Controlling multidrug resistant gram negative bacilli: a transformational journey

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Eighteen Years of Experience With *Acinetobacter baumannii* in a Tertiary Care Hospital

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**Objective:** To characterize the descriptive and molecular epidemiology of *Acinetobacter baumannii* in our hospital.

**Design:** Longitudinal analysis of electronic microbiology laboratory records and isolates.

**Setting:** A 1,500 bed public teaching hospital in the Miami area.

**Patients:** Consecutive patients with *A. baumannii* from January reaction and randomly amplified polymorphic DNA techniques. A total of 9,334 *A. baumannii* isolates were detected, of which 4,484 isolates (48%) were identified as first positive isolates per unique patient. Most of the burden of disease was located in the ICUs (odds ratio, 2.64 [95% CI, 2.17–3.22]; \(p < 0.0001\)) and in the adult wards (odds ratio, 3.867 [95% CI, 2.71–5.52]; \(p < 0.0001\)). Respi-
BUNDLE OF INTERVENTIONS
Colonized patient

Non-colonized patient
Colonized Patient

Hands

Environment
Non-colonized patient

Colonized patient

Hands

Environment

Shared Equipment

Colonized patient

Non-colonized patient
 Colonized Patient

Healthcare worker’s hands

Hospital environment
• Increase the distance
• Decrease contamination of hands and clothes
• Increase environmental disinfection
- Identification of carriers by surveillance cultures
- Physical separation (cohorting)
NURSING STATION
In the ideal world
- Identification of carriers by surveillance cultures
- Physical separation (cohorting)
- Cohorting nursing personnel
Fecal Patina

Screening for *Acinetobacter baumannii* Colonization by Use of Sponges

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(A) Sampling of the upper arm using a sponge. (B) *A. baumannii* colonies on modified Leeds Acinetobacter medium.
Chlorhexidine baths

- Daily applications
- No rinsing
- No additional soap and water
CHALLENGES WITH CHG
Environmental cleaning
Are the rooms cleaned daily?
Improved Cleaning of Patient Rooms Using a New Targeting Method

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We developed a new method using an invisible fluorescent marker to target standardized high-touch surfaces in hospital rooms. Evaluation of 1404 surface objects in 157 rooms in 3 hospitals revealed that 47% of targets had been cleaned. Surgical beds and 15 intensive care unit beds, and hospital B had 154 medical/surgical beds and 14 intensive care unit beds. The administrative, clinical, and housekeeping staffs of the 2 hospitals were completely independent. The third hospital was an acute care, short-term rehabilitation hospital. During the study, staff levels of environmental services remained stable at all hospitals, as did the time allocated for patient-room cleaning activities.

A viscous, translucent targeting solution was formulated using a stable, nontoxic base, to which was added a chemical marker that fluoresces under black light. The material is inconspicuous, dries rapidly on surfaces, and remains stable for several weeks. Approximately 0.2 mL of solution was applied to 12 standardized sites in each room to create well-circumscribed targets with diameters of ~1.5 cm (figure 1). These sites

figure 1. The manner in which a target is made visible on a bedside telephone, using a portable black light.
Figure 2. Change in the mean rate of environmental cleaning in the 36 study hospitals during the 3 phases of the study. HROs, high-risk objects; whiskers, 95% confidence intervals.
Use of UV Powder for Surveillance to Improve Environmental Cleaning

L. Silvia Munoz-Price, MD;¹² Ella Ariza-Heredia, MD;¹² Stephen Adams, RN;² Micheline Olivier, RN;³ Lisa Francois, RN;² Maria Socarras, RN;² Gabriel Coro, RN;³ Amos Adedokun, RN;² Theodora Pappas, RN;² Madelaine Tamayo, RN;¹² Regina McDade, RN;² Cameron Dezfulian, MI

panels, commodes, sinks, room computer keyboards, storage cabinet handles, and light switches. Nine infection preventionists applied UV powder to high-risk objects by using cotton swabs to cover completely an area of approximately 2.54 cm². This fine white powder is not readily visible to the naked eye but is readily detected using UV lamps (GlitterBug) 48 hours later. Surfaces were classified as dirty if UV powder was found untouched and clean if there was an obvious attempt to remove the UV powder (eg, to clean). Especially on
<table>
<thead>
<tr>
<th>Occupied room</th>
<th>Terminal cleaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Who?</strong></td>
<td><strong>How often?</strong></td>
</tr>
<tr>
<td>Bed rails</td>
<td>ES</td>
</tr>
<tr>
<td>Head/footboard</td>
<td>ES</td>
</tr>
<tr>
<td>Bedside table</td>
<td>ES</td>
</tr>
<tr>
<td>IV poles</td>
<td>Nursing</td>
</tr>
<tr>
<td>IV pumps</td>
<td>Nursing</td>
</tr>
<tr>
<td>Ventilators</td>
<td>Respiratory therapist</td>
</tr>
<tr>
<td>Air flow meters</td>
<td>Respiratory therapist</td>
</tr>
<tr>
<td>Vitals monitor</td>
<td>PCT/Nursing</td>
</tr>
<tr>
<td>Portable computers on wheels</td>
<td>User</td>
</tr>
<tr>
<td>Computer inside room</td>
<td>ES</td>
</tr>
</tbody>
</table>

ES: environmental services
ES: We bought UV lamps to do our own inspections
IS SPOT CLEANING OCCURRING?
Why is the environment important?

Acinetobacter baumannii: Association between Environmental Contamination of Patient Rooms and Occupant Status

L. Silvia Munoz-Price, MD;1,2,3 Nicholas Namias, MD;4 Timothy Cleary, PhD;5 Yovanit Fajardo-Aquino, MD;3 Dennise DePascale, MT;3 Kristopher L. Arheart, EdD;2,6 Jesabel I. Rivera, BS;7 Yohei Doi, MD, PhD7

We aimed to determine the association between the presence of Acinetobacter baumannii in patient rooms and the carrier status of the occupants. Fifty-six (39%) of 143 rooms with A. baumannii-positive patients had results positive for A. baumannii. Only 49 (10%) of 485 rooms with A. baumannii-negative patients were positive (odds ratio, 5.72 [95% confidence interval, 3.66–8.96]; P<.0001). Clinical and environmental isolates shared pulsed-field gel electrophoresis patterns.

Infect Control Hosp Epidemiol 2013;34(5):517-520

Weekly active surveillance cultures (rectal and respiratory samples) were standard among all of our adult ICU patients. The A. baumannii status of patients present in each of the ICUs was available in the patient census and maintained by the Infection Control Department on the basis of microbiology data. A patient with at least 1 culture positive for A. baumannii, including surveillance and clinical cultures, was considered to be positive for A. baumannii.

Environmental cultures were performed weekly on a rotating basis (1–2 units/week) across the selected ICUs. The following 4 standard objects were cultured from inpatient rooms: bed rails, bedside tables, intravenous pumps, and ventilator control panels (unless the object was not present). No other objects were analyzed in this project. Approximately 10 × 10 cm of each surface was sampled using premoistened 6-inch cotton swabs (Sterile Cotton-Tipped Applicators; MediChoice). A single swab was used for each individual surface. Swabs were promptly placed in trypticase soy broth (BD Diagnostics) and incubated overnight at 37°C. Broths showing turbidity were subcultured onto both blood and MacConkey agar plates. To aid in the detection of resistant
Rooms cultured
N=628

Patient Ab (+)
n=143

Environment Ab (+)
 n=56 (39%)

Environment Ab (-)
 n=87 (61%)

Patient Ab (-)
n=485

Environment Ab (+)
 n=49 (10%)

Environment Ab (-)
 n=436 (90%)

OR_{environment (+)|patient(+)} = 5.7 (95% confidence interval: 3.66-8.96; p<0.0001)
Why is the environment important?

<table>
<thead>
<tr>
<th>Multidrug-Resistant Bacteria</th>
<th>Hands Contaminated Before Room Entry(^a)</th>
<th>Gowns</th>
<th>Gloves</th>
<th>Hands After Removal</th>
<th>Gowns or Gloves (95% confidence intervals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methicillin-resistant</td>
<td>3.2% (5/157)</td>
<td>3.9%</td>
<td>11.2%</td>
<td>3.3%</td>
<td>13.8% (8.3% to 19.2%)</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em> (23 patients)</td>
<td>(6/152)</td>
<td>(17/152)</td>
<td>(5/152)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vancomycin-resistant</td>
<td>0.6% (1/181)</td>
<td>5.0%</td>
<td>10.0%</td>
<td>1.7%</td>
<td>13.9% (8.9% to 18.9%)</td>
</tr>
<tr>
<td><em>Enterococci</em> (27 patients)</td>
<td>(9/180)</td>
<td>(18/180)</td>
<td>(3/180)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multidrug-resistant</td>
<td>3.4% (3/89)</td>
<td>2.3%</td>
<td>17.4%</td>
<td>3.5% (3/86)</td>
<td>17.4% (9.4% to 25.4%)</td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em> (13 patients)</td>
<td>(2/86)</td>
<td>(15/86)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multidrug-resistant <em>Acinetobacter baumannii</em> (26 patients)</td>
<td>5.1% (9/176)</td>
<td>12.6%</td>
<td>29.3%</td>
<td>4.2%</td>
<td>32.9% (25.8% to 40.0%)</td>
</tr>
<tr>
<td></td>
<td>(21/167)</td>
<td>(49/167)</td>
<td>(7/167)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Interactions in which healthcare workers’ hands were contaminated before room entry were excluded from further analysis.

Morgan et al. Crit Care Med 2012 Apr
**Environmental Exposure to Carbapenem-Resistant Acinetobacter baumannii Acquisition**

Rossana Rosa, MD, FACP, CIC; Dennise Depascual, MD, FACP, CIC; Daniel H. Kett, MD, FACP, CIC; Louis Pizano, MD, FACP, CIC; L. Silvia Munoz-Price, MD, FACP, CIC

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*Environmental cultures.* Four standard objects from in-patient rooms were cultured: bed rails, bedside tables, intravenous pumps, and light panels. Samples were also collected elsewhere. Environmental cultures were performed across 5 adult ICUs on a monthly basis. A patient room was considered positive if any of the 4 objects were positive. Surveillance cultures were not performed on all patients on admission, nor thereafter. Sources of transmission included patient-to-patient transmission and cross-contamination from hand contact.

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![Diagram](image)

**Relative risk** \( \text{patient(AB+) \mid environment(AB+)} = 3.12 \ (X^2=4.5; \ p<0.028) \)**
**CRE positive patient**
- Physical separation from CRE negative patients
- Rectal surveillance
- Cohorting nursing personnel
- Chlorhexidine baths

**CRE negative patient**
- Physical separation from CRE positive patients
- Cohorting nursing personnel
- Chlorhexidine baths

**Healthcare worker’s hands**
- Hand hygiene
- Contact precautions

**Shared equipment**
- Daily and terminal disinfection
- Limit shared equipment
- Disinfect equipment between patient use

**Healthcare environment**
ESCMID guidelines for the management of the infection control measures to reduce transmission of multidrug-resistant Gram-negative bacteria in hospitalized patients

E. Tacconelli¹, M. A. Cataldo², S. J. Dancer³, G. De Angelis⁴, M. Falcone⁵, U. Frank⁶, G. Kahlmeter⁷, A. Pan⁸,⁹, N. Petrosillo², J. Rodríguez-Baño¹⁰,¹¹,¹², N. Singh¹³, M. Venditti³, D. S. Yokoe¹⁴ and B. Cookson¹⁵
STAGES OF CHANGE

- Establishing a sense of urgency
- Creating a coalition
- Developing a vision and strategy
- Communicating the change vision
- Empowering broad-based action
- Generating short term-wins
- Consolidating gains and producing more change
- Anchoring new approaches in the culture

Kotter JP. Leading Change. Harvard Business Review
Control of a two-decade endemic situation with carbapenem-resistant *Acinetobacter baumannii*: Electronic dissemination of a bundle of interventions

L. Silvia Munoz-Price, Yovanit Fajardo, Michael Hughes, Kristopher Arkin, et al.
Weekly emails
Ranked the units
Rates hospital wide

Period 1
Period 2
Period 3

TICU staff started driving the campaign
MID-LEVEL ADMINISTRATION

C-suite

Unit level nursing
Weekly Infection Control emails

C-suite

MID-LEVEL ADMINISTRATION
Weekly Infection Control emails

C-suite

MID-LEVEL ADMINISTRATION
Weekly Infection Control emails

C-suite

MID-LEVEL ADMINISTRATION

CHANGE
CHANGE IS NOT EASY
RATHER PAINFUL AND TRAUMATIC
Why?

- Inwardly focused cultures
- Paralyzing bureaucracy
- Parochial politics
- Low level of trust
- Lack of teamwork
- Arrogant attitudes

Kotter JP. Leading Change. Harvard Business Review
Management vs. Leadership

Management

• Planning
• Budgeting
• Organization
• Staffing
• Problem solving

Predictability
Order

Leadership

• Develop a vision of the future
• Strategies how to get there
• Align people
• Motivating and inspiring

Change

Kotter JP. Leading Change. Harvard Business Review
What is it that you (organization) want to be?
Turnaround vs. Realignment

Turnaround

• Recognized to be in big trouble
• Demands rapid, decisive action
• Most understand that substantial change is needed

Realignment

• Organization needs to be convinced that change is needed
• Requires more political work
• Shift the mind-set from denial to awareness

Watkins MD. The first 90 days. Harvard Business Review Press
What is it that you (organization) want to be?
In summary...

- There are many interventions
- Implement many at the time
- Identification and cohorting of carriers are key
THANK YOU!