

Are Your Cleaning Wipes Safe?
Dr. Laura Gavaldà, Hospital Universitari de Bellvitge, Barcelona, Catalonia, Spain
A Webber Training Teleclass

Are your cleaning wipes safe?

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

Dr. Laura Gavaldà

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June 2, 2016

What has been done since 1970?

APPLIED MICROBIOLOGY, Apr. 1971, p. 693-697
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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 decontamination but build-up of bacterial counts occurred if mops were not changed daily.

2

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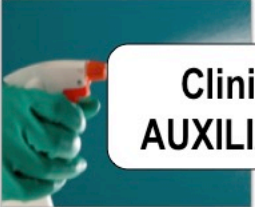
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Scenarios for decontaminating surfaces

Soaked cotton cloths			Microfiber cleaning systems
Sprays and dry towelettes			Ready-to-use towelettes

3

Scenarios for decontaminating surfaces

Soaked cotton cloths			Microfiber cleaning systems
Surfaces HOUSEKEEPERS			
Sprays and dry towelettes			Ready-to-use towelettes
Clinical devices AUXILIARY NURSES			

4

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Scenarios for decontaminating surfaces



Soaked cotton cloths

REUSABLE

Microfiber cleaning systems

Sprays and dry towelettes

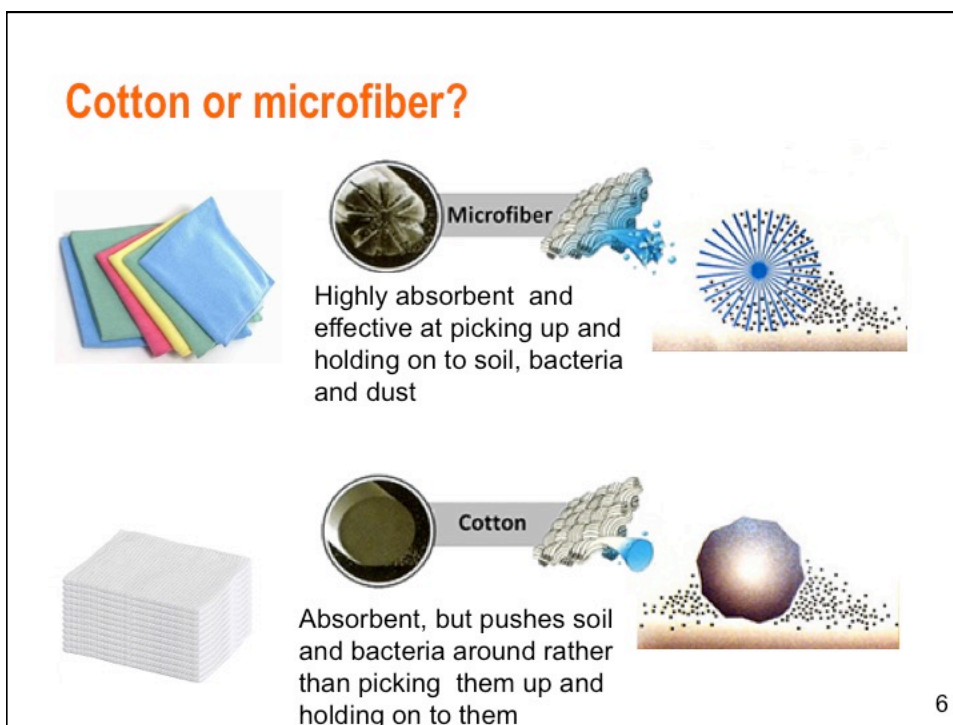
REUSABLE DISPOSABLE

DISPOSABLE

Ready-to-use towelettes

5

Cotton or microfiber?



Microfiber

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

Cotton

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

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**Double bucket
Color coding**



Cloths immersed in the same cleaning solution after each use

Microfiber cleaning system



Each cloth discarded after use: no contamination of cleaning solution

7

Ready to use wipes

Remove bioburden

Avoid bioburden transfer between surfaces

Kill bacteria (disinfectant wipes)



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**3-step test ,
ASTM Standard**

Stage 1: bacterial removal

Stage 2: bacterial transfer, adpressionn test

Stage 3: antimicrobial activity



9

**OUR
EXPERIENCE**



10

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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



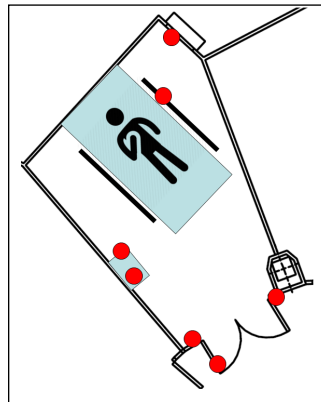
11

Environmental contamination by multidrug-resistant microorganisms after daily cleaning

Laura Gavaldà MD, MPH^{1,2}, Sandra Pequeño MD, MPH³, Ana Soriano RN⁴, M. Angeles Dominguez MD, MPH⁵

[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.



12

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 M. Angeles Dominguez MD, MPH⁵

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

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%

13

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 M. Angeles Dominguez MD, MPH⁵

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

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

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

Surfaces with same strain as patient:

22% in MRSA rooms

5% in *P. aeruginosa* rooms

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

14

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Conclusions

Despite performing 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.

15

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^{1,2}, Ana M. Soriano RN³, Jordi Càmaras MD⁴, Rosa Gasull RN⁵, Olga Arch RN⁶, Montserrat Ferrer RN⁷, Evelyn Shaw MD, MPH, PhD⁸, Rosa M. Granada MD⁹, M. Angeles Dominguez MD, PhD¹⁰, Miquel Pujol MD, PhD¹¹

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 occurred.
- 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

16

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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).

17

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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.

18

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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.

19

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AUXILIARY 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).

20

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AUXILIARY 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.

21

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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 <i>A. baumannii</i> 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)

22

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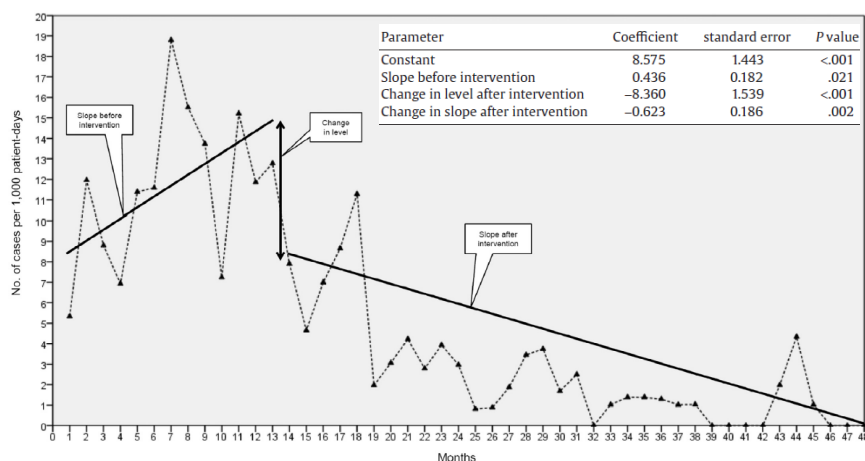
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23



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

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

24

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WHAT WE KNOW?



25

Clever hospital pathogens can...

PERSIST
on surfaces

HIDE
in biofilms

TRANSFER
to patients



Illustration: Don Smith

26

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

Axel Kramer¹, Ingeborg Schwebke² and Günter Kampf^{1,3}

BMC Infectious Diseases 2006, 6:130

Persistence of clinically relevant bacteria on dry inanimate surfaces

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

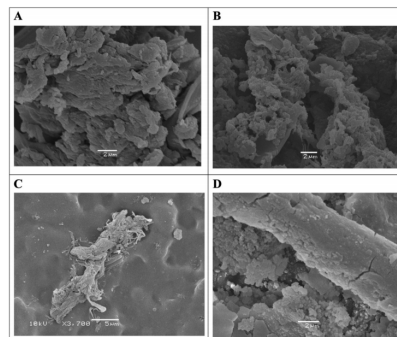
27

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. Hu¹, K. Johani^{1,2}, I.B. Gosbell^{1,3}, A.S.W. Jacobs⁴, A. Almatroudi^{1,5}, G.S. Whiteley⁶, A.K. Deva⁷, S. Jensen⁸, K. Vickery^{1,9}

Journal of Hospital Infection 91 (2015) 35–44

- Decommissioned intensive care unit: surfaces were destroyed 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.

28

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

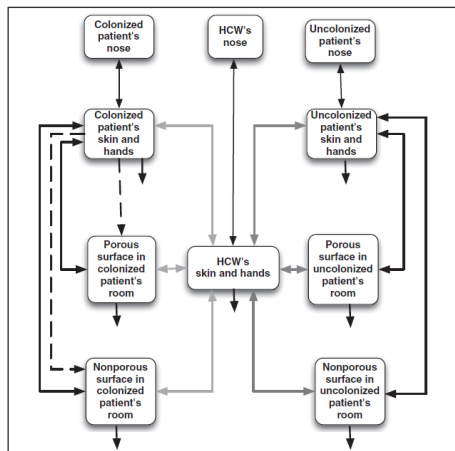
Horacio R. Plata*, Ian H. Sackrill, James S. Koopman and Joseph N. Eisenberg

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 contaminated but low transfer efficiency
2. Nonporous surfaces high MRSA transfer efficiency



29

So where are we at this point?

REVIEW

Annals of Internal Medicine

Cleaning Hospital Room Surfaces to Prevent Health Care-Associated Infections

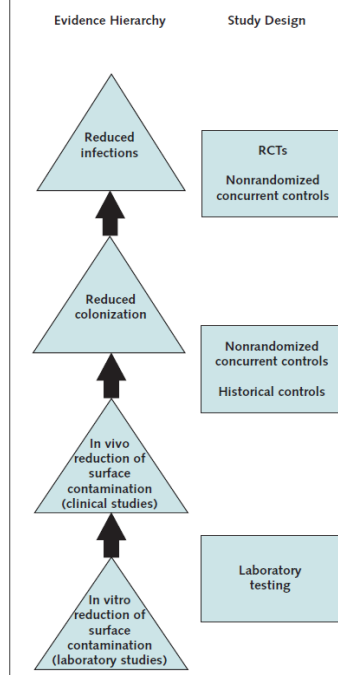
A Technical Brief

Jennifer H. Han, MD, MSc¹; Nancy Sullivan, BA¹; Brian F. Lee, MS, MA¹; David A. Peppers, MD; Janice L. Kazemian, MD; and Craig A. Umscheid, MD, MSc²

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).



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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

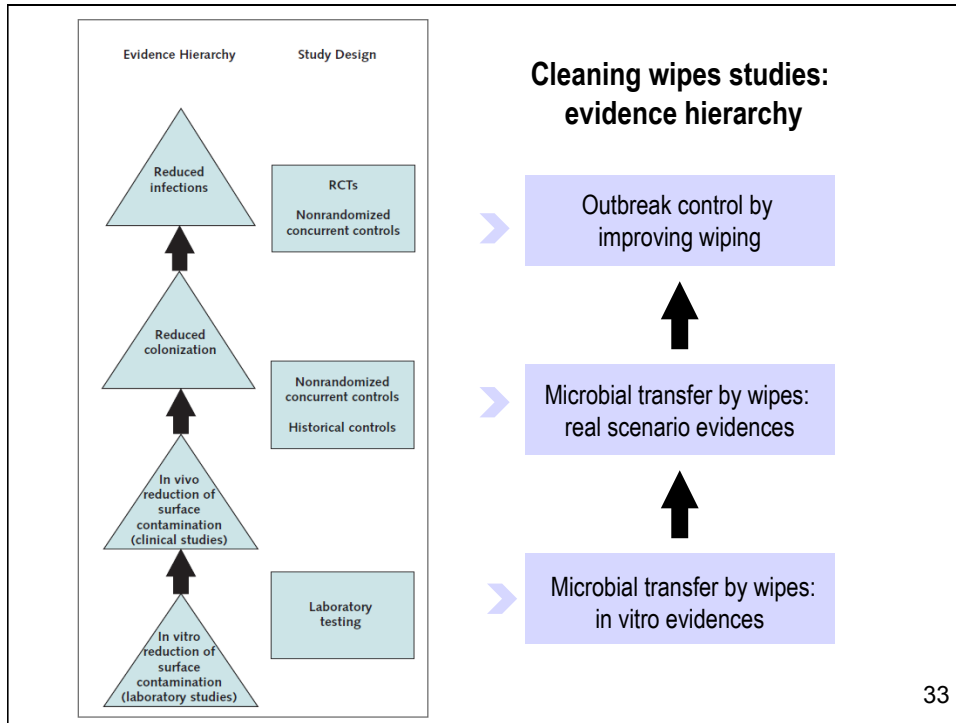


32

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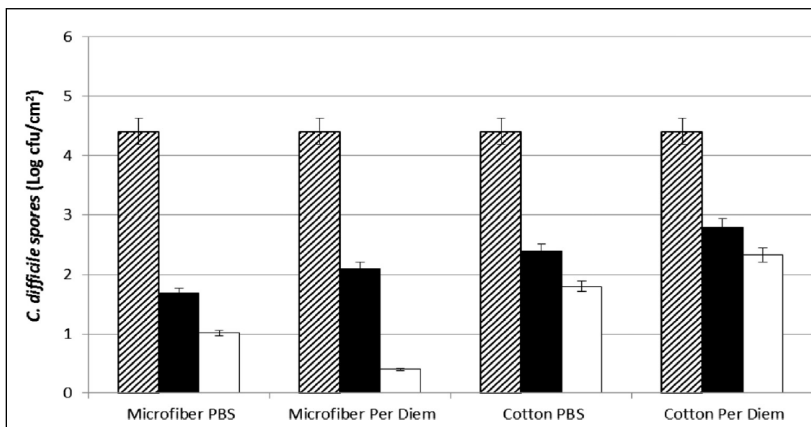
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Microfiber cloths: less bacterial transfer

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

Adriana N. Trajman MSc^{AB}, Kanchana Manickam PhD^{AC}, Michelle J. Alfa PhD^{A,C,B,*}

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



35

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

1. All wipes but one repeatedly 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.

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

36

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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 Westgate BSc, Jean-Yves Maillard PhD

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

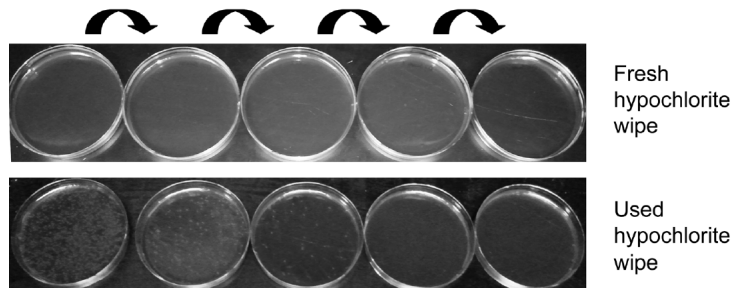
- Seven detergent wipes
- Transfer *S. aureus* and *A. baumannii*
- 3 consecutive surfaces
- 3-stage protocol.

Wipes	Spores on wipes* (CFU)	Total transferred (%)
<i>S aureus</i>		
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
<i>A baumannii</i>		
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

37

Used wipes are exhausted wipes

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



FRESH WIPE:

- 1) Spread aliquots containing *C. difficile* spores on 1 cm²
- 2) Wipe with premoistened hypochlorite 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 hypochlorite wipe on a clean surface until it dries
- 2) Same procedure as fresh wipe

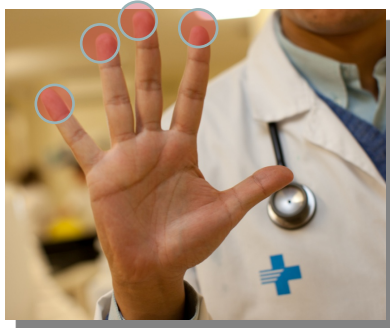
38

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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%**

39

STUDIES IN REAL SCENARIOS



40

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Are Your Cleaning Wipes Safe?

Dr. Laura Gavaldà, Hospital Universitari de Bellvitge, Barcelona, Catalonia, Spain
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Study on the effectiveness of disinfection with wipes against methicillin-resistant *Staphylococcus aureus* and implications for hospital hygiene

Ha Lam Cheng, MS, RN¹, Maureen Valerie Boost, MD, DPHI, MPH² and Joanne Wai Yee Chung, PhD²

Am J Infect Control 2011;39:577-80

1 Pre-decontamination swab on bed rail

2 Post-decontamination swab on bed rail

3 Decontamination with Wiping cloth

4 Trim out Zone A

5 Trim out Zone B

Step 1: A pre-decontamination swab is taken on bedrail (within the sterile 20cmx20cm 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 20cmx20cm paper frame) to evaluate bacterial removal from immediate environment

42

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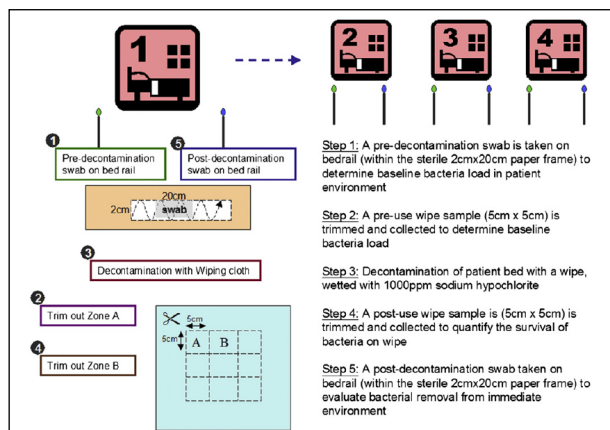
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Study on the effectiveness of disinfection with wipes against methicillin-resistant *Staphylococcus aureus* and implications for hospital hygiene

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Am J Infect Control 2011;39:577-80



Bed rails:

Predisinfection: **86%** MRSA

Postdisinfection: **34%** MRSA

Wipes:

Predisinfection: **53%** MRSA

Postdisinfection: **68%** MRSA

43

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

To Lam Cheng, MSc, RN,* Maureen Valerie Boost, MD, DPHI, MPH,¹ and Joanne Wai 'Se' Chung, PhD²

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:**
 - ✓ Nondisposable wipes should be thoroughly rinsed immediately after use of each patient
 - ✓ Patients under contact precautions should have separate cleaning tools from other patients
 - ✓ Disposable wipes are recommended for use in case of outbreak situations.

44

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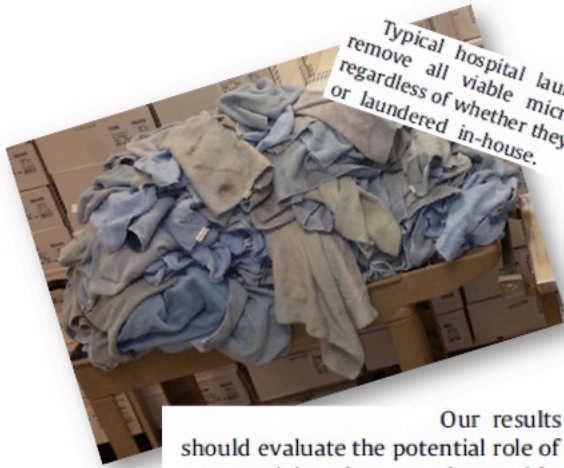
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Microbial contamination of hospital reusable cleaning towels

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.

45

OUTBREAK CONTROL



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Cleaning methods for controlling *A. baumannii* outbreaks

Responsibilities for the cleaning of all areas of the ward environment , including equipment, were clearly designated.

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.



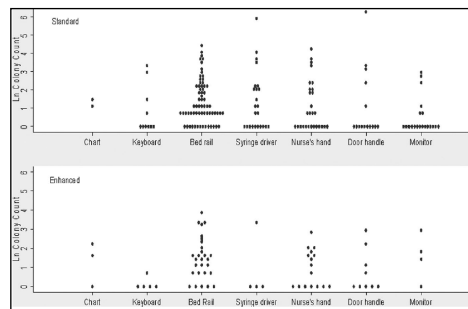
47

'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 enhanced cleaning of hand-contact surfaces:
 - ✓ Ultramicrofiber cloths
 - ✓ Bed area divided into four zones, with one cloth being used for each
 - ✓ Cloths washed in washing machine at 92°C for 10 minutes



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

48

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

Gillespie *et al.* Am J Inf Control, 2013 and 2015

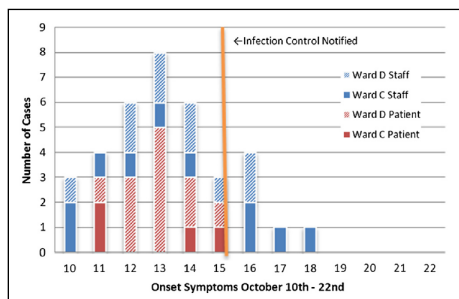
- Traditional technique: 2-step process first with a detergent followed by sodium hypochlorite solution.
- New technique: combination of microfiber and steam technology
 - ✓ Microfiber cloths dampened with water, no chemicals used
 - ✓ Dry steam dislodges organic matter
 - ✓ The microfiber cloth picks up the loosened matter

49

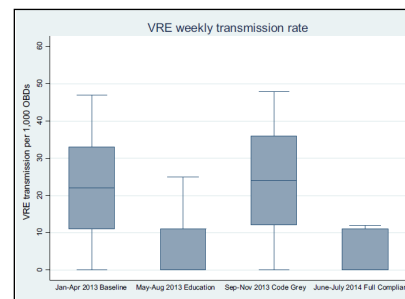
'One-room, one-wipe approach': indirect evidence (2)

Gillespie *et al.* Am J Inf Control, 2013 and 2015

Outbreak of Norovirus gastroenteritis



VRE transmission in ICU



50

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'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^{1,2,3,4}, Evelyn Lo MD^{1,2}, Nancy Olson BSc¹, Michelle MacRae¹, Louise Buelow-Smith RN¹

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).

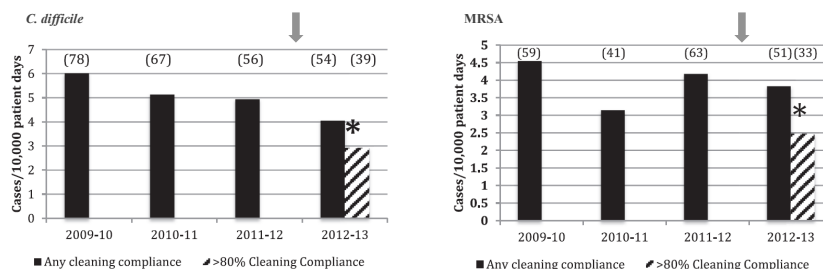
51

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

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



52

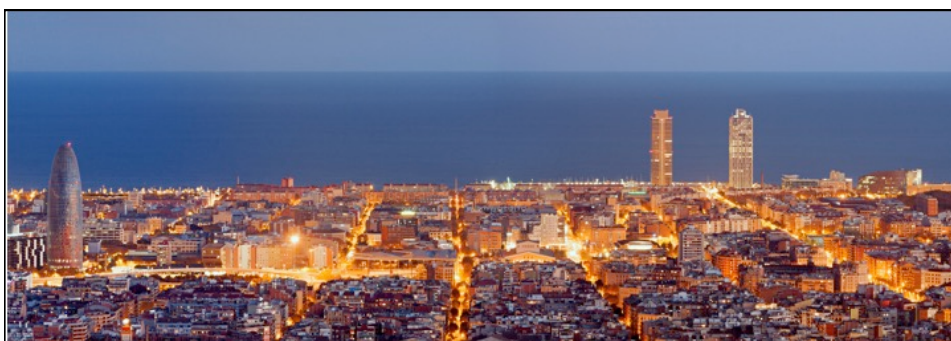
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A more precise approach

- 1 ROOM
- 1 SURFACE
- 1 WIPE
- 1 DIRECTION



THANK YOU

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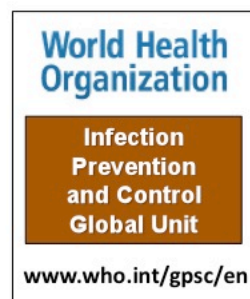
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