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

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paul@webbertraining.com

What has been done since 1970?

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

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.
Scenarios for decontaminating surfaces

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

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

Microfiber cleaning system

Cloths immersed in the same cleaning solution after each use

Each cloth discarded 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, adhesion test

Stage 3: antimicrobial activity

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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

- 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.
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Environmental contamination by multidrug-resistant microorganisms after daily cleaning
Laura Gavaldà MD, MPH; Sandra Peñarroja MD, MPH; Ana Sotizzio RN; M. Angeles Domínguez MD, MPH

American Journal of Infection Control 41 (2013) 79-8

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

<table>
<thead>
<tr>
<th>Type of high-touch surface</th>
<th>No. of samples</th>
<th>No. of samples with MDROs</th>
<th>Percentage of samples with MDROs</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the patient zone and in direct contact with the patient</td>
<td>13</td>
<td>7</td>
<td>53.8</td>
</tr>
<tr>
<td>In the patient zone and not in direct contact with the patient</td>
<td>39</td>
<td>12</td>
<td>30.8</td>
</tr>
<tr>
<td>In the room outside of the patient zone</td>
<td>39</td>
<td>7</td>
<td>17.9</td>
</tr>
</tbody>
</table>

NOTE. The χ² test for trend; P = .014.

OVERALL: 29%

Environmental contamination by multidrug-resistant microorganisms after daily cleaning
Laura Gavaldà MD, MPH; Sandra Peñarroja MD, MPH; Ana Sotizzio RN; M. Angeles Domínguez MD, MPH

American Journal of Infection Control 41 (2013) 79-8

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

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

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
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.

• 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
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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).

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### Control of endemic extensively drug-resistant Acinetobacter baumannii with a cohorting policy and cleaning procedures based on the ‘one-room, one-wipe’ approach

Lauro Gavaldà MD, MPH, Ana M. Serigó RN, Jordi Clotet MD, Rosa Gavaldà RN, Olga Artés RN, Montserratver RN, Fortuny Shaw MD, MPM, PhD, Rosa M. Cordero MD, PhD, Miquel Puig MD, PhD

American Journal of Infection Control 44 (2016) S20-4

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<table>
<thead>
<tr>
<th>Study period</th>
<th>Cleaning technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housekeepers</td>
<td>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.</td>
</tr>
<tr>
<td>Preintervention</td>
<td></td>
</tr>
<tr>
<td>Postintervention</td>
<td>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.</td>
</tr>
</tbody>
</table>

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## HOUSEKEEPERS

<table>
<thead>
<tr>
<th>Study period</th>
<th>Sharing practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housekeepers</td>
<td>Cleaning solutions and cloths were shared between different rooms, except for isolated patients. Cloths were manually disinfected with a 0.1% hypochlorite solution.</td>
</tr>
<tr>
<td>Preintervention period</td>
<td>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.</td>
</tr>
</tbody>
</table>

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## AUXILIARY NURSES

<table>
<thead>
<tr>
<th>Study period</th>
<th>Cleaning technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auxiliary Nurses</td>
<td>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.</td>
</tr>
<tr>
<td>Preintervention period</td>
<td>Same technique as in the preintervention period.</td>
</tr>
<tr>
<td>Postintervention period</td>
<td>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 chloride (SurfaSafe; Anios, Lille-Hellemmes, France) applied with a single-use cellulose wipe (DuPont Sontara, Basel, Switzerland).</td>
</tr>
</tbody>
</table>

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**AUXILIARY NURSES**

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

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICUs demographics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum of patient days</td>
<td>12,244</td>
<td>11,406</td>
<td>12,659</td>
<td>11,605</td>
</tr>
<tr>
<td>Discharges</td>
<td>290</td>
<td>250</td>
<td>245</td>
<td>226</td>
</tr>
<tr>
<td>XDR A. baumannii</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incidence rates</td>
<td>No. of new cases</td>
<td>132</td>
<td>67</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Incidence rate x 1,000 patient days</td>
<td>10.78</td>
<td>5.87</td>
<td>1.74</td>
</tr>
<tr>
<td>Relative risk (95% CI)</td>
<td>0.54 (0.41-0.73)</td>
<td>0.30 (0.18-0.48)</td>
<td>0.40 (0.18-0.89)</td>
<td></td>
</tr>
</tbody>
</table>

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Control of endemic extensively drug-resistant Acinetobacter baumannii with a coloring policy and cleaning procedures based on the 1 room, 1 wipe approach.
Laura Gavaldà MD, MPH; Ana M. Serrano RN, Leticia Corrales MD; Rosa Gavaldà RN; Olga Acuña RN; Maritza Corrales RN, strategic goals MD, MPH, PhD; Rosa M. Gavaldà MD; S. Angels Demasquier MD, PhD; Miguel Pujol MD, PhD.

American Journal of Infection Control 44 (2016) 529-4

Parameter | Coefficient | Standard error | P-value
---|---|---|---
Constant | 8.575 | 1.443 | <.001
Slope before intervention | 0.430 | 0.182 | <.001
Change in level after intervention | -8.360 | 1.539 | <.001
Change in slope after intervention | -0.623 | 0.186 | <.001

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Strengths

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

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Looking for other evidence supporting the ‘one room, one wipe’ approach

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WHAT WE KNOW?

Clever hospital pathogens can...

- PERSIST on surfaces
- HIDE in biofilms
- TRANSFER to patients
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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.

Persistence of clinically relevant bacteria on dry inanimate surfaces

<table>
<thead>
<tr>
<th>Species</th>
<th>Persistence Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acinetobacter spp.</td>
<td>3 days to 5 months</td>
</tr>
<tr>
<td>Clostridium difficile (spores)</td>
<td>5 months</td>
</tr>
<tr>
<td>Enterococcus spp.</td>
<td>5 days to 4 months</td>
</tr>
<tr>
<td>Klebsiella spp.</td>
<td>2 hours to 30 months</td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>6 hours to 16 months</td>
</tr>
<tr>
<td>Serratia marcescens</td>
<td>3 days to 2 months</td>
</tr>
<tr>
<td>Staphylococcus aureus, including MRSA</td>
<td>7 days to 7 months</td>
</tr>
</tbody>
</table>

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.

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Conclusions
1. Porous surfaces highly contaminated but low transfer efficiency
2. Nonporous surfaces high MRSA transfer efficiency

So where are we at this point?

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

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Outbreak control by improving wiping

Microbial transfer by wipes: real scenario evidences

Microbial transfer by wipes: in vitro evidences

IN VITRO STUDIES

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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. Trujillo MD†, Ranchana Merckian MD‡, Michelle J. Abu MD§


Can wet wipes transfer bacteria?

Efficacy of “sporidal” wipes against Clostridium difficile

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

1. All wipes but one repeated 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?

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

<table>
<thead>
<tr>
<th>Wipes</th>
<th>Spores on wipes (CFU)</th>
<th>Total transferred (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>66,890</td>
<td>213.45</td>
</tr>
<tr>
<td>B</td>
<td>3,633,282</td>
<td>33.90</td>
</tr>
<tr>
<td>C</td>
<td>5,078,282</td>
<td>119.46</td>
</tr>
<tr>
<td>D</td>
<td>4,941,786</td>
<td>0.11</td>
</tr>
<tr>
<td>E</td>
<td>14,537,759</td>
<td>1.20</td>
</tr>
<tr>
<td>F</td>
<td>13,388,894</td>
<td>0.37</td>
</tr>
<tr>
<td>G</td>
<td>16,705,056</td>
<td>0.00</td>
</tr>
</tbody>
</table>

*American Journal of Infection Control 43 (2013) 724-8*

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
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

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MRSA survival rates on dry mops used for cleaning the floors of rooms with colonized patients:


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

Am J Infect Control 2011;39:577-80

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

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.

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

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

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Microbial contamination of hospital reusable cleaning towels
Linda V. Sikic, PhD,*, Charles P. Gerba, PhD,*, Ilona Werth, BSc, Kathleen Engelbrecht, MS,.
David W. Reining, PhD, **


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

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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.


Strict environmental cleaning policy following CDC recommendations.


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.


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

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

CirCUl. NURS. 2011; 20:858–862

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


- 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

Outbreak of Norovirus gastroenteritis

VRE transmission in ICU

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

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).
A more precise approach

1 ROOM
1 SURFACE
1 WIPE
1 DIRECTION

THANK YOU

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June 9  CONTROLLING THE SPREAD OF VRE: IS ACTIVE SURVEILLANCE WORTHWHILE?
Prof. Hilary Humphreys, Royal College of Surgeons in Ireland

June 13  (FREE Teleclass - Broadcast live from the 2016 APIC conference)
BRIDGING THE GAP BETWEEN RESEARCH AND PRACTICE IN LONG-TERM CARE: AN INNOVATIVE MODEL FOR SUCCESS
Sharon Bradley, Pennsylvania Patient Safety Authority

June 13  (FREE Teleclass - Broadcast live from the 2016 APIC conference)
BEING HEARD: THE INFECTION PREVENTIONIST AND THE ORGANIZATIONAL STRUCTURE
Sharon Glowicz, Texas Health Resources, Presbyterian Hospital of Denton, Texas

June 16  STRATEGIES TO REDUCE SKIN INJURY IN CRITICALLY ILL PATIENTS
Kathleen M. Vollman, Advanced Nursing LLC

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