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ORIGINAL ARTICLE

Does place of treatment affect prognosis for chronic obstructive pulmonary disease (COPD)?

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Abstract

Background: It has been shown previously that mortality from acute chronic obstructive pulmonary disease (COPD) is higher at small hospitals than at large teaching hospitals. **Objective:** To examine mortality at this acute stage and referral for further treatment by specialties in Finland, and trends in these between the 1990s and 2000s. **Methods:** Data on all periods of treatment for patients over 44 years of age with a principal or subsidiary diagnosis of COPD beginning and ending in 1995–2004 were extracted from the Finnish hospital discharge register. Particular attention was paid to acute-stage treatment periods managed by a general practitioner, pulmonary specialist, or specialist in internal medicine that had begun as emergency admissions and had a principal diagnosis of COPD, and to any further treatment immediately following these. **Results:** General practitioners referred 5.1% of their acute-stage patients to a specialist in secondary care in 1995–2004. Of the total of 77 445 acute-stage treatment periods, 3% (2328) ended in the death of the patient, implying the loss of 8.3% of the patients involved. The age- and sex-adjusted risk of death attached to treatment periods managed by a general practitioner relative to those managed by a pulmonary specialist was 0.83 (95% CI 0.75–0.91).

Conclusion: It is quite possible to treat acute exacerbations of COPD efficiently and safely in a health centre hospital ward. New treatment modalities and health service structures seem to have led to a decrease in acute exacerbations of COPD since the year 2000, even though the number of patients with this disease has increased as a consequence of ageing of the population. Further research is required on the efficacy of treatment by a general practitioner, e.g., with data on re-hospitalization.

Key words: Chronic obstructive pulmonary disease, acute exacerbation, general practice, admission, mortality

Introduction

The Finnish healthcare system consists of primary care comprising more than 400 local-authority healthcare centres and secondary care comprising 20 district hospital boards, each run jointly by a number of local authorities. One aspect of this system is the existence of hospitals with inpatient wards run by general practitioners in conjunction with the healthcare centres. These physicians have traditionally been assigned a gatekeeper role with regard to the costs of healthcare, although perhaps a coordinator role would be a more appropriate way of looking at the situation (1). Many investigators have

pointed to the doctor's letter of referral as one of the most significant cost factors in the health service (2,3). In practice, however, general practitioners deal with about 95% of their outpatients without any referral (4). They are also responsible for treating almost two-fifths of the acute exacerbations of obstructive pulmonary disease which require hospitalization (5). These exacerbations are obvious healthcare burdens, accounting for at least two-thirds of the total costs of pulmonary diseases both in Europe and in the USA (6). Inpatient treatment can nevertheless be provided at a fraction of the cost of specialized hospital treatment (7). In addition, the

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acute exacerbation phase entails a substantial rate of hospital mortality (8,9).

The place where treatment is provided can be of significance with regard to prognosis for many diseases (10), and it has been shown previously that mortality at the acute exacerbation stage of chronic obstructive pulmonary disease (COPD) is higher at small hospitals than at large teaching hospitals (11). In this study, we examined mortality and referral for further treatment separately in cases managed initially by a general practitioner, a specialist in pulmonary diseases, or a specialist in internal medicine with respect to the first place where treatment was provided and the further treatment arranged immediately afterwards.

Material and methods

The hospital discharge register maintained by the National Research and Development Centre for Welfare and Health contains not only personal data and diagnoses of all hospital patients in Finland, including healthcare centres, but also information on the specialization under which each was treated, the date of admission, the person issuing the letter of referral, and the institution from which the patient was referred. The discharge data include the need for further treatment and the place where this was to be provided, and also an appropriate indication if the hospitalization period ended in death. For the present purposes, data on all treatment periods beginning and ending during the years 1995–2004 for patients aged over 44 years with a main or subsidiary diagnosis of COPD (International Classification of Diseases (ICD)-9: 491, 492, and 496; ICD-10: J41–J44) were extracted from this register, paying particular attention to acute-stage exacerbations managed by a general practitioner, pulmonary specialist, or specialist in internal medicine that began with an emergency admission and had COPD as their main diagnosis, and to any further treatment that followed on immediately from these periods, i.e., a treatment period beginning on the same day as the acute treatment period ended and also having COPD as its main or subsidiary diagnosis. A treatment period was deemed to have lasted 1 day if the dates of admission and discharge were the same. Patients were divided into age groups as of the day of admission: under 65 years, 65–74 years, 75–84 years, and over 85 years.

The data were handled using SPSS 13.0 for Windows (SPSS Inc.). Differences between groups were assessed with the chi-square test, with the limit for statistical significance set at $p < 0.05$. Mortality during a treatment period was calculated by dividing the number of deaths by the cumulative length of the

periods of the treatment of those admitted with COPD. Risk ratios and their 95% confidence intervals (CI) were calculated by Poisson regression using the free software package R (version 2.2.1). The mortality risk in 1995–1999 was compared with that in 2000–2004, separately for each speciality.

Results

Treatment periods and patients

There were a total of 77 445 treatment periods for acute exacerbations of COPD during the interval 1995–2004, involving 28 015 patients. Taking all the specialities together, the number of treatment periods per year decreased by 21.6% from the peak year, 1998, to 2004, the trend beginning during the year ending 1999 in the case of specialists in pulmonary diseases or internal medicine and 2001 in the case of general practitioners (Figure 1). The numbers of treatment periods managed by a general practitioner increased by 15% in the new decade by comparison with the 1990s. The mean length of a treatment period for an acute exacerbation of COPD decreased by 2.6 days between 1995 and 2004 when managed by a specialist in pulmonary diseases, by 1.0 days when managed by a specialist in internal medicine, and by 3.5 days when managed by a general practitioner (Figure 2). Women accounted for 24.3% of the treatment periods managed by general practitioners, while the figures for those managed by pulmonary specialists and specialists in internal medicine were exactly the same, 29.4% (chi-square 194.3, $p < 0.001$) (Table I). The patients treated by a general practitioner were on average 3.5 years older than those seen by a pulmonary specialist.

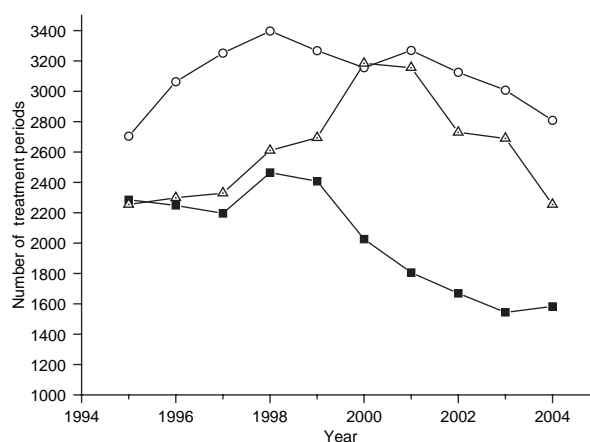


Figure 1. Numbers of emergency treatment periods for COPD managed by a general practitioner (—Δ—), a specialist in pulmonary diseases (—○—), and a specialist in internal medicine (—■—) in 1995–2004.

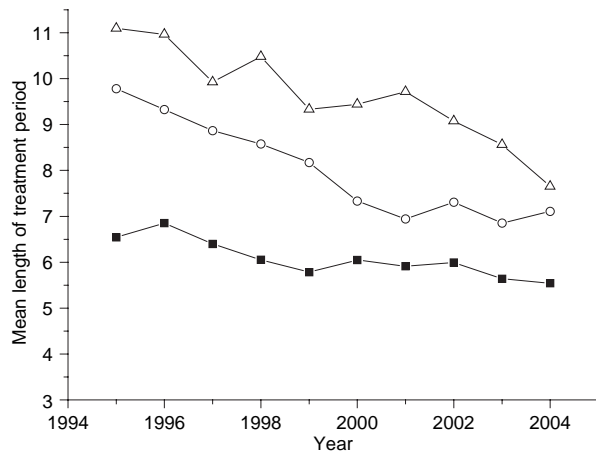


Figure 2. Mean lengths of emergency treatment periods for COPD (in days) when managed by a general practitioner (—Δ—), a specialist in pulmonary diseases (—○—), and a specialist in internal medicine (—■—) in 1995–2004.

Referral for further treatment

Of the emergency treatment periods for acute exacerbations of COPD, 12.5% led immediately to further treatment. General practitioners referred patients in 3.8% of their treatment periods to a pulmonary specialist and in 1.3% of cases to a specialist in internal medicine, while, correspondingly, pulmonary specialists referred patients to a general practitioner for further treatment in 7.0% of cases and specialists in internal medicine in 6.4%. General practitioners resorted to referrals less often in the 2000s than in the 1990s (chi-square 14.1, $p < 0.001$). Patients aged 75 years and over

were referred for further treatment statistically significantly less often than younger patients (chi-square 30.5, $p < 0.001$), and those aged at least 85 years less often still (chi-square 18.6, $p < 0.001$). Men were referred for further treatment more often than women (chi-square 4.7, $p = 0.029$). General practitioners made their referrals within 3 days of admission in 44.8% of cases and within 7 days of admission in 64.6%.

Of the patients referred to a pulmonary specialist, 80.8% had a main diagnosis of COPD, the figure for those referred to a specialist in internal medicine being 71.6%. Other main diagnoses recorded were: cardiac conditions (angina pectoris, acute cardiac infarction, or cardiac insufficiency) in 1.9% of cases referred to a pulmonary specialist and 8.7% of those referred to a specialist in internal medicine; pulmonary infections in 9.3% of cases referred to a pulmonary specialist and 7.8% of those referred to a specialist in internal medicine; and a pulmonary embolism in 0.2% of cases referred to a pulmonary specialist and 1.7% of those referred to a specialist in internal medicine.

Prognosis

Of the 77 445 treatment periods for acute exacerbations of COPD, 3% (2328) ended in death, involving 8.3% of the total number of patients. The age- and sex-adjusted risk of death for those attended by a general practitioner was 0.83 (95% CI 0.75–0.91) relative to those attended by a pulmonary specialist, while the corresponding risk ratio for those attended by a specialist in internal medicine relative to a pulmonary specialist was 1.49 (95% CI 1.34–1.65). On the time dimension, the risk of a treatment period managed by a general practitioner in 2000–2004 ending in death was 1.06 (95% CI 0.93–1.22) relative to the period 1995–1999, the corresponding ratios for a pulmonary specialist and a specialist in internal medicine being 0.97 (95% CI 0.97–1.12) and 1.06 (95% CI 0.90–1.23), respectively. As many as 30.8% of patients who died in a treatment period managed by a specialist in internal medicine had a cardiac condition as a subsidiary diagnosis (Table II).

Discussion

The study data contained in the hospital discharge register used here are generally regarded as highly reliable. An evaluation by Keskimäki & Aro (12), for example, showed that 96% of the dates of admission and discharge are indicated correctly, and they have also shown that principal diagnoses of respiratory diseases are marked correctly to an accuracy of three

Table I. Principal parameters for COPD treatment periods beginning with emergency admissions ($n = 77\ 445$) in 1995–2004 according to specialization.

	General practice	Pulmonary diseases	Internal medicine
Sex, <i>n</i>			
Male	19,837	21,900	14,274
Female	6,351	9,141	5,942
Mean age, years			
Men	74.1	71.0	72.1
Women	74.6	70.1	72.2
Age group, %			
under 65 years	14.3	23.8	20.2
65–74 years	36.5	42.3	40.6
75–84 years	39.0	30.5	32.8
85 years or over	10.2	3.4	6.5
Subsidiary diagnosis, %			
cardiovascular disease	32.7	39.0	38.6
respiratory disease	19.5	17.7	29.8
	8.7	22.3	10.6

Table II. Numbers of patients who died during treatment for acute exacerbation of COPD in 1995–2004 ($n=2328$), according to speciality and subsidiary diagnosis (%).

	General practice $n=812$	Pulmonary diseases $n=852$	Internal medicine $n=664$
Subsidiary diagnosis	58.7	51.2	55.1
Cardiac disease	23.2	17.9	30.8
Pneumonia	13.2	9.8	7.4
Malignancy	5.2	8.6	2.9
Other	58.4	63.7	58.9

digits in 94.1% of cases. These observation are also confirmed by the comparison of this data source with the register of cardiovascular diseases performed by Pajunen (13). Similarly, the diagnoses of COPD in the present material may be taken as reliable, since, in the context of the Finnish health-care system, the majority of them will have been made by pulmonary specialists for the purpose of entitlement to refunds on the costs of medication.

General practitioners were found to have referred their acute COPD exacerbation patients for further treatment in an average of about 5% of treatment periods. The lower risk of death among these patients than among those treated by a pulmonary specialist is naturally a consequence of the most difficult cases being referred to the latter, even though this may not emerge directly from a follow-up of COPD patients (14). The number of patients sent for further treatment decreased between the 1990s and the current decade, and at the same time the number of treatment periods increased and their duration became shorter, but the risk of death remained the same. The number of acute treatment periods for COPD decreased by about a fifth between 1999 and 2004, even though the total number of patients must have increased, on account of ageing of the population. This would suggest that the treatment of COPD in the 2000s is more efficient than before. If the condition of an acute-stage patient does not improve in the desired manner, a general practitioner is obliged to consider treatment for an infection or the possible existence of a cardiac condition. The considerably higher risk of death among patients attended by a specialist in internal medicine points to a concentration of cardiac diseases in this group.

The principal aetiological factor behind COPD is smoking, although the disease is inclined to manifest itself with a considerable delay. Trends in smoking over the last 50 years have been such that the number of male smokers has decreased to about a

third of its former level, while the incidence among women has doubled. The general ageing of the population also means that there are more COPD patients than ever before. Consequently, the age-adjusted number of treatment periods increased only slightly for men over the interval 1995–2001 but by almost a fifth in the case of women (5), and so this sex ratio will fall. In spite of this, the figures began to decline markedly in subsequent years, a pattern that cannot be attributed to the slow changes in smoking habits. The main reason presumably lies in changes in treatment modalities, as noted previously (15), and in the increased use of tiotropium, inhaled cortisone, and slow-acting bronchodilators (16–18), which have been shown to have reduced the numbers of exacerbations. Where the consumption of tiotropium in Finland was 0.09 defined daily does per 1000 inhabitants per day (DDD/1000 inh./day) in 2002, it had risen to 1.61 DDD/1000 inh./day in 2004, i.e., by a factor of 17.9, while the figures for budesonide/formoterol and fluticasone/salmeterol had risen 2.2-fold and 1.3-fold (19), respectively, although the latter combinations are admittedly also used for the treatment of asthma. Also, it would seem that mild exacerbations are nowadays managed in outpatient care, with no admission to a hospital ward at all. Thus, the number of days of hospitalization in wards for pulmonary diseases decreased by 10.2% from the year 2000 to 2004 and that in internal medicine wards by 7.0% (20), while that in inpatient wards at health centres declined by 3.2% between 2002 and 2004 (21). The trend in Finland at the moment is towards the concentration of emergency services in large units, so that it is the choice of location for further treatment that is particularly important for COPD patients in terms of both costs and quality of life. Non-invasive ventilation has been shown to reduce both the length of hospitalization periods and mortality (22). The national guidelines for the prevention and treatment of COPD, issued in 1998 (23), and the recommendations for appropriate treatment have done much to reduce hospital treatment for exacerbations, especially since the programme included the training of general practitioners in the treatment of this disease and its staging.

The figure of 3% for the proportion of treatment periods ending in death is similar to the 2.5% obtained in the USA for a sample extracted from disease registers for 1996 (24), although 3–4-fold increases have been quoted elsewhere for hospital deaths (9,25–26) reaching close to 25% for cases requiring intensive care (8,27). It may be concluded

from this that the present hospital admission criteria are at least not too stringent.

There are some limitations, however, concerning this study: limited information from the hospital discharge register, and the fact that the severity of acute exacerbation of COPD and patient medication could not be evaluated. The study's strengths are the large number of treatment periods, the length of observation time, and the reliability of the hospital discharge register.

Conclusion

It is evident from the above that it is quite possible to treat acute exacerbations of COPD efficiently and safely in a healthcare centre inpatient ward. New treatment modalities and health service structures seem to have led to a decrease in acute exacerbations of COPD since the year 2000, even though the number of patients with this disease has increased as a consequence of ageing of the population. As treatment at home becomes more common in the future, fewer exacerbations of COPD are likely to be treated in hospital, but such cases in general will become more serious. Further research is required on the efficacy of treatment by a general practitioner, e.g., with data on re-hospitalization.

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