# Do cardiovascular risk factors predict cardiovascular events in patients with community-acquired pneumonia (CAP)

Lysbeth Perez, Younes Aljohmani, Yohan Diaz Zuniga, Joannis Baez Gonzalez, Maribel Medina Teron, Brian Guinn, Raul Nakamatsu, Forest Arnold, Paula Peyrani

University of Louisville, School of Medicine, Division of Infectious Diseases

SCHOOL OF MEDICINE — DIVISION OF INFECTIOUS DISEASES

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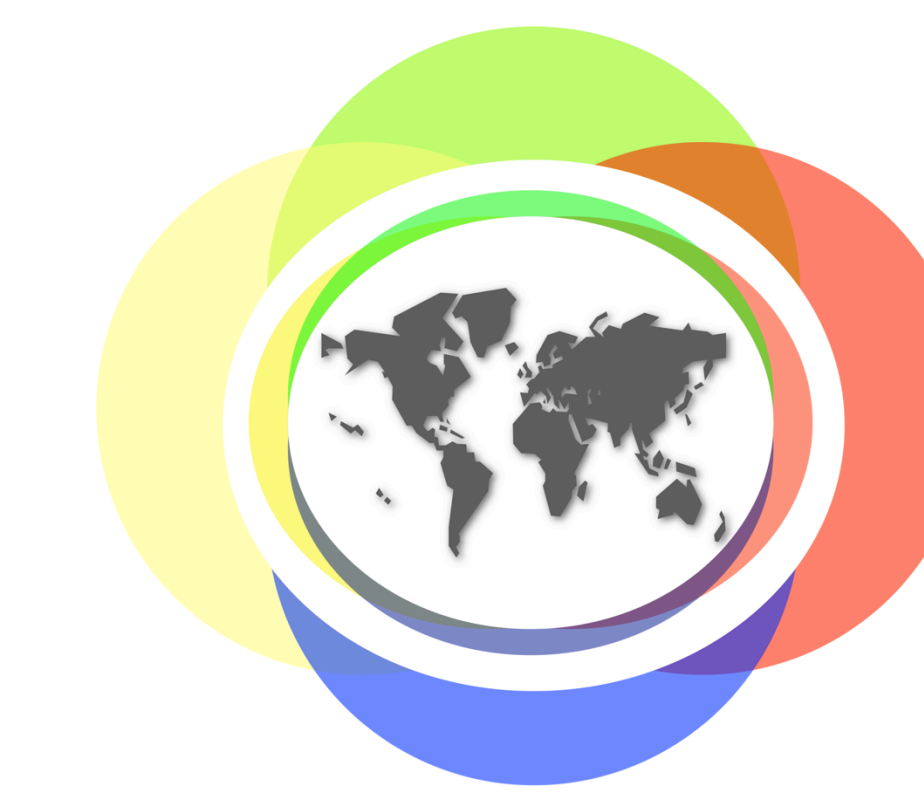
ABSTRACT

Introduction
The literature indicates that hospitalized patients with CAP have increased risk for cardiovascular events. In an attempt to identify patients for preventive therapy, it is necessary to define what patients are at high risk for these events. It is unclear if risk factors for cardiovascular events in the general population can be used to predict cardiovascular events in hospitalized patients with CAP.
The objective of this study was to evaluate the association between risk factors for cardiovascular events and the development of cardiovascular events in hospitalized patients with CAP.

Methods
This was a secondary data analysis of the Community-Acquired Pneumonia Organization (CAPO) International Cohort Study database. Seven cardiovascular risk factors were evaluated: family history for coronary artery disease, history of coronary artery disease, hypertension, hyperlipidemia, prior myocardial infarction, prior PTCA/CABG, and atrial fibrillation. The following cardiovascular events after hospitalization were evaluated: new cardiac arrhythmia, deterioration of old cardiac arrhythmia, pulmonary edema, acute myocardial infarction, cerebrovascular accident and pulmonary embolism.

Results
A total of 3,335 patients were included in the analysis, 1,418 with risk factors and 1,917 without. The presence of risk factors for cardiovascular events was significantly associated with the development of new cardiac arrhythmia, acute myocardial infarction, and pulmonary edema (P<0.01 for each).

Conclusions
This study indicates that the presence of risk factors for cardiovascular events can be used to predict some of the most common cardiovascular events in hospitalized patients with CAP. Patients with risk factors for cardiovascular events should be candidates for early preventive strategies.

INTRODUCTION

Community-acquired pneumonia (CAP) is a common condition and accounts for a significant amount of mortality and morbidity. CAP affects >5 million adults each year in the United States.[1] The literature indicates that hospitalized patients with CAP have increased risk for cardiovascular events.[2] Multiple studies have demonstrated that respiratory tract infections are associated with and increased risk for the development of an acute cardiac event (ACE).[3-6] CAP and cardiac diseases are mutually aggravating conditions. There is a surge of interest in the association between major cardiac conditions and CAP.

Different medications are currently used in patients with significant risks for cardiovascular events. Statins, one of medications most commonly prescribed, are known to reduce activation and recruitment of neutrophils to the lungs.[7] In an attempt to identify hospitalized patients with CAP for preventive therapy, it is necessary to define what patients are at high risk for these events. It is unclear if risk factors for cardiovascular events in the general population can be used to predict cardiovascular events in hospitalized patients with CAP.

The objective of this study was to evaluate the association between risk factors for cardiovascular events and the development of cardiovascular events in hospitalized patients with CAP.

METHODS

This was a secondary data analysis of the Community-Acquired Pneumonia Organization (CAPO) International Cohort Study database. 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). 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 criteria A, B, and C:

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

A. 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/mm3, left shift > 10% band forms/microliter, or leukopenia < 4,000 cells/mm^3

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

Study Groups

Patients were classified into the two study groups based on the presence of risk factors for cardiovascular events.
Seven cardiovascular risk factors were evaluated: family history for coronary artery disease, history of coronary artery disease, hypertension, hyperlipidemia, prior myocardial infarction, prior PTCA/CABG, and atrial fibrillation. The following cardiovascular events after hospitalization were evaluated: new cardiac arrhythmia (N-CA), deterioration of old cardiac arrhythmia (O-CA), pulmonary edema (E), acute myocardial infarction (AMI), cerebrovascular accident (CVA) and pulmonary embolism (PE).

Statistical Analysis

The statistical evaluation of our data utilized two primary methods. Evaluation of associations between categorical data was performed using Pearson's chi-square test. When appropriate, Fischer's exact test was used. To evaluate differences between two continuous variables the Mann-Whitney U-test was performed. All data were analyzed in R v.3.1.1 (R Foundation for Statistical Computing, Vienna, Austria). For the purposes of our research a P-value of ≤ 0.05 was considered statistically significant.

RESULTS

- A total of 3,335 patients were included in the analysis
  - 1,418 with risk factors and 1,917 without.
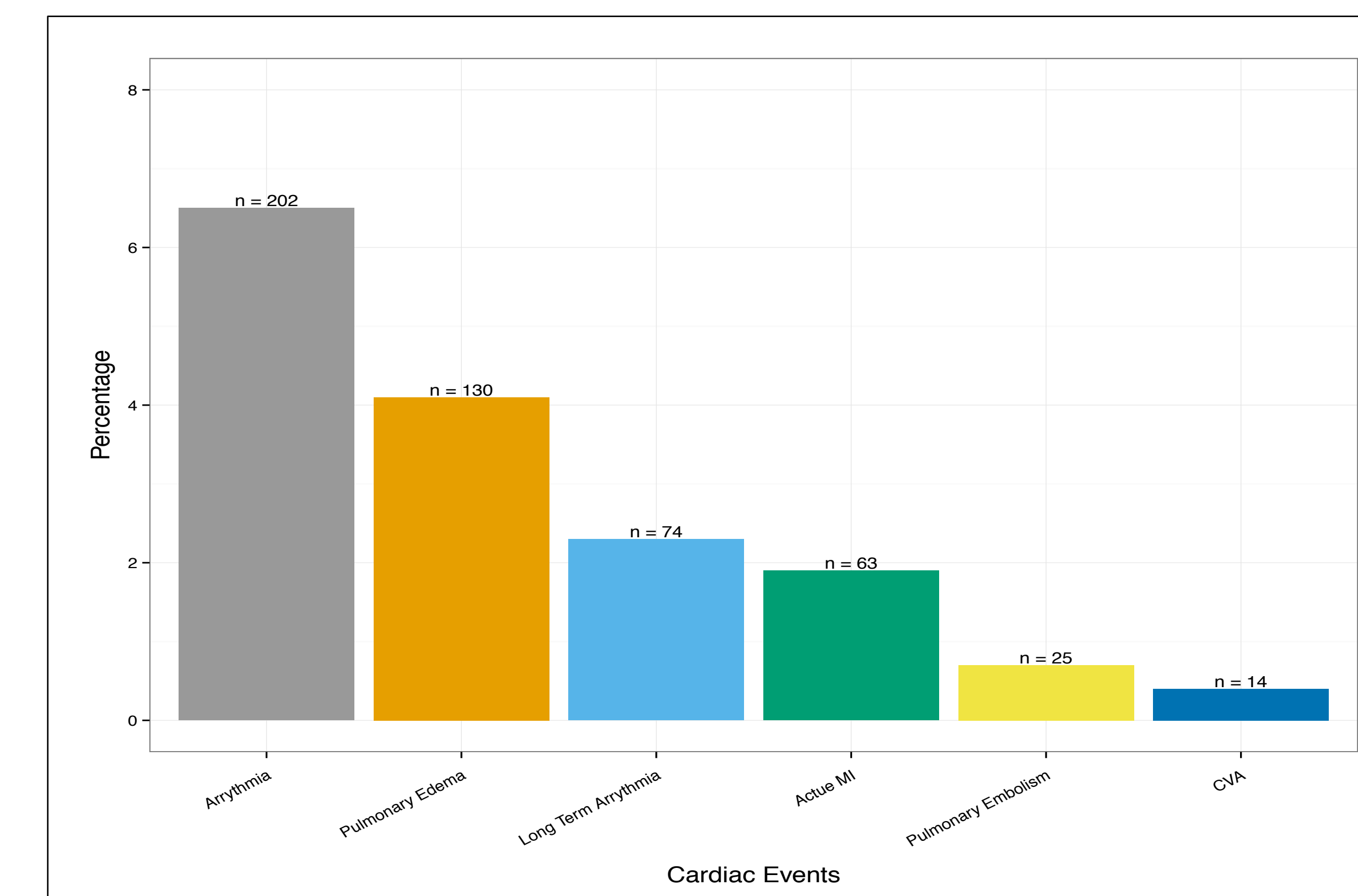- Patients' characteristics are shown in Table 1.
- The most common cardiovascular events found in hospitalized patients with pneumonia are shown in Figure 1.
- The association between the presence of risk factors for cardiovascular events and each individual cardiovascular event is shown in table 2.

Table 1: Patients' baseline characteristics

Variables	Cardiovascular RF (+) n = 1418	Cardiovascular RF (-) n = 1917	P-value
Demographics			
Age, Median (IQR)	76 (18)	56 (35)	<0.001
Nursing Home, n (%)	102 (7)	85 (4)	0.001
Sex, n (%)	871 (61)	1073 (56)	0.002
Comorbidities			
Diabetes Mellitus, n (%)	388 (27)	218 (11)	<0.001
CHF, n (%)	355 (25)	161 (8)	<0.001
Cardiovascular Meds, n (%)	1137 (80)	114 (6)	<0.001
Antiplatelet Meds, n (%)	568 (40)	70 (4)	<0.001
HIV, n (%)	20 (1)	262 (14)	<0.001
Cancer, n (%)	196 (14)	170 (9)	<0.001
COPD, n (%)	426 (30)	329 (17)	<0.001
Renal Disease, n (%)	186 (13)	121 (6)	<0.001
Liver Disease, n (%)	83 (6)	127 (7)	0.387
Physical Examination			
Temperature, Median (IQR)	37.5 (1.7)	37.8 (1.6)	<0.001
Systolic Blood Pressure, Median (IQR)	130 (37)	120 (32)	<0.001
Respiratory Rate, Median (IQR)	22 (10)	22 (10)	0.012
Altered Mental Status, n (%)	175 (13)	289 (15)	0.029
Labs / Radiography			
Hematocrit, Median (IQR)	38 (7.5)	38 (8)	<0.001
Pleural Effusion, n (%)	57 (92)	60 (88)	<0.001
BUN, Median (IQR)	37 (35)	28 (28)	<0.001
Glucose, Median (IQR)	128 (61)	114 (43)	0.029
Sodium , Median (IQR)	137 (6)	136 (5)	0.056
PAO2 (ABG), Median (IQR)	60 (18.2)	64 (22)	0.069
Ph. (ABG), Median (IQR)	7.4 (0.1)	7.5 (0.1)	0.566
Severity of Disease			
Pneumonia Severity Index, Median (IQR)	132 (43)	105 (55)	<0.001
Admitted to ICU, n (%)	160 (11)	315 (16)	<0.001

RESULTS

Table 2: Association between the presence of risk factors for cardiovascular events and each individual cardiovascular event

Variables	Cardiovascular RF (+) n = 1418	Cardiovascular RF (-) n = 1917	P-value
Cardiovascular Events			
Cardiac Arrhythmia, n (%)	142 (10)	60 (3)	<0.001
Acute Myocardial Infarction, n (%)	40 (3)	23 (1)	0.001
Pulmonary Edema, n (%)	70 (5)	60 (3)	0.011
Long-term Arrhythmia, n (%)	24 (2)	50 (3)	0.075
CVA, n (%)	7 (1)	7 (0)	0.598
Pulmonary Embolism, n (%)	11 (1)	14 (1)	1

CONCLUSIONS

- This study indicates that the presence of risk factors for cardiovascular events can be used to predict some of the most common cardiovascular events in hospitalized patients with CAP.

- Patients with risk factors for cardiovascular events should be candidates for early preventive strategies.

- In the field of clinical research patients with risk factors for cardiovascular events may be candidates to participate in clinical studies for new interventions.

- In clinical practice several medications are currently used to prevent cardiovascular events in the general population. Some of these medications may be appropriate to use in hospitalized patients with CAP.

- A recent randomized trial indicated that aspirin prevents the development of cardiovascular events in patients with pneumonia[8]. The regular use of aspirin in hospitalized patients with risk factors for cardiovascular events may improve outcomes of hospitalized patients with CAP.

Figure 1 Most common cardiovascular events found in hospitalized patients with pneumonia

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