

**ABSTRACT**

**Introduction**  
Mortality in CAP patients increases if empiric antibiotic therapy fails to cover the etiologic agent. Some patients hospitalized with CAP may be infected with multidrug resistant (MDR) bacteria such as MRSA or Pseudomonas. To identify these patients and provide broad-spectrum therapy, several risk factors are suggested as MDR predictors. These patients are considered to have healthcare-associated pneumonia (HCAP). Recently, the predictive value of these risk factors has been questioned.

**Objective**  
To define which risk factors for HCAP predict CAP infection due to MRSA or Pseudomonas.

**Methods**  
This was a secondary data analysis of the Community-Acquired Pneumonia Organization (CAPO) International Cohort Study database. Risk factors for HCAP evaluated include: 1) nursing home resident, 2) hospitalized in prior 90 days, 3) IV antibiotics in prior 90 days, 4) home infusion, and 5) home wound care. Poisson regression was used to define the predictive ability of each risk factor for MDR infection.

**Results**  
The following three risk factors were associated with MRSA or Pseudomonas infection, 1) IV antibiotics in prior 90 days (Risk Ratio 3.5, P=0.002); 2) Home wound care (Risk Ratio 2.0, P=0.03); and 3) Nursing home resident (Risk Ratio 2.0, P=0.02).

**Conclusions**  
This study indicates that IV antibiotics in the prior 90 days is the most important risk factor for MDR infection. These data emphasize the importance of obtaining an appropriate antibiotic history in all hospitalized patients with infections. Prior use of IV antibiotics should be considered one of the primary indicators for initial broad-spectrum antibiotic therapy.

**INTRODUCTION**

Mortality in patients with community-acquired pneumonia (CAP) increases if empiric antibiotic therapy fails to cover the etiologic agent. Empiric therapy is targeted to cover possible etiologic agents. Different risk factors have been established to define possible etiology<sup>1,2</sup>. Empiric therapy is a treatment based on likely organisms able to cause pneumonia before we have adequate microbiological results. Possible organisms are based on the patients' risk factors.

Some patients hospitalized with CAP may be infected with Multidrug Resistant (MDR) bacteria such as methicillin-resistant *Staphylococcus aureus* (MRSA) or *Pseudomonas aeruginosa*<sup>3</sup>. To identify these patients and provide broad spectrum therapy, several risk factors are suggested as MDR Predictors<sup>5</sup>. These include: home wound care or infusion therapy, dialysis, nursing homes, hospitalized more than 2 days in the prior 90 days<sup>4</sup>. These patients are considered to have healthcare associated pneumonia (HCAP). Recently, the predictive value of these risk factors has been questioned.

**INTRODUCTION**

To define which risk factors for HCAP predict CAP infection due to MRSA or Pseudomonas.

**METHODS**

**Study design and Study population**  
This was a secondary analysis of patients enrolled in the Community-Acquired Pneumonia Organization (CAPO) international cohort study. Data was collected between 2009 and 2015. In each participating center, non-consecutive medical records of hospitalized patients with the diagnosis of CAP were reviewed. A sample of the data collection form is available at the study website ([www.caposite.com](http://www.caposite.com)). Validation of data quality was performed at the study center before the case was entered in to the CAPO database. Institutional Review Board approval was obtained by each participating center.

**Study definitions**  
**CAP:** Diagnosis of CAP required the presence of criterion A, B, and C:  
A. New pulmonary infiltrate on imaging (CT scan or chest x-ray) at the time of admission to the hospital.  
B. Signs and Symptoms of CAP (at least one of the following)  
1. New or increased cough (per the patient)  
2. Fever >37.8°C (100.0°F) or hypothermia <35.6°C (96.0°F).  
3. Changes in WBC (leukocytosis >11,000 cells/mm<sup>3</sup>, left shift > 10% band forms/microliter, or leukopenia < 4,000 cells/mm<sup>3</sup>)  
C. Working diagnosis of CAP at the time of hospital admission with antimicrobial therapy given within 24 hours of admission.

Risk factors for MDR organisms were defined as follows:  
• Nursing Home resident  
• Hospitalized in prior 90 days  
• IV antibiotics in prior 90 days  
• Home infusion  
• Chronic dialysis  
• Home wound care

**Study Groups**  
Patients admitted to the hospital with at least one of the risk factors listed below were classified as HCAP.  
1. IV antibiotic  
2. Home wound care  
3. Nursing home resident.  
4. Patients without any of this RF for MDR bacteria were classified as No HCAP

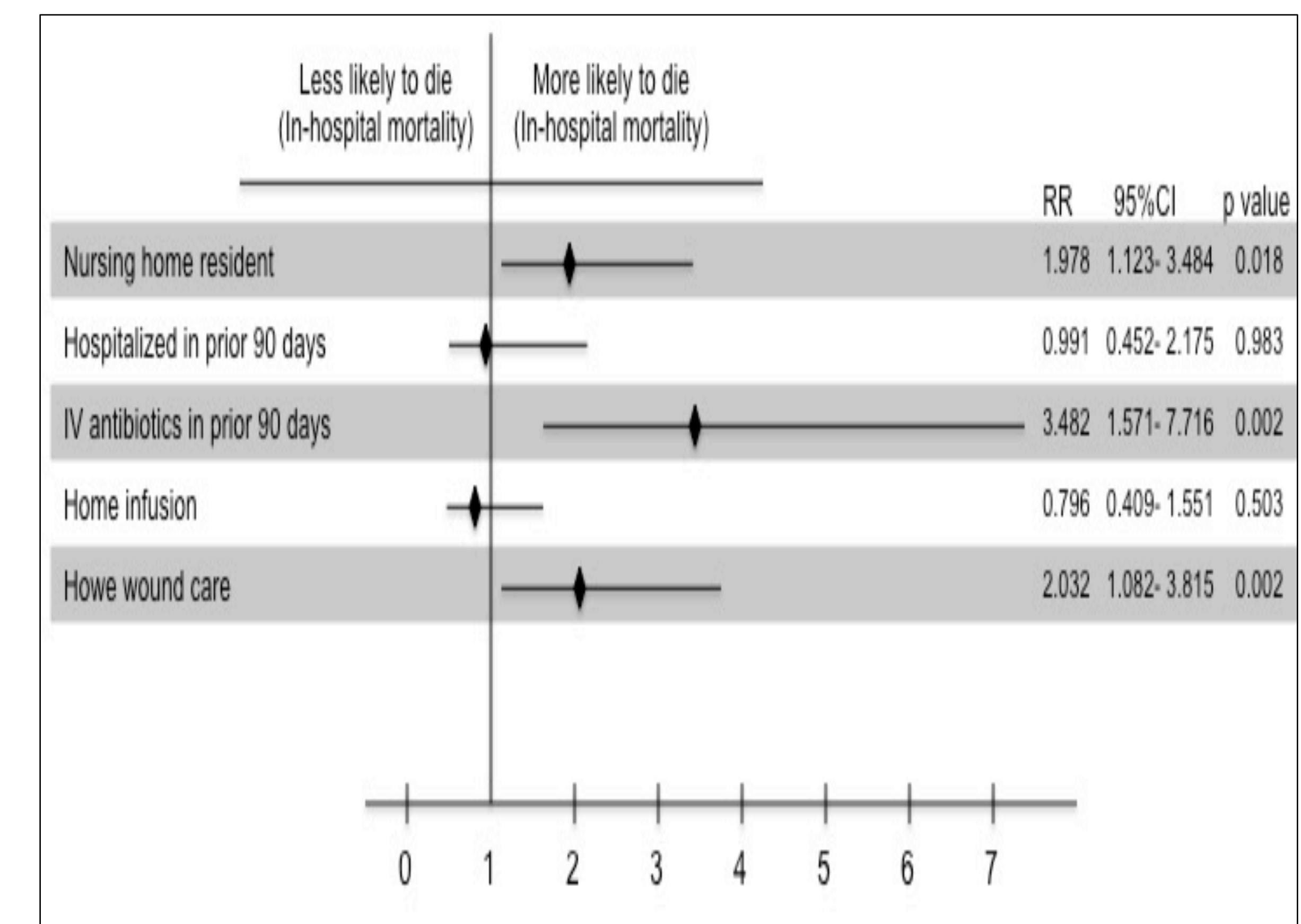
**Statistical Analyses**  
Baseline categorical explanatory variables were summarized as frequencies and percentages and differences between both groups of patients were analyzed using a chi-square test or Fisher's exact test when appropriate and warranted. Continuous variables were summarized as frequencies and interquartile range and differences between groups were analyzed by Wilcoxon-Mann-Whitney test.

**RESULTS**

- A total of 1,117 patients were included in this study
- Patients' characteristics are shown in Table 1
- Multivariate analysis of risk factors for MDR organisms as etiology of pneumonia is shown in Figure 1

**Table 1: Patient's Characteristics**

Variable	HCAP n=146	No HCAP n=971	P-value
<b>Demographics</b>			
Age, Median (IQR)	74 (24)	55 (32.5)	<0.001
Sex, n (%)	100 (68)	574 (59)	0.037
Nursing home resident, n (%)	62 (42)	0 (0)	<0.001
<b>Comorbid Conditions</b>			
Congestive Heart Failure, n (%)	35 (24)	83 (9)	<0.001
COPD, n (%)	59 (40)	167 (17)	<0.001
Diabetes, n (%)	40 (27)	157 (16)	0.002
HIV, n (%)	19 (13)	120 (12)	0.789
Renal Disease, n (%)	27 (18)	77 (8)	<0.001
Liver Disease, n (%)	13 (9)	67 (7)	0.387
Neoplastic Disease, n (%)	32 (22)	82 (8)	<0.001
<b>Physical Exam</b>			
Altered mental status on admission, n (%)	43 (31)	121 (13)	<0.001
Respiratory Rate, Median (IQR)	24 (10)	24 (10)	0.501
Systolic blood pressure, Median (IQR)	116 (39)	120 (34)	0.044
Temperature (degrees Celsius), Median (IQR)	37.4 (2)	37.8 (1.8)	0.094
Heart rate, Median (IQR)	105 (34.2)	104 (30)	0.765
<b>Lab/Radiography</b>			
pH, Median (IQR)	7.4 (0.1)	7.5 (0.1)	0.104
PaO2, Median (IQR)	61.4 (21.2)	63 (23)	0.034
Blood Urea Nitrogen, Median (IQR)	30.4 (30.5)	27.9 (29)	0.281
Serum sodium, Median (IQR)	137 (6)	136 (7)	<0.001
Serum glucose, Median (IQR)	121.5 (72.5)	116 (47)	0.487
Hematocrit, Median (IQR)	35.8 (9.3)	38.6 (7.1)	<0.001
Pleural effusion, n (%)	41 (28)	209 (22)	0.088
Pseudomonas or MRSA, n (%)	30 (21)	71 (7)	<0.001
<b>Severity of Disease</b>			
ICU admission, n (%)	33 (23)	183 (19)	0.311
Pneumonia Severity Index, Median (IQR)	142 (58.5)	107 (53)	<0.001



**Figure 1: Multivariate analysis of risk factors for MDR organisms as etiology of pneumonia**

**CONCLUSIONS**

- This study indicates that IV antibiotics in the prior 90 days is the most important risk factor for pneumonia due to pseudomonas or MRSA infection.
- Residing in a nursing home and receiving home wound care were also identified as risk factors for MDR organisms.
- Our study data emphasizes the importance of obtaining an appropriate antibiotic history in all hospitalized patients with infections.
- Prior use of IV antibiotics should be considered one of the primary indicators for initial broad-spectrum antibiotic therapy in hospitalized patients with CAP.
- Our data supports the IDSA and ATS guidelines.

**REFERENCES**

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