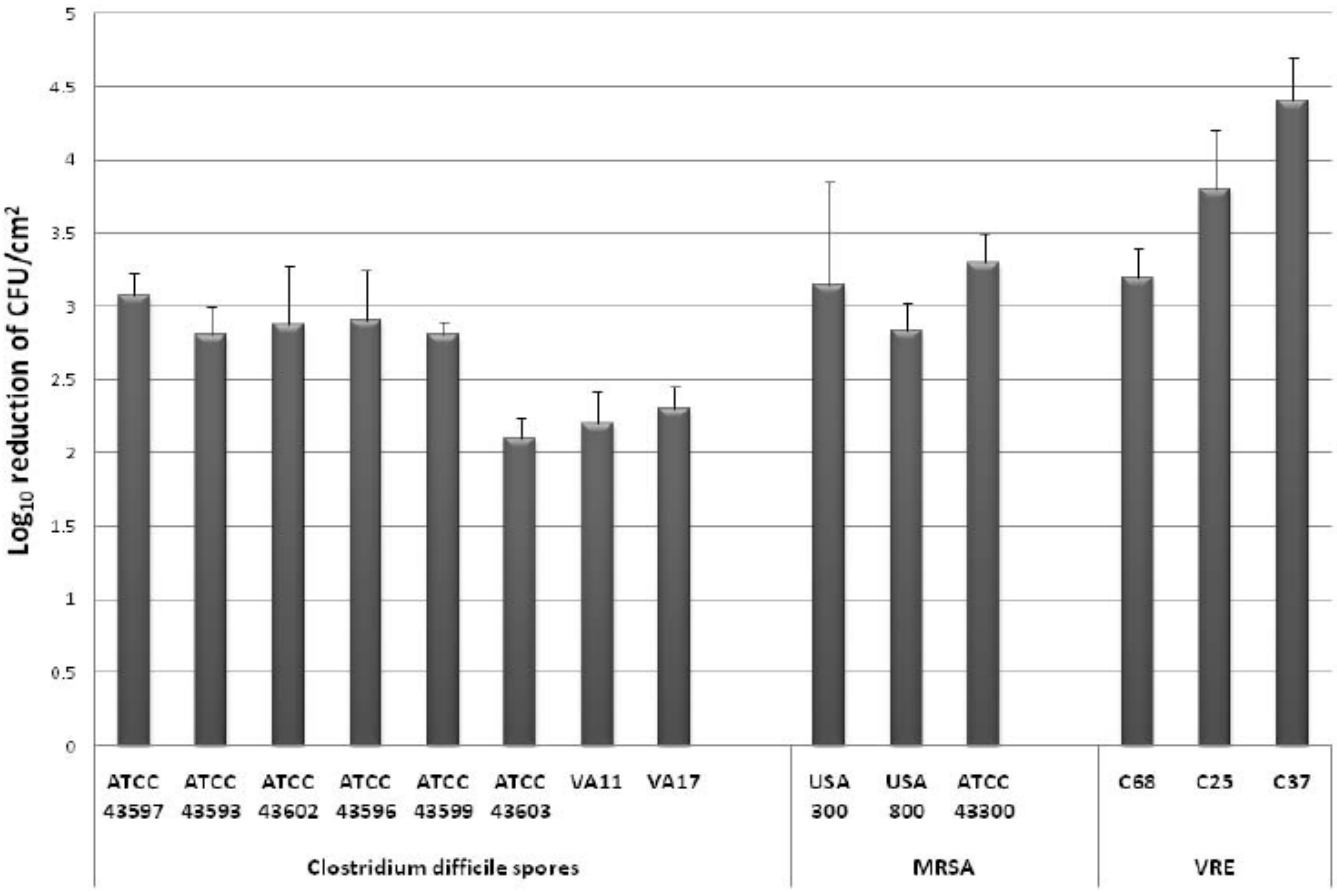


Figure 2 Mean reduction (log_{10} colony-forming units [CFU]/cm^2) in recovery of multiple strains of *Clostridium difficile*, methicillin-resistant *Staphylococcus aureus* (MRSA), and vancomycin-resistant *Enterococcus* (VRE) from laboratory bench top surfaces after the use of the Tru-D device. For each pathogen, the inoculum applied to the bench top was adjusted such that 10^3 to 10^5 CFU were recovered from the positive control specimens. The Tru-D device was operated at a reflected dose of 22,000 μWs/cm^2 for ~45 minutes.

UV Reflective Coating

Rutala, Gergen, Tande, Weber. 2012

With the nanoscale reflective coating, cycle times were 5-10m (~80% reduction) which would substantially reduce the turnover time of the room

Line-of-Sight	MRSA w/coating	MRSA no coating	*C. difficile* w/coating	*C. difficile* no coating
Cycle Time	5m03s	25m13s	9m24s	43m42s
Direct	4.70 (n=42)	4.72 (n=33)	3.28 (n=39)	3.42 (n=33)
Indirect	4.45 (n=28)	4.30 (n=27)	2.42 (n=31)	2.01 (n=27)
Total	4.60 (n=70)	4.53 (n=60)	2.91 (n=70)	2.78 (n=60)

ROOM DECONTAMINATION UNITS

Rutala, Weber. ICHE. 2011;32:743

TABLE 1. Comparison of Room Decontamination Systems That Use UV Irradiation and Hydrogen Peroxide (HP)

	Sterinis	Steris	Bioquell	Tru-D
Abbreviation	DMHP (dry mist HP)	VHP (vaporized HP)	HPV (HP vapor)	UV-C
Active agent	Stenusil (5% HP, <50 ppm silver cations)	Vaprox (35% HP)	35% HP	UV-C irradiation at 254 nm
Application	Aerosol of active solution	Vapor, noncondensing	Vapor, condensing	UV irradiation, direct and reflected
Aeration (removal of active agent from enclosure)	Passive decomposition	Active catalytic conversion	Active catalytic conversion	Not necessary
Sporicidal efficacy	Single cycle does not inactivate *Bacillus atrophaeus* BIs; ~4-$\log_{10}$ reduction in *Clostridium difficile*[a] and incomplete inactivation in situ	Inactivation of *Geobacillus stearothermophilus* BIs	Inactivation of *G. stearothermophilus* BIs; >6-$\log_{10}$ reduction in *C. difficile*[a] in vitro and complete inactivation in situ	1.7–4-$\log_{10}$ reduction in *C. difficile*[a] in situ
Evidence of clinical impact	None published	None published	Significant reduction in the incidence of *C. difficile*	None published

NOTE. Adapted from Otter and Yezli.[18] BIs, biological indicators; VRE, vancomycin-resistant *Enterococcus*.

[a] All *C. difficile* experiments were done with *C. difficile* spores.

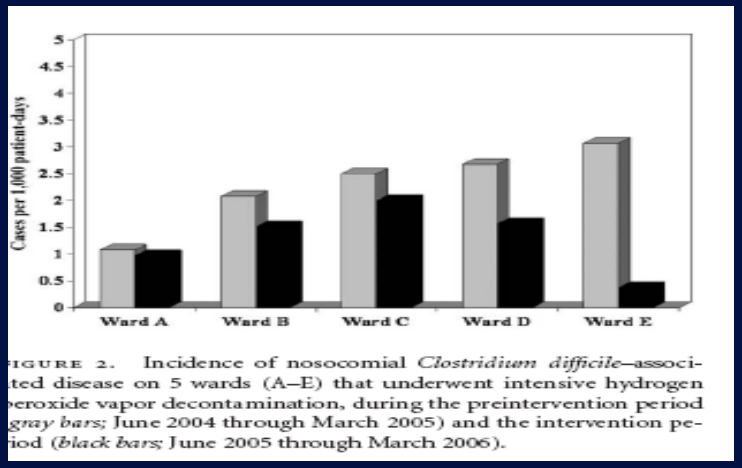
HP FOR DECONTAMINATION OF THE HOSPITAL ENVIRONMENT

Falagas, et al. J Hosp Infect. 2011;78:171.

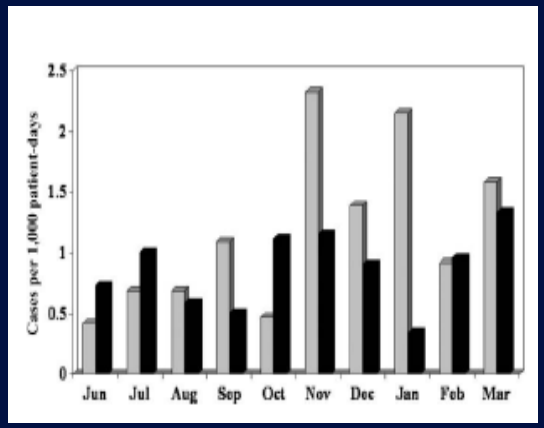
Author, Year	HP System	Pathogen	Before HPV	After HPV	% Reduction
French, 2004	VHP	MRSA	61/85-72%	1/85-1%	98
Bates, 2005	VHP	*Serratia*	2/42-5%	0/24-0%	100
Jeanes, 2005	VHP	MRSA	10/28-36%	0/50-0%	100
Hardy, 2007	VHP	MRSA	7/29-24%	0/29-0%	100
Dryden, 2007	VHP	MRSA	8/29-28%	1/29-3%	88
Otter, 2007	VHP	MRSA	18/30-60%	1/30-3%	95
Boyce, 2008	VHP	*C. difficile*	11/43-26%	0/37-0%	100
Bartels, 2008	HP dry mist	MRSA	4/14-29%	0/14-0%	100
Shapey, 2008	HP dry mist	*C. difficile*	48/203-24%; 7	7/203-3%; 0.4	88
Barbut, 2009	HP dry mist	*C. difficile*	34/180-19%	4/180-2%	88
Otter, 2010	VHP	GNR	10/21-48%	0/63-0%	100

ROOM DECONTAMINATION WITH HPV

- Study design
  - **Before and after study of HPV**
- Outcome
  - ***C. difficile* incidence**
- Results
  - **HPV decreased environmental contamination with *C. difficile* (p<0.001), rates on high incidence floors from 2.28 to 1.28 cases per 1,000 pt days (p=0.047), and throughout the hospital from 1.36 to 0.84 cases per 1,000 pt days (p=0.26)**



IGURE 2. Incidence of nosocomial *Clostridium difficile*–associated disease on 5 wards (A–E) that underwent intensive hydrogen peroxide vapor decontamination, during the preintervention period (*gray bars*; June 2004 through March 2005) and the intervention period (*black bars*; June 2005 through March 2006).



Boyce JM, et al. Infect Control Hosp Epidemiol. 2008;29:723-729.

UV ROOM DECONTAMINATION

Rutala, Weber. ICHE. 2011;32:744

UV irradiation

Advantages

- Reliable biocidal activity against a wide range of healthcare-associated pathogens
- Room surfaces and equipment decontaminated
- Room decontamination is rapid (~15 minutes) for vegetative bacteria
- Effective against *Clostridium difficile*, although longer exposure is required (~50 minutes)
- HVAC system does not need to be disabled, and the room does not need to be sealed
- UV light is residual-free and does not give rise to health or safety concerns
- No consumable products so costs include only capital equipment and staff time
- Good distribution in the room of UV energy via an automated monitoring system

Disadvantages

- All patients and staff must be removed from the room before decontamination
- Decontamination can be accomplished only at terminal disinfection (ie, cannot be used for daily disinfection) because the room must be emptied of people
- Capital equipment costs are substantial
- Does not remove dust and stains, which are important to patients and visitors; hence, cleaning must precede UV decontamination
- Sensitive to use parameters (eg, wavelength, UV dose delivered)
- Requires that equipment and furniture be moved away from walls
- Studies have not been conducted to demonstrate whether use of UV room decontamination decreases the incidence of healthcare-associated infections

HP ROOM DECONTAMINATIION

Rutala, Weber. ICHE. 2011;32:743

HP systems

- Advantages
  - Reliable biocidal activity against a wide range of healthcare-associated pathogens
  - Room surfaces and equipment decontaminated
  - Effective against *C. difficile*
  - Useful for disinfecting complex equipment and furniture
  - Does not require that furniture and equipment be moved away from the walls
  - HP is residual-free and does not give rise to health or safety concerns (aeration unit converts HP into oxygen and water)
  - Uniform distribution in the room via an automated dispersal system
  - Demonstrated to reduce healthcare-associated infections (ie, *C. difficile*)
- Disadvantages
  - All patients and staff must be removed from the room before decontamination
  - HVAC system must be disabled to prevent unwanted dilution of HP during use, and doors must be closed with gaps sealed by tape
  - Decontamination can be accomplished only as terminal disinfection (ie, cannot be used for daily disinfection) because the room must be emptied of people
  - Capital equipment costs are substantial
  - Decontamination requires ~3–5 hours
  - Does not remove dust and stains, which are important to patients and visitors; hence, cleaning must precede HP decontamination
  - Sensitive to use parameters (eg, HP concentration)

Summary

- Low-level disinfectants are effective in killing most HA pathogens and should be used for noncritical patient care items and environmental surfaces.
- *C. difficile* spore and norovirus require the use of a product that has a *C. difficile* spore claim or norovirus claim, respectively.
- UV and HP vapor/aerosol have been demonstrated to be effective against various HA pathogens (including *C. difficile* spores)
- Since contamination of surfaces is common (although the microbial load is low), even after surface disinfection, UV/HP technology should be considered for terminal room disinfection (e.g., after discharge of patients under CP, during outbreaks) if studies continue to demonstrate a benefit.

LECTURE OBJECTIVES

- Review the use of low-level disinfectants and the activity of disinfectants on key hospital pathogens
- Review "no touch" methods for room decontamination

THANK YOU!

disinfectionandsterilization.org