

Regional distribution of asthma-related hospital treatment periods in Finland in 1972–86

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We examined the use of asthma-related hospital services in geographically different areas of Finland in 1972–86, using data obtained from hospital discharge registers. A total of 254 402 cases diagnosed as asthma was identified (diagnosis 493, *International Classification of Diseases, 8th Revision*), information on the patient's place of residence enabling comparison of the southern, western, eastern, and northern parts of the country. Annual hospitalizations and the occurrence of new cases were calculated relative to the population, the former being found to increase throughout the country during the period studied, the most marked rise being 8.8% in Northern Finland (95% confidence interval 6.4–11.3%), and the smallest, 1.1%, in Western Finland (–0.2 to +2.5). A corresponding trend was also noted in the annual occurrence of new cases, which increased most in Northern Finland, i.e. by 4.8% (3.0–6.6), and decreased in Western Finland by 2.9% (–3.6 to –2.1). The change in asthma and the organization of treatment and factors related to the cold environment may, in combination, contribute to difficulties in the treatment of asthma in Northern Finland.

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An increased prevalence of asthma has been reported in the last 20 years, and the number of asthma-related hospital admissions has also been found to increase in many industrialized countries. Regional differences have been found in the use of hospital services, which are increasingly being used by children and young people, in particular (6, 16). The prevalence of asthma in young men in Finland has increased steadily from the early 1960s (7), as has the use of hospital services especially by the older age groups (9). In Scandinavia, the number of asthma-related hospital admissions among children has been found to have increased in Norway (14). Most of the factors contributing to the increased prevalence of asthma and increased use of hospital services have yet to be ascertained.

There has been some discussion of the role of environmental factors in the occurrence of asthma, but there has been little research into its prevalence in the entire population with reference to geographically different areas. Higher prevalences have been reported in children and young people living in northern than in southern Scandinavia (2, 3, 13, 22), and research carried out in the United States has indicated that asthma-related deaths among children and young adults are more common in the northern

and northeastern parts of the country, where there is also the most use of hospital services. Such regional differences were attributed to race and socioeconomic status (23). Corresponding differences in the use of asthma-related hospital services have also been found to be dependent on variations in local treatment practices (18).

Since Finland is a long, narrow country, stretching across the Arctic Circle, the geographic differences between its southern and northern parts are reflected most noticeably in the climate. However, it has a racially homogeneous population who are granted free medication for asthma irrespective of their income, provided that the diagnosis has been verified, by hospital examination or over a sufficiently long follow-up period. It is possible to examine the asthma-related use of hospital services in Finland by means of the discharge register maintained for the entire country by the National Board of Health, which enables analysis on a regional basis.

Material and methods

Finland was divided into four regions following the boundaries of the central hospital districts (Fig. 1). The total population increased slowly in 1972–86,

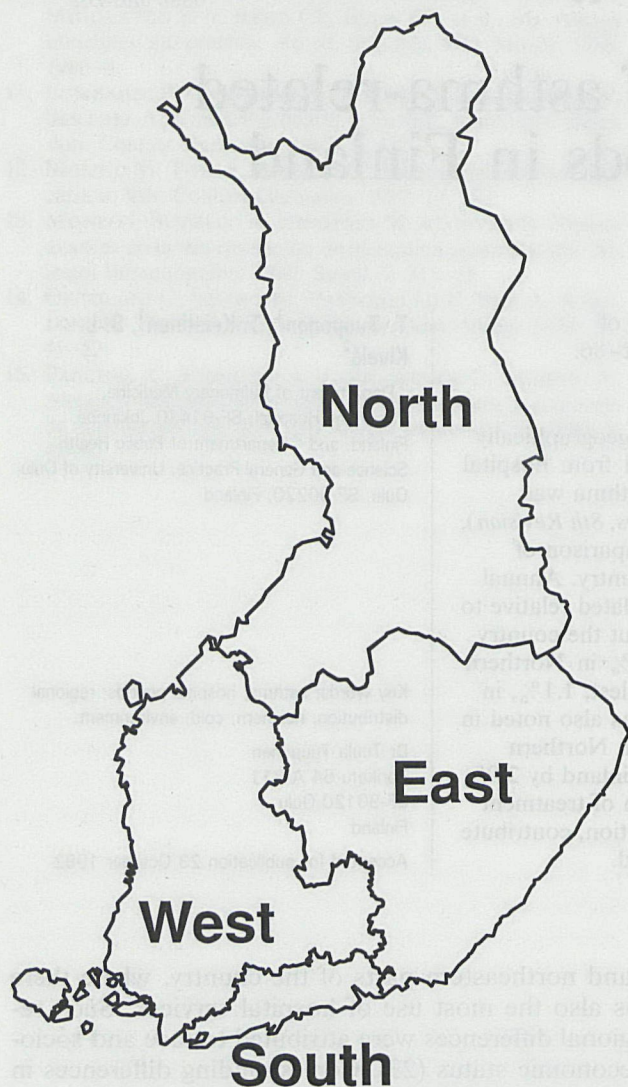


Fig. 1. Division of Finland into southern, western, eastern, and northern regions.

the average figure for the whole period being 4 785 637 inhabitants. Southern Finland was represented in the regional division by the Helsinki region, the most densely inhabited, which had an average population of 1 106 196 inhabitants. The populations of the other areas were comparable to this; 1 806 328 in Western Finland, 1 191 520 in Eastern Finland, and 681 593 in Northern Finland.

The National Board of Health is provided with registration data on all patients treated in hospitals in Finland, including their diagnoses. All treatment periods for which the main diagnosis was asthma were collected from the register (diagnosis 493, *International Classification of Diseases, 8th Revision*), including acute exacerbation stages, diagnostic examinations, and checkup visits. The number of asthma-related discharges was 255 387 in 1972–86, of which 254 402 also contained information on the

Table 1. Annual asthma-related treatment periods per 100 000 inhabitants in the regions of Finland in 1972–86

Region	Mean	SD	Average % Change/y	95% Confidence Interval
South	270	57.7	+4.8	+3.8 – +5.8
West	340	37.8	+1.1	–0.2 – +2.5
East	441	103.3	+5.2	+3.8 – +6.6
North	370	140.2	+8.8	+6.4 – +11.3
Entire country	353	67.3	+4.0	+2.8 – +5.3

patient's place of residence. The treatment periods were examined relative to the population of each region at the end of each year.

An asthmatic who had had no recorded asthma-related hospital treatment periods in 1972–6 and who was first treated in hospital in 1977 or later was considered to be a new case.

The register files were processed by computer at the Department of Public Health Science and General Practice, University of Oulu. The population data were based on information provided by the Central Statistical Office of Finland.

The relative change was analyzed by linear regression and natural logarithms for treatment periods relative to the total population and for occurrences of new asthma cases (11), the percentage change per year being equivalent to e to the power of $\beta - 1$. Hospital periods and new asthma cases were evaluated by regions by a two-sample t -test. The statistical analyses were performed by the SOLO program of BMDP Statistical Software, Inc.

Results

Treatment periods relative to the population were found to increase throughout the country during the interval in question (Table 1, Fig. 2), the most marked

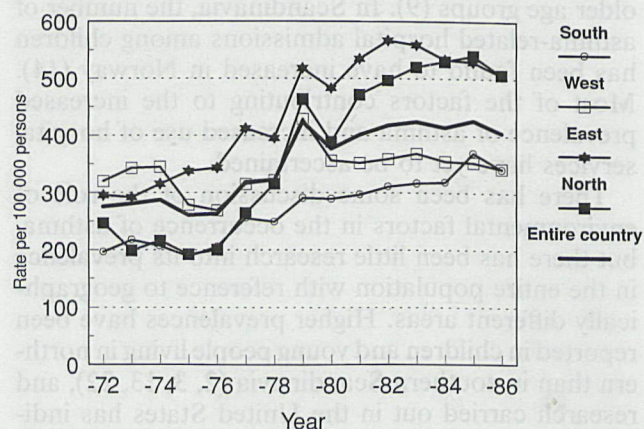


Fig. 2. Asthma-related treatment periods per 100 000 inhabitants in the regions of Finland in 1972–86.

Table 2. Annual occurrences of new asthma cases per 100 000 inhabitants in the regions of Finland in 1977–86

Region	Mean	SD	Average % Change/y	95% Confidence Interval
South	94.3	7.70	-0.2	-2.2 - +2.0
West	99.7	9.18	-2.9	-3.6 - -2.1
East	150.4	7.93	+0.2	-1.2 - +1.6
North	119.8	18.16	+4.8	+3.0 - +6.6
Entire country	113.8	4.14	-0.3	-1.2 - +0.7

rise being observed in Northern Finland, where the number of periods was the lowest in the country in the early 1970s but the highest in the 1980s. Although asthma-related use of hospital services was already high in Eastern Finland in the 1970s, a further rise was observed in that region, too.

The number of treatment periods was higher in Eastern Finland than in the southern and western parts of the country ($P = 0.0000$ and $P = 0.0022$), but no appreciable difference was observed between Eastern and Northern Finland. Treatment periods were also more numerous in the north and west than in Southern Finland ($P = 0.0193$ and $P = 0.0005$, respectively).

The annual number of new cases remained almost unchanged in Finland in 1977–86 (Table 2, Fig. 3). The most marked rise was observed in Northern Finland, where the emergence of new cases per year had been lowest in 1977. Numerous new asthma cases occurred in Eastern Finland throughout the period, but figures were found to decline steadily in Western Finland. There were more new cases in Eastern Finland than in the south, west, and north ($P = 0.0000$, $P = 0.0000$, $P = 0.0003$), while the highest number of new cases among the last three regions was in Northern Finland ($P = 0.0013$; 0.0073).

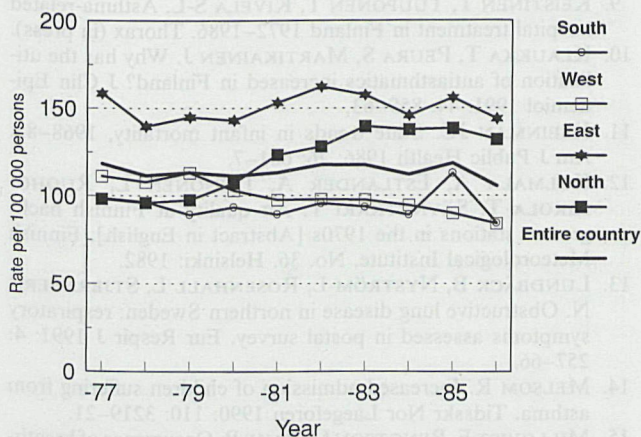


Fig. 3. Occurrences of new asthma cases per 100 000 inhabitants in the regions of Finland in 1977–86.

Discussion

The register maintained by the National Board of Health is an extensive one, as it covers all private, public, general, and mental hospitals in Finland. The correspondence between diagnosis data and patient records has been found to be quite good, even as high as 95% (1). The same disease classification was used in Finland throughout the period concerned (ICD, 8th revision), which means that the rise cannot be attributable to any changes in classification. It is similarly evident that no appreciable changes took place in the diagnostic practices employed in Finland during this period, as the grounds upon which the National Insurance Fund granted free medicine for asthma remained unchanged until the end of 1985.

The existence of the highest annual percentage increase in the number of asthma-related treatment periods in Northern Finland may be attributable to the increased prevalence of asthma there, as suggested by the emergence of new cases. The results obtained support observations of changes taking place in the occurrence of asthma in northern areas, as reported in both Finland and Sweden in the late 1980s. As indicated by interviews, a higher prevalence of asthma has been found among children living in Northern Finland than among those living in the south (22), the prevalence being 3.3% in the former region and 1.7% for the entire country. Research carried out in Sweden has indicated that the prevalence of asthma is higher among children and young men of conscription age in the northern part of the country than in the south or central area (2, 3). In fact, the prevalence among these young men doubled in the former region between 1971 and 1981, but remained unchanged in southern Sweden. A high prevalence (5.9%) has also been found in the rest of the adult population of northern Sweden (13).

Regional differences have been observed in the use of asthma-related hospital services in a number of countries, and have been regarded as being dependent on race and socioeconomic status in the United States (6, 23) and on regional differences in treatment practices employed in the various ethnic groups in New Zealand (17). Finland has a homogeneous population in racial terms, as there has not been much immigration; thus, the population is characterized by a range of indigenous genetic illnesses. Even so, there are differences in terms of cardiovascular diseases, mortality from which is higher in Eastern and Northern Finland. No plausible explanation has yet been found for this trend, but investigators have assumed that it is attributable not only to genetic factors, but also to social, cultural, and environmental ones (19). Changes in the occurrences of asthma in the form of increases in the number of

hospitalizations and the emergence of new cases were most prominent in the eastern and northern parts of the country. Regional variation of this kind cannot be accounted for by income differences, as health care in Finland was virtually free during the period examined here, and all asthmatics were granted free medication once their diagnosis had been verified.

There are obvious differences in average monthly temperature between Southern and Northern Finland, as the country is more than 1100 km long. The winter months are especially cold in the eastern part of the country because of the prevailing continental climate, as opposed to the more maritime climate typical of Western Finland. Many asthmatics experience more symptoms in winter (15), a season in which the number of asthma-related hospital admissions has been found to double relative to the summer months (4). One explanation for this may be that the respiratory infections which occur in winter enhance asthmatic symptoms (20). The foul-smelling, sulfur-rich emissions from industrial areas have been found to cause respiratory symptoms of various types even at extremely low concentrations (8), the most recent investigation carried out in Helsinki indicating that emissions which are below the permitted minimum level can still increase the number of asthma-related hospital admissions, whereas no appreciable changes were observed in this respect on warm days when the emissions were high (21). The background concentrations of air pollutants in Finland at some stations were higher in the late 1970s than in the first part of the decade (12). The role of cold conditions in combination with emissions should be considered, as the increased hospital treatment periods for asthma in Northern Finland occurred simultaneously with the observation of needle damage in the coniferous forest, which was found to be attributable to air pollution (24).

Northern Finland is a sparsely populated region and the distances involved when seeking medical advice are long, and this factor may increase the number of hospitalizations, since travel and clinical visit may take more than one day. The National Health Law of 1972 allowed for the development of basic health care services especially in Northern and Eastern Finland, where the number of general practitioners consequently increased. The accessibility and supply of specialist services in pulmonary diseases have been limited in Northern Finland in particular, and the treatment practices employed for asthma in the various regions may be partly attributable to the number of specialists available. Major regional differences have also been found in the cost of asthma medication (10). The treatment practices employed in the basic health care system influence the use made of hospital services (18), but asthma-

induced hospital admissions are regarded as reflecting the actual need for services in a given area irrespective of local treatment differences (5).

The use of asthma-related hospital services was found to be most prominent in Northern and Eastern Finland, and the rise in the number of hospital admissions and occurrences of new asthma cases to be most marked in the former region. A change in asthma itself in the north may be attributable to the cold and the simultaneous presence of air pollution, while differences in treatment organization may lead to differences in the use of asthma-related hospital services. Attention should thus be paid to monitoring the quality of the air and ensuring that treatment services of the same standard are available throughout the country.

References

1. ARO S, KOSKINEN R, KESKIMÄKI I. The correspondence of data about the diagnoses, operations and accidents in the hospital discharge register maintained by National Board of Health [in Finnish]. *Duodecim* 1990; 106: 1443-50.
2. ÅBERG N. Asthma and allergic rhinitis in Swedish conscripts. *Clin Exp Allergy* 1989; 19: 59-63.
3. ÅBERG N, ENGSTRÖM I, LINDBERG U. Allergic diseases in Swedish schoolchildren. *Acta Paediatr Scand* 1989; 78: 246-52.
4. BATES DV, SITZO R. Air pollution and hospital admissions in southern Ontario: the acid summer haze effect. *Environ Res* 1987; 43: 317-31.
5. BURNEY PGJ, PAPACOSTA AO, WITHNEY CH, COLLEY JRT, HOLLAND WW. Hospital admission rates and the prevalence of asthma symptoms in 20 local authority districts. *Thorax* 1991; 46: 574-9.
6. CARR W, ZEITEL L, WEISS K. Variations in asthma hospitalizations and deaths in New York City. *Am J Public Health* 1992; 82: 59-65.
7. HAAHELA T, LINDHOLM H, BJÖRKSTÉN F, KOSKENVUO K, LAITINEN LA. Prevalence of asthma in Finnish young men. *BMJ* 1990; 301: 266-8.
8. JAAKKOLA JJK, VILKKA V, MARTTILA O, JÄPPINEN P, HAAHELA T. The South Karelia air pollution study: the effects of malodorous sulfur compounds from pulp mills on respiratory and other symptoms. *Am Rev Respir Dis* 1990; 142: 1344-50.
9. KEISTINEN T, TUUPONEN T, KIVELÄ S-L. Asthma-related hospital treatment in Finland 1972-1986. *Thorax* (in press).
10. KLAUKKA T, PEURA S, MARTIKAINEN J. Why has the utilization of antiasthmatics increased in Finland? *J Clin Epidemiol* 1991; 44: 859-63.
11. KLEINMAN JC. State trends in infant mortality, 1968-83. *Am J Public Health* 1986; 76: 681-7.
12. KULMALA A, ESTLANDER A, LEINONEN L, RUOHOLA-AIROLA T, SÄYNÄTKARI T. Air quality at Finnish background stations in the 1970s [Abstract in English]. Finnish Meteorological Institute, No. 36. Helsinki: 1982.
13. LUNDBÄCK B, NYSTRÖM L, ROSENHALL L, STJERNBERG N. Obstructive lung disease in northern Sweden: respiratory symptoms assessed in postal survey. *Eur Respir J* 1991; 4: 257-66.
14. MELSOM R. Increased admission of children suffering from asthma. *Tidsskr Nor Laegeforen* 1990; 110: 3219-21.
15. MILLQVIST E, BENGTSON U, BAKE B. Occurrence of breathing problems induced by cold climate in asthmatics - a questionnaire survey. *Eur J Respir Dis* 1987; 71: 444-9.

16. MITCHELL EA. International trends in hospital admission rates for asthma. *Arch Dis Child* 1985; 60: 376-8.
17. MITCHELL EA. Racial inequalities in childhood asthma. *Soc Sci Med* 1991; 32: 831-6.
18. MITCHELL EA, ANDERSON HR, FREELING P, WHITE PT. Why are hospital admission and mortality rates for childhood asthma higher in New Zealand than in the United Kingdom? *Thorax* 1990; 45: 176-82.
19. NÄYHÄ S. Geographical variations in cardiovascular mortality in Finland, 1961-1985. *Scand J Soc Med* 1989; Suppl. 40.
20. POPE CA III. Respiratory disease associated with community air pollution and a steel mill, Utah Valley. *Am J Public Health* 1989; 79: 623-8.
21. PÖNKÄ A. Asthma and low level air pollution in Helsinki. *Arch Environ Health* 1991; 46: 262-70.
22. PÖYSÄ L, KORPPI M, PIETIKÄINEN M, REMES K, JUNTUNEN-BACKMAN K. Asthma, allergic rhinitis and atopic eczema in Finnish children and adolescents. *Allergy* 1991; 46: 161-5.
23. SLY RM, O'DONELL R. Regional distribution of deaths from asthma. *Ann Allergy* 1989; 62: 347-54.
24. TIKKANEN E. A review of research into forest damage connected with air pollution in Finnish Lapland. In: TIKKANEN E, VARMOLA M, eds. Research into forest damage connected with air pollution in Finnish Lapland and the Kola Peninsula of the USSR. Metsäntutkimuslaitoksen tiedonantoja 373. Rovaniemi: Metsäntutkimuslaitos, 1991: 7-19.

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