

LETTER



# Multidrug-resistant bacterial carriage and related healthcare-associated infections in a pediatric intensive care unit: a 6-year prospective study

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Dear Editor,

Few data exist about multidrug-resistant (MDR) bacterial carriage in pediatric intensive care units (PICUs) [1] and its impact on healthcare-associated infections (HCAIs), which cause considerable morbidity and mortality [2]. In adults, a 10% pooled prevalence of extended-spectrum  $\beta$ -lactamase-producing *Enterobacteriaceae* (ESBL-E) colonization at PICU admission has been found, with an additional 7% acquisition rate during the stay [3]. However, MDR bacterial carriage and its contribution to HCAIs may differ between children and adults because of the lower prevalences of chronic and degenerative organ dysfunction in the former. Our objectives were to estimate the 6-year prevalence of MDR bacterial carriage and to describe the epidemiology of related HCAIs in our PICU.

This single-center prospective cohort study performed at the Robert-Debre University Hospital (Paris, France) included consecutive children admitted to a tertiary 20-bed PICU in 2011–2016. Rectal and nasal swabs were collected routinely at admission and weekly thereafter to detect MDR bacteria (ESBL-E and methicillin-resistant *Staphylococcus aureus*, MRSA). MDR bacterial carriage was defined as imported when the admission swab was positive or when carriage was identified before

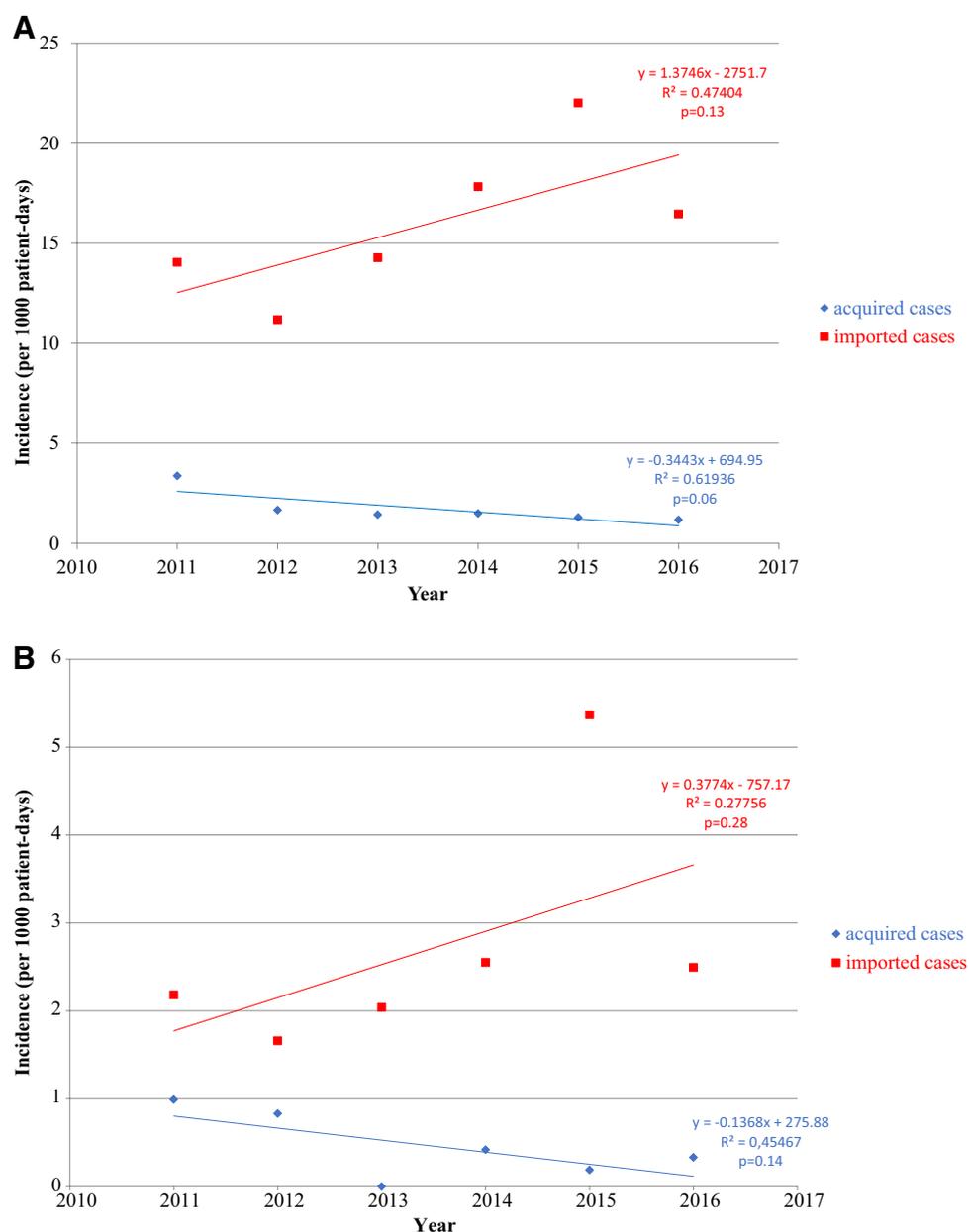
admission, and as acquired when the admission swab was negative and a subsequent swab positive. We recorded all major HCAIs including ventilator-associated pneumonia (VAP), central line-associated bloodstream infections (CLABSI), and catheter-associated urinary tract infections (CAUTI), defined on the basis of Centers for Disease Control criteria and confirmed retrospectively [4].

Of 5419 patients admitted during the study period (Supplementary Table 1), 550 (10.1%) carried ESBL-E and 99 (1.8%) MRSA. The ESBL-E incidence rate increased from 12.8 to 23.0/1000 patient-days as a result of an increase in imported cases ( $P=0.13$ ), contrasting with a steady decrease in acquired cases ( $P=0.06$ ) with an acquisition rate of only 1%. Likewise, the MRSA carriage incidence rate rose over time from 2.04 to 5.56/1000 patient-days as a result of an increase in imported MRSA cases ( $P=0.28$ ) and despite a decrease in acquired cases ( $P=0.14$ ) (Fig. 1). Over time, use declined for third-generation cephalosporins ( $P=0.04$ ) and increased for penicillins (mainly amoxicillin); carbapenem and vancomycin use tended to decline ( $P=0.59$  and 0.07, respectively) (Supplementary Fig. 1). The annual HCAI prevalence ranged from 1.9% to 4.3% and the incidence rate from 3.3 to 6.2/1000 patient-days. The prevalence of HCAIs due to MRSA, ESBL *E. coli*, and ESBL *K. pneumoniae* among carriers was 3% (3/99), 1.7% (6/350), and 3.0% (5/165), respectively. The 146 major HCAIs comprised 41.8% VAPs, 39% CLABSIs, and 19.2% CAUTIs. Of all these HCAIs, 13 (8.9%) were due to ESBL-E and 3 (2.0%) to MRSA, all in previously identified carriers.

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**Fig. 1** Incidence rate of extended-spectrum  $\beta$ -lactamase *Enterobacteriaceae* (a) and methicillin-resistant *Staphylococcus aureus* (b) carriage per 1000 patient-days

Despite a steady increase in MDR bacteria carriers at admission over the 6-year period, HCAs due to carried MDR bacteria were rare in our PICU, suggesting that preventive measures were effective. All MDR-HCAs (i.e., due to ESBL-E or MRSA) occurred in patients previously identified by routine surveillance swabs as carriers of the culprit organism. Therefore, incorporating routine screening results into first-line antibiotic selection,

combined with effective preventive measures against MDR bacteria transmission, may decrease the inappropriate use of vancomycin and carbapenems, as suggested by data from adult ICUs [5].

#### Electronic supplementary material

The online version of this article (<https://doi.org/10.1007/s00134-019-05584-3>) contains supplementary material, which is available to authorized users.

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### Compliance with ethical standards

#### Conflicts of interest

No conflict of interests to declare.

#### Ethical approval

The study was approved by the International Review Board of Robert-Debré Hospital, Paris, France (No 2018-422).

### Publisher's Note

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Accepted: 25 February 2019

Published online: 6 March 2019

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