

Hospital admissions of asthmatics by age and sex

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Asthma-related hospital admissions and the occurrence of new admissions were studied by age and sex in order to find the groups of asthmatics with high hospital admission rates. Data from the Finnish discharge register for 1972–92 were used to analyze the number of hospital admissions caused by asthma (defined in the *International Classification of Diseases*, 8th and 9th revisions, code 493) and occurrence of new asthma admissions between 1983 and 1992. A total of 192 195 asthma-induced treatment periods were identified, 91 223 for males and 100 972 for females. Boys were admitted twice as often as girls at the age of 1 year (11.2 in comparison with 5.9 admissions per 1000 per year), whereas the admission rate was consistently higher among women 25–55 years of age. The highest asthma admission rate among the elderly was at age 73 for men (10.3 per 1000) and 75 for women (9.5 per 1000). Occurrences of new asthma admissions were most frequent at the age of 1 year (5.3 per 1000 for boys and 2.9 per 1000 for girls) and remained constant among those aged 50–80 years. Asthma is not only a disease of childhood and adolescence. The number of middle-aged and elderly asthmatics requiring hospitalization is markedly high.

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The prevalence of asthma has increased in all industrialized countries during the past 20 years (1). In Finland, it has multiplied since the 1960s among military conscripts (2) and has risen particularly markedly among children and young people in the UK (3) and in the USA (4). Asthma is probably underdiagnosed among the elderly (5).

Hospital admission rates for asthma among children are high and have been reported to be rising (6, 7). On the other hand, Finnish studies suggest that hospital admissions for childhood asthma have remained constant while hospital use by the working and middle-aged sectors of the population has increased (8).

The increase in asthma hospitalization among children is partly due to an increase in the incidence of asthma, but it has also been assumed that the severity of asthma has increased (9) or that diagnostic practices have improved. Research into hospital use by the elderly population has shown that a great deal of this is related to readmission of the same patients (8).

Evaluation of the guidelines for asthma treatment and estimation of the resources needed by asthmatics are functions that require continuous

research. The aim of the present survey was to use the nationwide hospital discharge records to describe demographic data for the total population of asthmatic patients admitted to all hospitals in Finland over a 10-year period and to find the groups of asthmatics with high hospital admission rate.

Material and methods

The National Research and Development Centre for Welfare and Health is provided with discharge registration data on all patients treated in hospital in Finland, including diagnoses, dates of admission and discharge, and social security numbers. All treatment periods for which the main diagnosis was asthma (diagnosis 493, *International Classification of Diseases* [ICD], 8th revision 1972–86 and 9th revision 1987–92) were extracted from the register for the period 1972–92, including acute exacerbation stages, diagnostic examinations, and checkups. A total of 364 871 asthma admissions was found.

An asthmatic patient who had had no recorded asthma-related hospital treatment period in 1972–82 and was first treated in hospital on 1 January

1983 or later was recorded as having a "new admission" with asthma. Patients with incorrect or missing social security numbers were excluded from the analyses of new patients (1.9%).

The total population of Finland was 4 869 858 at the end of 1983 and 5 054 982 at the end of 1992. The numbers of hospital admissions and occurrences of new asthma admissions in this 10-year period were calculated from the discharge data. Relative rates were calculated by age and sex in relation to the total population. The population data were based on information provided by the Central Statistical Office of Finland.

Results

Admissions

A total of 192 195 admissions for asthma were recorded in 1983–92, 91 223 for males and 100 972 for females.

The annual hospital admission rate for childhood asthma was highest at the age of 1 year for both sexes, 11.2 per 1000 inhabitants for boys and 5.9 per 1000 for girls (Fig. 1). The asthma admission rate was low throughout adolescence, the lowest figure being found at the age of 17 years among boys (0.9 per 1000) and at 13 years among girls (also 0.9 per 1000). The rate of admissions then gradually increased with age from 13 years of age onward, although being higher in men aged 20 (7.0 per 1000) than in women (1.3 per 1000).

Between 25 and 55 years of age, the admission rate was consistently slightly lower among men, ranging from 1.0 to 6.8 per 1000 as compared with 1.2 to 7.1 per 1000 among women. The rates for men were 4.8 per 1000 at the age of 50, 8.6 at 65, and 7.5 at 80, and those for women 5.9, 7.7, and 7.8, respectively. The highest asthma admission rate among the elderly was reached at the age of 73 in men (10.3 per 1000) and 75 in women (9.5 per 1000), after which it decreased with advancing age.

Occurrence of new asthma admissions

The total number of new asthma admissions was 55 178, being 27 860 for males and 27 318 for females. The annual occurrence of new admissions in children was highest at the age of 1 year for both sexes, 5.3 per 1000 for boys and 2.9 per 1000 for girls (Fig. 2). New admissions accounted for 48% of all admissions of 1-year-old children. The lowest rate was found in adolescence, at the age of 15 for boys (0.37 per 1000) and at 13 for girls (0.31 per 1000). The rate was high in 20-year-old men, 3.3 per 1000, 48% of the admissions in this age group being due to new cases.

The occurrence of new asthma admissions between the ages of 25 and 55 years ranged from 0.4 to 1.8 per 1000 in men and from 0.5 to 1.9 per 1000 in women, while the highest rate in the elderly was found at the age of 72 for men, 2.0 per 1000, and 71 for women, 1.8 per 1000. After this, the occurrence of new asthma admissions decreased with advancing age. The rate for the 50-year-old population was 1.3 per 1000 for men and 1.7 per 1000 for women, that for the 65-year-old population 1.7 and 1.6, respectively, and that for the 80-year-old population 1.4 and 1.3.

Discussion

The results demonstrate that there are differences in asthma hospital treatment periods and in the occurrence of new asthma admissions by age and sex. The material is large, and the reliability of the discharge register has previously proved to be as high as 95% (10). Two revisions of the *ICD*, the 8th and 9th, were used during the study period, and the change of revision has had some influence on the diagnostic habit concerning asthma (11). Earlier research into diagnostic transfer does not attribute the rising admission rates for asthma to any concomitant decline in other respiratory diseases (12, 13). In our material, it was not possible to classify asthma hospitalizations according to the cause of admission. Only in the 9th revision of *ICD* has a fifth mark been used to distinguish exacerbation stages from other hospitalizations, and 31% of treatment periods were coded as exacerbations. When assessing our results, it is essential to realize that outpatient visits are not included in the material, so that no conclusions can be drawn regarding the prevalence of asthma or the distribution of this by age and sex.

Young children have narrow airways and may be more susceptible to obstruction due to an acute inflammatory process (14). Moreover, airway growth in relation to the growth of the lung parenchyma is slower in boys than in girls (15), so that boys may have smaller airways in relation to lung size, explaining the greater frequency and severity of lower-respiratory illness (16). Lower-respiratory-tract infections are potentially life-threatening in infants, and a wheezy infant is readily admitted to hospital. After the first year of life, hospital admission rates for asthma decrease due to airway growth, a lower frequency of respiratory infections, and probably, to some extent, efficient outpatient clinic treatment by pediatricians. The fact that asthma-related hospitalization rates are higher for boys throughout childhood and adolescence is due to the higher prevalence of the disease among boys, which is

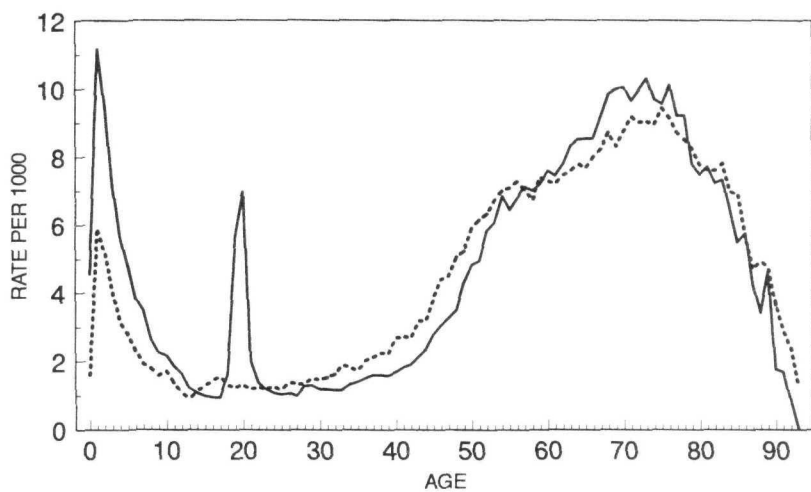


Fig. 1. Annual asthma-related hospital admission rates by age per 1000 inhabitants for males (solid line) and females (dotted line) from 1983 through 1992.

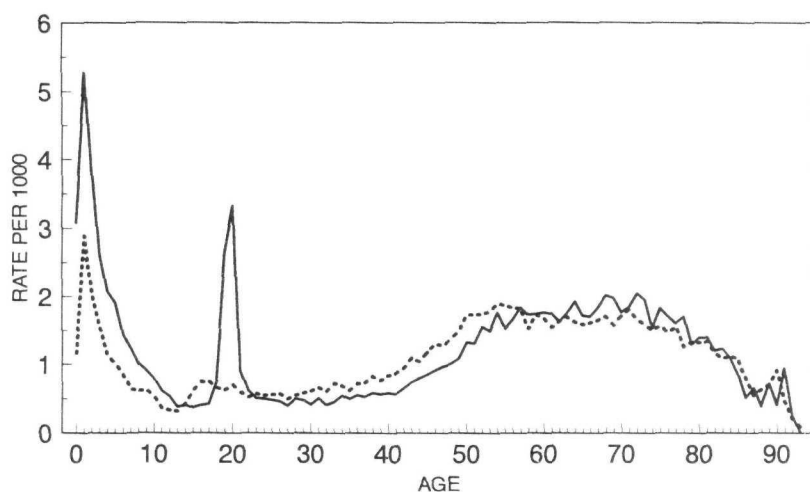


Fig. 2. Annual occurrence of new asthma admissions per 1000 inhabitants by age for males (solid line) and females (dotted line) from 1983 through 1992.

explained by the higher prevalence of atopy among boys (17).

Because asthma in small children is difficult to diagnose, the diagnostic examinations often take place in hospital. In Finland, the diagnostic practice for childhood asthma is quite uniform (18). In our material, there is some overlapping between asthma and wheezy bronchitis. In children under 5 years, there were 11 treatment periods with diagnosis "490" or "491" per 100 new asthma patients in the year of first asthma admission.

The occurrence of the lowest asthma admission rates in adolescence is partly due to the natural course of asthma, in that children are said to grow out of it. The prognosis for childhood asthma may not be as favorable as is popularly thought, however (19), and only a minority of asthmatics achieve long-lasting remission through medication (20). The high asthma-related hospitalization rate among men aged 20 is probably due to the strain experienced during compulsory military service, as strenuous exercise in a harsh climate may lead to the detection of asthma or to a worsening of

previously mild symptoms. Asthma is a frequent reason for exemption and discharge from military service (2). Army hospitals are included in the hospital discharge register, however, and all diagnostic examinations and periods of treatment for asthma exacerbation among conscripts take place in the military hospitals.

The higher admission rate among women aged 30–55 years may be due to female subjects seeking medical care more frequently than male (21). There is a trend to label wheezy dyspnea in men over 40 years as emphysematous in origin and that in women as asthmatic or bronchitic (22). This bias may have led to underdiagnosis of asthma among men. The diagnostic procedures undertaken during hospitalization and re-evaluations of asthma diagnoses probably reduce the diagnostic bias and decrease the overlapping between diagnoses of asthma and chronic obstructive pulmonary disease (COPD). Smoking and previous underdiagnosis and undertreatment of asthma together with other concurrent diseases may increase the risk of asthma hospitalization with advancing age.

The diagnosis of asthma among people aged 75 years or over is particularly difficult. The results of lung function tests are often unreliable, the allergic features of asthma are missing (23), and the symptoms resemble those of other concurrent diseases. Differential diagnoses between asthma and COPD are especially difficult in the elderly (24). In our material, 20% of asthmatics aged 75 years or more with new asthma admissions had been discharged with a diagnosis of COPD in 1977–92. It is possible to test the reversibility of the obstruction more reliably during hospitalization than in an outpatient clinic, and thus recurrent hospital treatment periods reduce the diagnostic transfer between asthma and obstructive bronchitis. Even so, there is some evidence that asthma in the elderly may be underdiagnosed and undertreated, leading to irreversible obstruction (5). The decline in lung functions with aging (25) also increases the risk of being admitted to hospital because of asthma exacerbation. The rapid decrease in asthma-related hospital admissions after 75 years of age may be due partly to the higher mortality rate among asthmatics (26).

In spite of these considerations, the present results provide an indication of the volume of hospital treatment needed for severe asthma in different groups defined by age and sex and give indirect information on the incidence of severe asthma.

In conclusion, asthma is one of the most common chronic diseases in the developed countries, and hospital treatment accounts for the most expensive part of its management. The middle-aged and elderly sectors of the population account for a

major proportion of asthma-related hospital treatment periods, and it is by focusing on these groups that the greatest savings in the total cost of asthma care can be made. Of course, it is possible that the increasing prevalence of asthma in childhood will lead to an increase in adult and elderly asthmatics in the future; therefore, if the costs of asthma hospitalization are to be reduced, more attention should be paid to the early diagnosis and treatment of asthma in middle-aged and elderly patients.

References

1. Yunginger JW, Reed CE, O'Connell EJ, Melton LJ, O'Fallon WM, Silverstein MD. A community-based study of the epidemiology of asthma. Incidence rates, 1964–1983. *Am Rev Respir Dis* 1992;146:888-94.
2. Haahtela T, Lindholm H, Björkstén F, Koskenvuo K, Laitinen LA. Prevalence of asthma in Finnish young men. *BMJ* 1990;301:266-8.
3. Burney PGJ, Chinn S, Rona RJ. Has the prevalence of asthma increased in children? Evidence from the national study of health and growth 1973–86. *BMJ* 1990;300:1306-10.
4. Weitzman M, Gortmaker SL, Sobol AM, Perrin JM. Recent trends in the prevalence and severity of childhood asthma. *JAMA* 1992;268:2673-7.
5. Burrows B, Barbee RA, Cline MG, Knudson RJ, Lebowitz MD. Characteristics of asthma among elderly adults in a sample of the general population. *Chest* 1991;100:935-42.
6. Strachan DP, Anderson HR. Trends in hospital admission rates for asthma in children. *BMJ* 1992;304:819-20.
7. Skobeloff EM, Spivey WH, St Clair SS, Schoffstall JM. The influence of age and sex on asthma admissions. *JAMA* 1992;268:3437-40.
8. Keistinen T, Tuuponen T, Kivelä S-L. Asthma related hospital treatment in Finland: 1972–86. *Thorax* 1993;48:44-7.
9. Anderson HR. Increase in hospital admissions for childhood asthma: trends in referral, severity, and readmissions from 1970 to 1985 in a health region of the United Kingdom. *Thorax* 1989;44:6:14-19.
10. Keskimäki I, Aro S. Accuracy of data on diagnoses, procedures and accidents in the Finnish Hospital Discharge Register. *Int J Health Sci* 1991;2:15-21.
11. Steward CJ, Nunn AJ. Are asthma mortality rates changing? *Br J Dis Chest* 1985;79:229-34.
12. Mitchell EA. International trends in hospital admission rates for asthma. *Arch Dis Child* 1985;60:376-8.
13. Khot A, Burn R, Evans N, Lenney C, Lenney W. Seasonal variation and time trends in childhood asthma in England and Wales 1975–81. *BMJ* 1984;289:235-7.
14. Martinez FD, Morgan WJ, Wright AL, Holberg CJ, Taussig LM, Group Health Medical Associates' Personnel. Diminished lung function as a predisposing factor for wheezing respiratory illness in infants. *N Engl J Med* 1988;319:1112-17.
15. Pagtakhan RD, Bjelland JC, Landau LI, et al. Sex differences in growth patterns of the airways and lung parenchyma in children. *J Appl Physiol* 1984;56:1204-10.
16. Tepper RS, Morgan WJ, Cota K, Wright A, Taussig LM, GHMA Pediatricians. Physiologic growth and development of the lung during the first year of life. *Am Rev Respir Dis* 1986;134:513-19.
17. Sears MR, Burrows B, Flannery EM, Herbison GB, Holdaway MD. Atopy in childhood. I. Gender and allergen related risks for development of hay fever and asthma. *Clin Exp Allergy* 1993;23:941-8.
18. Turpeinen M, Vanto T, Backman A. The criteria of childhood asthma. In: Haahtela T, Hannuksela M, Terho EO, editors. *Allergology* [in Finnish]. Helsinki: Kustannus Oy Duodecim, 1993:203.
19. Kelly JW, Hudson I, Phelan PD, Pain MCF, Olinsky A. Childhood asthma in adult life: a further study at 28 years of age. *BMJ* 1987;294:1059-62.
20. van Essen-Zandvliet EE, Hughes MD, Waalkens HJ, Duiverman EJ, Kerrebijn KF, Dutch CNSLD Study Group. Remission of childhood asthma after long-term treatment with an inhaled corticosteroid (budesonide): can it be achieved? *Eur Respir J* 1994;7:63-8.
21. Bailey WC, Richards JM Jr, Manzella BA, Brooks CM, Windsor RA, Soong S. Characteristics and correlates of asthma in a university clinic population. *Chest* 1990;98:821-8.
22. Dodge R, Cline MG, Burrows B. Comparisons of asthma, emphysema and chronic bronchitis diagnoses in a general population sample. *Am Rev Respir Dis* 1986;133:981-6.
23. Braman SS, Kaemmerlen JT, Davis SM. Asthma in the elderly. A comparison between patients with recently acquired and long-standing disease. *Am Rev Respir Dis* 1991;143:336-40.
24. Littlejohns P, Ebrahim S, Anderson R. Prevalence and diagnosis of chronic respiratory symptoms in adults. *BMJ* 1989;298:1556-60.
25. Knudson RJ, Lebowitz MD, Holberg CJ, Burrows B. Changes in the normal maximal expiratory flow-volume curve with growth and aging. *Am Rev Respir Dis* 1983;127:725-34.
26. Markowe HLJ, Bulpitt CJ, Shipley MJ, Rose G, Crombie DL, Fleming DM. Prognosis in adult asthma: a national study. *BMJ* 1987;295:949-52.

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