

# Outpatient Care Compared with Hospitalization for Community-Acquired Pneumonia

## A Randomized Trial in Low-Risk Patients

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**Background:** The Pneumonia Severity Index (PSI) has been advocated as an objective measure of risk stratification to help determine the initial site of treatment for patients with community-acquired pneumonia.

**Objective:** To determine whether outpatient care of PSI-defined low-risk patients with community-acquired pneumonia is as safe and effective as hospitalization.

**Design:** Unblinded, randomized, controlled trial.

**Setting:** 2 tertiary care hospitals.

**Patients:** 224 immunocompetent adults in risk class II or III (PSI scores  $\leq 90$  points) who received a diagnosis of community-acquired pneumonia in the emergency department and had no extenuating circumstances.

**Intervention:** Outpatient care with oral levofloxacin therapy or hospitalization with sequential intravenous and oral levofloxacin therapy.

**Measurements:** The primary end point was the percentage of patients with an overall successful outcome at the end of treatment, according to 7 predefined criteria. Secondary end points included patients' quality of life and satisfaction.

**Results:** Overall successful outcome was achieved in 83.6% of outpatients and 80.7% of hospitalized patients (absolute difference, 2.9 percentage points [95% CI,  $-7.1$  to 12.9 percentage points]). More outpatients were satisfied with their overall care (91.2% vs. 79.1%; absolute difference, 12.1 percentage points [CI, 1.8 to 22.5 percentage points]). Quality of life and the percentages of patients with adverse drug reactions (9.1% vs. 9.6%), medical complications (0.9% vs. 2.6%), subsequent hospital admissions (6.3% vs. 7.0%), and overall mortality (0.9% vs. 0%) were similar in the outpatient and hospitalization groups.

**Limitations:** The power to detect a serious complication, such as death, was limited given the relatively small sample size.

**Conclusions:** In selected patients who had community-acquired pneumonia, PSI risk class II and III, and were treated with levofloxacin, outpatient care in the absence of respiratory failure, unstable comorbid conditions, complicated pleural effusions, and social problems was as safe and effective as hospitalization and provided greater patient satisfaction.

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Community-acquired pneumonia continues to be a major health problem worldwide. In the United States, about 600 000 of the 4 million patients who develop community-acquired pneumonia each year are hospitalized, accounting for an annual cost of approximately \$23 billion (1). Selection of the initial site of care, whether outpatient or in-hospital, is one of the most important clinical decisions made in the treatment of community-acquired pneumonia and directly affects the intensity of laboratory testing, microbiological evaluation, and antibiotic therapy (2, 3). Nevertheless, investigators have reported considerable variations in hospital admission rates for patients with community-acquired pneumonia, suggesting that physicians do not use a uniform strategy for determining admission and tend to overestimate the likelihood of death from pneumonia (4). On the other hand, most low-risk patients with community-acquired pneumonia prefer to be cared for at home rather than in the hospital when given the choice (5).

The prognosis of patients with community-acquired pneumonia varies greatly (6). The Pneumonia Outcomes Research Team has developed a prediction rule based on the Pneumonia Severity Index (PSI) (7), which is calculated from data that are commonly available at presenta-

tion. The PSI accurately stratifies patients into 5 risk classes with 30-day mortality rates ranging from 0.1% in class I to 27.0% in class V (7). This index is viewed as an objective measure of risk stratification to help determine the initial site of care for community-acquired pneumonia (8, 9). Experts currently agree that patients in high-risk classes must be hospitalized, but the most appropriate site of care for patients in risk classes II or III, who account for 30% to 50% of hospitalizations, is still controversial. We designed this randomized trial to test the hypothesis that outpatient care of these low-risk patients with community-acquired pneumonia would be as safe and effective as hospitalization.

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Conversion of figure and tables into slides

**Context**

Physicians are sometimes unsure about managing a low-risk patient with community-acquired pneumonia at home.

**Contribution**

In this trial, 224 immunocompetent patients with community-acquired pneumonia and no respiratory failure, complicated pleural effusions, or unstable comorbid illnesses were randomly assigned to outpatient care with oral levofloxacin or hospitalization with initial intravenous levofloxacin therapy. About 80% of patients in both groups had successful outcomes without any complications. Treatment length and frequency of adverse drug events and subsequent hospital admissions were similar. Outpatients reported greater satisfaction with care than did inpatients.

**Implications**

Outpatient treatment appears effective for low-risk patients with community-acquired pneumonia.

—The Editors

**METHODS****Study Design and Setting**

This randomized trial was conducted between 1 October 2000 and 31 October 2002 in Barcelona, Spain, at 2 tertiary care hospitals: the IDIBELL-Hospital Universitari de Bellvitge, a 900-bed university public hospital, and the SCIAS-Hospital de Barcelona, a 300-bed private hospital. The ethical committees of both institutions approved the study.

**Patient Eligibility and Recruitment Process**

All immunocompetent patients who were at least 18 years of age and had received a diagnosis of community-acquired pneumonia in the emergency department (24 hours per day, 7 days per week) were screened for potential eligibility. Patients who had neutropenia, HIV infection, transplantation, or splenectomy or who were taking immunosuppressive drugs were not eligible. Community-acquired pneumonia was defined as the presence of a new infiltrate on chest radiography plus at least 1 of the following: fever (temperature  $\geq 38.0$  °C) or hypothermia (temperature  $< 35.0$  °C), new cough with or without sputum production, pleuritic chest pain, dyspnea, or altered breath sounds on auscultation. The chest radiograph was interpreted by the infectious disease consultant, not specifically by a radiologist. Patients with community-acquired pneumonia were stratified into risk classes by using the validated prediction rule calculated according to the PSI scores, as described elsewhere (7). Patients in risk classes I, IV, and V were excluded. Patients in risk classes II and III were considered for randomization but were excluded if they met 1 or more of the following criteria: pregnancy or breastfeeding, allergy to quinolones, receipt of quinolones in the preceding 3 months, respiratory failure ( $\text{PaO}_2 < 60$  mm

Hg, saturation of  $\leq 90\%$  using pulse oximetry, or both), concomitant unstable comorbid conditions necessitating hospitalization for treatment, complicated pleural effusion, shock, lung abscess, metastatic infection, severe social problems precluding adequate outpatient treatment, cognitive or psychiatric impairment, or inability to maintain oral intake. Patients in risk class II or III (PSI scores  $\leq 90$  points) without any of these exclusion criteria were randomly assigned.

We assessed 998 consecutive patients for eligibility and excluded 571 who presented in risk class I, IV, or V (Figure). Of 427 patients in risk classes II and III, 158 met exclusion criteria and 45 declined to participate. The most common reason for exclusion was respiratory failure in 114 patients, 51 (44.7%) in class II and 63 (55.3%) in class III. Ten patients were excluded because of concomitant unstable comorbid conditions; 3 had new-onset atrial fibrillation, 2 had an exacerbation of congestive heart failure, 2 had angina pectoris, 1 had diabetic ketoacidosis, 1 had severe acute renal failure, and 1 patient with liver disease had ascites. Eight patients were excluded because of social problems; 3 were homeless, and 5 with severe alcohol abuse lacked home care support. Forty-five patients (mean age, 62 years) declined to participate; 26 (57.8%) were men. Of these patients, 35 (77.8%) were in class II and 10 (22.2%) were in class III.

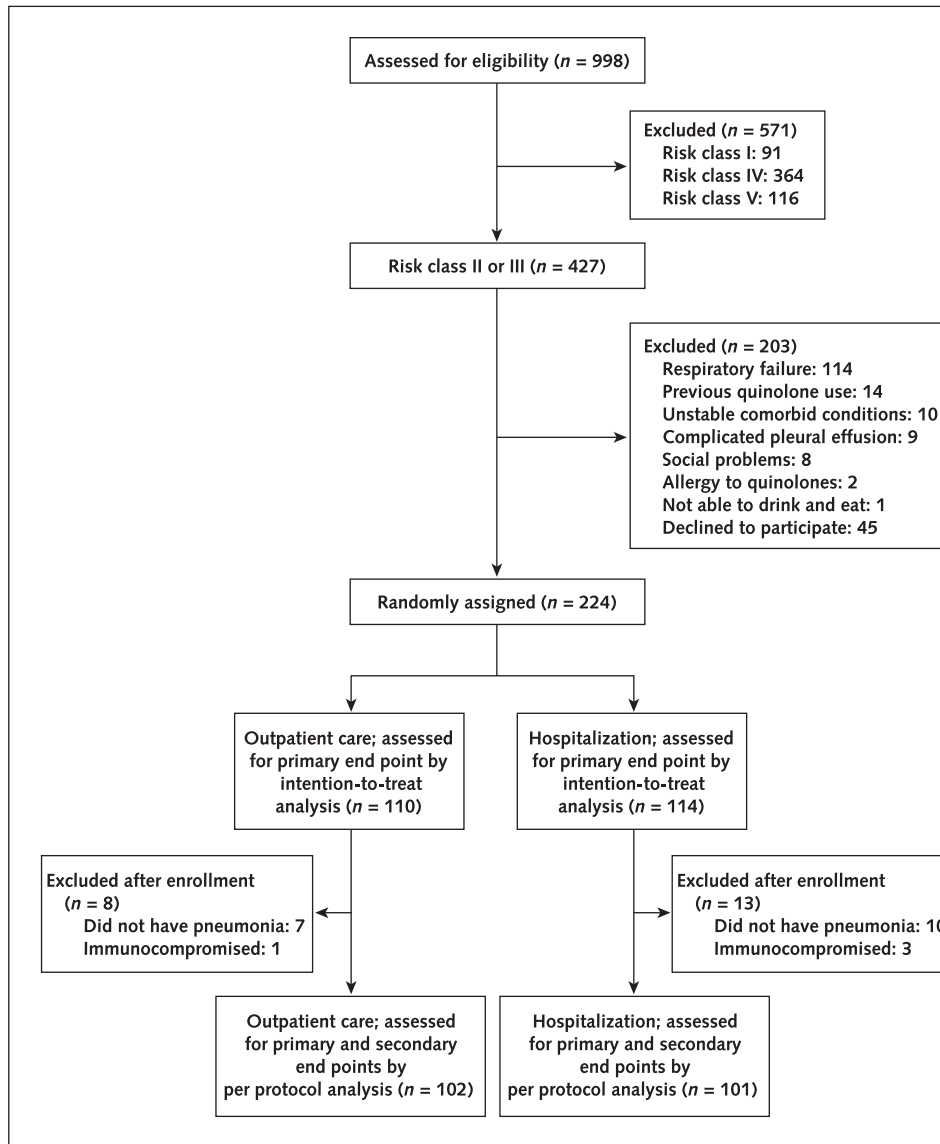
**Randomization**

Randomization was performed by using a computer-generated random code with a block size of 10. Randomization was stratified by hospital site, and the random code was held centrally, in a sealed envelope, by the clinical epidemiologist. In the emergency department, the infectious disease consultant (in most cases not a study investigator) opened sealed, sequentially numbered opaque envelopes to randomly assign patients who had provided written informed consent and met the study criteria. Patients were randomly assigned to receive outpatient care or hospitalization. Outpatients were given oral levofloxacin (500 mg/d), and hospitalized patients received sequential intravenous and oral levofloxacin (500 mg/d). All patients received detailed written information about their pneumonia diagnosis and their treatment plan, as well as emergency contact telephone numbers for a nurse or investigator physician.

**Study End Points**

The primary end point of the trial was the percentage of patients with an overall successful outcome, defined as meeting all of 7 predefined criteria: cure of pneumonia (as defined later), absence of adverse drug reactions, absence of medical complications during treatment, no need for additional visits, no changes in initial treatment with levofloxacin, absence of subsequent hospital admission in the 30 days after randomization, and absence of death from any cause in the 30 days after randomization. Secondary end

Figure. Study profile.



points included patients' health-related quality of life and satisfaction with the care received for pneumonia.

**Follow-up and Outcomes Assessment**

Patients assigned to outpatient care were visited at home by a nurse 48 hours after emergency department discharge. The visit included assessment of vital signs and measurement of oxygen saturation by pulse oximetry. If the nurse thought that a patient's condition was not improving (worsening of baseline vital signs, oxygen saturation, or both), one of the investigators made an additional visit. The nurse was involved only in outcome assessment. Patients assigned to hospitalization were seen daily during their hospital stay by attending physicians and by at least 1 of the investigators. Criteria for early switching from intravenous to oral levofloxacin were a respiratory rate of 24

breaths/min or less, a pulse rate of 100 beats/min or less, a temperature of 37.8 °C or lower on 2 occasions at least 8 hours apart, and maintenance of adequate oral intake. Physicians were advised to discharge patients after their clinical condition stabilized, in accordance with previously recommended criteria (10). All patients were seen at the outpatient clinic at days 7 and 30 after pneumonia diagnosis.

Pneumonia was considered cured when all baseline signs (fever, hypothermia, altered breath sounds) and symptoms (cough, chest pain, dyspnea) resolved and when infiltrates on chest radiograph disappeared, according to assessment at the final 30-day visit by at least 2 investigators who were not blinded to the treatment strategy. The investigators also assessed all the remaining variables used as criteria for the primary end point at days 7 and 30 after

randomization. All assessments were made by using a standard protocol with a checklist of items.

The Short Form-36 (SF-36) health survey questionnaire (11) was used to measure health-related quality of life. This instrument has been previously validated in patients with community-acquired pneumonia (12). The SF-36 includes 1 multi-item scale that assesses 8 health concepts: physical functioning, physical role, bodily pain, general health, vitality, social functioning, emotional role, and mental health. Scores range from 0 to 100; higher scores indicate better quality of life. The SF-36 was administered at days 7 and 30 after randomization, using the "1-week" recall period. The results of the questionnaire at 30 days were compared with data available for people of a similar age distribution in the general Spanish population (13).

Patients' satisfaction with overall care for pneumonia was evaluated at the final 30-day visit by means of a question, as described elsewhere (14). Patients were asked, "How would you rate your overall care for this episode of pneumonia?" Responses were recorded on a scale of 1 to 5, from "very unsatisfactory" to "very satisfactory." Patients were considered satisfied if the response recorded was 4 or 5.

### Microbiological Analysis

Etiologic diagnosis of community-acquired pneumonia was established as described elsewhere (15). Samples obtained per protocol consisted of 2 sets of blood cultures, a sputum sample when available, urine for detection of antigens, and paired acute and convalescent serum samples. Isolation of *Legionella* was attempted in sputum by the selective medium buffered charcoal yeast extract- $\alpha$ . *Streptococcus pneumoniae* antigen in urine was detected by using a rapid immunochromatographic assay (NOW, Binax, Portland, Maine). *Legionella pneumophila* serogroup 1 antigen in urine was detected by using a commercial immunochromatographic assay (NOW, Binax). Serologic studies were performed by using standard methods to determine antibodies against *L. pneumophila* and atypical agents. We used the National Committee for Clinical Laboratory Standards criteria to define susceptibility of pneumococcal isolates (16). Accordingly, minimum inhibitory concentration (MICs) used as breakpoints to define a pneumococcal isolate as resistant were at least 0.12  $\mu\text{g}/\text{mL}$  for penicillin, at least 1  $\mu\text{g}/\text{mL}$  for ceftriaxone, at least 0.5  $\mu\text{g}/\text{mL}$  for erythromycin, and at least 4  $\mu\text{g}/\text{mL}$  for levofloxacin.

### Statistical Analysis

On the basis of our own clinical experience, we estimated that approximately 85% of hospitalized patients would have an overall successful outcome. We estimated that we would need a total sample size of approximately 200 patients to achieve 90% power at a 5% significance level using a 1-sided equivalence test of proportions; this was predicated on a maximum allowable difference of 15 percentage points in the outpatient group resulting in equivalence (17). After taking into account the a priori

assumption that up to 10% of patients would not be evaluable, we set the sample size target for randomization at approximately 110 patients per treatment group.

To assess differences in the frequency of outcomes in the 2 treatment groups, relevant variables were compared by using the Fisher exact test, overall and by hospital. Percentage differences of each outcome and mean differences of each SF-36 scale score between the 2 groups, with corresponding 95% CIs, were also computed and presented. To rule out the effect of residual confounding, we also performed a multivariate analysis using unconditional logistic regression to estimate odds ratios and 95% CIs. As covariates, the model included hospital site, sex, age in 2 categories (19 to 67 years and 68 to 92 years), presence of comorbid conditions, and PSI score in tertiles (34 to 61 points, 62 to 74 points, and 75 to 90 points). This analysis was performed with data from the 2 hospitals combined and for each hospital separately. To formally explore any differences in results by hospital, we tested for an interaction between hospital site and treatment group in the fully adjusted logistic regression model mentioned earlier.

Data for the primary end point were analyzed on an intention-to-treat and per protocol basis. The intention-to-treat analysis included all randomly assigned patients. Since both analyses produced virtually the same results, only the intention-to-treat analysis is presented in detail. Secondary end points were analyzed per protocol. Statistical significance was established at the 0.05  $\alpha$  value. All reported *P* values are 2-sided.

### Role of the Funding Sources

The Spanish National Health Service and Aventis supported the study. The funding sources had no role in the study design; the collection, analysis, or interpretation of the data; or the decision to submit the manuscript for publication. Only the authors had full access to the data files for the study.

## RESULTS

A total of 224 patients were randomly assigned and included in an intention-to-treat analysis for the primary end point. Of these, 110 received outpatient care and 114 were hospitalized. After excluding 21 patients after enrollment who could not be evaluated, we analyzed the remaining 203 for the primary and secondary end points per protocol. The baseline characteristics of the patients in the 2 treatment groups were similar (Table 1) and did not differ significantly by hospital site. An etiologic diagnosis was established in 37 of 103 outpatients (35.9%) and 28 of 104 hospitalized patients (26.9%) who had pneumonia. The distribution of causative organisms did not differ between groups. *Streptococcus pneumoniae* (22 outpatients vs. 16 hospitalized patients) and *L. pneumophila* (6 outpatients vs. 5 hospitalized patients) were the most frequently isolated pathogens, followed by atypical agents (4 outpatients vs. 3 hospitalized patients) and *Haemophilus influenzae*

Table 1. Patient Characteristics\*

Characteristic	Outpatient Group (n = 110)	Hospitalized Group (n = 114)
Sex, n (%)		
Male	69 (62.7)	66 (57.9)
Female	41 (37.3)	48 (42.1)
Hospital, n (%)		
IDIBELL-Hospital Universitari de Bellvitge	75 (68.2)	78 (68.4)
SCIAS-Hospital de Barcelona	35 (31.8)	36 (31.6)
Age		
Mean age $\pm$ SD, y	67.5 $\pm$ 11.8	64.9 $\pm$ 13.4
Age group, n (%)		
19–49 y	6 (5.5)	9 (7.9)
50–69 y	54 (49.1)	55 (48.2)
70–92 y	50 (45.5)	50 (43.9)
Alcohol consumption >80 g/d, n (%)†	13 (12.4)	7 (6.4)
Current tobacco smoking, n (%)‡	21 (19.8)	24 (21.8)
Influenza vaccine in the current season, n (%)§	44 (42.7)	49 (46.2)
Pneumococcal vaccine in the previous 5 years, n (%)	15 (15.6)	13 (13.1)
Comorbid conditions, n (%)	71 (64.5)	78 (68.4)
Mean oxygen saturation with room air $\pm$ SD, %	94.5 $\pm$ 2.0	94.5 $\pm$ 1.8
Multilobar pneumonia, n (%)	8 (7.3)	9 (7.9)
Risk class, n (%)		
II	55 (50.0)	63 (55.3)
III	55 (50.0)	51 (44.7)
Mean PSI score $\pm$ SD	70.0 $\pm$ 11.6	66.9 $\pm$ 12.5

\* PSI= Pneumonia Severity Index.

† No data were available for 5 patients in the outpatient group and 4 patients in the hospitalized group.

‡ No data were available for 4 patients in each group.

§ No data were available for 7 patients in the outpatient group and 8 patients in the hospitalized group.

|| No data were available for 14 patients in the outpatient group and 15 patients in the hospitalized group.

(3 outpatients vs. 3 hospitalized patients). Bacteremia occurred in 3 outpatients (*S. pneumoniae* in 2 and *Escherichia coli* in 1) and in 1 hospitalized patient (*S. pneumoniae*). Forty-one percent of *S. pneumoniae* isolates were penicillin-resistant (MIC range, 0.5  $\mu$ g/mL to 4  $\mu$ g/mL), and 35% of the strains were resistant to erythromycin (MIC >256  $\mu$ g/mL for all strains). Only 1 pneumococcal strain was resistant to ceftriaxone (MIC, 2  $\mu$ g/mL). All *S. pneumoniae* isolates were susceptible to levofloxacin (MIC range, 0.5  $\mu$ g/mL to 1  $\mu$ g/mL).

The mean length of antibiotic therapy ( $\pm$ SD) was 10.19  $\pm$  1.97 days in outpatients and 10.00  $\pm$  2.56 days in hospitalized patients ( $P > 0.2$ ). The mean length of intravenous antibiotic therapy ( $\pm$ SD) in hospitalized patients was 2.25  $\pm$  0.94 days, and the mean length of hospital stay ( $\pm$ SD) was 5.1  $\pm$  2.07 days. No patients in either group received any important co-treatments.

Overall successful outcome was achieved in 83.6% of outpatients and 80.7% of hospitalized patients (absolute difference, 2.9 percentage points [95% CI, -7.1 to 12.9 percentage points]) (Table 2). To minimize the effect of potential confounding by patients' characteristics, we also performed a multivariate analysis adjusting for hospital site, sex, age, presence of comorbid conditions, and PSI score. In the intention-to-treat analysis, the overall odds ratio for successful outcome linked to treatment group (outpatient care vs. hospitalization) was 0.76 (CI, 0.37 to 1.54) for both hospitals combined, 0.78 (CI, 0.33 to 1.86) for IDIBELL-Hospital Universitari de Bellvitge, and 0.75 (CI, 0.18 to 3.12) for SCIAS-Hospital de Barcelona. No

statistically significant differences in the primary end point by hospital site were observed ( $P > 0.2$  for the interaction term between treatment group and hospital site in the fully adjusted logistic regression model). Equivalent results were obtained in the per protocol analysis.

Similar numbers of patients required subsequent hospital admission in the 2 groups: 7 of 110 outpatients (6.3%) and 8 of 114 hospitalized patients (7.0%) (Table 2). In the outpatient group, the reasons for hospitalization were as follows: blood cultures positive for *E. coli* (1 patient, 3 days after randomization), angina pectoris (1 patient, 15 days after randomization), exacerbation of chronic obstructive pulmonary disease (2 patients, 21 and 24 days after randomization), lung cancer (1 patient, 6 days after randomization), exacerbation of congestive cardiac failure (1 patient, 3 days after randomization), and intestinal ischemia (1 patient, 14 days after randomization). A diabetic patient assigned to outpatient care and subsequently hospitalized for bacteremic *E. coli* pneumonia was cured without further modification of initial levofloxacin therapy and was discharged 4 days after admission. Only 1 patient died, an 88-year-old man assigned to outpatient care who was admitted with acute abdomen due to intestinal ischemia 14 days after presentation with pneumonia. By the time of the subsequent hospitalization, his respiratory symptoms and the pulmonary infiltrate had disappeared, and his death was considered unrelated to the original diagnosis of pneumonia. In the hospitalized patients, the reasons for subsequent hospitalization were exacerbation of chronic obstructive pulmonary disease (3 pa-

Table 2. Outcomes for Study Patients by Treatment Group

Event	Outpatient Group (n = 110)	Hospitalization Group (n = 114)	Difference (95% CI)*	P Value†
Successful outcome, n (%)	92 (83.6)	92 (80.7)	2.9 (−7.1 to 12.9)	>0.2
Unsuccessful outcome, n (%)‡	18 (16.4)	22 (19.3)		
No cure of pneumonia, n (%)§	0 (0.0)	0 (0.0)	0.0	>0.2
Adverse drug reactions, n (%)	10 (9.1)	11 (9.6)	−0.5 (−8.2 to 7.1)	>0.2
Phlebitis, n	0	6		
Skin rash, n	2	0		
Vomiting, n	0	2		
Diarrhea, n	4	1		
Insomnia, n	4	2		
Medical complications, n (%)	1 (0.9)	3 (2.6)	−1.7 (−5.2 to 1.7)	>0.2
Heart failure or arrhythmia, n	1	1		
Acute confusion, n	0	1		
Pulmonary embolism, n	0	1		
Need for additional visits, n (%)	2 (1.8)	2 (1.7)	0.1 (−3.4 to 3.5)	>0.2
Changes in initial antibiotic therapy, n (%)	3 (2.7)	4 (3.5)	−0.8 (−5.3 to 3.8)	>0.2
Subsequent hospital admission within 30 days, n (%)	7 (6.3)	8 (7.0)	−0.7 (−7.2 to 5.9)	>0.2
Overall mortality within 30 days, n (%)	1 (0.9)	0 (0.0)	0.9 (−0.9 to 2.7)	<0.2

\* Values are percentage points.

† Fisher exact test.

‡ Six patients in each treatment group had >1 cause of unsuccessful outcome.

§ Not applicable to 7 outpatients and 10 hospitalized patients who did not have pneumonia.

tients, 9, 10, and 12 days after randomization), angina pectoris (1 patient, 27 days after randomization), ventricular tachycardia (1 patient, 19 days after randomization), femoral fracture (1 patient, 14 days after randomization), pleuropericarditis (1 patient, 5 days after randomization), and lung cancer (1 patient, 10 days after randomization).

There were no differences between groups in health-related quality of life according to the SF-36 scale at days 7 and 30 after diagnosis of pneumonia (Table 3). At the 30-day visit, the scores in both groups, although still abnormal, were close to those of the general population in Spain. For the analysis of patients' satisfaction, data were available for 91 of 102 outpatients and 86 of 101 hospitalized patients. Outpatients more frequently reported satisfaction with overall care than did hospitalized patients (83 of 91 [91.2%] vs. 68 of 86 [79.1%]; absolute difference, 12.1 percentage points [CI, 1.8 to 22.5 percentage points];  $P = 0.03$ ). Patients who completed the questionnaire at the final 30-day visit ( $n = 177$ ) were similar to those who did not ( $n = 26$ ) in terms of baseline character-

istics such as male sex (59% vs. 61%), mean age ( $\pm$ SD) ( $66.0 \pm 12.6$  years vs.  $67.0 \pm 12.6$  years), risk class for disease severity (class II, 55% vs. 46%; class III, 45% vs. 54%), and mean PSI score ( $\pm$ SD) ( $67.4 \pm 12.6$  points vs.  $71.0 \pm 12.6$  points).

## DISCUSSION

This randomized trial was designed to compare 2 strategies for the management of low-risk patients with community-acquired pneumonia. Patients in risk class I, who were younger than 50 years of age and did not have comorbid conditions, poor vital signs, or altered mental status, were not included because outpatient care is generally considered acceptable for this group (2). To avoid potential bias related to the antibiotic treatment, we used levofloxacin therapy in both treatment groups. Levofloxacin offers appropriate protection against the most frequent causative organisms of community-acquired pneumonia, it has a favorable safety profile, and the pharmacokinetic vari-

Table 3. Health-Related Quality of Life at Days 7 and 30 in the Study Groups and in the General Spanish Population\*

SF-36 Scales	Mean Score at Day 7		Mean Difference (95% CI)	Mean Score at Day 30		Mean Difference (95% CI)	Mean Score in the General Spanish Population
	Outpatient Group (n = 102)	Hospitalized Group (n = 101)		Outpatient Group (n = 102)	Hospitalized Group (n = 101)		
Physical functioning	68.5 $\pm$ 24.8	65.7 $\pm$ 24.7	2.8 (−4.2 to 9.8)	79.1 $\pm$ 21.4	74.4 $\pm$ 26.6	4.7 (−2.3 to 11.7)	84.7 $\pm$ 24.0
Physical role	29.6 $\pm$ 41.0	22.3 $\pm$ 38.8	7.3 (−4.0 to 18.6)	78.0 $\pm$ 37.6	70.9 $\pm$ 41.2	7.1 (−4.3 to 18.5)	83.2 $\pm$ 35.2
Bodily pain	60.9 $\pm$ 31.7	56.2 $\pm$ 33.2	4.7 (−4.5 to 13.9)	81.3 $\pm$ 25.8	82.3 $\pm$ 23.2	−1.0 (−8.0 to 6.0)	79.0 $\pm$ 27.9
General health	60.1 $\pm$ 22.4	55.8 $\pm$ 20.3	4.3 (−1.9 to 10.5)	63.5 $\pm$ 22.7	59.2 $\pm$ 22.6	4.3 (−2.3 to 10.9)	68.3 $\pm$ 22.3
Vitality	48.8 $\pm$ 25.1	47.3 $\pm$ 24.9	1.5 (−5.6 to 8.6)	68.0 $\pm$ 22.0	64.6 $\pm$ 24.2	3.4 (−3.3 to 10.1)	66.9 $\pm$ 22.1
Social functioning	60.3 $\pm$ 28.6	57.1 $\pm$ 30.1	3.2 (−5.1 to 11.5)	86.4 $\pm$ 21.1	85.1 $\pm$ 25.0	1.3 (−5.3 to 7.9)	90.1 $\pm$ 20.0
Emotional role	69.1 $\pm$ 44.1	67.4 $\pm$ 44.7	1.7 (−11.1 to 14.5)	89.2 $\pm$ 27.5	83.5 $\pm$ 36.0	5.7 (−3.6 to 15.0)	88.6 $\pm$ 30.1
Mental health	66.6 $\pm$ 23.7	68.3 $\pm$ 22.3	−1.7 (−8.3 to 4.9)	74.2 $\pm$ 21.4	77.5 $\pm$ 18.3	−3.3 (−9.1 to 2.5)	73.3 $\pm$ 20.1

\* All values are means  $\pm$  SD. SF-36 = Short Form-36.

ables of oral administration and sequential therapy for levofloxacin are similar (18). Recently, the emergence of levofloxacin-resistant *S. pneumoniae* strains, mainly in patients with previous quinolone use, has become a matter of concern (19). In our trial, receipt of quinolones in the preceding 3 months was considered an exclusion criterion. All *S. pneumoniae* strains isolated during the study period were susceptible to levofloxacin.

Our results concur with those from 2 previous studies that used different designs, namely comparison with a retrospective control group (14) and randomization by hospitals rather than patients (20). In Atlas and colleagues' emergency department–based study (14), outpatient care and treatment with oral clarithromycin were recommended for patients in risk classes I to III. Patients were excluded from home triage regardless of PSI score if there were extenuating circumstances, such as chronic oxygen dependency, severe social or psychiatric problems compromising home care, or inability to take oral medications and nutrition. In comparison with retrospective controls identified during the previous year, a higher percentage of patients were treated initially as outpatients during the intervention period than during the control period (57% vs. 42%). However, more outpatients during the intervention period were subsequently admitted to the study hospital (9% vs. 0%). None of the 166 patients in the intervention group died during the 4-week follow-up period. In a controlled trial by Marrie and associates (20), 19 Canadian hospitals were assigned to continue conventional management or to implement a critical pathway using 1) PSI score to aid admission decisions, 2) levofloxacin therapy, and 3) practice guidelines for the care of inpatients. Outpatient care was recommended for patients in risk classes I to III. In this study, the hospitals assigned to implement the protocol admitted fewer low-risk patients than did the control hospitals (31% vs. 49%); quality of life and the occurrence of complications, readmission, and mortality did not differ between the 2 strategies (20).

In our study, selected patients in risk classes II and III who received a diagnosis of community-acquired pneumonia in the emergency department were randomly assigned to outpatient care or hospitalization. Patients were followed to assess a variety of medical outcomes, quality of life, and satisfaction with care. To date, no similar randomized study has been performed to test whether low-risk patients with community-acquired pneumonia who are treated as outpatients would have outcomes equivalent to those of comparable patients who are hospitalized.

Some observational studies have noted the limitations of the PSI, and investigators have argued that the decision to hospitalize should not be made on the basis of the PSI score alone (21–23). In a previous study (22), we found that a significant number of low-risk patients (PSI score  $\leq$  90 points) who were hospitalized on the basis of conventional admission criteria presented with respiratory failure and a need for supplementary oxygen, with unstable co-

morbid conditions, or with complicated pleural effusion. In our current randomized study, these irrefutable contraindications for outpatient care were found in approximately one third of patients considered for inclusion. Therefore, when evaluating patients with community-acquired pneumonia to determine suitability for outpatient treatment, physicians must first look carefully for the possible presence of extenuating circumstances that require hospitalization.

We found no differences between groups in terms of the percentage of patients who had an overall successful outcome according to strict predefined criteria. The multivariate analyses further confirmed the equivalence of the 2 treatment strategies. A significant number of outpatients were 70 years of age or older and had successful outcomes, as occurred in patients with *Legionella* pneumonia or multilobar pneumonia. Although it is assumed that inpatient care leads to better outcomes, our study shows that hospitalization places patients at risk for some complications, such as phlebitis or pulmonary embolism.

Our study has several limitations. First, it had a relatively small sample size and was not powered to detect differences in mortality. The expected mortality rate in patients in risk classes II and III is approximately 1% (7). Because the mortality rate is lower among patients without extenuating circumstances, such as respiratory failure and unstable comorbid conditions, our finding that 1 of 224 patients died was not unexpected. Second, our conclusions apply only to a subset of patients in PSI risk class II and III who have good oxygenation and no unstable comorbid conditions, complicated pleural effusions, or severe social problems. Third, our finding that outpatient care of low-risk patients treated with levofloxacin was as safe and effective as hospitalization might not apply in settings with higher rates of quinolone resistance among respiratory pathogens or higher rates of previous quinolone use. Fourth, outcomes were assessed by investigators who were aware of patient treatment assignments.

In agreement with a previous study (20), we did not find differences between groups in patients' health-related quality of life during follow-up. Improving patient satisfaction is an important goal in the management of community-acquired pneumonia. In our study, outpatients were more frequently satisfied with their overall care for pneumonia than were hospitalized patients. The percentage of outpatients satisfied with care was high and was close to the figure found by other researchers (14). In an era of cost containment and resource constraints in many health care systems, adequate resource allocation and cost-effective health care delivery are of paramount importance (24). In the United States, the estimated average cost of an episode of community-acquired pneumonia in a hospitalized patient is \$6000 to \$7000, compared with less than \$200 for patients treated in the outpatient setting (25). Therefore, our finding that carefully selected low-risk patients with community-acquired pneumonia can do as well in an out-

patient setting as similar patients who are hospitalized might have significant economic implications.

Our data provide strong evidence in favor of outpatient care for selected low-risk patients with community-acquired pneumonia, firmly supporting recent recommendations (8, 9). According to the results of our randomized trial, patients in PSI risk classes II and III can be safely treated with levofloxacin as outpatients in the absence of respiratory failure, unstable comorbid conditions requiring hospitalization, complicated pleural effusions, and social problems compromising outpatient care. Such treatment will lead to greater patient satisfaction and should be considered as the standard of care for selected low-risk patients with community-acquired pneumonia.

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