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Major article

## Control of a two-decade endemic situation with carbapenem-resistant *Acinetobacter baumannii*: Electronic dissemination of a bundle of interventions

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## Key Words:

Culture change

Management

Mass communication

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**Background:** Our institution continued to experience a hyperendemic situation with carbapenem-resistant *Acinetobacter baumannii* despite a bundle of interventions. We aim to describe the effect of the subsequent implementation of electronic dissemination of the weekly findings of a bundle of interventions.

**Methods:** This was a quasiexperimental study performed at a 1,500-bed, public, teaching hospital. From January 2011 to March 2012, weekly electronic communications were sent to the hospital leadership and intensive care units (ICUs). These communications aimed to describe, interpret, and package the findings of the previous week's active surveillance cultures, environmental cultures, environmental disinfection, and hand cultures. Additionally, action plans based on these findings were shared with recipients.

**Results:** During 42 months and 1,103,900 patient-days, we detected 438 new acquisitions of carbapenem-resistant *A baumannii*. Hospital wide, the rate of acquisition decreased from  $5.13 \pm 0.39$  to  $1.93 \pm 0.23$  per 10,000 patient-days, during the baseline and postintervention periods, respectively ( $P < .0001$ ). This effect was also observed in the medical and trauma ICUs, with decreased rates from  $67.15 \pm 10.56$  to  $17.4 \pm 4.6$  ( $P < .0001$ ) and from  $55.9 \pm 8.95$  to  $14.71 \pm 4.45$  ( $P = .0004$ ), respectively.

**Conclusion:** Weekly and systematic dissemination of the findings of a bundle of interventions was successful in decreasing the rates of carbapenem-resistant *A baumannii* across a large public hospital.

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*Acinetobacter baumannii* is a gram-negative coccobacillus that has become one of the most worrisome and frequent organisms causing hospital-acquired infections.<sup>1,2</sup> Infections because *A baumannii* occur mainly in intensive care units (ICUs), ranging from lower respiratory tract, bloodstream, and urinary tract infections.<sup>1</sup> A recent surveillance in the state of Maryland showed

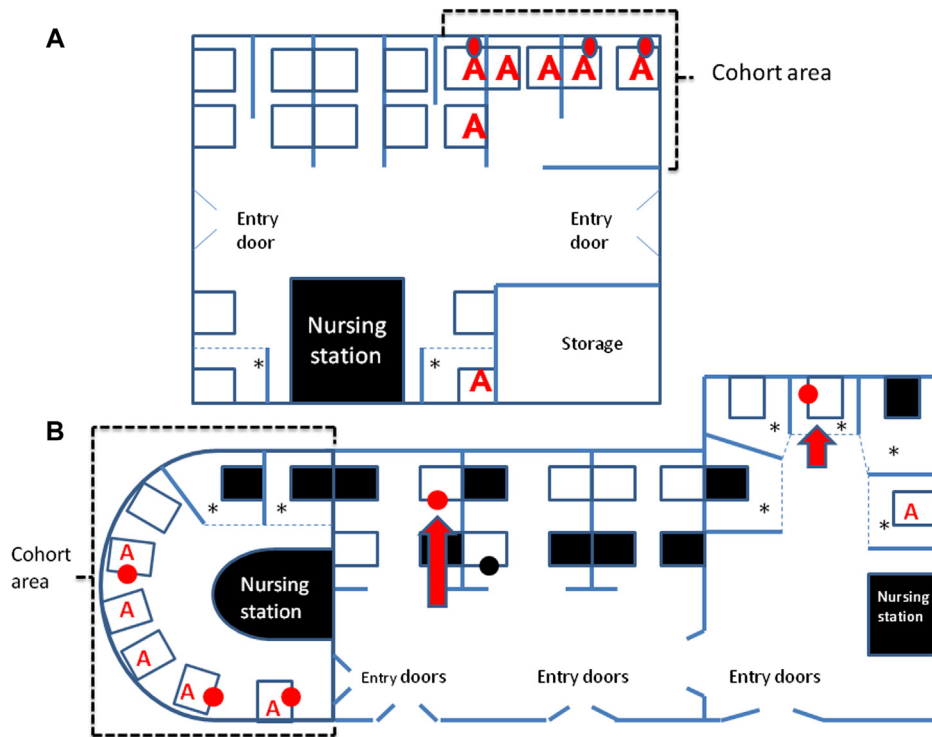
34% of colonization with *A baumannii* among mechanically ventilated patients.<sup>3</sup> Additionally, all-cause mortality among patients with infections because of *A baumannii* has been documented to be in the range of 40%.<sup>2,4</sup> This is in part due to the limited antibiotic options available for the treatment of these infections.

Nosocomial outbreaks of *A baumannii* may last for years because of the long survival of this organism in the inanimate environment.<sup>2,5-7</sup> In our institution, we have experienced an endemic situation with carbapenem-resistant *A baumannii* for close to 2 decades.<sup>8</sup> Throughout 2009 and 2010, we instituted several interventions aimed at decreasing the horizontal transmission of

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**Fig 1.** Unit maps of intensive care units. (A) Medical intensive care unit; (B) trauma intensive care unit. The letter A represents beds occupied by carbapenem-resistant *Acinetobacter baumannii*-positive patients. Circles represent sites contaminated with carbapenem-resistant *A. baumannii*. Arrows represent environmental contamination of objects not belonging to an *Acinetobacter*-positive patient room. \*Single patient room.

this organism.<sup>9</sup> These interventions included weekly surveillance cultures, increased environmental disinfection, contact isolation, and cohorting of *A. baumannii*-positive patients.<sup>10-12</sup> Daily chlorhexidine baths were implemented across the ICUs since mid-2009 and throughout the span of this project. Despite all these efforts, we were unable to steadily decrease the number of new acquisitions of *A. baumannii*. One of the challenges we faced consisted on rapidly communicating our findings from the preceding week to our thousands of health care workers. Thus, we decided to extensively disseminate the findings of the surveillance cultures along with their clinical interpretation using weekly electronic communications directed to the hospital administration, including the medical and nursing leadership. This article describes the impact of these electronic communications on the rate of new acquisitions of carbapenem-resistant *A. baumannii* throughout the hospital and in particular in the 2 ICUs with the highest number of new acquisitions.

## METHODS

This project describes an infection control initiative implemented at a 1,500-bed, public, university-affiliated hospital. We retrospectively evaluated the prospectively collected infection control electronic database on new acquisitions of carbapenem-resistant *A. baumannii* from January 1, 2010, to June 30, 2013.

The main outcome of the study was the monthly rate of new acquisitions of carbapenem-resistant *A. baumannii* among hospitalized patients. A new acquisition was defined as the isolation of the first carbapenem-resistant *A. baumannii* isolate after 48 hours of hospitalization in a patient without previous history of *A. baumannii*. Isolates obtained within 48 hours of admission were considered community acquired. Rates were calculated at the hospital level based on the number of new acquisitions per 10,000

patient-days; this denominator was provided by the hospital administration based on billing data. Additionally, the 2 units known to have the highest burden of disease (medical and trauma intensive care units, MICU and TICU, respectively) were analyzed separately.<sup>8</sup> This project was deemed to be a non-human subject research by the Internal Review Board of University of Miami and therefore was exempted from review.

### Weekly electronic communications

Between January 14, 2011, and March 30, 2012, the medical director of infection control (L.S.M-P.) sent weekly e-mails to the hospital leadership. Recipients included the C-suite of the hospital, the Quality and Patient Safety Division, and the nursing and medical directors of inpatient units. The periods before, during, and after the weekly electronic communications were labeled as period 1, 2, and 3, respectively. Each electronic communication graphically described and interpreted the findings of the preceding week bundle of interventions. Items described included the number and location of new carbapenem-resistant *A. baumannii* acquisitions. Additionally, environmental findings (see below) including culture results and ultraviolet markers (as indicators of cleaning) were described and discussed. Results of environmental cultures were provided in the form of maps of the units showing the location of carbapenem-resistant *A. baumannii*-positive patients and objects (Fig 1). Finally, action plans were outlined in each communication.

ICUs with the highest number of acquisitions received daily (Monday through Friday) electronic communications with the line listing of both their new carbapenem-resistant *A. baumannii* acquisitions and the location of their existing carbapenem-resistant *A. baumannii*-positive patients. These daily e-mails were sent by the infection preventionist responsible for each unit. The distribution of these daily electronic communications included the unit's

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