

# Trends of ventilator-associated pneumonia incidence in the elderly patients admitted in French Intensive Care Units between 2007 and 2014

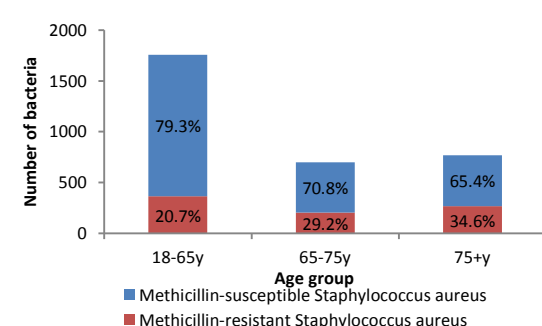
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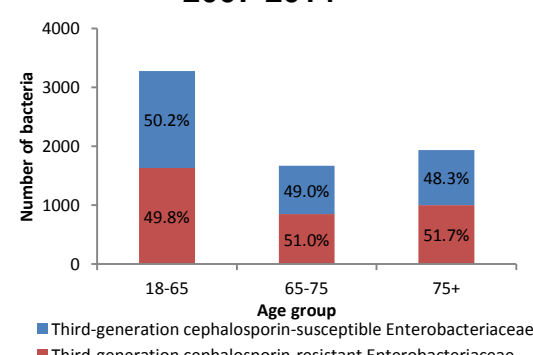
## Introduction

- During the last decade, the number of elderly patients admitted to intensive care units (ICU) has increased due to secular trends and improvement of ICU outcomes.
- Elderly are particularly exposed to healthcare-associated infections (HAIs) due to age-associated physiological and anatomical conditions.
- In ICU, ventilator-associated pneumonia (VAP) remains the major cause of HAI, but epidemiological data on VAPs in the elderly are limited.
- **Objective : assess the trends of VAPs incidence according to age**, with particular focus on elderly patients admitted in French ICUs between 2007 and 2014

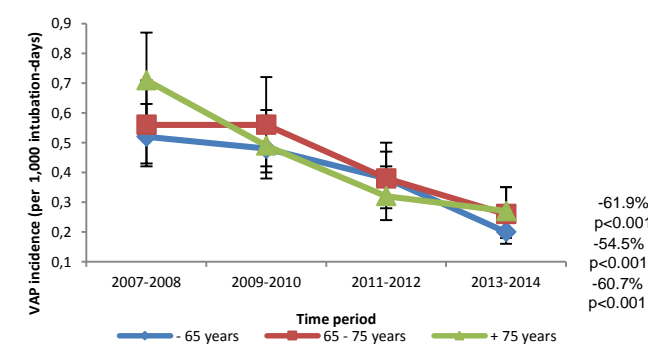
- Overall, 200,537 patients hospitalized in 289 ICUs and accounting for 2,092,665 patients-days were included in the study. Among them, 130,712 were intubated, accounting for 1,227,424 intubation-days.
- 46.2% were adults, 22.2% olds, and 31.6% very olds patients.
- 16,055 of them (attack rate : 12.3%) developed a VAP during their hospitalization.
- Mean age was 63.9 ( $\pm 16.6$ ) years, M/F gender ratio was 1.62. 25.1% of patients died during their hospitalization.



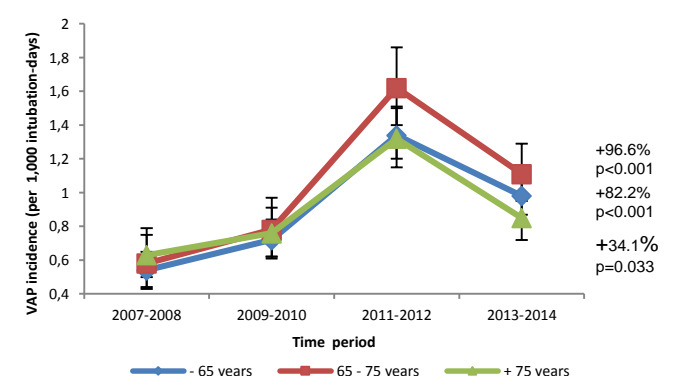
**Figure 2a : Numbers and proportions of MRSA isolated in VAPs by age group in French ICU, 2007-2014**



**Figure 3a : Numbers and proportions of 3GCRE isolated in VAPs by age group in French ICU, 2007-2014**



**Figure 3a : VAPs caused by MRSA by age group in French ICU, 2007-2014**



**Figure 3b : VAPs caused by 3GCRE by age group in French ICU, 2007-2014**

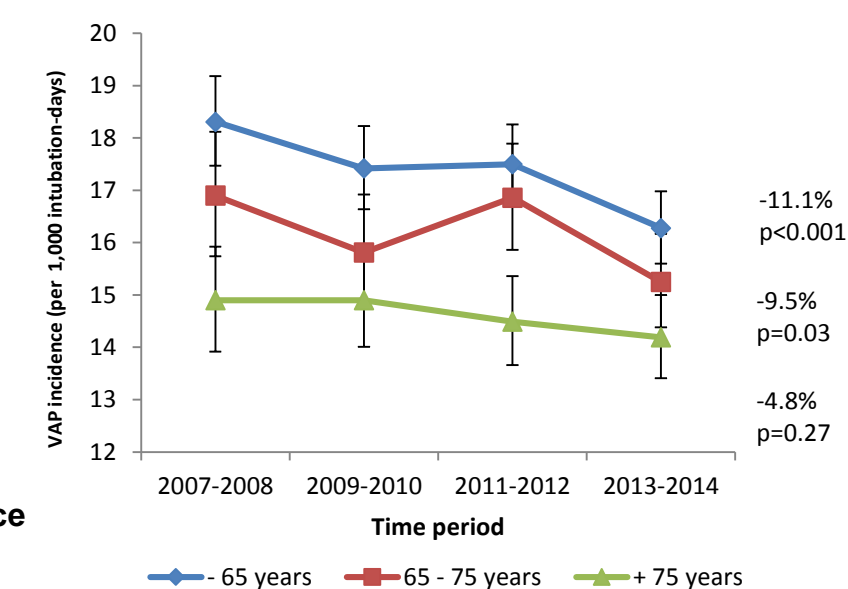
## Discussion

- Very-old age was associated with a lower VAPs incidence rate, but a higher proportion of multi-resistant bacteria in ICU patients from France.
- Decreased VAPs incidence rate was observed only for the adults group in multivariate analysis.
- Infection control measures targeted to the elderly patients with focus on multi-resistant bacteria and geriatric evaluation might help to prevent VAPs in this increased population.

## Methods

- Data of the multicenter prospective French National HAI surveillance Network in ICU (REA-RAISIN).
- Inclusion criteria: All adult patients (>18 years old), hospitalized  $\geq 48$  hours between 01/01/2007 and 31/12/2014 in an ICU participating  $\geq 2$  complete years during the time period. VAP was defined according to standardized criteria in accordance with ECDC definition.
- 4 time periods : 2007-2008, 2009-2010, 2011-2012 and 2013-2014. Age was categorized in 3 groups : adult (18-65y), old (65-75y) and very old (75+y).
- VAPs incidence rates were expressed for 1,000 intubation-days.
- Overall and age-stratified multivariate mixed-effects Poisson regressions were performed to examine the effect of age and time on VAPs incidence rates, center was the random effect.

- Overall VAPs incidence rates were :
  - 17.30 (n=7,918, 95% CI: 16.92-17.69) for the adults group
  - 16.13 (n=3,838, 95% CI: 15.62-16.65) for the olds group
  - 14.58 (n=4,299, 95% CI: 14.15-15.02) for the very olds group
- VAPs incidence rates decreased over time in adults group ( $p < 0.001$ ) and olds group ( $p = 0.03$ ). No decrease was observed in very old patients ( $p = 0.27$ ) (**Figure 1**)



**Figure 1 : VAPs incidence rates by age group in French ICU, 2007-2014.**

Variables	Adjusted IRR of VAPs (95% CI) <sup>a</sup>	p-value
<b>&lt; 65 years old</b>		
2007-2008	1	
2009-2010	0.95 (0.89-1.02)	0.15
2011-2012	0.96 (0.90-1.03)	0.26
2013-2014	0.91 (0.85-0.97)	0.004
<b><math>\geq 65</math> and &lt; 75 years old</b>		
2007-2008	1	
2009-2010	0.92 (0.83-1.02)	0.11
2011-2012	1.00 (0.90-1.10)	0.92
2013-2014	0.91 (0.82-1.00)	0.047
<b><math>\geq 75</math> years old</b>		
2007-2008	1	
2009-2010	1.00 (0.91-1.10)	0.93
2011-2012	0.99 (0.89-1.08)	0.76
2013-2014	0.99 (0.90-1.09)	0.84

NOTE: IRR: Incidence rate ratio. <sup>a</sup>Stratified by age and adjusted for gender, antibiotics, trauma, diagnosis category, patient origin, immunodeficiency, SAPS-II at admission in the unit. The variable time period was forced in the models.

- Proportion of multi-resistant bacteria increased with age for methicillin-resistant *Staphylococcus aureus* (MRSA) ( $P < 0.001$ , **Figure 2a**) and third-generation cephalosporins-resistant *Enterobacteriaceae* (3GCRE) ( $P = 0.01$ , **Figure 2b**).
- Incidence of VAPs caused by MRSA decreased over time in all groups (**Figure 3a**). Conversely, VAPs caused by 3GCRE increased over time in all groups between 2007-2008 and 2011-2012 and decreased during 2013-2014 (**Figure 3b**).
- The stratified models (**Table 1**) disclosed that adjusted VAP incidence decrease selectively in the adults group in 2013-2014 compared with 2008-2009 (aIRR=0.907, 95% CI: 0.848-0.969,  $P = 0.004$ ).
- In the pooled analysis, overall adjusted incidence decreased by 7.0% (95% CI: 2.0-11.0%,  $P < 0.001$ ) from 2007-2008 to 2013-2014. Low age was an independent risk factor for VAP (adjusted incidence rate ratio [aIRR]=0.93, 95% CI: 0.89-0.97,  $P < 0.001$ ) in adult compared with very old patients .

**Table 1 : Incidence rate ratio for VAPs adjusted with multivariable mixed-effects Poisson regression analysis stratified by age**

## Contacts

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