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*Article*

# Influence of Socioeconomic Status on Features and Outcome of Community-Acquired Pneumonia

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**Abstract** The influence of socioeconomic status on the features and evolution of community-acquired pneumonia in 107 consecutive hospitalized patients was investigated. Thirty-four (31.8%) patients were considered to have a low socioeconomic status. These patients were more likely immigrants, middle-aged, with fewer comorbid illnesses, and were more often tobacco, alcohol, or drug consumers ($P<0.01$). The distribution of etiologies was significantly different according to socioeconomic status, with tuberculosis occurring more frequently in the low socioeconomic group ($P<0.05$). Low socioeconomic status was not associated with a more severe presentation or outcome of pneumonia but was an independent factor that predicted a significantly longer length of hospitalization (5.9 days longer; 95% confidence interval, 2.2–9.5 days; $P<0.003$), entailing a substantial excess cost per hospital stay.

## Introduction

Community-acquired pneumonia (CAP) is one of the most common infectious diseases in occidental countries. Data from the USA suggest that there are approximately 2–4 million cases per year and that more than 600 000 patients are hospitalized [1–4]. The aggregate cost of hospitalization for the disease approaches $4 billion per year. Numerous factors have been associated with the prognosis of CAP in a large number of studies [5–15], such as demographic, clinical, biological, radiological, and microbiologic parameters. However, the socioeconomic status has never been studied as a potential risk factor that could predict the features and evolution of CAP. Poverty, unemployment, and homelessness are increasing in Western countries. This point is of importance since patients with CAP and poor socioeconomic status are usually cared for in public hospitals. Therefore, the purpose of this study was to determine whether poor social and economic conditions could influence the features and evolution of CAP in a cohort of hospitalized patients.

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## Patients and Methods

We prospectively analyzed 107 patients consecutively admitted to our department of internal medicine in a university hospital from June 1992 to November 1993 for the treatment of pneumonia. To be included, patients had to be at least 18 years of age and have a principal diagnosis of pneumonia. On admission, patients had to have at least one of the major or two of the minor criteria, along with a new infiltrate on a chest radiograph. Major criteria were cough, sputum production, and history of fever (>37.8 °C); minor criteria were dyspnea, pleuritic chest pain, pulmonary consolidation on examination, and leukocytosis (leukocyte count >12 000/$mm^3$). An infiltrate on a chest radiograph was considered new if it disappeared following treatment with an anti-infective agent that was active against the microorganism suspected or proven to be responsible for pneumonia. Patients with a pulmonary infiltrate that was proven to be of noninfectious origin and/or that did not disappear following treatment with an anti-infective agent were excluded. Immunodepression was not a criterion of exclusion.

*Identification of Pathogens.* Infections were classified into five categories on the basis of clinical, radiological, microbiological, and serological findings: (i) proven bacterial pneumonia (pathogen found in blood, pleural fluid, or protected-brush specimen obtained by bronchoscopy or bronchoalveolar lavage); (ii) atypical pneumonia, proven by a serologic result positive for *Mycoplasma pneumoniae* (Platelia EIA; Sanofi Diagnostic

Pasteur, France), *Chlamydia pneumoniae* (indirect immunofluorescence method; Servibio, Israel), or *Legionella pneumophila* (indirect immunofluorescence method; Servibio), or by a positive direct fluorescent antibody test for *Legionella pneumophila*; (iii) tuberculous pneumonia (proven by a culture positive for *Mycobacterium tuberculosis*); (iv) opportunistic infection due to *Pneumocystis carinii* or *Toxoplasma gondii* (proven by positive findings in direct microscopy of bronchoalveolar lavage fluid); and (v) other infections, considered to be of undetermined origin. The need for invasive procedures was determined by the clinician in charge of the patient.

*Risk Factors.* The following clinical, sociodemographic, radiologic, and laboratory data were recorded upon admission and during hospitalization: age, gender, smoking habits, alcohol intake, intravenous drug addiction, socioeconomic status, previous antibiotic treatment, duration of symptoms prior to admission, fever, blood pressure, respiratory rate, dyspnea, chest pain, altered mental status, leukocyte count, hemoglobin level, serum albumin, renal insufficiency, $PaO_2$, $PaCO_2$, presence of a comorbid illness (pulmonary disease, chronic heart failure, diabetes mellitus, neoplastic disease, neurologic disease), HIV infection, AIDS, need for intensive care, mortality, and length of hospitalization. The socioeconomic status was classified in two categories. The socioeconomic status was considered low when one of the following conditions was present: prolonged unemployment (duration of unemployment sufficiently prolonged to lead to the discontinuation of unemployment benefits), homelessness, poor living conditions including overcrowding and/or insalubrious living conditions, patient receiving free medical care, or patient living solely by means of governmental assistance. The socioeconomic status was considered as average if none of these conditions were present.

*Statistical Analysis.* Univariate analysis of the relationships between patient characteristics, outcome, and socioeconomic status was performed using Student's *t* test for continuous variables, chi-square test, and Fisher's exact test for categorical variables. Factors influencing the duration of hospitalization were determined using two steps: in the first one, a univariate analysis was performed, using Student's *t* test for categorical variables and Pearson correlation coefficient tests for continuous variables. In the second step, a multivariate analysis was performed, using a stepwise linear regression. The variables entered in this regression were age, gender, and all variables linked with the duration of hospitalization with a $P$ value of $<0.10$. All tests involved in this statistical analysis were computed using the SAS statistical software (SAS Institute, USA).

**Table 1** Characteristics of the study population ($n=107$)

| | |
|---|---|
| Sociodemographic factors | |
| Age (years)[a] | 51 ± 23.3 |
| Male (*n*) | 72 (67.3%) |
| Ethnic group | |
| Caucasian (*n*) | 71 (66.3%) |
| Black African (*n*) | 19 (17.8%) |
| Maghrebian (*n*) | 17 (15.9%) |
| Low socioeconomic status (*n*) | 34 (31.8%) |
| Cigarette smoking (*n*) | 40 (37.4%) |
| Alcohol (*n*) | 24 (22.4%) |
| Drug addiction (*n*) | 9 (8.4%) |
| History, physical examination | |
| Duration of symptom before admission (days)[a] | 17 ± 22.4 |
| Comorbid illness (*n*) | 51 (47.7%) |
| HIV infection (*n*) | 28 (26.2%) |
| AIDS (*n*) | 23 (21.5%) |
| Temperature (°C)[a] | 38.7 ± 0.82 |
| Antibiotic before admission (*n*) | 31 (29%) |
| Respiratory rate >30/min (*n*) | 32 (29.9%) |
| Blood pressure <90 mmHg (*n*) | 11 (10.3%) |
| Chest pain (*n*) | 26 (24.3%) |
| Dyspnea (*n*) | 56 (52.3%) |
| Etiology of pneumonia | |
| Tuberculous (*n*) | 23 (21.5%) |
| Bacterial (*n*) | 14 (13.1%) |
| Atypical (*n*) | 10 (9.3%) |
| Opportunistic (*n*) | 14 (13.1%) |
| Undetermined (*n*) | 46 (43%) |
| Laboratory | |
| Hemoglobin <9 g/dl (*n*) | 8 (7%) |
| Platelet count $<100\times10^9/mm^3$ (*n*) | 7 (6.5%) |
| Positive blood culture (*n*) | 10 (9.3%) |
| Serum creatinine >1.7 mg/dl (*n*) | 5 (4.7%) |
| $PaO_2$ (mmHg)[a] | 66.2 ± 18.5 |
| Outcome | |
| Hospitalization in intensive care units (*n*) | 9 (8.4%) |
| Death (*n*) | 9 (8.4%) |
| Length of hospitalization (days)[a] | 15.3 ± 8.6 |

[a] Mean ± standard deviation

## Results

One hundred seven patients were admitted for pneumonia via the emergency room. Features and evolution of pneumonia in the study population are shown in Table 1. The etiology of pneumonia was determined in 61 (57%) cases: *Mycobacterium tuberculosis*, 23 cases; bacteria, 14 cases; atypical pathogens, 10 cases; and opportunistic organisms, 14 cases. The etiology was of undetermined origin in 46 cases. Opportunistic infections were due to *Pneumocystis carinii* in 13 cases and to *Toxoplasma* in one case. Bacteria identified were *Streptococcus pneumoniae* in seven cases, *Staphylococcus aureus* in five cases, *Haemophilus influenzae* in one case, and *Enterococcus faecalis* in one case. Atypical pneumonia was due to *Chlamydia pneumoniae* in four cases, *Legionella pneumophila* in three cases, and *Mycoplasma pneumoniae* in three cases. The crude mortality rate was 8.4% and the mean length of hospitalization was 15.3 days.

Thirty-four (31.8%) patients were considered to have a low socioeconomic status. Patients with a low socioeconomic status had several specific characteristics. They were more likely to be substance abusers (alcohol, tobacco, or drug addiction; $P=0.007$, 0.002, and 0.002, respectively), younger in age ($P=0.01$), and immigrants ($P=0.001$) as compared with the remaining 73 patients with an average socioeconomic status. Clinically, they differed from the other group only by the fact that they had fewer comorbid illnesses ($P=0.01$) (Table 2). The distribution of etiologies was significantly different among the two populations ($P=0.04$), with tuberculosis being more frequent (35.3%) and opportunistic infections less frequent (2.9%) in patients with low socioeconomic status (Table 3).

The outcome of pneumonia was identical in both groups in terms of hospitalization in an intensive care

**Table 2** Univariate analysis of the characteristics of the patients at presentation according to socioeconomic status

| Characteristic | Low socioeconomic status ($n=34$) | Average socioeconomic status ($n=73$) | $P$ value |
|---|---|---|---|
| Sociodemographic factors | | | |
| Age (years)[a] | 43 ± 18 | 55 ± 24 | 0.01 |
| Male | 27 (79.4%) | 45 (61.6%) | 0.06 |
| Ethnic origin | | | |
| Caucasian | 14 (41.2%) | 57 (78%) | 0.001 |
| Black African | 11 (32.3%) | 8 (11%) | |
| Maghrebian | 9 (26.5%) | 8 (11%) | |
| Cigarette smoking | 19 (55.9%) | 21 (28.8%) | 0.007 |
| Alcohol | 14 (41.2%) | 10 (13.7%) | 0.002 |
| Drug addiction | 7 (20.5%) | 2 (2.7%) | 0.002 |
| History, physical examination | | | |
| Comorbid illness | 10 (29.4%) | 41 (56.2%) | 0.01 |
| HIV | 9 (26.5%) | 19 (26%) | NS |
| AIDS | 5 (14.7%) | 18 (24.6%) | NS |
| Antibiotic before admission | 8 (23.5%) | 23 (31.5%) | NS |
| Days before hospitalization[a] | 19 ± 21 | 16 ± 23 | NS |
| Temperature (°C)[a] | 38.7 ± 0.8 | 38.7 ± 0.8 | NS |
| Chest pain | 9 (26.5%) | 17 (23.3%) | NS |
| Dyspnea | 16 (47%) | 40 (54.8%) | NS |
| Systolic blood pressure < 90 mmHg | 3 (8.8%) | 8 (10.9%) | NS |
| Respiratory rate > 30/min | 7 (20.5%) | 25 (34.2%) | NS |
| Altered mental status | 7 (20.5%) | 9 (12.3%) | NS |
| Laboratory findings | | | |
| $PaO_2$ (mmHg)[a] | 66.5 ± 15 | 66.1 ± 19 | NS |
| $PCO_2$ (mmHg)[a] | 33.7 ± 5 | 34.7 ± 5 | NS |
| CD4+ cell count (cells/mm$^3$) | 421 (7–1122) | 372 (3–1256) | NS |
| Leukocyte count (cells/mm$^3$) | 7687 (580–38360) | 7690 (1530–20320) | NS |
| Hemoglobin level < 9 g/dl | 4 (11.8%) | 4 (5.5%) | NS |
| Serum creatinine > 1.7 mg/dl | 1 (2.9%) | 4 (5.5%) | NS |
| Serum albumin (mg/dl)[a] | 30.8 ± 5 | 31 ± 6 | NS |
| Platelet count < 100 000/mm$^3$ | 3 (8.8%) | 4 (5.5%) | NS |
| Positive blood culture | 4 (11.8%) | 6 (8.2%) | NS |

[a] Mean ± standard deviation
NS, not significant

unit and death attributed to pneumonia (Table 4). However, the outcome differed with regard to length of hospitalization ($P=0.02$). The presence of a low socioeconomic status was associated with a longer period of hospitalization (Table 4).

Univariate analysis of factors influencing the duration of hospitalization showed that, in addition to low socioeconomic status, drug addiction, renal insufficiency, HIV infection, presence of a comorbid illness, and low serum albumin level were also significantly associated with an increased duration of hospitalization (Table 5).

Multivariate analysis demonstrated that low socioeconomic status, age (analyzed as a continuous variable), AIDS, and renal insufficiency were independent risk factors significantly related to a prolonged hospitalization (Table 6). Therefore, the duration of hospitalization could be expressed in our study population with the following equation: length of hospitalization = 5.88 + (age × 0.1) + (socioeconomic status × 5.9) + (serum creatinine > 1.7 mg/dl × 12.3) + (AIDS × 8.9), where age is expressed in year, 1 or 0 is attributed to the presence or absence of low socioeconomic status, serum creatinine > 1.7 mg/dl, and AIDS, respectively. Thus, according to this multivariate analysis, taking into account the interaction between age and socioeconomic status (patients with a low socioeconomic status were younger), the increase in the duration of hospitalization attributable to socioeconomic status was not of 4 days, as shown by univariate analysis (Table 4), but of 6 days (5.9 days; 95% confidence interval, 2.2–9.5 days; $P<0.003$) (Table 6).

## Discussion

A number of important factors associated with an unfavorable course of pneumonia have been previously identified. These factors include age, clinical symptoms, and specific microbiological or radiographic findings [5–15]. However, socioeconomic status has never been considered a possible risk factor affecting the outcome of pneumonia. This parameter could yet be very important to consider for the treatment and the cost of CAP

**Table 3** Etiology of pneumonia according to socioeconomic status. The distribution of the etiologic categories was significantly different among the two groups of patients ($P=0.04$)

| Etiology of pneumonia | No. (%) with low socioeconomic status ($n=34$) | No. (%) with average socioeconomic status ($n=73$) |
|---|---|---|
| Bacterial | 6 (17.6) | 8 (11) |
| Atypical | 3 (8.8) | 7 (9.6) |
| Tuberculous | 12 (35.3) | 11 (15.1) |
| Opportunistic infection | 1 (2.9) | 13 (17.8) |
| Undetermined | 12 (35.9) | 34 (46.6) |

**Table 4** Univariate analysis of outcome according to socioeconomic status

| | Low socioeconomic status ($n=34$) | Average socioeconomic status ($n=73$) | *P* value |
|---|---|---|---|
| Intensive care unit (*n*) | 4 (11.8%) | 5 (6.8%) | NS |
| Death (*n*) | 1 (2.9%) | 8 (10.9%) | NS |
| Length of hospitalization (days) [a] | 18 ± 9.7 | 14 ± 7.8 | 0.02 |

[a] Mean ± standard deviation
NS, not significant

**Table 5** Univariate analysis of factors influencing the duration of hospitalization. Patients that were transferred to the intensive care unit or died were not included in the analysis. Only significant results were noted in this table, even though all factors listed in Table 1 were analyzed

| Factor | Mean duration of hospitalization in days (range) | *P* value |
|---|---|---|
| Low socioeconomic status | | 0.02 |
| Present ($n=29$) | 17.8 (6–35) | |
| Absent ($n=60$) | 13.5 (3–41) | |
| Drug addiction | | 0.05 |
| Present ($n=7$) | 20.7 (8–35) | |
| Absent ($n=82$) | 14.4 (3–41) | |
| Serum creatinine >1.7 mg/dl | | 0.04 |
| Present ($n=4$) | 23.3 (12–35) | |
| Absent ($n=85$) | 14.5 (3–41) | |
| HIV infection | | 0.06 |
| Present ($n=22$) | 13.9 (3–35) | |
| Absent ($n=67$) | 17.8 (7–41) | |
| Comorbid illness | | 0.06 |
| Present ($n=40$) | 16.7 (5–41) | |
| Absent ($n=49$) | 13.4 (5–41) | |
| AIDS | | 0.005 |
| Present ($n=18$) | 19.7 (3–41) | |
| Absent ($n=71$) | 13.7 (3–35) | |
| Serum albumin level[a] | | 0.015 |

[a] Serum albumin was analyzed as a continuous variable

**Table 6** Multivariate analysis of factors influencing the duration of hospitalization

| | Coefficient | 95% CI | *P* value |
|---|---|---|---|
| Age | 0.1 | 0.021–0.178 | 0.02 |
| Low socioeconomic status | 5.9 | 2.2–9.5 | 0.003 |
| Serum creatinine >1.7 mg/dl | 12.3 | 4.2–20.4 | 0.005 |
| AIDS | 8.9 | 4.9–12.8 | 0.0001 |

CI, confidence interval

[16]. Indeed, almost one-third of our study population was considered to have a low socioeconomic status. The main finding of our study was that low socioeconomic status was an independent parameter that significantly prolonged the duration of hospitalization by 6 days. This result was not due to more severe pneumonia at presentation and was observed in a group of patients who were younger and had fewer comorbid illnesses than patients with an average socioeconomic status. In addition, this prolonged hospital stay was not due to a more unfavorable clinical outcome, as assessed by transfer to an intensive care unit and mortality. Interestingly, a similar result was recently reported by Salit et al. [16] in New York. In their study population, characterized by a very high proportion of psychiatric patients and drug abusers, it was shown that homeless patients stayed in hospital 4.1 days longer than the other patients [16], a result very similar to our findings.

Our study population differed from that of previously published studies because HIV infection and tuberculosis were not exclusion criteria. HIV infection has been excluded from all the studies investigating the prognosis factors of CAP [5–15]. However, pneumonia is frequent in patients with HIV infection, and recurrent pneumonia is now included in the AIDS-defining criteria [17]. It was extremely important to take this factor into account in our study since HIV infection could have been a confounding factor of low socioeconomic status or a factor associated with unfavorable outcome. Indeed, AIDS was found to be an independent parameter that prolonged the duration of hospitalization, despite the fact that HIV infection was equally distributed among patients with or without low socioeconomic status.

The prevalence of tuberculosis was extremely high in our study, as previously reported by our group in a similar urban population [18]. This observation may be explained by two different factors: (i) the clinical presentation of tuberculosis was often that of acute or subacute pneumonia, and could not be differentiated from other CAP; and (ii) a significant proportion of patients in our study population had a low socioeconomic status, as mentioned above, and this parameter was linked with a higher proportion of tuberculosis

(Table 3). A considerable proportion of our study population comprised immigrants from African countries where the prevalence of tuberculosis is high. Of note, neither the etiology of pneumonia (Table 5) nor, more specifically, the etiology of tuberculosis was significantly associated with a prolonged duration of hospitalization ($16.6 \pm 7$ days vs. $14.3 \pm 8$ days for tuberculous vs. nontuberculous patients; $P = 0.26$).

The more prolonged duration of hospitalization in patients with a low socioeconomic status may be explained by several medical and social factors related to the difficult management of CAP in these patients [16]. Hospitalization assures that treatment is available and is actually taken by the patients, which increases the likelihood that clinical outcome will be favorable. Indeed, follow-up care is extremely difficult in these patients. In addition, difficulties in placing patients in housing or shelters may explain the prolonged duration of hospitalization, particularly during the winter months, when overcrowding becomes more of a problem. The lack of low-cost housing in the city or intermediate structures between hospital and shelters may also contribute to a medically unjustified prolonged hospital stay.

In conclusion, low socioeconomic status was associated with prolonged duration of hospitalization that was not explained by medical factors. This condition should be taken into account when evaluating the cost of hospitalization for CAP. The search for intermediate structures less expensive than hospitals is warranted to allow a quick discharge of patients with a low socioeconomic status.

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