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 < 0.00001) 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.**

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

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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.[1] 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.[1] 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 16–19 age group and 12 150 per 100 000 in those aged 70–79 years.[2]

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,[3] 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

Demographic data	*Hospitalised patients (n=93)*	*Non-hospitalised patients (n=1963)*
Mean (SD) age (years)	61 (16)	50 (20)
% male	61	52
% employed	26	45
% institutionalised	13	4
% smokers	23	45
% ex-smokers	35	23

Table 2 Concomitant diseases of the study population (%)

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

treatment for those patients who show one or more of these factors.[6–17] 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.[18–19] 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.[18 19] 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 χ^2 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. χ^2 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 χ^2. 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 sociodemographic 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.

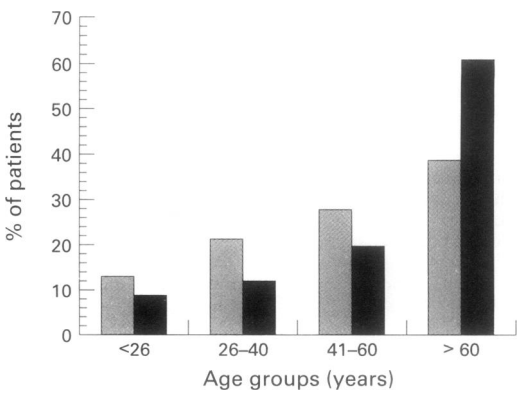

Figure 1 Age distribution of the study cohort; solid, percentage of patients admitted to hospital; shaded, percentage of patients not admitted to hospital.

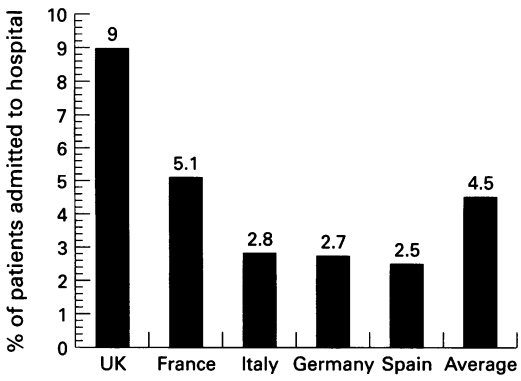

Figure 2 Hospital admissions by country.

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 ($\leq$ 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).

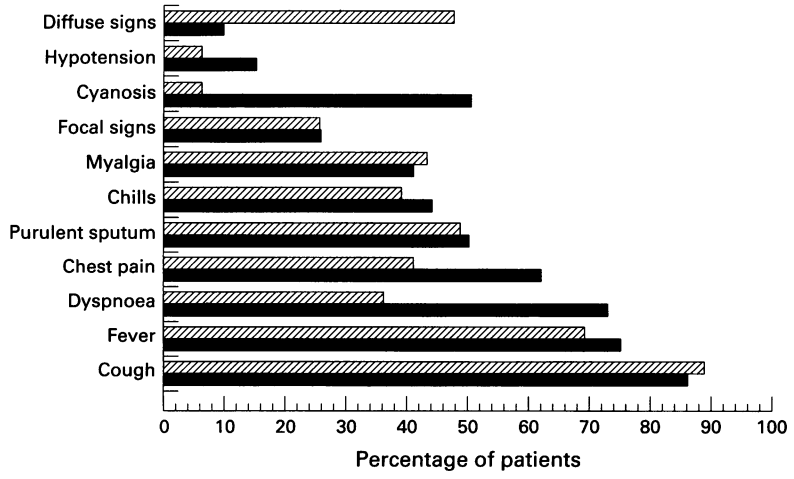

Figure 3 Clinical symptoms and signs of the study population; solid, patients admitted to hospital (n = 93); shaded, patients not admitted to hospital (n = 1963).

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, institutionalisation, 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

Table 3 Univariate analysis of association between clinical diagnosis and admission to hospital

Diagnosis	Hospitalised patients (n=93)	Non-hospitalised patients (n=1963)	Odds ratio	95% CI	p value
Acute bronchitis	5 (5.4%)	673 (34%)	0.10	0.04 to 0.3	< 0.0001
Flu or flu-like syndrome	12 (12.9%)	593 (30%)	0.30	0.2 to 0.6	0.0002
Acute exacerbation of chronic bronchitis	24 (25.8%)	373 (19%)	1.48	0.9 to 2.4	NS
Bronchopneumonia or pneumonia	52 (55.9%)	316 (16%)	6.61	4.3 to 10.1	< 0.0001
Not defined	—	8 (0.4%)	—	—	—

Table 4 Univariate analysis of patient related factors, signs and symptoms in relation to admission to hospital

Factors	Hospitalised patients	Non-hospitalised patients	Odds ratio	95% CI	Univariate p values
Age > 60 years	57	720	3.0	1.7 to 4.0	< 0.0001
Institutionalised	12	70	4.2	2.2 to 8.0	< 0.0001
Any chronic disease	62	842	2.7	1.7 to 4.2	< 0.0001
Cardiac insuffiency	19	164	2.8	1.6 to 4.8	< 0.0001
Asthma	15	133	2.7	1.5 to 4.7	0.001

overall costs of LRTI. Previous studies of patients with LRTI showed admission rates between 1% for patients with infections of the airways[2] up to 42% for those with community acquired pneumonia.[20] Since our study summarised all types of LRTI, our data are in good accordance with these findings. The differences in the hospital admission rate between the UK and the other four European countries are likely to be related to the different types of health care systems.

Although there are no established guidelines in Europe on hospital admission of patients with LRTI, our results show that appropriate clinical assessment is a strong and useful instrument for making this decision. It is surprising to see how closely the practice of GPs in Europe agrees with the guidelines for the management of community acquired pneumonia recently published by the American Thoracic Society (ATS).[21] Specific risk factors identified by the ATS to increase the risk of death or the risk of a complicated course in patients with community acquired pneumonia are age over 65 years, severe concomitant diseases such as chronic obstructive airway disease or cardiac failure, and physical findings of severe infection such as dyspnoea, hypotension, or hypoxaemia. Admission to hospital of patients with community acquired pneumonia is strongly recommended when these risk factors are present, especially if they occur in combination. In our study most of these factors showed a significant association with the GPs' decision to admit to hospital patients with LRTI, reflecting a wide agreement between such recommendations and current clinical practice.

The decision to admit patients with LRTI to hospital is important, both from a clinical point of view and from a public health perspective. Despite this clinical and economic importance, to our knowledge only two studies have so far addressed this issue. In a study by Fine and coworkers[22] physicians were asked to give their reasons for admitting to hospital 63 patients with community acquired pneumonia and not admitting a further 87 patients with the same disease. Their results suggested that physicians relied most often on the general clinical appearance of their patients when making a decision about admission to hospital. More specifically, the severity of the current illness, a high age, and coexistent diseases were the most important and significant criteria for this decision, while financial considerations or social factors had a low ranking. A study by Koivula and coworkers[13] identified a history of asthma, immunosuppressive therapy, and chronic lung diseases as factors that significantly influenced the decision to admit to hospital patients with community acquired pneumonia, whereas age or institutionalisation of the patient did not increase the admission rate. The results of these two studies are in partial agreement with our findings in patients with community acquired LRTI. However, when using multivariate analysis for investigating a number of significant factors that influence the decision to admit these patients to hospital, we were able to show that, besides a diagnosis of pneumonia, signs of more severe infectious disease are most important.

Our study does have some shortcomings. Firstly, due to the design of the study it was not possible to verify the diagnosis given by the GPs to an individual patient. However, we feel that this is unimportant as it does not matter how the GP makes the diagnosis, but it is what he or she thinks with regard to the management of the patient with LRTI that is important. Secondly, since the patients were not followed up we cannot draw any conclusions with regard to the actual necessity of hospital admission in individual cases. Nevertheless, since the primary aim of our study was to identify the criteria currently used by European GPs in their decision to admit to hospital patients with LRTI, this does not influence our conclusions. However, the crite-

Table 5 Multivariate analysis of patient related factors, signs and symptoms in relation to admission to hospital

Factors	Hospitalised patients	Non-hospitalised patients	Odds ratio	95% CI	Multivariate p values
Diagnosis of pneumonia	52	316	6.6	4.3 to 10.1	< 0.00001
Chest pain	58	826	2.3	1.5 to 3.5	< 0.00001
Cyanosis	47	87	4.1	2.4 to 7.1	< 0.00001
Dyspnoea or tachypnoea	68	715	4.9	3.1 to 7.9	< 0.00001
Hypotension	15	121	2.9	1.6 to 5.2	< 0.00001

Table 6 Risk factors for mortality and/or complicated course of lower respiratory tract infections or community aquired pneumonia in seven studies

Risk factors	*Odds ratio*	*p value*	*Type of analysis*	*Reference no.*
Age	2.8	< 0.05	MV	22
	1.5	< 0.01	MV	16
	NA	< 0.01	UV	6
	NA	< 0.05	UV	12
	NA	< 0.002	UV	10
	NA	< 0.001	UV	15
Concomitant diseases	3.2	< 0.05	MV	22
	2.5	< 0.01	MV	16
	NA	0.008	UV	10
Institutionalisation	3.2	< 0.0001	MV	16
	9.0	< 0.05	MV	13
	NA	< 0.05	UV	14
Immunosuppression	12.0	< 0.05	MV	22
	13.5	< 0.05	MV	13
	2.8	< 0.05	MV	16
	NA	< 0.05	UV	15
Arterial hypotension	3.7	0.014	MV	10
	NA	< 0.01	UV	12
	NA	< 0.05	UV	14
Tachypnoea (> 30/min)	3.2	0.028	MV	10
	1.5	< 0.01	MV	16

NA = not applicable; MV = multivariate; UV = univariate.

ria identified in this study should not be misinterpreted as risk factors for admitting patients with LRTI to hospital.

In contrast to the lack of information on the current practice of admission to hospital of patients with LRTI, there are a lot of data on the risk factors associated with death or a complicated course in these patients.[6-17 22] Most of these studies investigated patients with community acquired pneumonia. Table 6 gives an overview of recent studies on this subject. Sociodemographic factors significantly associated with death or a complicated course include age, concomitant diseases, immunosuppression, and origin of the patient from an institution. Of the wide range of clinical signs and symptoms investigated in the different studies, hypotension and tachypnoea seem to be the most important clinical factors associated with morbidity and mortality. In our study three of these factors (age, institutionalisation, concomitant diseases) were shown by univariate analysis to influence significantly GPs' decisions to admit to hospital, and the two clinical signs (hypotension, tachypnoea) were also found to be significant criteria in multivariate analysis. Thus, the current clinical practice revealed in our study agrees, not only with recent recommendations, but also with well documented risk factors that lead to the admission to hospital of patients with LRTI.

Based on the known risk factors for patients with community acquired pneumonia, several attempts have been made to develop a pneumonia-specific risk score or prognostic index for deciding when to admit such patients to hospital.[23-25] The most widely used risk factors included in such indices are demographic and clinical parameters. An index based on comorbidity, pre-existing lung diseases, extent of lung involvement on radiography, possibility of aspiration, and duration of symptoms was evaluated by Black and coworkers.[24] They found this scoring system to be useful in a relatively small number of patients (n =141), but this result remains to be validated in larger trials. A pneumonia prognostic index developed by Fine and coworkers primarily uses clinical data[25] 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.

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