Are your cleaning wipes safe?

Evidence supporting the “one-room, one-wipe” approach in healthcare settings

Dr. Laura Gavaldà

Preventive Medicine Department

Hospital Universitari de Bellvitge

Barcelona, Catalonia, Spain

Hosted by Paul Webber

paul@webbertraining.com

What has been done since 1970?

APPLIED MICROBIOLOGY, Apr. 1971, p. 693–697

Vol. 21, No. 4
Printed in U.S.A.

Hospital Sanitation: the Massive Bacterial Contamination of the Wet Mop

JOHN C. N. WESTWOOD, MARY A. MITCHELL, AND SUZANNE LEGACÉ

Ottawa General Hospital and Department of Microbiology and Immunology, Faculty of Medicine, University of Ottawa, Ottawa 2, Ontario, Canada

Received for publication 19 August 1970

Conclusion: Mops, stored wet, supported bacterial growth to very high levels and could not be adequately decontaminated by chemical disinfection. Laundering and adequate drying provided effective deconatamination but build-up of bacterial counts occurred if mops were not changed daily.

Scenarios for decontaminating surfaces

Soaked cotton cloths

Microfiber cleaning systems

Sprays and dry towelettes

Ready-to-use towelettes

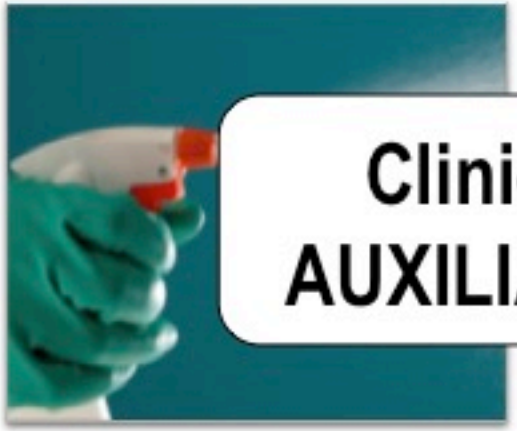
Scenarios for decontaminating surfaces

Soaked cotton cloths

Surfaces
HOUSEKEEPERS

Microfiber cleaning systems

Sprays and dry towelettes



Clinical devices
AUXILIARY NURSES

Ready-to-use towelettes

Scenarios for decontaminating surfaces

Soaked cotton cloths

REUSABLE

Microfiber cleaning systems

Sprays and dry towelettes

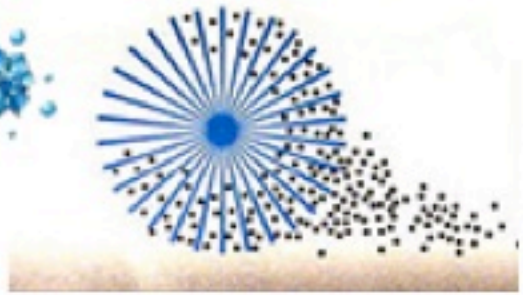
REUSABLE
DISPOSABLE

DISPOSABLE

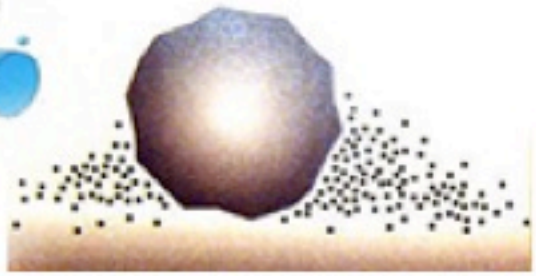
Ready-to-use towelettes

Cotton or microfiber?

Highly absorbent and effective at picking up and holding on to soil, bacteria and dust



Absorbent, but pushes soil and bacteria around rather than picking them up and holding on to them



Double bucket
Color coding

Cloths immersed in the same cleaning solution after each use

Microfiber cleaning system

Each cloth discarted after use: no contamination of cleaning solution

Ready to use wipes

Remove bioburden

Avoid bioburden transfer between surfaces

Kill bacteria (disinfectant wipes)

3-step test ,
ASTM Standard

Stage 1: bacterial removal

Stage 2: bacterial transfer, adpressionn test

Stage 3: antimicrobial activity

OUR EXPERIENCE

Bellvitge Hospital Universitar

Institut Català de la Salut

800-bed referral teaching hospital in Barcelona, Spain

3 medical-surgical ICUs, 12 rooms each

Standard cleaning procedure:

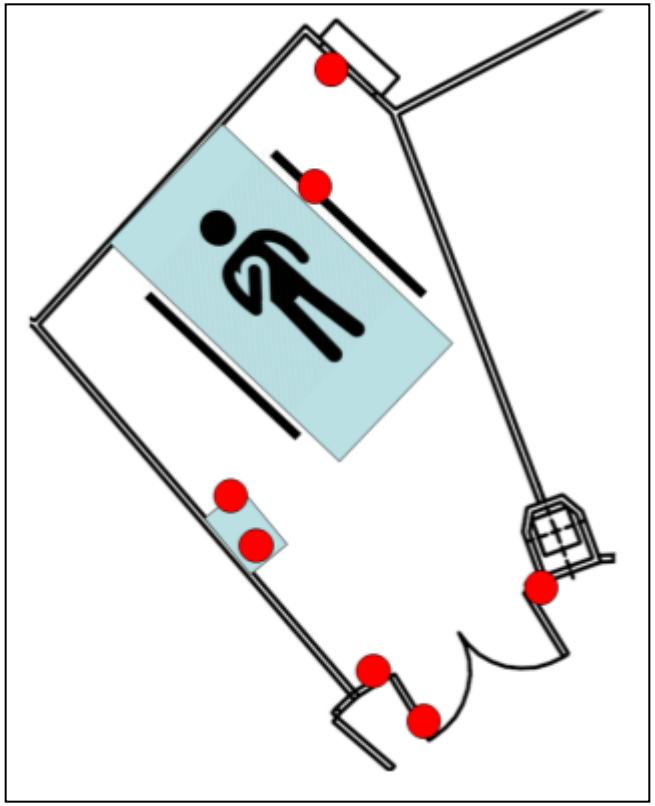
- Color coded, double bucket technique
- Reusable cotton cloths shared between rooms
- Hypochlorite solutions shared between rooms
- Exception: isolated patients
- Used cloths manually disinfected

Environmental contamination by multidrug-resistant microorganisms after daily cleaning

Laura Gavaldà MD, MPH [a,*], Sandra Pequeño MD, MPH [a], Ana Soriano RN [a], M. Angeles Dominguez MD, MPH [b]

American Journal of Infection Control 43 (2015) 776-8

- 13 ICU rooms with patients in contact precautions infected with MRSA, multiresistant *P. aeruginosa* or multiresistant *A. baumannii*.
- Cultures of 7 high-touch surfaces within the first hour after daily cleaning.
- Surfaces cleaned 3 times/day with a 0.1% chlorine solution with reusable cotton wipes. New wipes and new cleaning solutions used for each room. Wipes manually disinfected with a 0.1% chlorine solution.



Environmental contamination by multidrug-resistant microorganisms after daily cleaning

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Results of samples obtained within the first hour after daily cleaning of intensive care unit rooms, according to the type of high-touch surface

Type of high-touch surface	No. of samples	No. of samples with MDROs*	Percentage of samples with MDROs*
In the patient zone and in direct contact with the patient†	13	7	53.8
In the patient zone and not in direct contact with the patient‡	39	12	30.8
In the room outside of the patient zone§	39	7	17.9

NOTE. The χ^2 test for trend; $P = .014$.

OVERALL: 29%

Environmental contamination by multidrug-resistant microorganisms after daily cleaning

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Molecular typing results of clinical and environmental isolates of MRSA and multiresistant *Pseudomonas aeruginosa* and phenotypical concordance of multiresistant *Acinetobacter baumannii* isolates for each studied room

Patient no. and MDRO strain	Surface samples with identical MDROs	Surface samples with other MDROs
1. *P aeruginosa* 3232	1 (14.3)	0
2. *P aeruginosa* 3232	1 (14.3)	0
3. *P aeruginosa* 3233	0	
4. *P aeruginosa* 3233	0	
5. MRSA 48 (ST228)	3 (42.9)	
6. MRSA 33 (Q1)	6 (85.7)	
7. MRSA	0	
8. MRSA 33	5 (71.4)	
P aeruginosa 3213	0	
9. MRSA	0	0
P aeruginosa 3111	2 (28.6)	
A baumannii	0	
10. *A. baumannii*	5 (71.4)	0
11. *A. baumannii*	2 (28.6)	0
12. *A baumannii*	0	0
13. *A baumannii*	0	0

NOTE. Values are n (%). Percentages are expressed within each room.

Surfaces with same strain as patient:

22% in MRSA rooms

5% in *P. aeruginosa* rooms

Environmental contamination by multidrug-resistant microorganisms after daily cleaning

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American Journal of Infection Control 43 (2015) 776-8

Conclusions

Despite performig the correct routine daily cleaning, high-touch surfaces in intensive care units remain contaminated with the same MDRO as the occupant.

Using the same wipe for different rooms can pose a risk to patients because of cross-transmission.

Control of endemic extensively drug-resistant *Acinetobacter baumannii* with a cohorting policy and cleaning procedures based on the 1 room, 1 wipe approach

Laura Gavaldà MD, MPH [a,*], Ana M. Soriano RN [a], Jordi Cámara MD [b], Rosa Gasull RN [c], Olga Arch RN [d], Montserrat Ferrer RN [c], Evelyn Shaw MD, MPH, PhD [d], Rosa M. Granada MD [c], M. Angeles Dominguez MD, PhD [b], Miquel Pujol MD, PhD [d]

American Journal of Infection Control 44 (2016) 520-4

- After a period of high endemicity, extensively drug-resistant *A. baumannii* rates were quite stable in our hospital, but in 2011 an increase of new cases occured.

- Intervention study, 4 years (13 months pre, 35 months post)

- Interventions:

  - Screening, isolation and cohorting of patients
  - Improving cleaning applying the ‘one room, one wipe’ approach

The ‘one-room, one-wipe’ approach

- Aim: to **avoid sharing cleaning wipes** between different rooms or patient locations.
- Considered as a **standard precaution**: applied even when the colonization status is not known nor suspected.
- **Patient-based approach**, in contrast with colour coded cleaning system (area-based approach).
- Colour coded cleaning system can be applied **within the same room.**
- Same approach for **furniture/surfaces** (housekeepers) as for **clinical devices/equipment** (auxiliary nurses).

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HOUSEKEEPERS

Study period	Cleaning technique
Housekeepers	
Preintervention period	Double-bucket technique: 1 bucket containing a 0.1% chlorine solution with detergent and the other containing rinse water. The same cotton cloth is soaked in the cleaning solution but had always had to be rinsed previously in the water bucket.
Postintervention period	Microfiber cleaning system (TTS bucketless system; TTS, Santa Giustina in Colle, Italy): the appropriate number of microfiber cloths for cleaning a previously defined specific area are provided. Clean cloths are soaked in a basin containing 0.1% chlorine solution. Dirty cloths are placed in a bag on the cart and sent to the laundry.

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HOUSEKEEPERS

Study period	Sharing practices
Housekeepers	
Preintervention period	Cleaning solutions and cloths were shared between different rooms, except for isolated patients. Cloths were manually disinfected with a 0.1% hypochlorite solution.
Postintervention period	For each room, 2 different cloths were used. They were never shared between different rooms. All cleaning solutions were prepared in a central cleaning station. Cloths were laundered according to the manufacturer's recommendations and stored in a unique warehouse.

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AUXILARY NURSES

Study period	Cleaning technique
Auxiliary Nurses	
Preintervention period	Application of a manually prepared solution of water and detergent with a reusable cotton cloth. Rinse with a different wet cloth. Disinfection using gauze with 70% ethyl alcohol.
Postintervention period	
February 2012-May 2013	Same technique as in the preintervention period.
June 2013-December 2014	Routine cleaning: ready-to-use disinfectant wipes with cationic surfactant tensioactives, quaternary ammonium compounds, and polymeric biguanide (Clinell Universal Wipes; GAMA Healthcare, London, UK). Terminal cleaning: detergent and disinfectant foam with quaternary ammonium compounds and biguanide chlorhydrate (Surfa'Safe; Anios, Lille-Hellemmes, France) applied with a single-use cellulose wipe (DuPont Sontara, Basel, Switzerland).

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AUXILARY NURSES

Study period	Sharing practices
Auxiliary Nurses	
Preintervention period	Cleaning solutions and cloths were shared between different rooms, except for isolated patients. Gauzes were discarded after use. Cloths were manually disinfected with a 0.1% hypochlorite solution.
Postintervention period	
February 2012-May 2013	Cleaning solutions and clothes were discarded between different rooms. Gauzes were discarded after use. Cloths were manually disinfected with a 0.1% hypochlorite solution.
June 2013-December 2014	Wipes were directly applied on the surface and discarded after use, without an additional rinse. They were never shared between different rooms.

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Parameter	2011	2012	2013	2014
ICUs demographics				
Sum of patient days	12,244	11,406	12,659	11,605
Discharges	290	250	245	226
XDR *A baumannii* incidence rates				
No. of new cases	132	67	22	8
Incidence rate × 1,000 patient days	10.78	5.87	1.74	0.69
Relative risk (95% CI)*		0.54 (0.41-0.73)	0.30 (0.18-0.48)	0.40 (0.18-0.89)

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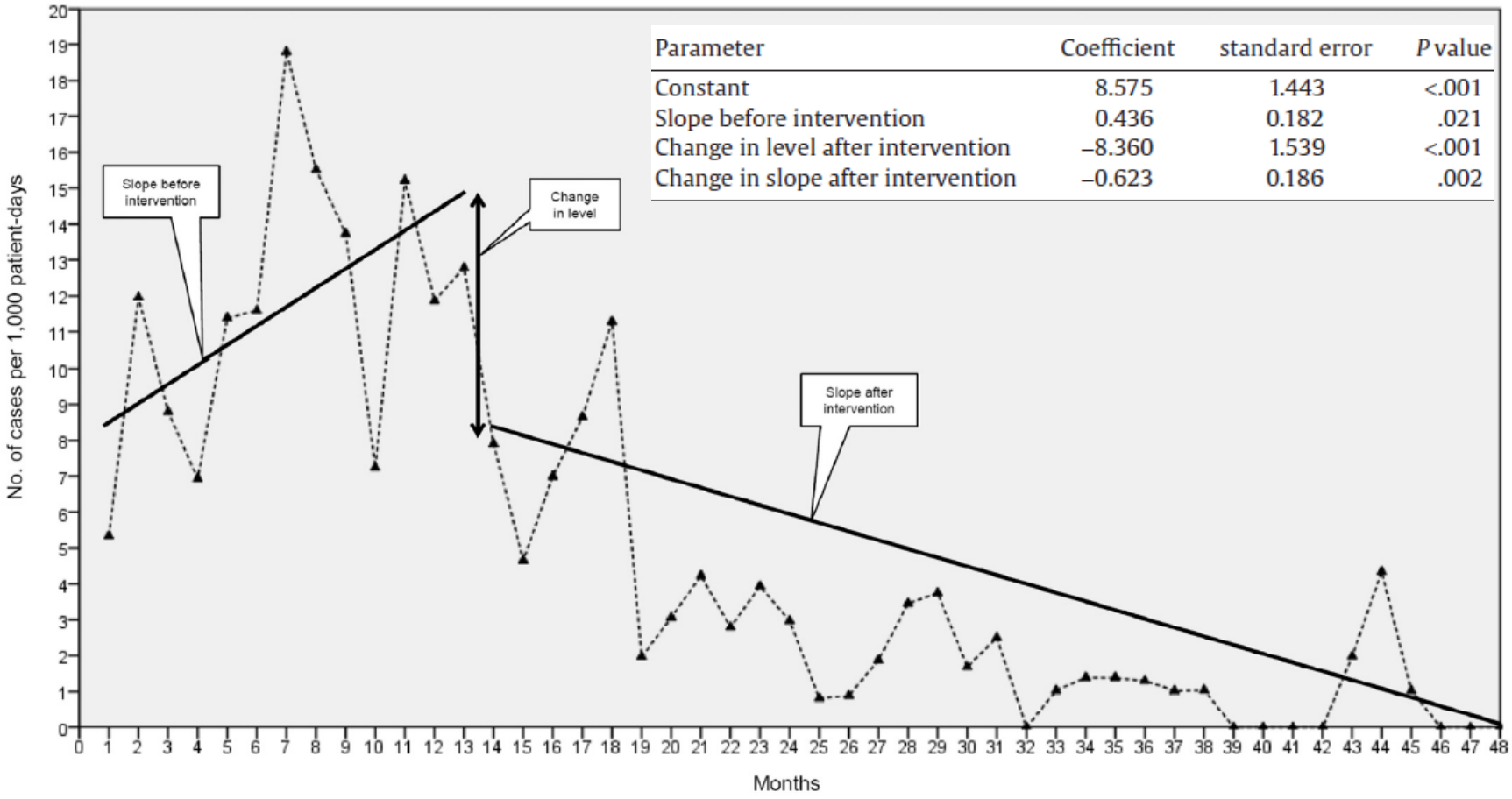
Parameter	Coefficient	standard error	*P* value
Constant	8.575	1.443	<.001
Slope before intervention	0.436	0.182	.021
Change in level after intervention	–8.360	1.539	<.001
Change in slope after intervention	–0.623	0.186	.002



1. Different interventions
2. No surface cultures
3. No wipe cultures

Looking for other evidence supporting the 'one room, one wipe' approach

WHAT WE KNOW?

Clever hospital pathogens can...

PERSIST
on surfaces

HIDE
in biofilms

TRANSFER
to patients

illustration: Don Smith

How long do nosocomial pathogens persist on inanimate surfaces? A systematic review

Axel Kramer*[1], Ingeborg Schwebke[2] and Günter Kampf[1,3]

BMC Infectious Diseases 2006, **6**:130

Persistence of clinically relevant bacteria on dry inanimate surfaces

Acinetobacter spp.	3 days to 5 months
Clostridium difficile (spores)	5 months
Enterococcus spp.	5 days to 4 months
Klebsiella spp.	2 hours to 30 months
Pseudomonas aeruginosa	6 hours to 16 months
Serratia marcescens	3 days to 2 months
Staphylococcus aureus, including MRSA	7 days to 7 months

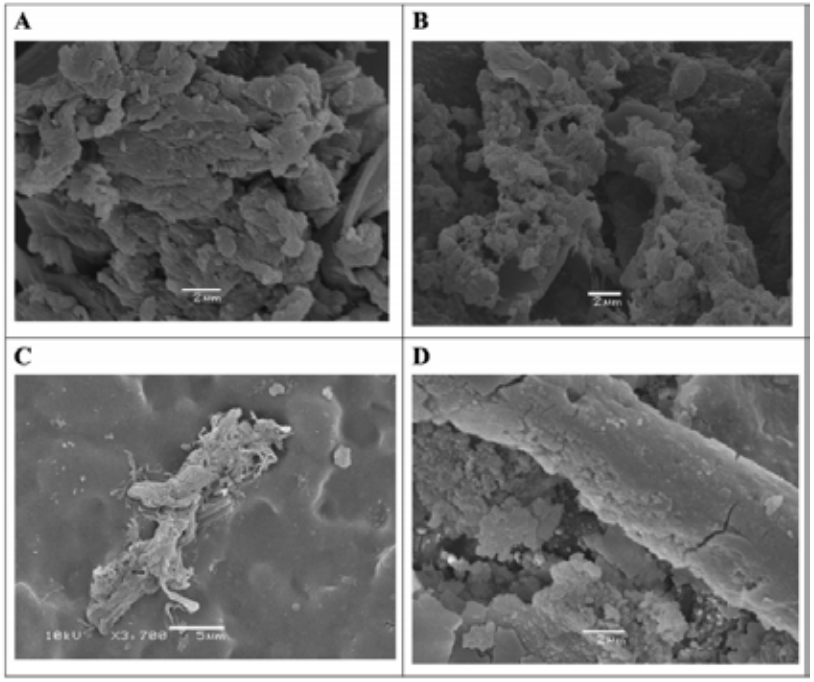
Conclusion: Most common nosocomial pathogens may persist on surfaces for months and can thereby be a continuous source of transmission if no regular surface disinfection is performed.

Intensive care unit environmental surfaces are contaminated by multidrug-resistant bacteria in biofilms: combined results of conventional culture, pyrosequencing, scanning electron microscopy, and confocal laser microscopy

H. Hu[a], K. Johani[a,b], I.B. Gosbell[c,d], A.S.W. Jacombs[a], A. Almatroudi[a,e], G.S. Whiteley[f], A.K. Deva[a], S. Jensen[c], K. Vickery[a,*]

Journal of Hospital Infection 91 (2015) 35–44

- Decomissioned intensive care unit: surfaces were distroyed and sampled.
- Samples taken after two terminal cleans (500 ppm chlorine-free solution).
- Biofilm in 93% (41/44) of samples.
- Polymicrobial biofilms, species with multidrug-resistant strains.



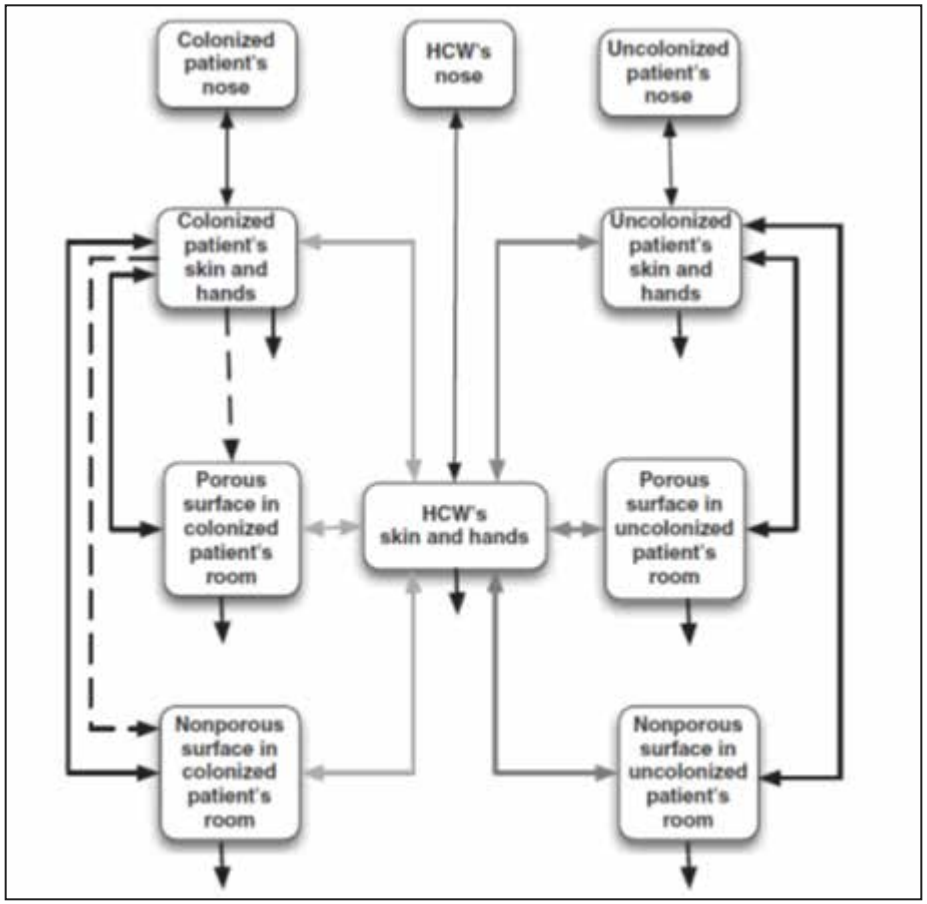
Conclusion: Dry surface biofilms containing MDROs are found on hospital surfaces despite terminal cleaning. How these arise and how they might be removed requires further study.

The dynamics of methicillin-resistant *Staphylococcus aureus* exposure in a hospital model and the potential for environmental intervention

Nottasom Pitpat*, Ian H Spicknall, James S Koopman and Joseph NS Eisenberg

BMC Infectious Diseases 2013, **13**:595

- Deterministic model of MRSA fate, transport and exposure
- Healthcare workers hands the sole vector



Conclusions

1. Porous surfaces highly contaminared but low transfer efficiency

2. Nonporous surfaces high MRSA transfer efficiency

So where are we at this point?

REVIEW | Annals of Internal Medicine

Cleaning Hospital Room Surfaces to Prevent Health Care–Associated Infections

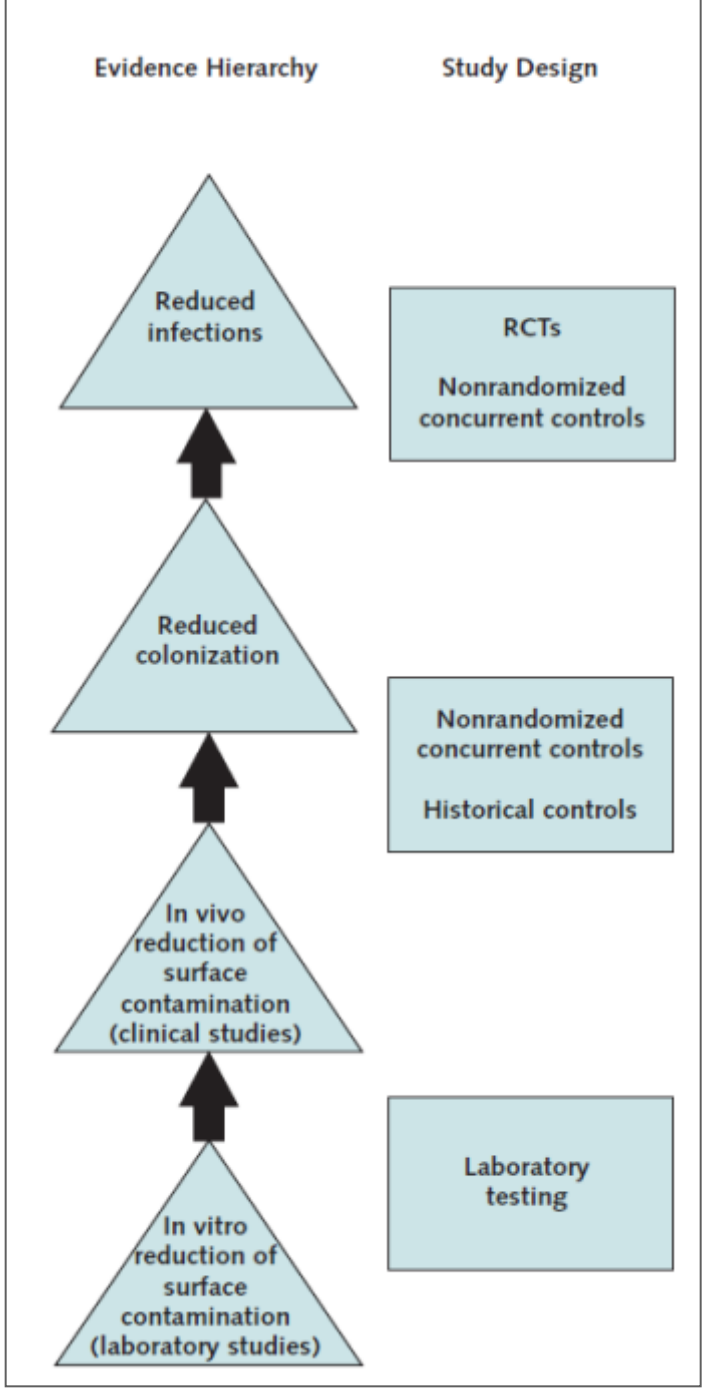
A Technical Brief

Jennifer H. Han, MD, MSCE*; Nancy Sullivan, BA*; Brian F. Leas, MS, MA*; David A. Pegues, MD; Janice L. Kaczmarek, MS; and Craig A. Umscheid, MD, MSCE

Ann Intern Med. 2015;163:598-607.

Conclusions

1. Environmental cleaning is an important component of a multifaceted infection control strategy to prevent HAIs.
2. Emerging technologies have led to increased interest in evaluating environmental cleaning, disinfecting, and monitoring in hospitals.
3. A major limitation of the evidence is the lack of comparative studies addressing the relative effectiveness of various cleaning strategies.
4. Few studies assess clinical, patient-centered outcomes (HAIs rates).

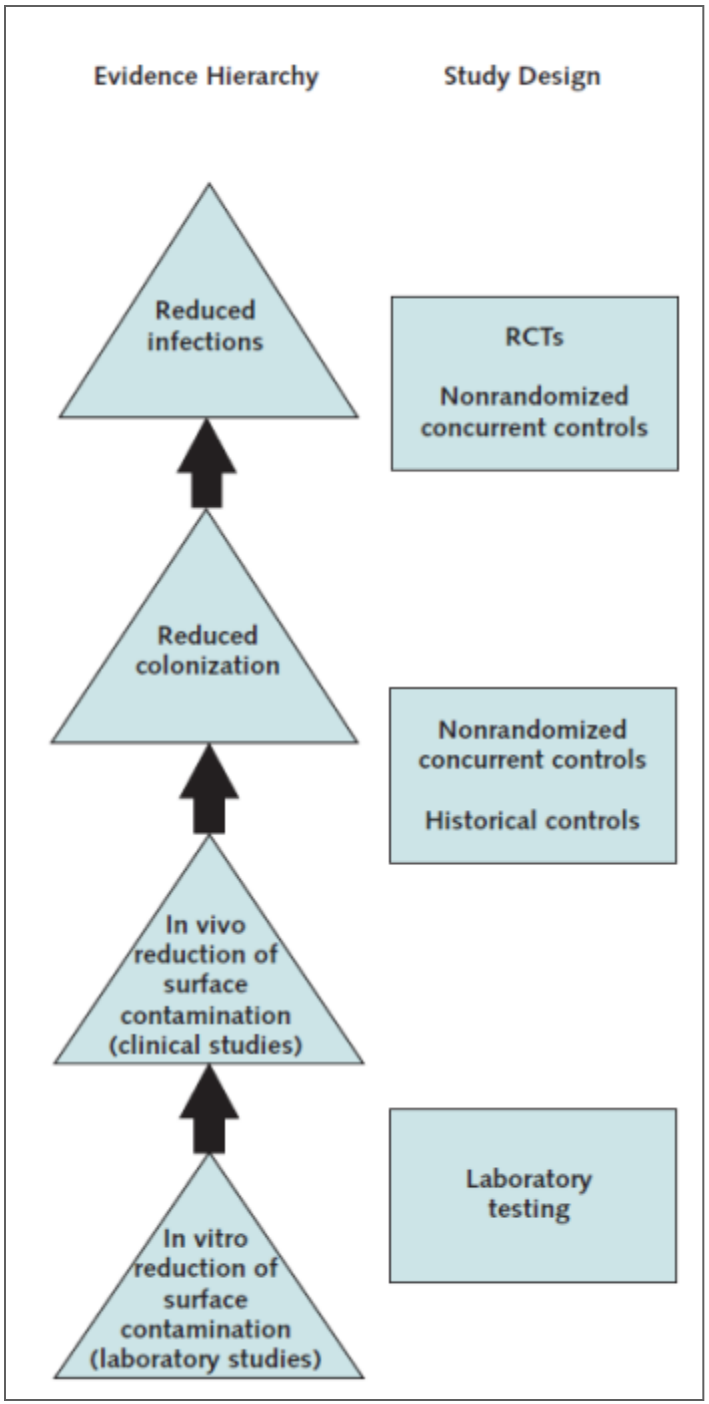


Taking a new look at the ideal disinfectant

- Broad spectrum
- Fast acting
- Non toxic
- Surface compatibility
- (...)
- **Easy to use:** it should be available in multiple forms, such as wipes, sprays, pull-tops and refills. Directions for use should be simple.

Effective Surface Decontamination:

Product and Practice = Perfection



Cleaning wipes studies: evidence hierarchy

Outbreak control by improving wiping

Microbial transfer by wipes: real scenario evidences

Microbial transfer by wipes: in vitro evidences

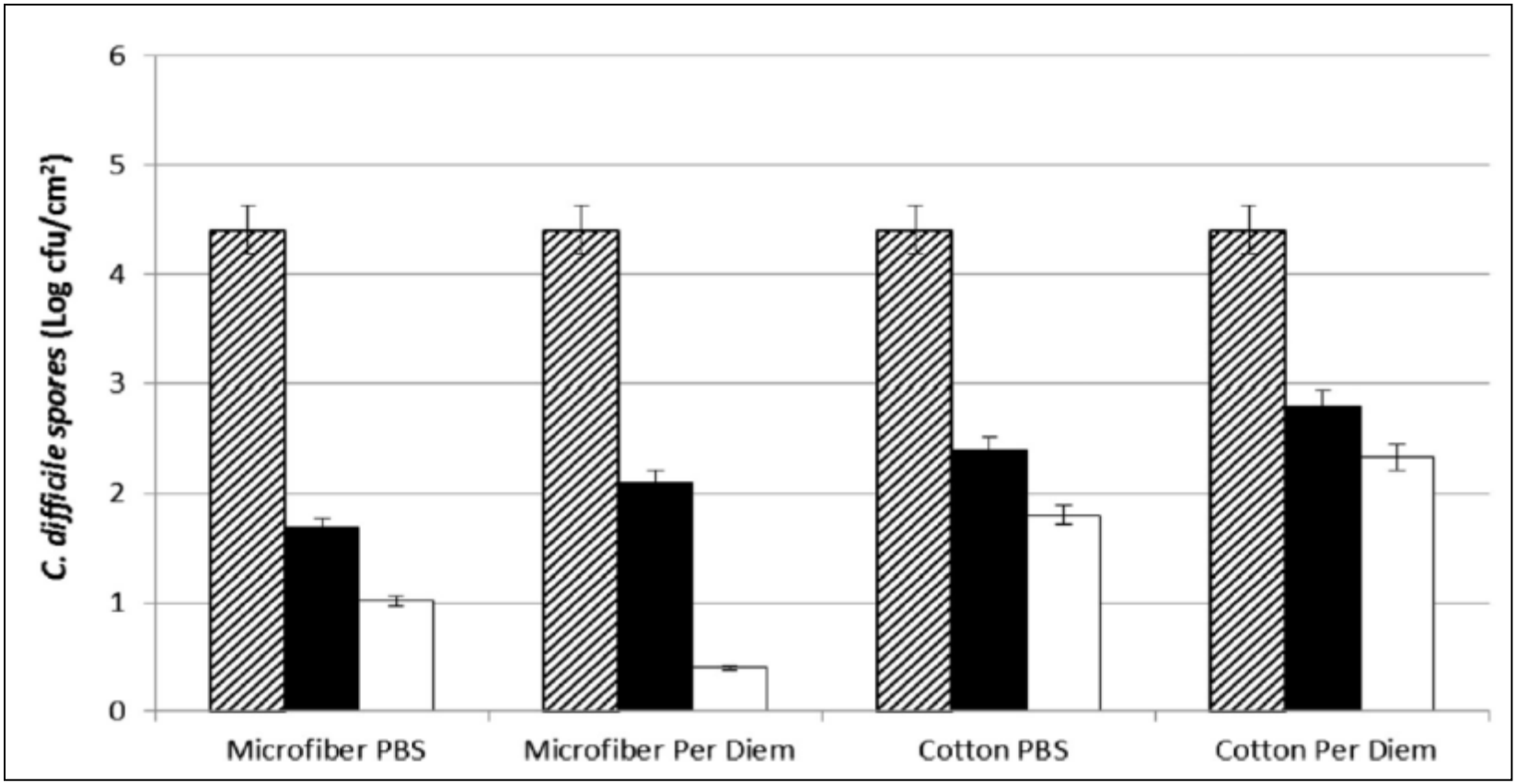
IN VITRO STUDIES

Microfiber cloths: less bacterial transfer

Microfiber cloths reduce the transfer of *Clostridium difficile* spores to environmental surfaces compared with cotton cloths

Adriana N. Trajtman MSc [a,b], Kanchana Manickam PhD [a,c], Michelle J. Alfa PhD [a,c,b,*]

American Journal of Infection Control 43 (2015) 686-9



Can wet wipes transfer bacteria?

Efficacy of "sporicidal" wipes against *Clostridium difficile*

Harsha Siani, BSc, Callum Cooper, BSc, and Jean-Yves Maillard, PhD

Am J Infect Control 2011;39:212-8

Ten wipes tested for sporicidal efficacy using the 3-stage protocol

	Bacterial transfer after 10 seconds of wiping at 500 ± 5 g surface pressure
Unmedicated wipe	5 consecutive transfers; TNTC
Hypochlorite-soaked wipe	5 consecutive transfers; TNTC
Wipe A	<11 spore transfers in the first adpression
Wipe B	**5 consecutive transfers; TNTC**
Wipe C	5 consecutive transfers; TNTC
Wipe D	**5 consecutive transfers; from 0 to TNTC**
Wipe E	5 consecutive transfers; from 0 to TNTC
Wipe F	**5 consecutive transfers; from 3 to TNTC**
Wipe G	5 consecutive transfers; TNTC
Wipe H	5 consecutive transfers; TNTC
Wipe J	5 consecutive transfers; TNTC

1. All wipes but one repetedly transferred *C. difficile* spores to other surfaces
2. It would be safer to ensure a "one-wipe, one-application, one-direction".
3. The manufacturer should supply appropriate instructions on the use of the wipes.

Can wet wipes transfer bacteria?

Major article

Pathogen transfer and high variability in pathogen removal by detergent wipes

Lauren Ramm MPharm, Harsha Siani MPhil, Rebecca Wesgate BSc, Jean-Yves Maillard PhD *

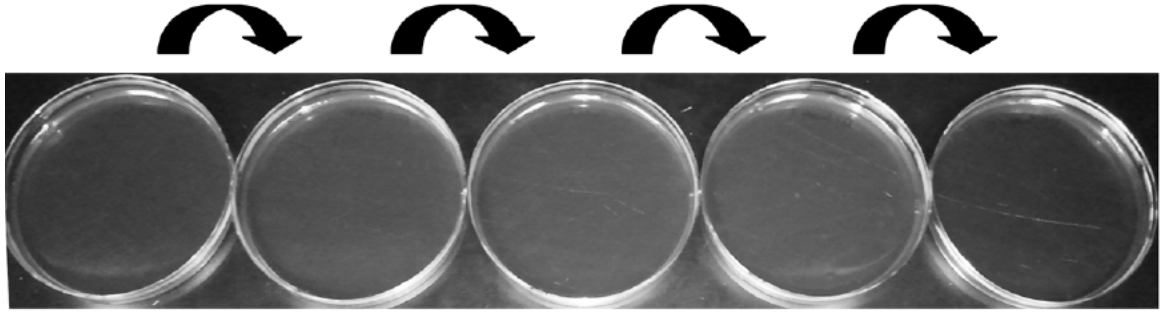
American Journal of Infection Control 43 (2015) 724-8

- Seven detergent wipes
- Transfer *S. aureus* and *A. baumannii*
- 3 consecutive surfaces
- 3-stage protocol.

Wipes	Spores on wipes* (CFU)	Total transferred (%)
S aureus		
A	66,890	213.45
B	3,633,282	33.90
C	5,078,282	119.46
D	4,941,786	0.11
E	14,537,759	1.20
F	13,388,894	0.37
G	16,705,056	0.00
A baumannii		
A	13,388,894	0.04
B	1,505,426	0.05
C	3,442,779	8.05
D	1,505,426	0.03
E	507,976	0.08
F	507,804	0.06
G	777,048	0.00

Used wipes are exhausted wipes

Transfer of *C. difficile* spores by hypoclorite premoistened wipes



Fresh hypochlorite wipe

Used hypochlorite wipe

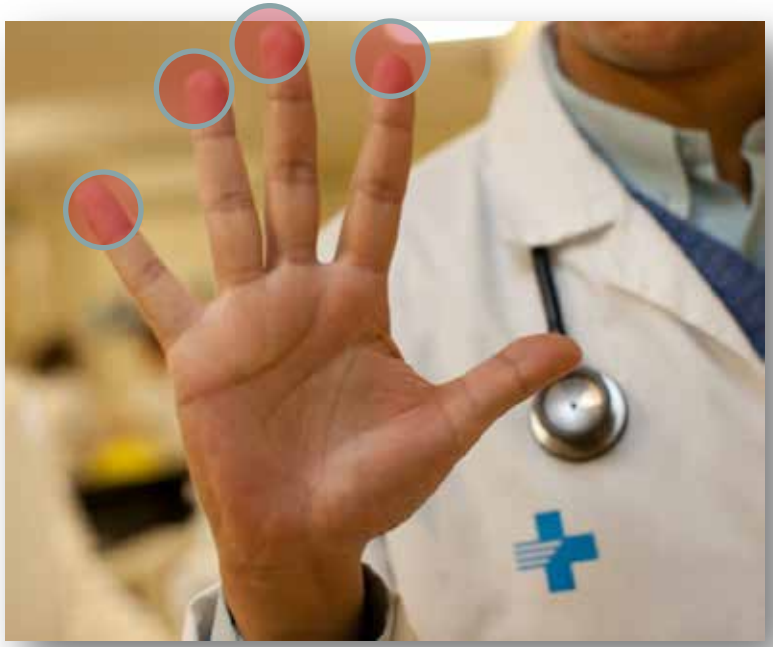
FRESH WIPE:

1) Spread aliquots containing *C. difficile* spores on 1 cm^2
2) Wipe with premoistened hypoclorite wipe for 10 seconds
3) Sequentially wipe onto 4 clean sites for 10 seconds
4) Sample the sites after 5 minutes of wet contact time

USED WIPE:

1) Apply fresh premoistened hypoclorite wipe on a clean surface until it dries
2) Same procedure as fresh wipe

Good wiping = no fomite-to-hand transfer



Microbial transfer to hands:

Non-treated fomites: **36%**

Disinfectant-wipe treated fomites, dried for 10 minutes: **0.1%**

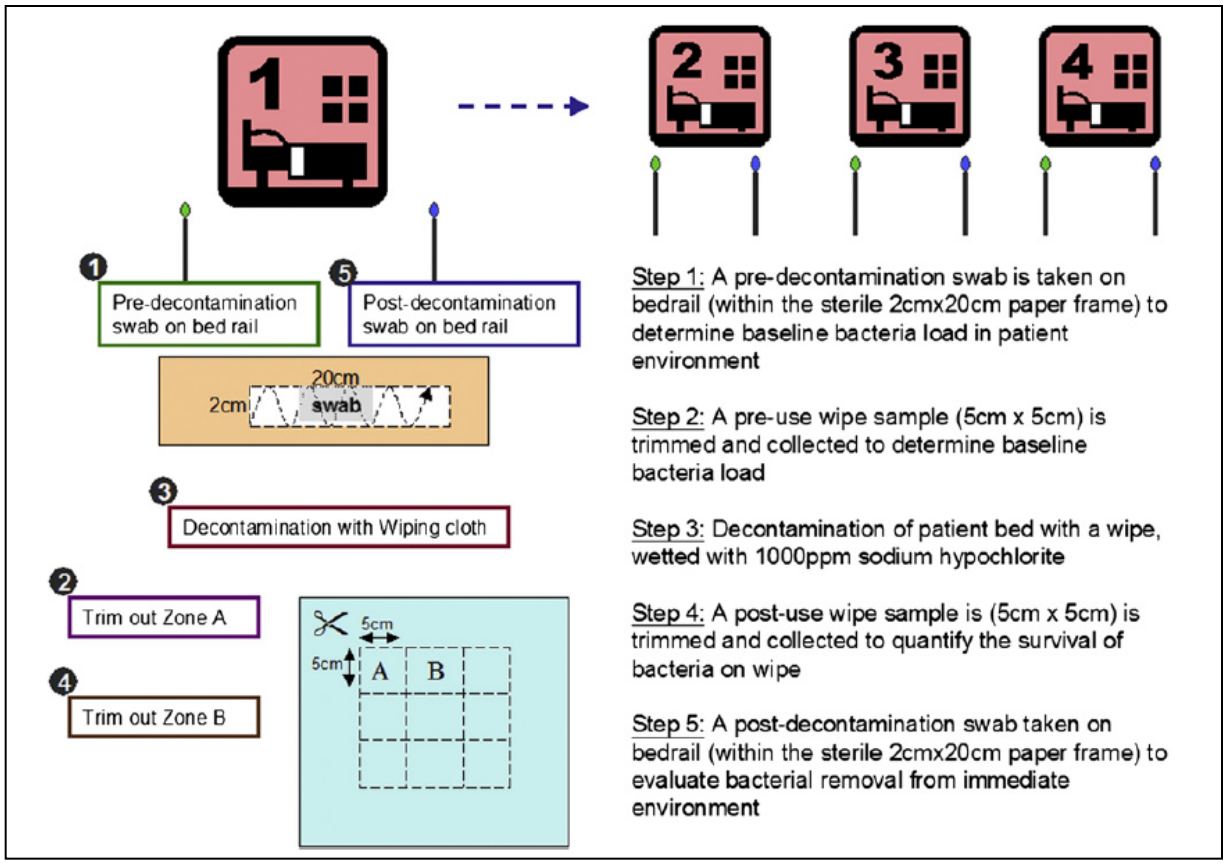
STUDIES IN REAL SCENARIOS


MRSA survival rates on dry mops used for cleaning the floors of rooms with colonized patients:
Oie & Kamiya. J Hosp Infect, 1996
14 days: 26% - 42%
28 days: 0.1% - 16%

Study on the effectiveness of disinfection with wipes against methicillin-resistant *Staphylococcus aureus* and implications for hospital hygiene

Ka Lam Cheng, MSc, RN,[a] Maureen Valerie Boost, MD, DPhil, MPH,[b] and Joanne Wai Yee Chung, PhD[c]

Am J Infect Control 2011;39:577-80



Step 1: A pre-decontamination swab is taken on bedrail (within the sterile 2cmx20cm paper frame) to determine baseline bacteria load in patient environment

Step 2: A pre-use wipe sample (5cm x 5cm) is trimmed and collected to determine baseline bacteria load

Step 3: Decontamination of patient bed with a wipe, wetted with 1000ppm sodium hypochlorite

Step 4: A post-use wipe sample is (5cm x 5cm) is trimmed and collected to quantify the survival of bacteria on wipe

Step 5: A post-decontamination swab taken on bedrail (within the sterile 2cmx20cm paper frame) to evaluate bacterial removal from immediate environment

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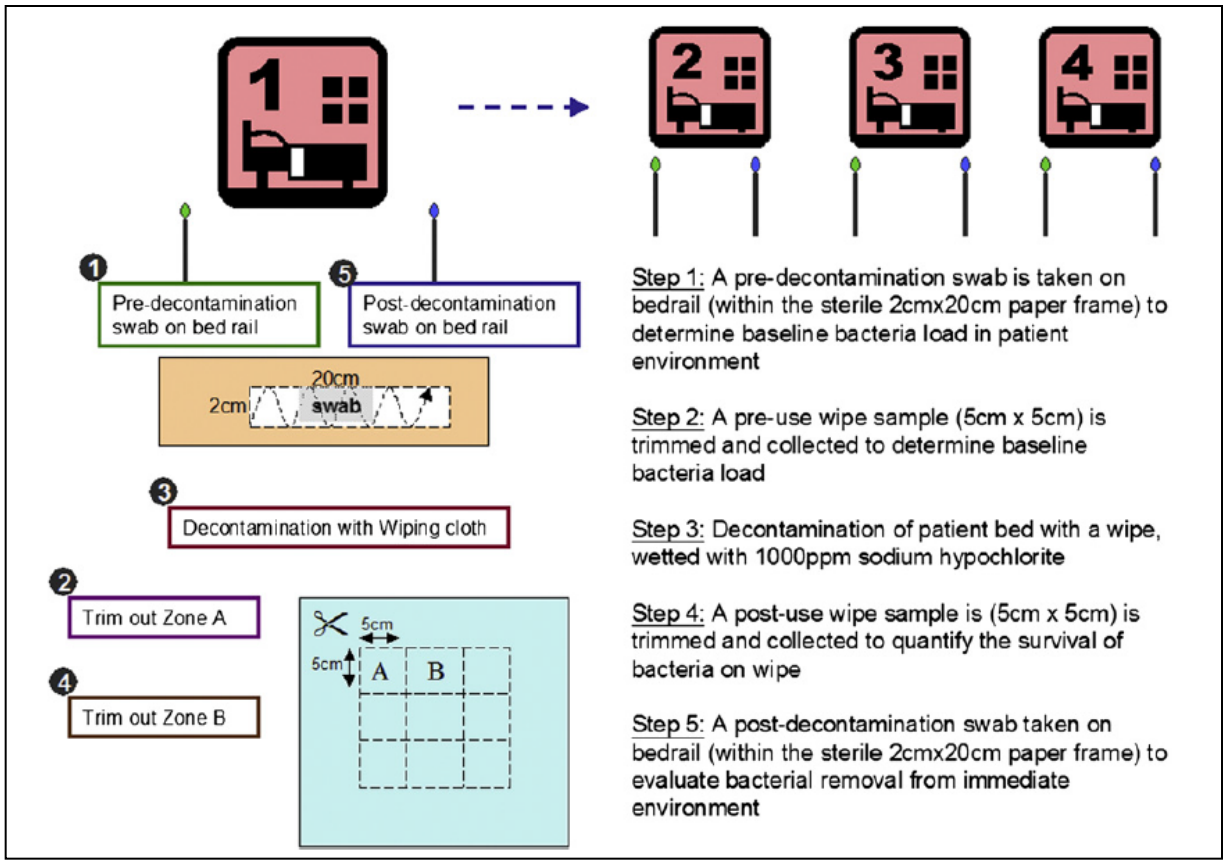


Bed rails:
Predisinfection: **86%** MRSA
Postdisinfection: **34%** MRSA

Wipes:
Predisinfection: **53%** MRSA
Postdisinfection: **68%** MRSA

Study on the effectiveness of disinfection with wipes against methicillin-resistant *Staphylococcus aureus* and implications for hospital hygiene

Ka Lam Cheng, MSc, RN,[a] Maureen Valerie Boost, MD, DPhil, MPH,[b] and Joanne Wai Yee Chung, PhD[c]

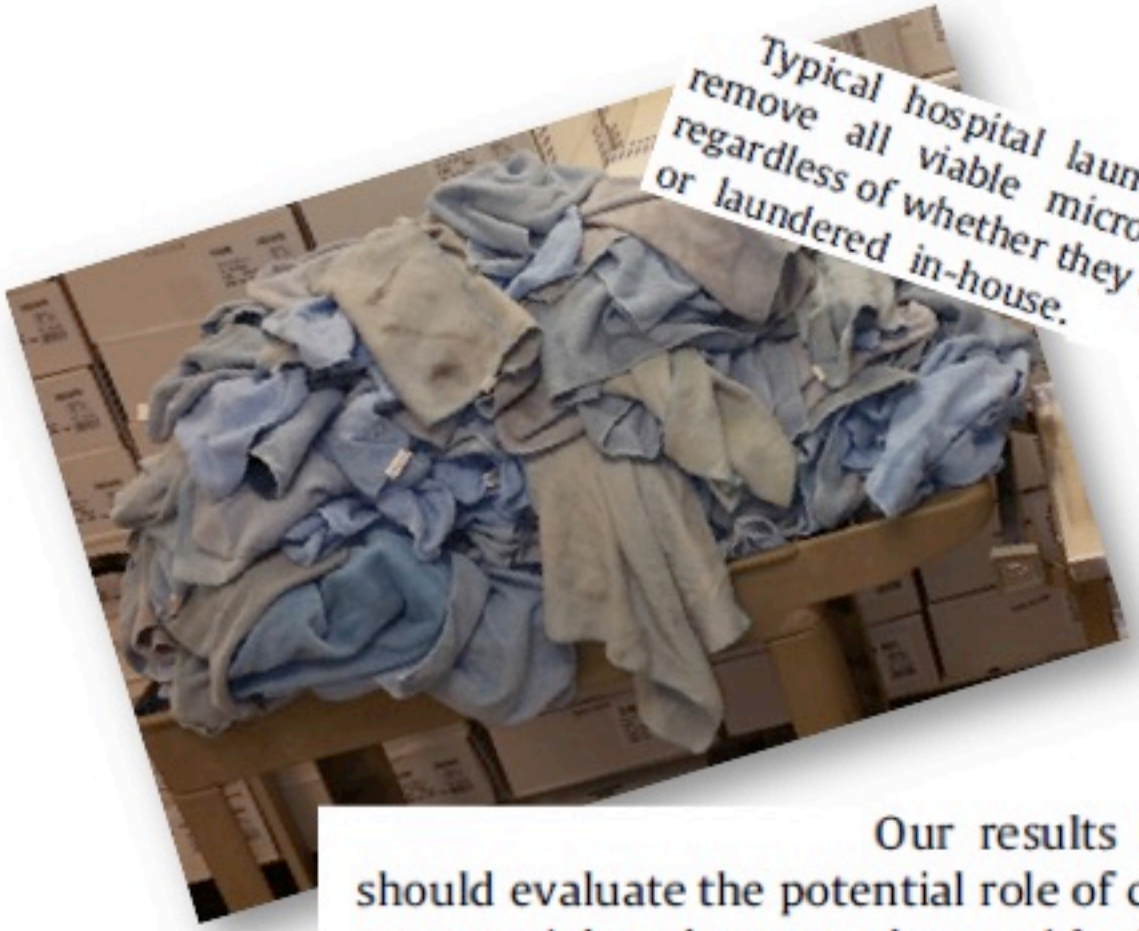
Am J Infect Control 2011;39:577-80

- Strong and significant correlation between MRSA count on bed rails and contamination of post-use wipes.
- Reduction of MRSA load in wipes after rinsing with disinfectant.
- **Conclusions:**
  - ü Nondisposable wipes should be throroughly rinsed immediately after use of each patient
  - ü Patients under contact precautions should have separate cleaning tools from other patients
  - ü Disposable wipes are recommended for use in case of outbreak situations.

Microbial contamination of hospital reusable cleaning towels

Laura Y. Sifuentes PhD[a], Charles P. Gerba PhD[a], Ilona Weart BS[b], Kathleen Engelbrecht MS[c], David W. Koenig PhD[c,*]

American Journal of Infection Control 41 (2013) 912-5



Typical hospital laundering practices are not sufficient to remove all viable microorganisms and spores from towels, regardless of whether they are sent to a central laundering facility or laundered in-house.

Our results indicate that future studies should evaluate the potential role of cloth towels as a reservoir for nosocomial pathogens, along with their possible role in overall cleaning procedures at hospitals, clinics, and long-term care institutions.

OUTBREAK CONTROL

Cleaning methods for controlling *A. baumannii* outbreaks

Resposibilities for the cleaning of all areas of the ward environment , including equipment, were clearly desingnated.

Wilks *et al*. Inf Control Hosp Epidemiol, 2006

Environmental cleaning with 1:100 sodium hypochlorite solution.

Apisarnthanarak *et al*. Clin Inf Dis, 2008.

Strict environmental cleaning policy following CDC recommendations.

Rodriguez-Baño *et al*. Am J Inf Control, 2009.

The original disinfectant was switched to bleach wipes.

Munoz-Price *et al*. Am J Inf Control, 2014

[…] reviewing the process of environmental cleaning and disinfection […]

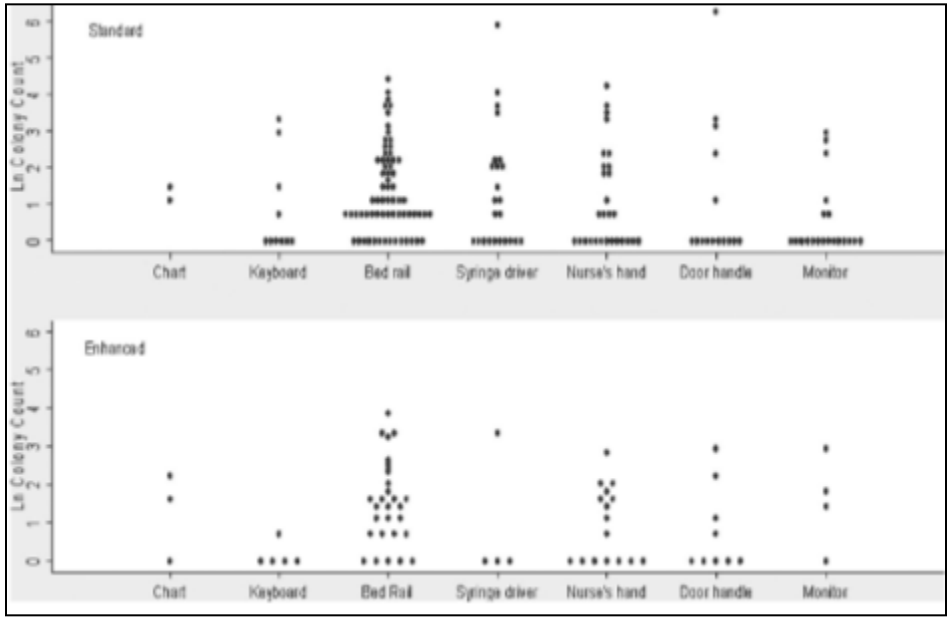
Liu *et al*. PLOS ONE, 2014.

‘One room, one wipe approach’: indirect evidences (1)

The impact of enhanced cleaning within the intensive care unit on contamination of the near-patient environment with hospital pathogens: A randomized crossover study in critical care units in two hospitals*

Crit Care Med 2011; 39:651–658

- Crossover study, 1 year, 2 ICUs
- Standard cleaning: disposable cloths
- Intervention: additional twice-daily enhaced cleaning of hand-contact surfaces:
  - ü Ultramicrofiber cloths
  - ü Bed area divided into four zones, with one cloth being used for each
  - ü Cloths washed in washing machine at 92ºC for 10 minutes



Conclusion: Enhaced cleaning reduced environmental contamination and hand carriage, but no significant effect was observed on patient acquisition of MRSA.

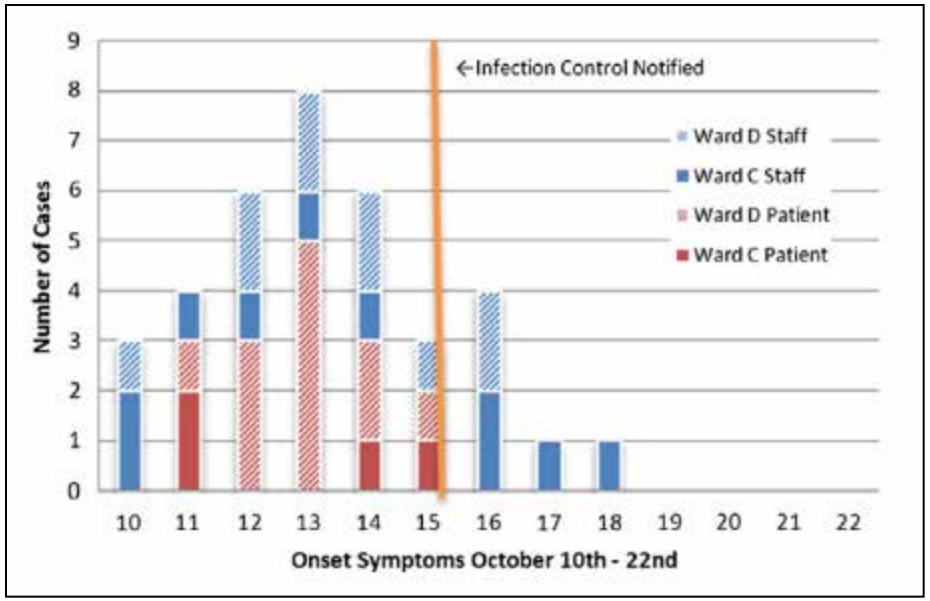
‘One-room, one-wipe approach’: indirect evidence (2)

- Traditional technique: 2-step process first with a detergent followed by sodium hypoclorite solution.

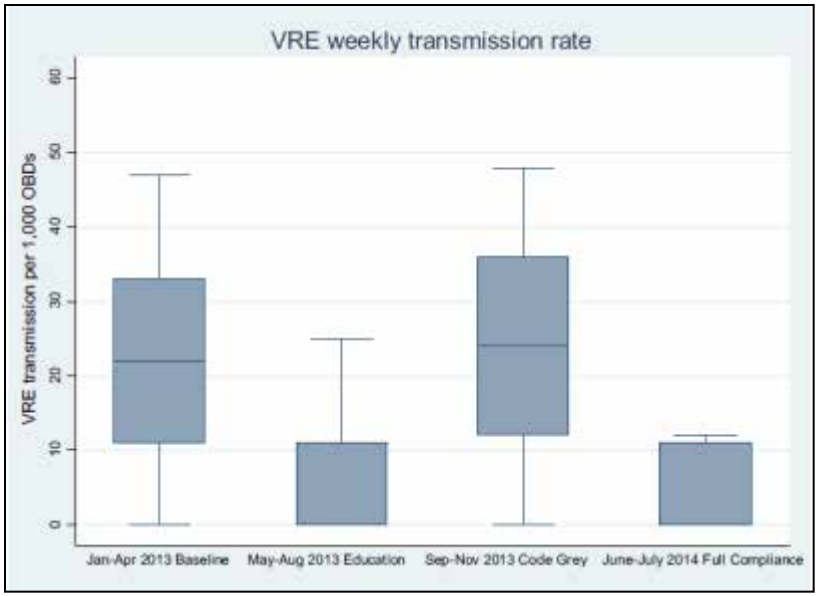
- New technique: combination of microfiber and steam technology
  - ü Microfiber cloths dampened with water, no chemicals used
  - ü Dry steam dislodges organic matter
  - ü The microfiber cloth picks up the loosened matter

‘One-room, one-wipe approach’: indirect evidence (2)

Outbreak of Norovirus gastroenteritis



VRE transmission in ICU



‘One-room, one-wipe approach’: indirect evidence (3)

Use of a daily disinfectant cleaner instead of a daily cleaner reduced hospital-acquired infection rates

Michelle J. Alfa PhD[a,b,*], Evelyn Lo MD[b,c], Nancy Olson BSc[a], Michelle MacRae[c], Louise Buelow-Smith RN[c]

American Journal of Infection Control 43 (2015) 141-6

Old cleaning system: hydrogen peroxide with cotton rags.

New cleaning system: accelerated hydrogen peroxide in disposable wipes.

For each patient zone, 2 wipes were used for the bed, bedside table, chair, and leading edge of the privacy curtain. The common zone used 1 wipe for the room door knob, computer keyboard and mouse, and other items in the common area; 3 wipes were used in the bathroom (includes the door knob).

‘One-room, one-wipe approach’: indirect evidence (3)

Use of a daily disinfectant cleaner instead of a daily cleaner reduced hospital-acquired infection rates

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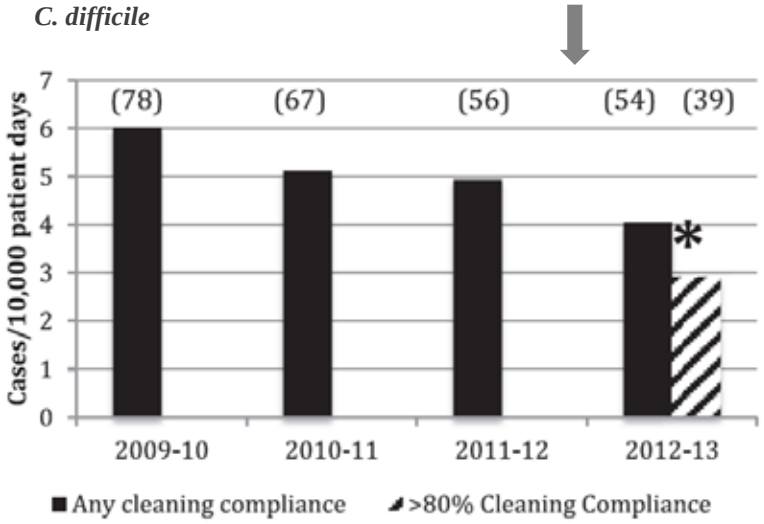

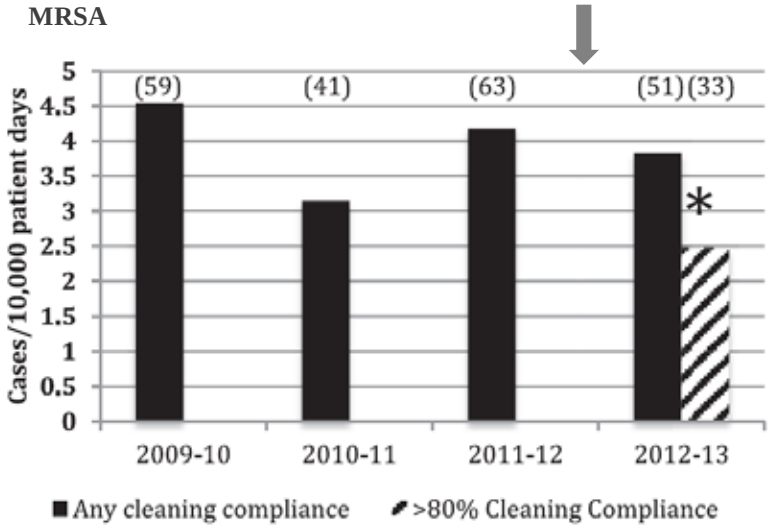

A more precise approach

1 ROOM

1 SURFACE

1 WIPE

1 DIRECTION

THANK YOU

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