ERJ Express. Published on April 12, 2006 as doi: 10.1183/09031936.06.00131905

COPD is associated with increased mortality in patients with community-acquired pneumonia

Marcos I. Restrepo, MD, MSc; Eric M. Mortensen, MD, MSc; Jacqueline A. Pugh, MD; Antonio Anzueto, MD

From the VERDICT, Audie L Murphy VA Hospital (EMM, MIR, and JAP), the University of Texas Health Science Center at San Antonio, Divisions of General Medicine (EMM and JAP) and Pulmonary and Critical Care Medicine (MIR and AA).

Corresponding author: Marcos I. Restrepo, MD, MSc. VERDICT (11C6) at the South Texas Veterans Health Care System Audie L. Murphy division at San Antonio. 7400 Merton Minter Boulevard ; San Antonio Texas, 78284 or Email: restrepom@uthscsa.edu. Phone: (210)-617-5300 ext. 5314; Fax: (210) 567-4423;

Running head: **COPD is a predictor of mortality in pneumonia**

Descriptor: Community-acquired pneumonia

Body Word count: 2878

Dr. Mortensen was supported by Howard Hughes Medical Institute faculty-start up grant 00378-001 and a Department of Veteran Affairs Veterans Integrated Service Network 17 new faculty grant. Dr. Pugh was supported by Department of Veteran Affairs grant HFP98-002.
The views expressed in this article are those of the authors and do not necessarily represent the views of the Department of Veterans Affairs.

ABSTRACT

Patients with chronic obstructive pulmonary disease (COPD) that develop community-acquired pneumonia (CAP) may have worse clinical outcomes. However COPD is not included as a distinct diagnosis in validated instruments that predict mortality in patients with CAP. Our aim was to evaluate the impact of COPD as a co-morbid condition on 30- or 90- day mortality in CAP patients.

A retrospective, observational study was conducted at two hospitals. Eligible patients had a discharge diagnosis and radiologic confirmation of CAP.

In 744 patients with CAP, 215 patients had a co-morbid diagnosis of COPD and 529 did not have COPD. The COPD group had a higher mean pneumonia severity index score (PSI, 105±32 vs. 87±34; p=0.05), and were admitted to the intensive care unit more frequently (25% vs. 18%; p=0.04). After adjusting for severity of disease and processes of care, CAP patients with COPD had significantly higher 30-day mortality (hazard ratio = 1.32, 95% confidence interval 1.01-1.74) and 90-day mortality (hazard ratio = 1.34, 95% confidence interval 1.02-1.76) versus non-COPD patients.

COPD patients hospitalized with CAP had higher 30- and 90- day mortality when compared to patients without COPD. COPD should be evaluated for inclusion CAP prediction instruments.

Word count: 195

Key words: Community-acquired pneumonia, chronic obstructive pulmonary disease, mortality

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is currently the 5th leading cause of death, while community-acquired pneumonia (CAP) is the 7th leading cause of overall death and first leading cause of infectious death in the United States (1, 2). COPD alone affects about 20 million Americans, and is one of the most frequently reported co-morbid conditions in CAP patients (3-6). Despite COPD being one of the most frequent co-morbid conditions and a risk factor to develop pneumonia, it has not been shown to be a risk factor for mortality in CAP patients (6-9). The well validated prediction rule developed as part of the Pneumonia Outcomes Research Team (PORT) cohort study that evaluated 30-day mortality in patients with CAP excluded chronic pulmonary disease as risk factor (10). The prediction rule was based on 20 variables that included five co-morbid illnesses (cardiovascular, history of malignancy, cerebrovascular, renal, and liver diseases) (10, 11). In addition, Fine et al. published a meta-analysis related to the prognosis and outcomes in CAP patients, and found that patients with pulmonary diseases, including COPD, asthma and interstitial lung disease did not have higher mortality (6). However, in previous research (PORT studies and the meta-analysis), the diagnosis of COPD was combined with asthma and interstitial lung diseases, which might be inaccurate knowing that these conditions have different natural histories, which may bias the overall impact of COPD on CAP morbidity and mortality (6). Therefore, we are unaware of any studies that specifically evaluated the association of mortality in hospitalized CAP patients with COPD only as chronic pulmonary disease and excluding asthma and interstitial lung disease.

The purpose of this study was to examine if the co-morbid condition of COPD is a predictor for increased mortality in patients hospitalized for CAP. We hypothesized that COPD patients with CAP will have a higher mortality than patients with CAP without COPD.

METHODS

This is a retrospective cohort study of hospitalized CAP patients at two academic teaching tertiary care hospitals in San Antonio, Texas. The Institutional Review Board of the University of Texas Health Science Center at San Antonio approved the research protocol with exempt status.

Study Sites/Inclusion and Exclusion Criteria

We identified all patients admitted to the study hospitals between January 1, 1999 and December 1, 2002 with a primary discharge diagnosis of pneumonia (ICD-9 codes 480.0-483.99 or 485-487.0) or secondary discharge diagnosis of pneumonia with a primary diagnosis of respiratory failure (518.81) or sepsis (038.xx). Patients were included in this study if they were: 1) $\geq$ 18 years of age, 2) had an admission diagnosis of CAP, 3) a chest x-ray or chest computerized tomography within 24 hours of admission with findings that were consistent with CAP.

Exclusion criteria included 1) discharged from an acute care facility within 14 days of admission, 2) transfer after being admitted to another acute care hospital, 3) HIV/AIDS and 4) having "comfort measures only" status during the admission. If a subject was admitted more than once during the study period, only the first hospitalization was abstracted.

Definition of COPD

We based the definition of COPD on baseline clinical data obtained by chart review. Due to the absence of pulmonary function tests, terms including "chronic obstructive pulmonary disease, emphysema, and chronic bronchitis" were used as a proxy measures for COPD. Missing values

or data were assumed to be normal and to not have COPD. This strategy is widely used in the application of prognostic prediction rules and reflects the methods used in the original Pneumonia Severity Index (PSI) score studies (10, 12).

The primary outcomes were 30- and 90-day mortality, and secondary outcomes were length of hospital stay, need for intensive care unit (ICU) admission, and need for mechanical ventilation. We included both 30- and 90-day mortality, respectively to differentiate between the proportion of deaths attributable to pneumonia (30-day) and to other causes (90-day) (13).

Mortality was assessed using information from the Texas Department of Health and Department of Veteran Affairs clinical database. Mortality status was assessed through December 2002.

Data Abstraction

Chart review data included: demographics, co-morbid conditions, physical examination findings, laboratory data, and chest radiographic reports. Co-morbid conditions were identified from either the admission note or the chart problem list. In addition, data on important processes of care measures for patients hospitalized with CAP were also abstracted: timing of first dose of antibiotics, collection of blood cultures prior to antibiotic administration, and obtaining blood cultures and oxygen saturation measurement within 24 hours of presentation (23, 24). Antimicrobial therapy was considered guideline-concordant if it agreed with either the 2003 Infectious Diseases Society of America or 2001 American Thoracic Society (ATS) guidelines (23, 24). Information on outpatient corticosteroid use was recorded from either the admission note or the electronic medical record.

Diagnostic criteria

Microbiologic data results were reviewed, and a microbiologic cause was assigned independently by 2 of the principal investigators (M.I.R. and E.M.M.). The cause of pneumonia was stratified as definitive or presumptive. A definitive diagnosis was considered to present if one of the following conditions were met: (1) positive blood cultures for bacterial or fungal pathogens (in the absence of an extrapulmonary source of infection); (2) pleural fluid cultures yielding a bacterial pathogen; (3) endotracheal aspirates with moderate or heavy growth of bacterial pathogens; (4) significant quantitative culture growth from bronchoscopic respiratory samples (in protected specimen brush cultures of at least 10^3 cfu/mL, and in bronchoalveolar lavage of at least 10^4 cfu/mL). In addition, a presumptive diagnosis was made if qualitative valid sputum

sample yielded one or more predominant bacterial pathogens. Definitive and presumptive causes were combined for reporting purposes. When two or more microbiologic causes were present, the cause was classified as polymicrobial pathogens. A patient was considered to have CAP of unknown cause if no diagnostic tests were performed, or tests were performed but test results did not meet criteria for assigning a microbiologic cause (including a contaminant pathogen).

Risk Adjustment

The pneumonia severity index (PSI) was used to assess severity of illness at presentation. The PSI is a validated prediction rule for 30-day mortality in patients with CAP (10). This rule was based on three demographic characteristics, five co-morbid illnesses, five physical examination findings, and seven laboratory and radiographic findings from the time of presentation. Patients were classified into five risk classes with 30-day mortality ranging from 0.1% for Class I to 27% for Class V for patients enrolled in the PORT cohort study (10).

Statistical Analyses

Univariate statistics were used to test the association of demographic and clinical characteristics with all-cause 30- and 90-day mortality. Categorical variables were analyzed using the Chi-square test and continuous variables were analyzed using Student's t-test.

We used two Cox proportional hazard models to estimate, and graph, the baseline survivor functions with either 30- or 90-day mortality as the dependent variable (14). We included variables in the survival analysis if they were either previously demonstrated to be associated with CAP-related outcomes (e.g. PSI and processes of care) (10) or had a p-value < 0.10 in the

univariate analyses. History of COPD was entered as an independent, dichotomized variable into the model, and we used the PSI score as the risk adjustment tool (10). In addition, we used the process of care measures (initial antibiotics within 4 hours; obtaining blood cultures prior to initial dose of antibiotics, and whether antimicrobial therapy was guideline concordant) as potential confounding variables. All analyses were performed using SPSS version 13.0 for Windows.

Results

744 patients with an admission diagnosis of CAP were identified. Two hundred and fifteen patients had the concomitant clinical diagnosis of COPD, compared to 529 patients who did not have COPD.

Patient Characteristics

The cohort consisted of 582 (78%) men and 162 (22%) women. Their mean age (± standard deviation) was 61 years (± 16), with a range of 18 to 105 years. Eighty three percent of the patients were admitted through the emergency department from their own home and seven percent from a nursing home. One hundred and twenty eight (17%) patients had received outpatient antibiotic therapy prior to admission (Table 1).

One or more concomitant co-morbid medical conditions were present in 635 (85%) patients. The most frequently associated conditions were congestive heart failure (123 patients) and a prior history of stroke (105 patients). No known prior significant medical disorders existed in 109 (15%) patients. CAP patients with COPD were significantly more likely to be older men, admitted from a nursing home and placed in the ICU within 24 hours of admission (Table 1). In addition, COPD patients with CAP had higher rates of congestive heart failure and history of neoplastic disease. Physical examination and laboratory/radiological data demonstrated that CAP patients with COPD were significantly more likely to be tachypneic, acidotic and hypoxemic, but less likely to have hyperglycemia compared to non-COPD patients. COPD patients used inhaled corticosteroids more frequently however used similar amounts of systemic steroids compared to patients without COPD (Table 1).

Administration of antibiotics within 4 hours (35% vs. 26%, p=0.02) was more commonly performed in COPD patients. However, COPD patients had other processes of care less commonly performed, including collection of appropriate blood cultures prior to antibiotics and in the first 24 hours (70% vs. 77%, p=0.04), and a tendency to have received antimicrobial therapy not concordant with the recommendation from national guidelines (74% vs. 80%, p=0.05). There were no statistically significant differences in the rate of oxygenation status assessment.

Pneumonia Etiology (Table 2)

An etiologic diagnosis could not be obtained in 77% of the cohort. A microbiologic diagnosis was assigned in 172 patients (23%) with identified microorganisms from cultures of the blood and/or sputum. Diagnosis was established by a positive blood culture in 63 (8.5%) patients. Bacteremia was present in 53 (10.0%) hospitalized CAP patients without COPD and 10 (4.6%) patients with COPD. The organisms most frequently involved were *Streptococcus pneumoniae* (56 cases), and *Staphylococcus aureus* (39 cases). Hospitalized CAP patients with COPD had more infections attributable to *P. aeruginosa*, a trend of higher rates of *H. influenzae*, but less *S. aureus* than patients without COPD (Table 2). However, there were no other statistically significant differences between other pathogens in either group.

Clinical Outcomes

For this study cohort the median length of stay was longer by 2 days in COPD versus non-COPD patients (7 +/- 8 vs. 9 +/- 25; p=0.05). Overall 30- and 90-day mortality was 10% and 14%,

respectively. Unadjusted mortality was lower for non-COPD patients compared to COPD patients: 30-day 8.7% vs. 10.6% (p=0.4); 90-day 11.7% vs. 18.6% (p=0.013). Mean PSI score were significantly higher for COPD patients than for CAP patients without COPD (105 +/-32 vs. 87 +/-34; p=0.05). One hundred and forty eight (20%) patients were admitted to the ICU and 83 (14%) required mechanical ventilation. When comparing COPD and non-COPD patients, the proportion of patients that required hospitalization in the ICU was higher in COPD patients, but the percentage needing mechanical ventilation was not (Table 3). There were no differences in mortality within 30- or 90-days for CAP patients with COPD that needed ICU admission, received mechanical ventilation or were bacteremic (Table 3). In addition, CAP patients with COPD receiving any form of corticosteroids, whether inhaled or systemic did not have any significant differences in 30- or 90-day mortality as compared to non-COPD patients (Table 3).

In the Cox proportional hazard model after adjusting for potential confounders including processes of care and severity of illness, patients with a history of COPD had significantly increased 30-day (hazard ratio [HR] 1.32, 95% confidence interval [CI] 1.01-1.74) and 90-day (HR = 1.34, 95% CI 1.02-1.76) mortality. The Cox survival curve shows the difference in mortality from the initiation of the hospitalization to 30 and 90 days for patients with and without COPD (Figure 1).

Discussion

In this study we found that COPD patients hospitalized with CAP, as compared to patients without COPD, have significantly higher 30- and 90-day mortality. In addition, hospitalized CAP patients with COPD have significantly higher rates of ICU admission and a longer length of hospital stay as compared to those without COPD. These data confirm that COPD should be considered for inclusion as a co-morbid condition for pneumonia severity of illness measures.

COPD is considered a risk factor for the development of CAP and previous studies of CAP including outpatient, inpatient, and ICU cohorts have shown that COPD is a frequently reported co-morbid condition (3, 4, 9, 15-20). However, COPD has not been previously identified as to be a risk factor for mortality in CAP patients (6-9). Our study showed that hospitalized CAP patients with COPD have a higher mortality at 30- and 90-days as compared to patients without CAP. We feel that we found this difference by examining only patients with COPD, and excluding other pulmonary conditions including asthma, bronchiectasis, and interstitial lung disease. Therefore we were able to examine the impact of COPD without dealing with other potential confounding pulmonary conditions. Torres and colleagues showed in a large Spanish multicenter study an in-hospital mortality rate of 8% in cohort of 124 CAP patients with COPD (21). However, the main difference compared to our study, was the lack of a comparison group of CAP patients without COPD, which limited their ability to compare clinical outcomes.

There were important differences in COPD versus non-COPD patients, which include being older men, more admissions from a nursing homes and requiring ICU within 24 hours of admission. In addition, COPD patients with CAP were more tachypneic, acidotic, and

hypoxemic. All of these variables are also included in the PSI score, the severity of illness predictor used in our study (10). The PSI score uses five co-morbid illnesses (cardiovascular, history of malignancy, cerebrovascular, renal, and liver diseases), but does not include COPD as one of them (10).

We expected that COPD patients hospitalized with CAP, that had higher PSI scores, rates of ICU admission, and a longer length of stay in the hospital will also have a higher mortality. One of the possible explanations is the PSI score does not completely adjust for all the abnormalities that are common in COPD patients. In addition, the ability to accurately predict medical outcomes in CAP influences patient management decisions made by physicians. These include the decision to hospitalize the patient, the length of inpatient care if the patient is hospitalized, the choice of antimicrobial or other types of immediate therapies. The choice of appropriate empiric antibiotic regimens will depend on several factors that include the etiology of CAP.

Our results showed that hospitalized CAP patients with COPD had more infections attributable to *P. aeruginosa*. Other studies found that *P. aeruginosa* is an important pathogen in patients with pulmonary co-morbidities, specially those with bronchiectasis (3, 21, 22). Our data showed that, *P. aeruginosa* was the second most common organism in patients with COPD, therefore appropriate anti-pseudomonas coverage should be considered in patients with COPD, whether or not bronchiectasis is present. Our data supports the Infectious Diseases Society of America (23) and the American Thoracic Society (24) clinical practice treatment guidelines which recommends stratifying patients based on the presence of coexisting cardiopulmonary disease (COPD and congestive heart failure) to select an appropriate antimicrobial agent. Therefore, it is

important to recognize COPD in patients with CAP so that they may receive appropriate antimicrobial therapy.

Our study has several limitations that are important to acknowledge. First, it was a retrospective cohort study, and inherent problems related to this design include ascertainment and selection bias. However we do not feel that this study has significant problems with either bias due to our methods using admission and discharge diagnosis ICD-9 codes to identify patients and the fact that we encountered only a small amount of missing data. Furthermore, we were able to verify that all the patients had a radiological diagnosis of CAP. Second, our sample was predominantly male since one of our sites was a VA hospital and we are unable to examine whether females with COPD and CAP may have a different clinical course, or outcomes, as compared to males. Third, unfortunately we do not have information on serological studies including Legionella urinary antigen. Fourth, patients were also identified as having COPD by medical history which has been demonstrated in past studies to be the same method to identify other co-morbid conditions included to create the PSI score (6, 10, 21, 25, 26). However, we were unable to collect data regarding pulmonary function tests or COPD disease severity. Pulmonary function data could be helpful in predicting which patients with COPD might have the highest morbidity and mortality when they develop CAP.

In conclusion this study demonstrates significantly higher 30- and 90-day mortality, increased length of stay and ICU admission in COPD patients for hospitalized CAP as compared to patients without COPD. These findings have implications on how to evaluate patients with CAP and COPD, and to decide which antimicrobial agents should be used as initial empiric therapy.

Further prospective cohort studies are warranted to determine the impact of COPD severity (confirmed by pulmonary function tests) and the use of anti-pseudomonal antibiotics on clinical outcomes for COPD patients with CAP.

Acknowledgments

The authors appreciate the assistance of Dr. Antonio Torres in preparing the manuscript, and editorial support.

References

1. Mannino DM, Homa DM, Akinbami LJ, Ford ES, Redd SC. Chronic obstructive pulmonary disease surveillance--United States, 1971-2000. *MMWR Morb Mortal Wkly Rep* 2002;51:1-16.
2. Anonymous. Update: influenza activity--United States and worldwide, 1999-2000 season, and composition of the 2000-01 influenza vaccine. *MMWR Morb Mortal Wkly Rep*. 2000;49:375-81.
3. Ruiz M, Ewig S, Marcos MA, Martinez JA, Arancibia F, Mensa J, Torres A. Etiology of community-acquired pneumonia: impact of age, comorbidity, and severity. *Am J Respir Crit Care Med* 1999;160:397-405.
4. Farr BM, Bartlett CL, Wadsworth J, Miller DL. Risk factors for community-acquired pneumonia diagnosed upon hospital admission. British Thoracic Society Pneumonia Study Group. *Respir Med* 2000;94:954-63.
5. Farr BM, Sloman AJ, Fisch MJ. Predicting death in patients hospitalized for community-acquired pneumonia. *Ann Intern Med* 1991;115:428-36.
6. Fine MJ, Smith MA, Carson CA, Mutha SS, Sankey SS, Weissfeld LA, Kapoor WN. Prognosis and outcomes of patients with community-acquired pneumonia. A meta-analysis. *JAMA* 1996;275:134-41.
7. Feldman C, Viljoen E, Morar R, Richards G, Sawyer L, Goolam Mahomed A. Prognostic factors in severe community-acquired pneumonia in patients without co-morbid illness. *Respirology* 2001;6:323-30.

8. Community-acquired pneumonia in adults in British hospitals in 1982-1983: a survey of aetiology, mortality, prognostic factors and outcome. The British Thoracic Society and the Public Health Laboratory Service. *Q J Med* 1987;62:195-220.

9. Fine MJ, Orloff JJ, Arisumi D, Fang GD, Arena VC, Hanusa BH, Yu VL, Singer DE, Kapoor WN. Prognosis of patients hospitalized with community-acquired pneumonia. *Am J Med* 1990;88:1N-8N.

10. Fine MJ, Auble TE, Yealy DM, Hanusa BH, Weissfeld LA, Singer DE, Coley CM, Marrie TJ, Kapoor WN. A prediction rule to identify low-risk patients with community-acquired pneumonia. *N Engl J Med* 1997;336:243-50.

11. Metlay JP, Fine MJ. Testing strategies in the initial management of patients with community-acquired pneumonia. *Ann Intern Med* 2003;138:109-18.

12. Fine MJ, Singer DE, Hanusa BH, Lave JR, Kapoor WN. Validation of a pneumonia prognostic index using the MedisGroups Comparative Hospital Database. *Am J Med* 1993;94:153-9.

13. Moroney JF, Fiore AE, Harrison LH, Patterson JE, Farley MM, Jorgensen JH, Phelan M, Facklam RR, Cetron MS, Breiman RF, et al. Clinical outcomes of bacteremic pneumococcal pneumonia in the era of antibiotic resistance. *Clin Infect Dis* 2001;33:797-805.

14. Lee ET, Wang JW. Statistical methods for survival data analysis. Wiley series in probability and statistics; 2003.

15. Almirall J, Bolibar I, Balanzo X, Gonzalez CA. Risk factors for community-acquired pneumonia in adults: a population-based case-control study. *Eur Respir J* 1999;13:349-55.

16. Almirall J, Mesalles E, Klamburg J, Parra O, Agudo A. Prognostic factors of pneumonia requiring admission to the intensive care unit. *Chest* 1995;107:511-6.

17. Torres A, Serra-Batlles J, Ferrer A, Jimenez P, Celis R, Cobo E, Rodriguez-Roisin R. Severe community-acquired pneumonia. Epidemiology and prognostic factors. *Am Rev Respir Dis* 1991;144:312-8.

18. Garcia-Ordonez MA, Garcia-Jimenez JM, Paez F, Alvarez F, Poyato B, Franquelo M, Colmenero JD, Juarez C. Clinical aspects and prognostic factors in elderly patients hospitalised for community-acquired pneumonia. *Eur J Clin Microbiol Infect Dis* 2001;20:14-9.

19. Lim WS, Lewis S, Macfarlane JT. Severity prediction rules in community acquired pneumonia: a validation study. *Thorax* 2000;55:219-23.

20. Lim WS, van der Eerden MM, Laing R, Boersma WG, Karalus N, Town GI, Lewis SA, Macfarlane JT. Defining community acquired pneumonia severity on presentation to hospital: an international derivation and validation study. *Thorax* 2003;58:377-82.

21. Torres A, Dorca J, Zalacain R, Bello S, El-Ebiary M, Molinos L, Arevalo M, Blanquer J, Celis R, Iriberri M, et al. Community-acquired pneumonia in chronic obstructive pulmonary disease: a Spanish multicenter study. *Am J Respir Crit Care Med* 1996;154:1456-61.

22. Arancibia F, Bauer TT, Ewig S, Mensa J, Gonzalez J, Niederman MS, Torres A. Community-acquired pneumonia due to gram-negative bacteria and pseudomonas aeruginosa: incidence, risk, and prognosis. *Arch Intern Med* 2002;162:1849-58.

23. Mandell LA, Bartlett JG, Dowell SF, File TM, Jr., Musher DM, Whitney C. Update of practice guidelines for the management of community-acquired pneumonia in immunocompetent adults. *Clin Infect Dis* 2003;37:1405-33.

24. Niederman MS, Mandell LA, Anzueto A, Bass JB, Broughton WA, Campbell GD, Dean N, File T, Fine MJ, Gross PA, et al. Guidelines for the management of adults with community-acquired pneumonia. Diagnosis, assessment of severity, antimicrobial therapy, and prevention. *Am J Respir Crit Care Med* 2001;163:1730-54.

25. Menendez R, Torres A, Zalacain R, Aspa J, Martin Villasclaras JJ, Borderias L, Benitez Moya JM, Ruiz-Manzano J, Rodriguez de Castro F, Blanquer J, et al. Risk factors of treatment failure in community acquired pneumonia: implications for disease outcome. *Thorax* 2004;59:960-5.

26. Roson B, Carratala J, Fernandez-Sabe N, Tubau F, Manresa F, Gudiol F. Causes and factors associated with early failure in hospitalized patients with community-acquired pneumonia. *Arch Intern Med* 2004;164:502-8.

Figure Legend

Figure 1- Cox survival curve for the proportion of surviving hospitalized CAP patients by the presence of COPD after adjusting for other potential confounders.

Table 1- Subject Demographic and clinical characteristics by COPD diagnosis

Variable	non-COPD n= 529 No. (%)	COPD n= 215 No. (%)	p-value
Age, years +/- standard deviation	58.2 +/-16.5	69.4 +/-12.2	<0.001
Men	385 (73)	197 (92)	<0.001
Nursing home resident	31 (6)	22 (10)	0.04
Admitted through emergency department	483 (83)	180 (84)	NS
Admitted to the ICU	95 (18)	53 (25)	0.04
Needed mechanical ventilation	56 (10)	28 (13)	NS
Preexisting Comorbid Conditions			
Congestive heart failure	69 (13)	54 (25)	<0.001
History of stroke	72 (14)	33 (15)	NS
Chronic liver disease	62 (12)	21 (10)	NS
History of malignancy	43 (8)	35 (16)	0.002
Renal insufficiency	59 (11)	23 (11)	NS
Bronchiectasis	3 (0.6)	3 (1.4)	NS
History, Physical, Laboratory, and Radiographic Data			
Altered mental status	54 (10)	25 (12)	NS
Respiratory rate > 30 per minute	49 (10)	30 (14)	0.06
Systolic blood pressure < 90 mmHg	10 (2)	8 (4)	NS
Heart rate > 125 per minute	71 (13)	28 (13)	NS

Temperature < 95^{o} or > 104^{o}	13 (3)	6 (3)	NS
Arterial pH < 7.35	27 (5)	20 (9)	0.03
Arterial oxygenation saturation < 90%	104 (20)	66 (31)	0.001
Hematocrit < 30%	50 (10)	13 (6)	NS
Serum blood urea nitrogen > 30 mg/dL	118 (22)	41 (19)	NS
Serum glucose > 250 mg/dL	61 (11)	14 (6)	0.04
Serum sodium < 130 meq/L	81 (15)	27 (13)	NS
Pleural effusion on chest radiograph	132 (25)	49 (23)	NS
PSI, mean ($\pm$ SD)	87 +/-34	105 +/-32	0.05
Corticosteroids use	77 (15)	83 (39)	< 0.001
Oral steroids	48 (9)	26 (12)	NS
Inhaled steroids	32 (6)	70 (33)	< 0.001

***** NS is p value > 0.05; COPD: chronic obstructive pulmonary disease.

Table 2- Etiologic definition used for diagnosis of pneumonia in patients with COPD and non-COPD patients*

Microorganisms	non-COPD (n=529) No. (%)	COPD (n=215) No. (%)
Streptococcus pneumoniae	42 (7.3)	14 (6.5)
Staphylococcus aureus	32 (6.0)	7 (3.2)
Pseudomonas aeruginosa [a, b]	7 (1.3)	12 (5.6)
Haemophilus influenzae [c]	10 (1.9)	8 (3.7)
Enterobacteriacea [d]	13 (2.5)	4 (1.9)
Miscelaneous [e]	5 (0.9)	2 (0.9)
Other Gram-positive cocci [f]	4 (0.7)	0 (0)
Polymicrobial	6 (1.1)	6 (2.8)
All identified pathogens	119 (22.5)	53 (24.6)
• Test performed	469 (88.6)	182 (84.6)
• No test performed	60 (11.3)	33 (15.3)

* Percentages have been rounded and may not sum 100. Unless otherwise indicated, data are number (percentage) of patients. We did not performed statistical comparisons for enterobacteriacea, miscellaneous or other Gram positive cocci due to the small sample size.

[a] P value = 0.001

[b] All *P. aeruginosa* isolates ocurred in non-bronchiectatic patients.

[c] P value = 0.07

[d] Enterobacteriacea included *Escherichia coli*, *Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Proteus mirabilis.*

[e] Miscelaneous consists of *Acinetobacter* species, *Aspergillus* species, and *Haemophilus parainfluenzae*.

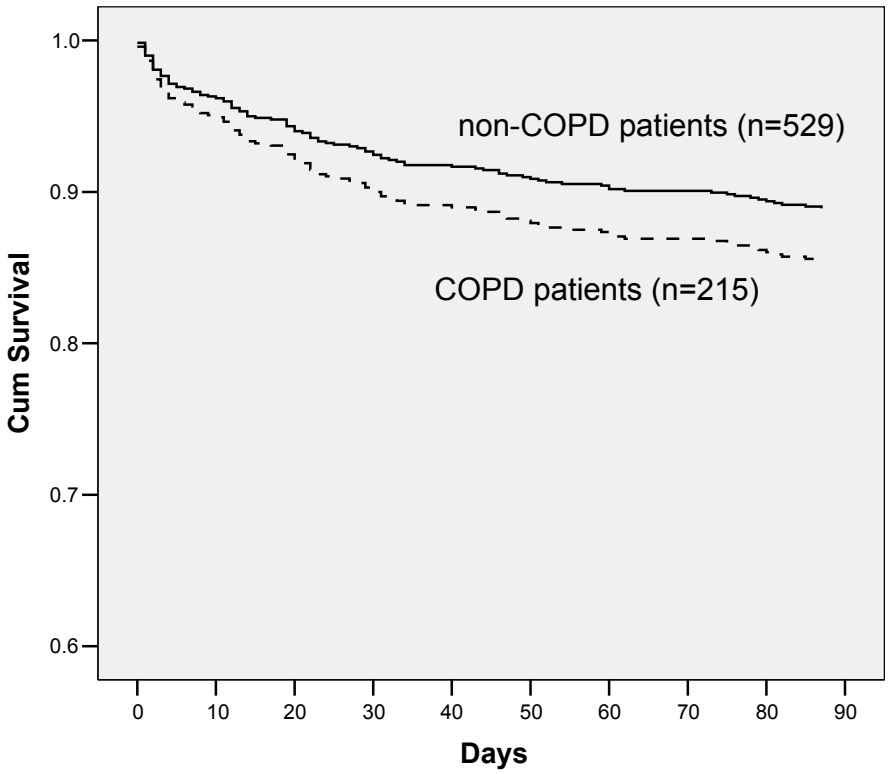
[f] Pathogens detected included *Enterococcus* species, and *Streptococcus* species.

Table 3- Comparison of 30- and 90-day mortality in the presence or absence of COPD in hospitalized patients with CAP*

		Mortality at 30 days			Mortality at 90 days		
Risk Class	**Number per class**	**non-COPD (n=529) %**	**COPD (n=215) %**	***P***	**non-COPD (n=529) %**	**COPD (n=215) %**	***P***
ICU admission	95	23/95 (24)	12/53 (23)	0.8	25/95 (26)	17/53 (32)	0.5
Mechanical ventilation	83	4/55 (7)	2/28 (7)	1.0	6/55 (11)	5/28 (18)	0.4
Bacteremic pneumonia	63	9/53 (17)	2/10 (20)	0.8	10/53 (19)	3/10 (30)	0.4
Any corticosteroids	160	5/77 (6)	7/83 (6)	0.6	8/77 (10)	16/83 (19)	0.3
Inhaled corticosteroids	102	2/32 (6)	6/70 (9)	0.7	4/32 (12)	13/70 (19)	0.4
Systemic corticosteroids	74	3/48 (6)	2/26 (8)	0.8	5/48 (10)	4/26 (15)	0.5

* ICU, intensive care unit; COPD, chronic obstructive pulmonary disease.

Figure 1.


1.0
0.9
0.8
0.7
0.6
Cum Survival
non-COPD patients (n=529)
COPD patients (n=215)
0
10
20
30
40
50
60
70
80
90
Days