

Discordance of physician clinical judgment vs. pneumonia severity index (PSI) score to admit patients with low risk community-acquired pneumonia: a prospective multicenter study

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Background: The relationship between clinical judgment and the pneumonia severity index (PSI) score in deciding the site of care for patients with community-acquired pneumonia (CAP) has not been well investigated. The objective of the study was to determine the clinical factors that influence decision-making to hospitalize low-risk patients (PSI ≤ 2) with CAP.

Methods: An observational, prospective, multicenter study of consecutive CAP patients was performed at five hospitals in Spain. Patients admitted with CAP and a PSI ≤ 2 were identified. Admitting physicians completed a patient-specific survey to identify the clinical factors influencing the decision to admit a patient. The reason for admission was categorized into 1 of 6 categories. We also assessed whether the reason for admission was associated with poorer clinical outcomes [intensive care unit (ICU) admission, 30-day mortality or readmission].

Results: One hundred and fifty-five hospitalized patients were enrolled. Two or more reasons for admission were seen in 94 patients (60.6%), including abnormal clinical test results (60%), signs of clinical deterioration (43.2%), comorbid conditions (28.4%), psychosocial factors (28.4%), suspected H1N1 pneumonia (20.6%), and recent visit to the emergency department (ED) in the past 2 weeks (7.7%). Signs of clinical deterioration and abnormal clinical test results were associated with poorer clinical outcomes ($P < 0.005$).

Conclusions: Low-risk patients with CAP and a PSI ≤ 2 are admitted to the hospital for multiple reasons. Abnormal clinical test results and signs of clinical deterioration are two specific reasons for admission that are associated with poorer clinical outcomes in low risk CAP patients.

Keywords: Community-acquired pneumonia (CAP); hospitalization; pneumonia severity index (PSI)

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Introduction

Community-acquired pneumonia (CAP) is a common disease and is associated with substantial morbidity, mortality and health care costs (1). Annual incidence of CAP admissions to hospitals has increased significantly in recent years (2). Annual spending for CAP hospital admissions exceeds \$8.4 billion in the United States (3), and hospitalization accounts for a substantive portion of the total health care expenditures (4,5). Several clinical practice guidelines have emerged recommending use of a validated severity of illness scores to guide clinical decision-making about inpatient versus outpatient treatment of CAP (6,7). The most commonly recommended severity of illness scores are the pneumonia severity index (PSI) score and the CURB-65 (6,8-11). However, despite these validated severity of illness scores, several cohort studies have reported 26–62% of low risk CAP patients (PSI ≤ 2 or CURB-65 ≤ 1) are admitted to the hospital (12-17). High health care resource utilization and incremental costs are driven by these low risk CAP patients (16,18-20).

Several studies have evaluated the reasons why clinicians do not rely solely on pneumonia severity of illness scores to determine inpatient *vs.* outpatient treatment for CAP patients (16,18,21,22). Previous studies have shown that clinical judgment plays an important role in decision-making because severity of illness scores do not capture all important clinical risk factors to determine that most appropriate site for treatment (11). However, previous studies (12,13,16,21) are limited by several factors: (I) retrospective design; (II) small sample size; (III) different severity of illness scores; (IV) influence of physician preferences; (V) local hospital practices; and (VI) active participation in an intervention trial (23-25).

The objective of our study is to determine the clinical factors that influence physician decision-making to hospitalize low-risk patients (PSI ≤ 2) with CAP in a multicenter, prospective cohort study. Additionally, we will assess if the reason for admission was associated with poorer clinical outcomes.

Methods

Study design

This is a multicenter, prospective cohort study of patients hospitalized with CAP. Five public hospitals from Spain participated in the study: (I) Hospital A Coruña, a 1,382-bed

teaching hospital serving a population of 514,466 people; (II) Complejo Hospitalario de Ourense, a 904-bed teaching hospital serving a population of 257,259; (III) Complejo Hospitalario de Pontevedra, a 622-bed community hospital serving a population of 225,499; (IV) Hospital del Bierzo, a 408-bed community hospital serving a population of ~150,000; and (V) Hospital do Barbanza, a 80-bed community hospital serving a population of 65,387. All patients signed an informed consent for entering into the study. The study protocol was approved by the Institutional Review Board (CEIC de Galicia #078/12).

Study population

Eligible subjects were patients hospitalized for CAP. Inclusion criteria were: (I) age >18 years; (II) diagnosis of CAP based on lower respiratory tract symptoms per guidelines (10); (III) pneumonia confirmed by chest radiograph within 24 h of admission; (IV) PSI score ≤ 2 indicative of low-severity CAP that should not require hospital admission per guidelines (6,7). Exclusion criteria were: (I) health-care associated pneumonia (26); and (II) admission for comfort care only. We excluded patients with health-care associated pneumonia due to important controversies surrounding this term and the risk of multi-drug resistant pathogens (27). If a patient had >1 admission during the study period, only the first hospitalization was included in the study.

Main objective and data collection

The main objective of our study was to determine the clinical factors that influence physician decision-making to hospitalize low-risk patients. During the study period, the standard approach to clinical decision-making about admission to the hospital was based solely on physician judgment without the use of pneumonia severity of illness scores, such as PSI or CURB-65. Research teams at each site assessed all patients admitted to the hospital with pneumonia from Monday to Friday. If a patient met all inclusion criteria, the principal investigator contacted the admitting physician within 24 hours of admission to collect data on the clinical factors that influenced decision-making to admit the patient despite the low severity of illness.

Data collected were: demographics, comorbidities, previous antibiotic treatment, oral intolerance, physical exam findings, arterial blood gas analysis, laboratory data,

and chest radiographs. Additional data collected from the medical record were inpatient antibiotic regimen(s), length of hospital stay, admission to the intensive care unit (ICU), and 30- and 90-day, mortality and readmissions. Oral intolerance was defined as inability to administer oral antibiotic therapy. The PSI and CURB-65 scores were calculated on admission. Another severity of illness tool like the SMART-COP (28) score was calculated after the study finished.

Reasons for admission were categorized into six principal categories with several subcategories (*Table S1*). The six main categories were: (I) psychosocial factors; (II) comorbid conditions; (III) signs of clinical deterioration findings; (IV) abnormal clinical test results; (V) repeat visit to the emergency department (ED) in the past 2 weeks; and (VI) other causes not included in other categories.

Clinical outcomes

We also wanted to see if there was a relationship between the specific reasons for admission and adverse events at 30 days (defined as a composite endpoint of ICU admission and 30-day readmission or death), hospital length of stay (LOS) and days of antibiotic therapy. Hospital LOS was calculated as the date of hospital discharge minus the date of hospital admission. Days of antibiotic therapy were calculated as the total number of days of inpatient treatment plus the total number of days of outpatient treatment prescribed at the time of hospital discharge.

Statistical analysis

Absolute numbers and percentages are summarized as categorical variables. Continuous variables are presented as means \pm standard deviation (SD) or medians and interquartile ranges (IQR) when non-normally distributed. A prior test for normality of data distribution, the Kolmogorov-Smirnov test, was performed. Chi-squared and Fisher's exact tests were employed to compare baseline data and reasons for admission with clinical outcomes. The composite outcome was defined as the dependent variable. The relationship between the composite outcome and those variables related with dependent variable were calculated with the Pearson or Spearman, when appropriate, correlation coefficient. All data were statistically analyzed with SPSS (version 18.0, Chicago, IL, USA) and STATA (version 13 STATA Corporation, College Station, TX, USA).

Results

Patient characteristics

During a two-year period, 155 patients were enrolled. Demographics, comorbid conditions, severity of disease, radiographic, physical and laboratory data on admission are summarized in *Table 1*. Patients were predominantly men (56.1%) with a median age of 45 year (IQR: 19–71). Twenty-five percent of patients had received previous outpatient antibiotic therapy. The most common clinical and laboratory findings on admission were respiratory failure (32%) and pleural effusion (10.3%). All patients had a PSI \leq 2, 84.4% [147] had a CURB-65 of 0 or 1, and only 5% had a CURB-65 of 2.

Antibiotic therapy

Patients received antibiotics for a median of 11 days (IQR: 6–36 days), with two-third patients [101] receiving guideline-concordant treatment. The commonest empiric antibiotic regimen was levofloxacin monotherapy (60%), followed by a combination of a beta-lactam and a macrolide antibiotic (27.7%).

Reason for admission

The reasons for admission are shown in *Table 2*. All patients had at least one primary reason for admission to the hospital according to their treating physician. Most patients had only 1 reason for hospital admission [61 patients (39.4%)], followed by 2 reasons [60 (38.7%)], or \geq 3 reasons [34 (21.9%)] (*Figure S1*).

The most common reason for hospital admission was the presence abnormal clinical test results [93 (60%)], followed by abnormal physical exam findings [67 (43.2%)], comorbid conditions [44 (28.4%)] and psychosocial factors [44 (28.4%)] (*Figure 1*).

The most frequent reasons for admission within the group of abnormal clinical test results were respiratory failure/hypoxemia [62 (40%)] and leukocytosis [24 (15.5%)] The most common reasons for admission due to abnormal physical exam findings were tachypnea, poor general health condition, and abnormal auscultation findings (13.5%, 13.5%, and 12.3%, respectively). Most common comorbid conditions as the reason for admission were the presence of a stable or decompensated comorbidity (16.8% and 5.8%, respectively). The most frequent psychosocial factors for

Table 1 Characteristics of low risk class patients hospitalized with pneumonia

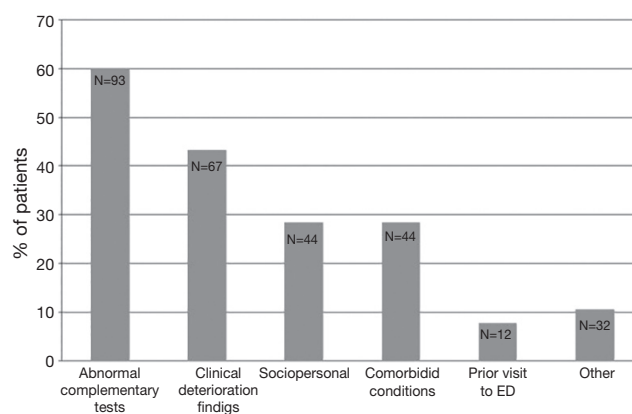
Characteristics	Total cohort (n=155)	Adverse event at 30 days	No adverse event at 30 days
Demographics			
Men	87 (56.1)	2 (28.6)	85 (57.4)
Age in year, median [IQR]	45 [32–58]	49 [37–61]	45.5 [43–48]
Conditions pre-admission			
Habits			
Smokers	50 (32.3)	3 (42.8)	47 (31.8)
Alcoholism	20 (12.9)	0 (0)	20 (13.5)
Other drugs	5 (3.2)	0 (0)	5 (3.4)
Residence			
Private home	154 (99.4)	7 (100.0)	147 (95.4)
Homeless/shelter	0 (0)	0 (0)	0 (0)
Oral intolerance	10 (6.5)	0 (0)	10 (6.8)
Outpatient antibiotic therapy	38 (24.5)	2 (28.7)	36 (24.3)
Preexisting comorbid conditions			
Heart failure	1 (0.6)	0 (0)	1 (0.7)
History of stroke	0 (0)	0 (0)	0 (0)
History of malignancy	0 (0)	0 (0)	0 (0)
Renal insufficiency	0 (0)	0 (0)	0 (0)
Chronic liver disease	1 (0.6)	0 (0)	1 (0.7)
COPD	1 (0.6)	0 (0)	1 (0.7)
Immunosuppression	4 (2.6)	0 (0)	4 (2.7)
History, physical exam, laboratory and radiographic data			
Altered mental status	0 (0)	0 (0)	0 (0)
RR >30 breaths/min	5 (3.2)	0 (0)	5 (3.4)
Systolic BP <90 mmHg	7 (4.5)	1 (14.3)	6 (85.7)
Heart rate >125 beats/min	8 (5.2)	1 (14.3)	7 (4.7)
Temperature <35 °C or ≥40 °C	0 (0)	0 (0)	0 (0)
Arterial pH <7.35	0 (0)	0 (0)	0 (0)
Arterial pO ₂ <60 mmHg or oxygen saturation <90%	50 (32.3)	3 (42.9)	47 (32.0)
Hematocrit <30%	4 (2.6)	0 (0)	4 (2.7)
Serum creatinine >1.2 mg/dL	14 (9)	1 (14.3)	13 (8.8)
Serum glucose >250 mg/dL	1 (0.6)	0 (0)	1 (0.7)
Serum sodium <130 mEq/L	6 (3.9)	0 (0)	6 (4.1)
Leukocytes <4,000 cell/ mm ³	6 (3.9)	1 (14.3)	5 (3.4)
Pleural effusion	15 (9.7)	2 (28.6)	13 (8.8)
Multilobar infiltrates	9 (5.8)	1 (14.4)	8 (5.4)
Bilateral infiltrates	19 (12.3)	0 (0)	19 (12.3)
Severity of illness			
PSI I, medium [IQR]	53 [36–63]	51 [47–66]	53 [36–61.5]
CURB-65, medium [IQR]	0 [0–1]	0 [0–1]	0 [0–0]
SMART-COP [IQR]	1 [1–2]	2 [2–2]	1 [1–2]

IQR, interquartile range; PSI, pneumonia severity index.

Table 2 Categories for admission of low-risk CAP patients

Variables	All patients (n=155)
Psychosocial factors	44 (28.4)
Patient lives alone	3 (1.9)
Patient did not understand the treatment	1 (0.6)
No possibility of supervision of the treatment	1 (0.6)
Patient with an intellectual deficit	3 (1.9)
Alcoholic problem	3 (1.9)
Drug abuse	2 (1.3)
Relationship of any hospital staff	1 (0.6)
Psychiatric problems	3 (1.9)
Oral intolerance	7 (4.5)
Failure of outpatient therapy	25 (16.1)
Comorbid conditions	44 (28.4)
Stable comorbidity present	26 (16.8)
Unstable comorbidity	9 (5.8)
Incidental finding and further work-up requirements	8 (5.2)
Home oxygen	1 (0.6)
Home non-invasive ventilation	1 (0.6)
Signs of clinical deterioration	67 (43.2)
High fever	16 (10.3)
Thoracic pain	17 (11)
Hypotension	4 (2.6)
Tachycardia	6 (3.9)
Tachypnea	21 (13.5)
Poor general condition	21 (13.5)
Abnormal auscultation	19 (12.3)
Abnormal clinical test results	93 (60.0)
Leukocytosis/leukopenia	24 (15.5)
Renal failure	4 (2.6)
Respiratory failure-hypoxemia	62 (40.0)
Hyponatremia	1 (0.6)
Pleural effusion	15 (9.7)
Bilateral infiltrates	14 (9.0)
Multilobar infiltrates	10 (6.5)
Suspicion of sepsis	5 (3.2)
Suspicion of empyema	6 (3.9)
Recent emergency department visit	12 (7.7)
Other causes	
H1N1 pneumonia suspicion	32 (20.6)

CAP, community-acquired pneumonia.

**Figure 1** Physicians' perspective on the reasons for admission of low-risk community acquired pneumonia patients.

admission were failure of previously outpatient therapy [25 (16.1%)] and oral intolerance [7 (4.5%)].

Clinical outcomes

The composite outcome was detected in 7 (4.5%) patients [(3 (1.9%) patients were readmitted at 30 days, 4 (2.6%) had an ICU admission, and there were no deaths at 30 days]. The mean LOS in the hospital was 7.14±5.73 days. The calculated median LOS in the hospital was 6 days. No objective clinical parameters registered at the time of hospital admission were associated with the composite outcome (*Table S2*). Among the reasons for admission, only signs of clinical deterioration ($r^2=0.18$; $P=0.043$) and abnormal clinical test results ($r^2=0.18$; $P=0.042$) were associated with the composite outcome (*Table 3*). Specific reasons for admission associated with the composite outcome were hypotension ($r^2=0.34$), tachycardia ($r^2=0.28$), renal failure ($r^2=-0.03$) and suspicion of sepsis ($r^2=0.48$).

Discussion

Our study shows that low-risk CAP patients are often admitted to the hospital for multiple reasons. Several important clinical factors play a role in the clinical decision-making to admit a patient with CAP. However, poor clinical outcomes are not associated with the physicians' reasons for admission. Most low-risk CAP patients admitted to the hospital had ≥2 reasons for admission according to their physicians. The categories of clinical reasons for admission associated with poorer clinical outcomes were the presence of abnormal clinical test results and signs of clinical deterioration.

Table 3 Composite outcome of adverse events and clinician reasons for admission

Variables	All (n=155), N (%)	Adverse event at 30 days: ICU admission, 30-day readmission, or 30-day mortality			
		No (n=148), N (%)	Yes (n=7), N (%)	OR (95% CI)	P value
Psychosocial factors	44 (28.4)	6 (85.71)	1 (14.29)	0.39 (0.05–3.37)	0.7
Patient lives alone	3 (1.9)	7 (100.0)	0 (0)	–	1
Patient do not understand the treatment	1 (0.6)	7 (100.0)	0 (0)	–	1
No possibility of supervision of the treatment	1 (0.6)	7 (100.0)	0 (0)	–	1
Patient with an intellectual deficit	3 (1.9)	6 (85.71)	1 (14.29)	12.16 (0.96–153.6)	0.1
Alcoholic problem	3 (1.9)	7 (100.0)	0 (0)	–	1
Drug abuse	2 (1.3)	7 (100.0)	0 (0)	–	1
Relationship of any hospital staff	1 (0.6)	7 (100.0)	0 (0)	–	1
Psychiatric problems	3 (1.9)	7 (100.0)	0 (0)	–	1
Oral intolerance	7 (4.5)	7 (100.0)	0 (0)	–	1
Failure of outpatient therapy	25 (16.1)	7 (100.0)	0 (0)	–	0.6
Comorbid conditions	44 (28.4)	6 (85.71)	1 (14.29)	0.38 (0.45–3.26)	0.7
Stable comorbidity present	26 (16.8)	7 (100.0)	0 (0)	–	0.6
Unstable comorbidity	9 (5.8)	7 (100.0)	0 (0)	–	1
Incidental finding and further work-up requirement	8 (5.2)	6 (85.71)	1 (14.29)	2.57 (0.28–23.74)	0.4
Home oxygen	1 (0.6)	7 (100.0)	0 (0)	–	1
Home non-invasive ventilation	1 (0.6)	7 (100.0)	0 (0)	–	1
Signs of clinical deterioration	67 (43.2)	1 (14.49)	6 (85.71)	8.56 (1.01–72.88)	0.043
High fever	16 (10.3)	7 (100.0)	0 (0)	–	1
Thoracic pain	17 (11.0)	7 (100.0)	0 (0)	–	1
Hypotension	4 (2.6)	4 (57.14)	3 (42.86)	110 (9.3–1,305.4)	<0.001
Tachycardia	6 (3.9)	5 (71.43)	2 (28.57)	14.4 (2.11–97.95)	0.024
Tachypnea	21 (13.5)	6 (85.71)	1 (14.29)	2.72 (0.49–15)	0.2
Poor general condition	21 (13.5)	5 (71.43)	2 (28.57)	1.07 (0.12–9.33)	1
Abnormal auscultation	19 (12.3)	5 (71.43)	2 (28.57)	3.08 (0.55–17.14)	0.2
Abnormal clinical test results	93 (60.0)	0 (0)	7 (100.0)	–	0.042
Leukocytosis/leukopenia	24 (15.5)	5 (71.43)	2 (28.57)	2.29 (0.41–12.55)	0.3
Renal Failure	4 (2.6)	0 (0)	7 (100.0)	–	0.042
Respiratory failure-hypoxemia	62 (40.0)	3 (42.8)	4 (57.4)	2 (0.5–9.6)	0.3
Hypoxemia	20 (12.9)	6 (85.71)	1 (14.29)	1.13 (0.12–9.92)	1
Hyponatremia	1 (0.6)	7 (100.0)	0 (0)	–	1
Pleural effusion	15 (9.7)	5 (71.43)	2 (28.57)	4.15 (0.73–23.6)	0.1
Bilateral infiltrates	14 (9.0)	7 (100.0)	0 (0)	–	1
Multilobar infiltrates	10 (6.5)	6 (85.71)	1 (14.29)	2.57 (0.28–23.74)	0.2
Suspicion of sepsis	5 (3.2)	4 (57.14)	3 (42.86)	54.7 (7.07–423.77)	0.001
Suspicion of empyema	6 (3.9)	6 (85.71)	1 (14.29)	4.76 (0.48–47.4)	0.2
Recent emergency department visit	12 (7.7)	6 (85.71)	1 (14.29)	2.07 (0.23–18.81)	0.4
Other causes					
H1N1 pneumonia suspicion	32 (20.6)	6 (85.71)	1 (14.29)	–	1

ICU, intensive care unit.

Although a correlation has been demonstrated between PSI and CURB-65 scores and 30-day mortality risk, the evidence also suggests that physician judgment plays an important role in clinical decision-making to admit patients with CAP (29). The PSI score was designed to identify patients with CAP at low risk for mortality (30) and guide clinicians to manage these patients as outpatients. However, multiple studies have demonstrated that a considerable proportion of patients with low pneumonia severity of illness scores (PSI ≤ 2) are still admitted to the hospital (22,31-36). Additionally, cohort studies from different parts of the world, including the United Kingdom (22), Spain (33), and the United State (37), have reported hospitalization rates of low-risk CAP patients (PSI =1-3) to be 55%, 56%, and 66%, respectively. Implementation of evidence-based clinical guidelines has decreased hospitalization of low-risk CAP, but even in the best case scenario, the admission rate for low-risk CAP with PSI ≤ 2 remains high (23.9%) (14).

Several studies have tried to elucidate why patients are admitted to the hospital despite a low pneumonia severity of illness score. In a single center interventional trial, Halm *et al.* assessed reasons for admission of low risk CAP patients and showed the presence of active comorbidities (55%) was the main reason for admission (38). The study by Halm *et al.* included patients older than ours (40% >65 years) and they excluded patients who were considered inappropriate candidates for outpatient care due to an oxygen saturation <90% on room air, inability to take oral medications, recent hospitalization, psychiatric illness, substance abuse, neuromuscular disease, pregnancy, homelessness, or inaccessibility by telephone. Similar to our study, Halm *et al.* surveyed the physician to assess the reasons for admission of low-risk CAP patients.

In a retrospective observational study, Arnold *et al.* defined the clinical factors associated with admission of low-risk CAP patients with a PSI ≤ 2 (16). The main reasons for admission were psychosocial factors (45%) and comorbid conditions that required hospitalization (43%). This study differs from ours because the reasons for admission were adjudicated made by a committee retrospectively. Additionally, our study demonstrated that abnormal clinical test results were a primary reason for admission, rather than concern for comorbidities or psychosocial factors. For example, hypoxemia was the reason for admission in 63 (40.6%) patients in our study, compared with only 1 (1.5%) in Arnold's study. Rosón *et al.* suggested that respiratory failure and pleural complications were the most common reasons for admission of low-risk CAP patients (39). Rosón *et al.* (39) concluded that 40%

of low-risk CAP patients had no compelling reason for admission. Aujesky *et al.* (13) found that the presence of comorbidities was the main reason for admission in 71% of the patients with low-risk CAP defined as a PSI ≤ 3 . In our study, we were able to differentiate at the time of admission if the comorbid conditions were stable *vs.* unstable, and if a new abnormal finding was detected, whether further work-up was indicated. Although it was prospective, the Aujesky *et al.* (13) study was an interventional trial and active participation in the trial could alter the results. Furthermore, study investigators contacted the ED a week after the hospitalization leading to potential recall bias, while our study investigators made contact with the ED in <24 hours. Recall bias may also explain why more patients in our study had >2 reasons for admission compared to the Aujesky study (21.9% *vs.* 15.7%) (13).

We would also like to highlight that the second most common reason for admission, after respiratory failure, was the suspicion of *H1N1 Influenza A* virus as the causative microorganism of pneumonia. Although this reason for admission was not listed in the original study protocol, it was frequently reported in the "other" category for admission. We have to remember that our study was conducted during the worldwide H1N1 influenza pandemic.

We believe that clinical judgement is influenced by the experience and the knowledge of the staff that admitted pneumonia patients. In our cohort most of the admitting physicians were not residents (70%), and most of them were specialist in internal medicine (45%), followed by pulmonologist (22%).

Our study has some limitations to recognize. Even though this was a multicenter study, all of the hospitals were in Spain, and this data may have limited applicability to other populations, countries, or healthcare systems. Second, the admitting physicians were requested to explain all reasons for admission but ranking of the reasons was not performed. Third, although it was a multicentre study in five hospitals attending an important population, the number of patients included was low (n=155); this can be explained by (I) we only included patients that were specifically admitted to the investigator hospital ward, so it could be a proportion of admitted patients in another services that we did not evaluate; (II) with the aim of selecting the pneumonias with the lowest severity we excluded patients with PSI =3, patients that similar studies has mostly times included; and (III) we excluded weekend admissions. Finally, selection bias may be present because of two aspects, first one is that the decision of admission was not based on the use of clinical scales

meaning a poor implementation of objective severity scores but reflecting a real scenario in clinical practice; and second, weekend admissions were excluded; however, we do not feel this is a major limitation because the same physicians were admitting patients during the weekdays and weekends.

Conclusions

Our study is the first multicentre prospective study, specially focused on detecting the causes for admission in low risk CAP patients which demonstrates that there are multiples reasons for admission of low-risk CAP patients despite a low PSI score. These reasons for admission are not accounted for by the severity of illness scores for CAP. Abnormal clinical test results and signs of clinical deterioration are two specific reasons for admission that may be associated with poorer clinical outcomes in certain patients. Additional studies are needed to assess the generalizability of our results to other populations and healthcare systems.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: The study was approved by the Institutional Review Board (CEIC de Galicia #078/12) and written informed consent was obtained from all patients.

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Table S1 Emergency department physicians' perspectives on reasons for admission of low risk community acquired pneumonia patients

Variables	Definition
Socio-personal problems	
Patient lives alone	To understand that as the patients live alone an inpatient treatment is needed
Patient did not understand the treatment	To understand that patients are not going to understand an outpatient treatment so an inpatient treatment is needed
No possibility of supervision of the treatment	To understand that patients do not have anybody who potentially could supervised the outpatient treatment so an inpatient treatment is needed
Patient with an cognitive deficient	To understand that patients have any kind of intellectual deficit and are not going to understand an outpatient treatment so an inpatient treatment is needed
Alcoholism	To understand that the daily alcohol consumption of the patients make it possible to not take correctly the outpatient treatment so an inpatient treatment is needed
Drug problems	To understand that the active drug consumption of the patients make it possible to not take correctly the outpatient treatment so an inpatient treatment is needed
Oral intolerance	To understand that inability of the patients to tolerate an oral intake of medicines make the need of an intravenous inpatient treatment
Familiarity with any hospital staff	To decide to admit the patient because it is related with any hospital staff
Failure of outpatient therapy	To understand that patient received an outpatient therapy that did not work so an inpatient treatment is needed
Comorbid conditions	
Stable comorbidity present	To understand that patients have any comorbidity that even it is stable could compromise the evolution if an outpatient treatment is done
Unstable comorbidity	To understand that patients should be admitted because have any comorbidity that it is not controlled at the moment of admission
Incidental finding and further work-up	To find some sign or symptom or complementary data that have to be more studied
Home oxygen	To understand that patients should be admitted because the patient is under treatment with domiciliary oxygen
Home non-invasive ventilation	To understand that patients should be admitted because the patient is under treatment with noninvasive positive-pressure ventilation
Subjective clinical deterioration findings	
High fever	To understand that the patient have fever enough to worry and decide the admission
Hypotension	To understand that the patient have hypotension enough to worry and decide the admission
Tachycardia	To understand that the patient have tachycardia enough to worry and decide the admission
Tachypnea	To understand that the patient have tachypnea enough to worry and decide the admission
Poor general condition	To understand that the condition of the patient does not guarantee a potential correct evolution in the ambulatory level
Abnormal auscultation	To find any auscultatory findings to worry about
Complementary abnormal tests	
Leukocytosis/leukopenia	To understand that the patient have leukocytosis or leukopenia enough to worry and decide the admission
Renal Failure	To understand that the presence of renal failure is a reason strong enough to decide the admission
Respiratory failure-hypoxemia	To understand that the presence of respiratory failure is a reason strong enough to decide the admission
Hyponatremia	To understand that the presence of hyponatremia is a reason strong enough to decide the admission
Pleural effusion	To understand that the presence of pleural effusion on the chest X-ray is a reason strong enough to decide the admission
Bilateral infiltrates	To understand that the presence of bilateral infiltrates on the chest X-ray is a reason strong enough to decide the admission
Multilobar infiltrates	To understand that the presence of multilobar infiltrates on the X-ray is a reason strong enough to decide the admission
Big infiltrate	To understand that the infiltrate on the chest X-ray has a size enough to decide the admission
Suspicion of sepsis	To understand that the physician understand patient have sepsis
Suspicion of empyema	To understand patient have an empyema
Prior week emergency department visit	To understand that as the patient at least came to hospital once during the last week should be admitted
Other	Open ended response

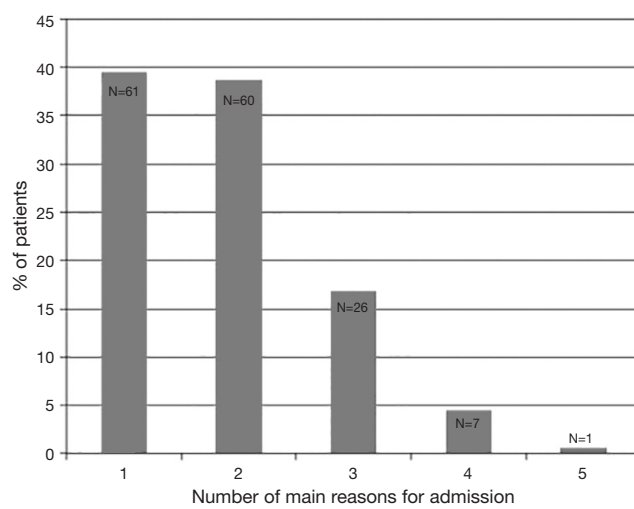


Figure S1 Number of main reasons for admission.

Table S2 Association between poor clinical outcomes and characteristics on admission of the study population

Variables	All (n=155)	Composite of 30-death + ICU admission + 30D-readmission		OR	P
		No (n=148)	Yes (n=7)		
Demographics					
Male	87 (56.1)	85 (57.4)	2 (28.6)	0.3 (0.05–1.57)	0.2
Age in year, median [IQR]	45 [32–58]	45 [31.5–57.5]	57 [35–61]	–	0.4
Conditions pre-admission					
Habits					
Smokers	50 (32.3)	48 (31.8)	2 (50)	1.61 (0.35–7.49)	0.6
Alcoholism	20 (12.9)	20 (13.5)	0 (0)	–	0.6
Other drugs	5 (3.2)	5 (3.3)	0 (0)	–	1
Residence					
Private home	154 (99.4)	147 (99.3)	7 (100)	–	1
Homeless/shelter	0 (0)	0 (0)	0 (0)	–	–
Oral intolerance	10 (6.5)	10 (6.76)	0 (0)	–	1
Outpatient antibiotic therapy	38 (24.5)	36 (24.3)	2 (28.6)	1.24 (0.23–6.69)	0.7
Preexisting comorbid conditions					
Heart failure	1 (0.6)	1 (0.7)	0 (0)	–	1
History of stroke	0 (0)	0 (0)	0 (0)	–	–
History of malignancy	0 (0)	0 (0)	0 (0)	–	–
Renal insufficiency	0 (0)	0 (0)	0 (0)	–	–
Chronic liver disease	1(0.6)	0 (0)	0 (0)	–	–
COPD	1(0.6)	1 (0.7)	0 (0)	–	1
Immunosuppression	4 (2.6)	4 (2.7)	0 (0)	–	1
History, physical, laboratory and radiographic data					
Altered mental status	0 (0)	0 (0)	0 (0)	–	–
RR >30 breaths/min	5 (3.2)	5 (3.4)	0 (0)	–	–
Systolic BP <90 mmHg	7 (4.5)	6 (4.0)	1 (14.3)	3.94 (0.4–38.14)	0.3
Heart rate >125 beats/min	8 (5.2)	7 (4.73)	1 (14.3)	3.35 (0.35–31.81)	0.3
Temperature <35°C or ≥40°C	0 (0)	0 (0)	0 (0)	–	–
Arterial pH <7.35	0 (0)	0 (0)	0 (0)	–	–
Arterial pO ₂ <60 mmHg or oxygen saturation <90%	50 (32.3)	47 (31.2)	3 (42.9)	1.59 (0.34–7.41)	0.7
Hematocrit <30%	4 (2.6)	4 (2.7)	0 (0)	–	1
Serum Creatinine >1.2 mg/dL	14 (9.0)	13 (8.8)	1 (14.29)	1.73 (0.19–15.49)	0.5
Serum glucose >250 mg/dL	1 (0.6)	1 (0.7)	0 (0)	–	1
Serum sodium <130 mEq/L	6 (3.9)	6 (4.0)	0 (0)	–	1
Leukocytes <4,000 cell/mm ³	6 (3.9)	5 (3.4)	1 (14.29)	4.73 (0.47–47.08)	0.2
Pleural effusion	16 (10.3)	14 (9.5)	2 (28.6)	3.82 (0.68–21.6)	0.1
Multilobar infiltrates	9 (5.8)	8 (5.4)	1 (14.29)	2.91 (0.31–27.22)	0.3
Bilateral infiltrates	19 (12.3)	19 (12.8)	0 (0)	–	0.6
Severity of illness					
PSI I	53 [36–63]	53 [36–61.5]	51 [47–66]	–	0.4
CURB-65	1 [1–2]	1 [1–2]	1 [1–2]	–	0.9

IQR, interquartile range; PSI, pneumonia severity index.