An analysis of decisions by European general practitioners to admit to hospital patients with lower respiratory tract infections

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Abstract
Background – The purpose of this study was to identify factors on which European general practitioners (GPs) base their decisions to admit to hospital patients with lower respiratory tract infections (LRTI).

Methods – A survey was carried out from December 1993 to January 1994 to identify factors that affect GPs’ decisions to admit to hospital patients with LRTI by collecting data on 2056 patients from 605 GPs in France, Germany, Italy, Spain, and the UK.

Results – Only 93 (4.5%) of the patients included in the study were admitted to hospital. Univariate analysis showed that age > 60 years, institutionalisation of the patient, concomitant diseases, cardiac insufficiency, asthma, a diagnosis of pneumonia, and clinical signs such as chest pain, cyanosis, tachypnoea and hypotension significantly (odds ratio (OR) > 2.0, p < 0.002) influenced the decision to admit to hospital. No influence could be shown for sex, smoking habits, history of bronchiectasis or chronic bronchitis, the presence of fever, chills, myalgia, cough or purulent sputum, and the diagnoses of acute bronchitis, influenza or exacerbation of chronic bronchitis. In the multivariate analysis only the presence of chest pain (OR 2.3, 95% confidence interval (CI) 1.5 to 3.5), cyanosis (OR 4.1, 95% CI 2.4 to 7.1), dyspnoea (OR 4.9, 95% CI 3.1 to 7.9), and hypotension (OR 2.9, 95% CI 1.6 to 5.2), as well as a diagnosis of pneumonia (OR 6.6, 95% CI 4.3 to 10) (all p < 0.0001) remained as factors that significantly affected the decision to admit to hospital.

Conclusions – Clinical signs of severe infection and a diagnosis of pneumonia are the main factors that induce GPs to admit patients with LRTI to hospital in Europe.

Keywords: hospitalisation, community acquired pneumonia, chronic bronchitis, lower respiratory tract infection.

Infections of the respiratory tract are the most common types of infectious diseases in developed countries. In the USA it has been estimated that over 200 million episodes of respiratory tract infections occur each year, corresponding to an incidence of nearly one infection per inhabitant per year. In this study the morbidity of these infections was found to account for an estimated 75 million physician visits and almost 150 million days lost from work per year. The costs of medical care alone were estimated to amount to more than $10 billion each year. Although exact data on the incidence of respiratory tract infections are not available for Europe, an estimate of the true incidence of lower respiratory tract infections (LRTI) in Europe is available from a study in the UK where, in 1993, an incidence of 4400 cases per 100 000 per year has been found which was age related, ranging between 810 cases per 100 000 in the 16–18 age group and 12 150 per 100 000 in those aged 70–79 years.

Most types of respiratory tract infections are self-limiting but infections of the lower respiratory tract such as pneumonia and acute exacerbations of chronic bronchitis are still severe diseases associated with severe morbidity and a substantial mortality rate. Moreover, LRTI account for a substantial proportion of total public health costs, of which admission to hospital is one of the most important cost factors. In the USA the cost of hospital admission of patients with community acquired pneumonia exceeds 1.5 billion dollars per year, so every effort has to be made to reduce the number of hospital admissions for LRTI. On the other hand, for some subgroups of patients with LRTI, admission to hospital will clearly reduce the risk of death or severe complications.

For physicians it is often difficult to differentiate between patients with LRTI who can be treated at home and those for whom admission to hospital will be life-saving. Previous studies have shown that there is considerable variability in hospital admissions of, for example, patients with community acquired pneumonia,4,5 which suggests that there is a need for recommendations on the decision whether or not to admit such patients to hospital. Many studies performed so far on the admission to hospital of patients with LRTI have concentrated on the evaluation of patient-related or disease-related risk factors associated with a higher mortality or a complicated course. These studies have identified a number of risk factors and strongly suggest hospital based...
### Table 1 Demographic characteristics of the study population

<table>
<thead>
<tr>
<th>Demographic data</th>
<th>Hospitalised patients (n=93)</th>
<th>Non-hospitalised patients (n=1963)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (SD) age (years)</td>
<td>61 (16)</td>
<td>50 (20)</td>
</tr>
<tr>
<td>% male</td>
<td>61</td>
<td>52</td>
</tr>
<tr>
<td>% employed</td>
<td>26</td>
<td>45</td>
</tr>
<tr>
<td>% institutionalised</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>% smokers</td>
<td>23</td>
<td>45</td>
</tr>
<tr>
<td>% ex-smokers</td>
<td>35</td>
<td>23</td>
</tr>
</tbody>
</table>

### Table 2 Concomitant diseases of the study population (%)

<table>
<thead>
<tr>
<th>Concomitant disease</th>
<th>Hospitalised patients (n=93)</th>
<th>Non-hospitalised patients (n=1963)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic bronchitis</td>
<td>21.5</td>
<td>14.5</td>
</tr>
<tr>
<td>Cardiac insufficiency</td>
<td>20.4</td>
<td>8.4</td>
</tr>
<tr>
<td>Asthma</td>
<td>16.1</td>
<td>7.2</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>4.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Allergy</td>
<td>2.7</td>
<td>1.5</td>
</tr>
<tr>
<td>Bronchiectasis</td>
<td>3.2</td>
<td>1.4</td>
</tr>
<tr>
<td>Upper respiratory tract infection</td>
<td>—</td>
<td>1.3</td>
</tr>
<tr>
<td>Hepatic diseases</td>
<td>—</td>
<td>1.2</td>
</tr>
<tr>
<td>Bronchial carcinoma</td>
<td>—</td>
<td>0.3</td>
</tr>
<tr>
<td>Others</td>
<td>6.9</td>
<td>3.6</td>
</tr>
<tr>
<td>Any concomitant disease</td>
<td>67</td>
<td>43</td>
</tr>
</tbody>
</table>

treatment for those patients who show one or more of these factors. However, most of these studies have been performed from a hospital perspective and therefore may not be applicable to general practitioners (GPs).

We have therefore carried out a survey of European GPs with regard to their management of patients with LRTI and have analysed their current practice of admission to hospital in this patient group. The main goal of this study was to identify factors that affect GPs' decisions to admit to hospital a patient with LRTI rather than to determine high risk groups of patients with LRTI who should be treated in hospital.

**Methods**

Data were obtained by interviews of 605 GPs conducted in five European countries (France (F), n = 123; Germany (G), n = 121; Italy (I), n = 120; Spain (S), n = 121 (Manresa, personal communication); UK, n = 120) from December 1993 to January 1994 as described previously. GPs were asked to describe the way they had managed their last four patients with an LRTI such as bronchopneumonia, pneumonia, acute bronchitis, acute exacerbation of chronic bronchitis, or flu or flu-like syndrome. In this manner, information on 2056 patients was obtained (F, 369; G, 484; I, 360; S, 363; UK, 480). The interviews were carried out by SOFRES (Montrouge, France).

**METHODS OF ANALYSIS**

Differences in variables between patient subgroups were analysed using the χ² test and Fisher's exact test for categorical variables as appropriate. The Student's t test was used for continuous variables. A two-tailed p value of less than 0.01 was considered statistically significant. When appropriate, continuous variables were analysed as categorical variables using clinically defined cut off points. All variables in the database were analysed to compare patients with an LRTI admitted to hospital with those treated on an outpatient basis. Odds ratios and their 95% confidence intervals were calculated using a computed statistical analysis system (GraphPad, San Diego, USA).

All factors which showed a significant association with the decision to admit to hospital by univariate analysis (p < 0.01) were entered into a multivariate analysis performed by multiway frequency tables, measures of association, and the log-linear model using the P4F routines of the BMDP software package (University of California, Berkeley, USA). The log-linear model was used because the response variable was a binomial random variable (admission or no admission to hospital). Partial association tests were used to analyse the significance of deleting a particular effect from the model by calculation of the likelihood ratio. χ² and marginal association tests were used to test the significance of deleting an effect from the model which contains all effects after summing over levels of categorical variables not included in the effect by calculation of the Pearson χ². Because of the multiple tests and the relatively small number of patients admitted to hospital, only p values of < 0.00001 were considered significant in the multivariate analysis.

**Results**

**HOSPITAL ADMISSIONS**

Only 93 patients (4.5%) of the 2056 patients with LRTI included in this study were admitted to hospital. Important socio-demographic data of the patients who were and were not admitted to hospital are shown in table 1. In comparison with the whole study population, patients admitted to hospital were older (fig 1), were institutionalised more frequently, smoked less (table 1), and more often had concomitant diseases, especially chronic bronchitis, asthma and cardiac failure (table 2), than those treated at home. Analysis of hospital admissions in the five countries showed a higher than average rate of hospital admissions in the UK (9.0%) and France (5.1%), and a lower than average rate in Spain, Germany, and Italy (fig 2), although there were no significant differences in the frequency of each diagnosis and the patient population between the five countries.
Admission to hospital of patients with lower respiratory tract infections

Figure 2 Hospital admissions by country.

REASONS FOR ADMISSION TO HOSPITAL
Presentation
Symptoms and signs present at the first consultation are shown in fig 3. The most frequent symptoms were cough, fever, and expectoration of purulent sputum. Signs of more severe infection were only seen in a few patients (cyanosis 6.5%, hypotension 6.6%). With the exception of cough (17.9%) and dyspnoea (12.3%), only a small proportion of all symptoms had been present before the onset of the current LRTI (≤ 5%), but no differences could be observed between patients admitted and not admitted to hospital. In contrast, patients admitted to hospital more often showed signs of more severe types of infections such as chest pain, cyanosis, dyspnoea or hypotension, whereas no differences were seen in the incidence of fever, chills, myalgia, cough, purulent sputum, and focal signs during auscultation at the time of first presentation (fig 3).

Presumptive diagnosis
Based on patient history, symptoms and signs, the GP made a presumptive clinical diagnosis of LRTI which was attributed to one of the following diseases: acute bronchitis (n = 678, 33%), flu or flu-like syndrome with lower respiratory tract involvement (n = 605, 29.4%), acute exacerbation of chronic bronchitis (n = 397, 19.3%), and bronchopneumonia (without focal signs) or pneumonia (with focal signs) (n = 368, 17.9%). Not surprisingly, fewer patients with acute bronchitis or flu were admitted to hospital than those with pneumonia (table 3). The diagnosis of acute exacerbation of chronic bronchitis was the same in the whole study population and in the group admitted to hospital. Univariate analysis of association between the clinical diagnosis and the rate of hospital admission showed a significant association of acute bronchitis or flu with outpatient management and of pneumonia with hospital treatment (table 3).

History of current LRTI
An abrupt onset of the symptoms of the current LRTI was reported by 1342 (65.1%) patients and a more gradual onset by 720 (34.8%). The mean time elapsed between the initial symptoms of LRTI and the first consultation was 4.2 (2.7) days, but nearly half of the patients saw their GPs within two days of the onset of symptoms. The first consultation took place at the doctor's surgery in 58.4% of the cases and at home in 41.6%. No significant differences were observed between patients who were and were not admitted to hospital.

ANALYSIS OF ASSOCIATION BETWEEN PATIENT-RELATED FACTORS, SYMPTOMS, AND SIGNS AND ADMISSION TO HOSPITAL
The association of 23 patient-related factors, symptoms, and signs with the hospital admission rate was investigated by univariate analysis. No association was found for sex, smoking habits, concomitant bronchiectasis or chronic bronchitis, and the current history of LRTI development (data not shown). This was basically the same for the symptoms or signs such as fever, chills, myalgia, cough, purulent sputum production, and auscultation findings (data not shown). In contrast, 10 patient-related factors, symptoms and signs showed a significant association with the rate of hospital admission by univariate analysis (tables 4 and 5). However, age >60 years, institutionalization, any concomitant disease, cardiac insufficiency, and a history of asthma no longer showed a significant association with the hospital admission rate when analysed by multivariate analysis (table 4). Only a presumptive clinical diagnosis of pneumonia or bronchopneumonia and signs of a more severe type of infection (chest pain, cyanosis, dyspnoea, and hypotension) were found to show a significant association with the hospital admission rate when analysed using a multivariate log-linear model (table 5).

Discussion
Our findings show that the decision of European GPs to admit to hospital patients with lower respiratory tract infections is mainly influenced by the presence of clinical signs of more severe infection and the presumptive diagnosis of pneumonia. The overall rate of hospital admission in patients with LRTI is therefore low. This finding is encouraging for all those concerned with the use of health care resources since costs of hospital admissions account for a considerable proportion of the
Factors

Hypotension

Admission

Diagnosis

Cyanosis

47 (8.4%)

4.1

0.2

0.0001

Acute exacerbation of chronic bronchitis

24 (25.8%)

373 (19%)

1.48

0.9

NS

Bronchopneumonia or pneumonia

52 (55.9%)

316 (16%)

6.6

4.3

< 0.0001

Not defined

8 (0.4%)
A pneumonia prognostic index developed by Fine and coworkers primarily uses clinical data such as age, chest pain, abnormality of vital signs, mental status, and high risk aetiology of the infection. The scoring system, developed in a prospective study of 346 patients admitted to hospital, was validated in more than 14,000 patients and performed well in classifying low risk patients but failed to identify high risk patients. Moreover, scoring systems using criteria such as high risk aetiology of the infection are of no use to GPs since this information is never available to them.

With regard to the currently used decision criteria of GPs identified in our study, we feel that future recommendations should lay emphasis on the careful assessment of patient-related risk factors and on the physical examination instead of using scoring systems. Our finding that the criteria on which European GPs currently base their decision to admit to hospital a patient with LRTI agree with both recent international recommendations and significant risk factors for mortality or a complicated course of LRTI is encouraging and reflects good clinical practice.

This study was supported by grants from Rhone DPC Europe and Association pour l’Etude de la Respiration et de l’Environnement.

6 Woodhead MA, Macfarlane JT, McCracken JS, Rose DH, Finch RG. Prospective study of the aetiology and outcome of pneumonia in the community. Lancet 1987;i:671-4.


