



**ABSTRACT**

**Introduction**

*Streptococcus pneumoniae* (Sp) is one of the most common etiologic agents of CAP. There are two vaccines indicated for the prevention of Sp CAP in adults aged 65 years and older, a polysaccharide vaccine (PPV-23) and a protein-conjugate vaccine (PCV-13). Controversy exists regarding the benefit of PPV-23 in the prevention of hospitalization due to Sp CAP in the elderly.

The objective of this study was to define the effectiveness of the PPV-23 vaccine for the prevention of hospitalization due to Sp CAP in the elderly.

**Methods**

This was a secondary data analysis of the Community-Acquired Pneumonia Organization (CAPO) International Cohort Study database. A test-negative design was used to document vaccine effectiveness. The vaccine effectiveness was calculated as 1-risk ratio.

**Results**

A total of 2,688 patients with CAP were included in the study, 693 with prior PPV-23 and 1,995 without a history of the vaccine. In those with a history of PPV-23, 7% had Sp CAP, while 12% of patients without a history of the vaccine had Sp CAP. The vaccine effectiveness was 43%.

**Conclusions**

This study indicates that PPV-23 is an effective vaccine for the prevention of hospitalization due to Sp CAP in the elderly. Our data support the current CDC recommendation of offering a series of pneumococcal vaccines (PPV-23 + PCV-13) to all elderly patients.

**INTRODUCTION**

*Streptococcus pneumoniae* (Sp) is the leading cause of community-acquired pneumonia (CAP) in adults and especially elderly, which is one of the major causes of morbidity and mortality world wide<sup>1</sup>. The prevalence of pneumococcal pneumonia is increasing especially in certain population like the elderly, associated with comorbidities, and immunocompromised. Sp causes approximately 20–60% of community-acquired pneumonia cases in the United States<sup>2</sup>. Active immunization is the key to overtake this problem and in order to decrease the burden of the pneumococcal disease. There are two vaccines indicated for the prevention of Sp CAP in adults aged 65 years and older, a polysaccharide vaccine (PPV-23) and a protein-conjugate vaccine (PCV-13). Controversy exists regarding the benefit of PPV-23 in the prevention of hospitalization due to Sp CAP in the elderly.

The objective of this study was to define the effectiveness of the PPV-23 vaccine for the prevention of hospitalization due to Sp CAP in the elderly.

**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 were collected between 2001 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:

New pulmonary infiltrate on imaging (CT scan or chest x-ray) at the time of admission to the hospital.

Signs and Symptoms of CAP (at least one of the following)

New or increased cough (per the patient)

Fever >37.8°C (100.0°F) or hypothermia <35.6°C (96.0°F).

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>

Working diagnosis of CAP at the time of hospital admission with antimicrobial therapy given within 24 hours of admission.

**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.

A test-negative design was used to document vaccine effectiveness.

The vaccine effectiveness was calculated as 1-risk ratio.

P-values ≤ 0.05 were considered statistically significant. All data were analyzed in R v.3.1.1 (R Foundation for Statistical Computing, Vienna, Austria)

**RESULTS**

- A total of 2,688 patients with CAP were included in the study, 693 with prior PPV-23 and 1,995 without a history of the vaccine. Patients' characteristics are shown in table 1
- In those with a history of vaccine, 7% had Sp CAP, while 12% of patients without a history of the vaccine had Sp CAP. So our analysis shows the vaccine effectiveness was 43%.

**RESULTS**

Table 1 Patients' characteristics

Variable	Prior polysaccharide pneumococcal vaccination n = 693 n (%)	No Prior polysaccharide pneumococcal vaccination n = 1995 n (%)	P-value
Age, median (IQR)	79 (11)	78 (12)	<0.001
Male gender	458 (66)	1266 (63)	0.232
Patients from the United states n (%)	279 (40)	471 (24)	<0.001
<b>Comorbid conditions/ history</b>			
COPD, n (%)	268 (39)	681 (34)	0.034
Diabetes, n (%)	155 (22)	424 (21)	0.555
Congestive heart failure, n (%)	175 (25)	491 (25)	0.759
Cerebrovascular accident, n (%)	201(29)	409 (21)	<0.001
Liver disease, n(%)	29 (4)	88 (4)	0.914
Renal disease, n (%)	98 (14)	283 (14)	1.000
<b>Number of comorbidities, n (%)</b>			
0	103 (14.8)	463 (23.2)	<0.001
1	260 (37.5)	695 (34.8)	
2	211 (30.4)	518 (26.0)	
3	88 (12.7)	219 (11.0)	
4	24 (3.5)	75 (3.8)	
5	6 (1.9)	24 (1.2)	
6	1 (0.1)	1 (0.1)	
Cancer, n (%)	97 (14)	270 (14)	0.749
History of hospitalization for CAP in prior year, n(%)	55 (8)	168 (8)	0.749
<b>Admission data</b>			
Season of admission, n(%)			
Winter, n(%)	549 (32)	182 (33)	
Spring, n(%)	495 (29)	313 (32)	
Summer, n(%)	330 (19)	151 (16)	
Fall, n (%)	350 (20)	318 (19)	0.047
<b>Etiology</b>			
S.pneumoniae Identified, n (%)	46 (7)	233 (12)	<0.001

**CONCLUSIONS**

- This study indicates that PPV-23 is an effective vaccine for the prevention of hospitalization due to Sp CAP in the elderly.
- Our data support the current CDC recommendation of offering a series of pneumococcal vaccines (PPV-23 + PCV-13) to all elderly patients<sup>3,4,5</sup>.
- Efforts dedicated to prevention of pneumococcal pneumonia are needed to prevent pneumonia-related hospitalization in the elderly population.

**REFERENCES**

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