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Differences in utilization of asthma drugs between two neighbouring Swedish provinces: relation to symptom reporting

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Differences in utilization of asthma drugs between two neighbouring Swedish provinces: relation to symptom reporting. L. Larsson, G. Boëthius, M. Uddenfeldt.
ABSTRACT: Utilization of anti-asthma drugs is rapidly increasing and varies markedly between counties in Sweden. In 1989, the sales in the county of Gävleborg were less than 60% of those in neighbouring Jämtland.

In order to study the possible reasons for - and effects of - this difference, an epidemiological survey was started in 1989, the first part of which is reported here. A questionnaire was sent to all 16 yr olds, and to a random sample of 30–39 and 60–69 yr olds, in the two counties. A total of 12,500 questionnaires were distributed.

Overall response rate was 90%. A total of 7.2% in Jämtland and 5.8% in Gävleborg ($p<0.01$) reported that they had had asthma at some time. A similar significant difference between the counties was also present in response to questions on attacks of shortness of breath, wheezing and self-reported diagnosis of asthma, as well as on use of anti-asthma drugs. There were no statistically significant differences between the counties in positive answers to questions concerning history and symptoms of chronic bronchitis; approximately 5% in the oldest age group.

The findings support earlier results indicating a high asthma prevalence in northern Sweden. Contrary to reports from other countries, the prevalence was higher in the colder and less urbanised of the two provinces. We conclude that the differences in drug sales between the counties reflect a difference in prevalence of asthmatic symptoms.
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Sales of anti-asthmatic drugs have increased continuously in Sweden over the past two decades. In 1980, they amounted to 30 DDD (defined daily doses) per 1,000 inhabitants and day, and in 1989 to 65 DDD, with considerable variation in sales between different provinces [1, 2]. In the county of Jämtland 93 DDD per 1,000 inhabitants and day were sold in 1989, while the corresponding figure in the neighbouring county of Gävleborg was only 55 DDD (table 1) [1]. This regional diference has increased over the years (Fig. 1). Prescription monitoring also revealed that the proportion of the population in Jämtland with prescriptions for anti-asthma drugs increased from 2.8% in 1975 to 5.8% in 1989 [3].

There may be several reasons for the general increase in drug use and for the marked differences between counties, including changes and differences in morbidity, demographic factors, accessibility of health care, diagnostic criteria and treatment principles.

Morbidity data on obstructive airway disease from the two counties are missing. Differences in the

Table 1. – Sales of anti-asthmatic drugs in 1989 in the counties of Jämtland and Gävleborg

ATC*		No. of DDD** per 1,000 inhabitants/day	
Code	Group	Jämtland	Gävleborg
R03A	Inhaled β_2-agonists	33.4	23.2
BA	Inhaled steroids	39.8	15.9
BB	Ipratroprium bromide	1.2	1.3
BC	Sodium cromoglycate	1.0	1.1
C	Systemic β_2-agonists	7.6	6.1
D	Xanthines	10.1	6.9
Total		93.1	54.5

*: Anatomical Therapeutic Chemical (ATC) classification; **: According to defined daily doses (DDD) used in 1989.

morbidity of asthma between different regions have been reported for western Europe, where the disease seems to be more prevalent at low altitude and in warm climates than at high altitude [4, 5]. In Sweden, a higher prevalence has been found in the colder north of the country [6, 7].

In order to study these factors a broad epidemiological and clinical investigation on obstructive lung disease in the counties of Jämtland and Gävleborg was started in 1989.

We now report the first part of the investigation - a postal questionnaire with a twofold aim: to assess possible differences in the prevalence of obstructive airway disease symptoms and self-reported disease and to identify symptomatic individuals for further diagnostic evaluation.

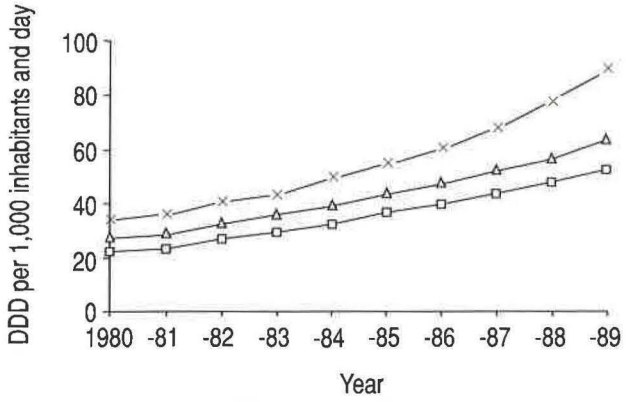

Fig. 1. – Sales of anti-asthmatic drugs in the county of Jämtland (x), the county of Gävleborg (❑) and in Sweden overall (Δ), 1980–1989.

Material and methods

Study areas

The county of Jämtland, in central Sweden, is a sparsely populated area of 49,000 km² (fig. 2). The western part, bordering Norway, is mountainous, while the central and eastern parts contain more farming areas, forests and watercourses. Jämtland has a cold inland climate with a mean January temperature varying from -8° to -11°C and a mean July temperature varying from 12 to 15°C. The average annual temperature is 1 to 3°C.

In Gävleborg, the southern part of Gästrikland was selected for the study. The region is situated on the Baltic coast at low altitude and covers 4,200 km² (fig. 2). In the southern part of Gävleborg, the mean January temperature is -5°C and the mean July temperature 17°C. The annual mean temperature is 5°C.

Demographic factors

Jämtland has 134,000 inhabitants and the population density is 3·km^{-2}. About 60,000 people live in the only town, Östersund. Main occupations are public services, farming, forestry and tourism. In 1989, 63.4% of the inhabitants aged ≥20 yrs were working, and had an average annual income of 106,300 Swedish crowns (SEK).

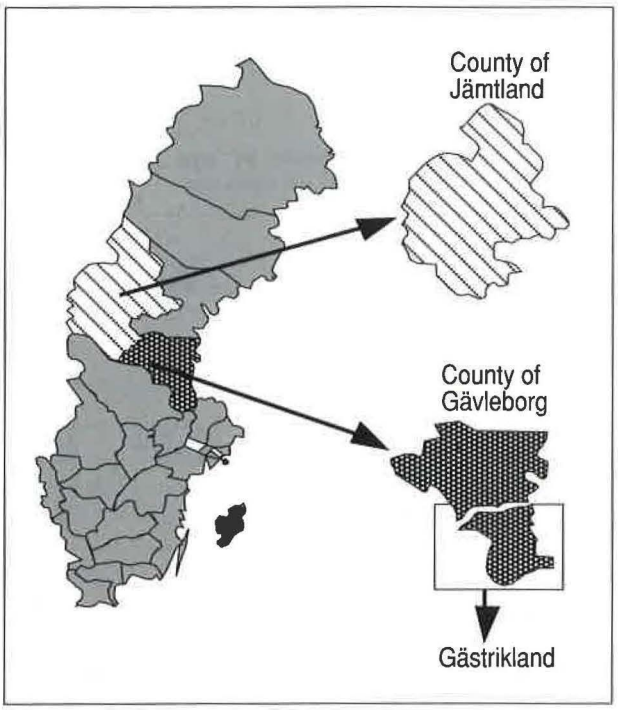

Fig. 2. – Map of Sweden and the counties of Jämtland and Gävleborg.

The population of Gästrikland is 147,000, and the majority (128,000) live in the two towns of Gävle and Sandviken (density 35·km^{-2}). Main occupations are industrial labour, farming and public services. In 1989, 64.0% of the population ≥20 yrs of age were working and the average income was 111,600 SEK.

The number of doctors in the public health care system was close to 2 per 1,000 inhabitants in both counties in 1989, and the total sum spent on health care by society was 12,000 SEK per inhabitant in Jämtland and 11,600 SEK per inhabitant in Gävleborg. In addition, there were a few doctors in private practice in each county. An average of 2.1 consultations with a doctor were made by the inhabitants in each county in 1989.

The population in both provinces is predominantly Swedish. In Jämtland a small minority are Laplanders and 1.8% of the residents are foreign nationals. In Gävleborg 2.6% of the inhabitants are foreign nationals.

Study population

Three age-groups, 16 yrs, 30–39 yrs and 60–69 yrs of age, were included in the study. The youngest group included all individuals born in 1974. In the older groups a sample of approximately 13% was drawn from the population record by selecting individuals born on the same four days in each month. In Jämtland, 6,149 individuals were included and

in Gävleborg 6,583. There were similar numbers of men and women in all age-groups. Altogether, 170 individuals were excluded (deceased, living abroad *etc.*). Death certificates from the 31 deceased individuals were examined, and no deaths were reported to have been due to obstructive airway disease. The age distribution of the remaining study population is seen in table 2.

The proportion of individuals making any purchase of anti-asthma medication in 1989 was not significantly different between responders and non-responders. The proportion among 16 yr old responders was 7.7% and non-responders 6.7%. The corresponding figures in 30–39 yr olds and 60–69 yr olds were 4.4 *versus* 3.4% and 5.4 *versus* 5.5%, respectively.

Table 2. – Study population by age, province and smoking habits; number of individuals, response rate and frequency of smokers and ex-smokers

Age yrs	16		30–39		60–69		Total	
County	Jämtland	Gävleborg	Jämtland	Gävleborg	Jämtland	Gävleborg	Jämtland	Gävleborg
Subjects n	1779	1848	2348	2542	1967	2076	6094	6466
Response rate %	93.4	89.1	88.9	84.3	94.4	91.4	92.0	88.0
Smokers %	4.0	5.0	29.4*	32.8	21.5	21.4	19.2	21.0
Ex-smokers %	3.1	2.7	28.1	25.9	32.4	31.3	22.1	21.0

*: p≤0.05, *vs* Gävleborg.

Questionnaire

The questionnaire was a modification of that previously used in studies in northern Sweden [8, 9], and was based on the British Medical Research Council questionnaire [10]. The 22 questions were answered by filling boxes with "yes" or "no, not as far as I know". All of the forms were distributed during four weeks, in February and March 1990.

Response rate and drop-out study

Non-responders received a reminder after two weeks and a second reminder after a further two weeks. In the second reminder, a possibility was given to state, anonymously, the reason for not wanting to answer the questionnaire. Only 88 persons out of 1,700 used this opportunity, and most of them stated they had not answered because they did not have any symptoms of this type. The questionnaire was answered by 345 individuals after the second reminder. Response rate was 92.0% in Jämtland, and 88.0% in Gävleborg (table 2).

The sales of medication requiring a physicians prescription have been registered on an individual basis for 20 yrs in Jämtland [3]. The registration covers individuals born on the same four dates as those included in the age groups 30–39 and 60–69 yrs.

The purchase of anti-asthmatic drugs in 1989 among non-responders was compared to the purchase of the total population in the corresponding age-groups. In this way, we were able to gain information about purchases of medication of all non-responders in the two older age-groups and of 13% of non-responders in the 16 yrs age-group.

Statistics

Results are given as percentage of positive answers of all the answers to a question and the percentage of questionnaires returned in which the question was not answered. Differences were analysed for statistical significance using the Chi-squared test. Significance is marked with * when p≤0.05, ** when p≤0.01, and † when p≤0.001 (two-tailed p-value, Yate's correction used).

Approval

The study was approved by the Ethics Committee at the University of Umeå.

Results

Smoking habits

In the two younger age groups, the frequency of current smoking was higher in Gävleborg. The difference was statistically significant in the 30–39 yr old group (table 2).

More women in the two younger age groups smoked. In Gävleborg, 7.3% of 16 yr old girls were smokers compared with 2.9% of the boys. The corresponding figures in Jämtland were 4.5 *versus* 3.4%. Among 30–39 yr olds, 35% of women and 26% of men smoked, while in the 60–69 yr olds more men than women smoked (25 *versus* 18%).

Asthma

The frequency of positive answers to all five questions about asthma and symptoms associated with

asthma was higher in Jämtland (table 3). In most instances, the difference between the counties reached statistical significance. A family history of asthma was more often recognised by women than by men. In Jämtland, there was a marked male dominance in asthma diagnosed by a physician among the 16 yr olds (7.1 *versus* 4.4%; $p<0.05$); otherwise no major sex differences were seen. Asthmatic symptoms were more common among smokers and ex-smokers than among nonsmokers.

Chronic bronchitis and emphysema

There were no significant differences between the provinces in the frequency of positive answers to the questions on chronic bronchitis (table 4). Less than 1% of 16 yr olds had a history of chronic bronchitis. A female dominance was seen in positive replies to the questions on family history (5.5 *versus* 3.3%; $p<0.001$) and of longstanding cough (16.2 *versus* 12.0%; $p<0.001$); otherwise no sex differences were seen.

Table 3. – Questions on asthma; frequency of positive and missing answers (%) in Jämtland and Gävleborg in 3 age groups

	16 yrs		30–39 yrs		60–69 yrs		Total		Missing
Question	Jämtland	Gävleborg	Jämtland	Gävleborg	Jämtland	Gävleborg	Jämtland	Gävleborg	Total
1	18.3 **	14.1	21.7†	16.9	19.1†	14.6	19.8†	15.3	2.4
2	6.8	6.4	8.3†	5.3	6.5	5.8	7.2**	5.8	4.7
3	11.5*	9.2	13.0†	9.6	15.2**	11.8	13.3†	10.8	1.7
4	5.9	5.4	6.6†	4.0	5.8	5.4	6.1**	4.9	1.0
5	7.4	6.1	10.3**	8.0	13.3	12.6	10.4*	9.0	1.6

Questions: 1) Do you have a family history of asthma? 2) Have you ever had asthma? 3) Have you ever had asthma symptoms (attacks of shortness of breath, with or without cough and wheeze)? 4) Do you have asthma diagnosed by a physician? 5) Do you usually have wheezing or whistling sounds in your chest? *: $p\leq0.05$; **: $p\leq0.01$; †: $p\leq0.001$ *vs* Gävleborg.

Table 4. – Questions on history and symptoms of chronic bronchitis; positive and missing answers (%)

	16 yrs		30–39 yrs		60–69 yrs		Total		Missing
Question	Jämtland	Gävleborg	Jämtland	Gävleborg	Jämtland	Gävleborg	Jämtland	Gävleborg	Total
1			1.6	1.7	5.4	4.9	2.7	2.5	6.1
2			2.1	1.8	5.3	4.7	2.8	2.4	1.3
3	10.8	11.3	15.7	15.5	15.9	14.6	14.3	13.9	1.0
4	2.3	2.4	4.3	4.2	5.9	5.3	4.3	4.1	1.3
5	11.6	12.3	17.5	15.7	23.2	20.8	17.6	16.4	1.6

Questions: 1) Have you ever had chronic bronchitis? 2) Do you have chronic bronchitis or emphysema diagnosed by a physician? 3) Have you had any long-standing period of cough in the last five years? 4) If yes, have you had such periods lasting three months or more during two consecutive years? 5) Do you have phlegm when coughing, or do you have phlegm in the chest that you can not cough up?

Table 5. – Questions on nonspecific airway reactivity; positive and missing answers (%)

	16 yrs		30–39 yrs		60–69 yrs		Total		Missing
Question	Jämtland	Gävleborg	Jämtland	Gävleborg	Jämtland	Gävleborg	Jämtland	Gävleborg	Total
1	16.4	15.3	16.2†	11.1	23.5†	17.0	18.7†	14.3	2.0
2	15.1	14.6	16.6	14.3	23.6†	19.1	19.0†	16.0	2.3
3	5.3	4.5	9.2**	6.9	19.8†	14.6	11.5†	8.7	3.1
4	6.0	5.9	13.1*	10.9	18.9	16.9	12.9*	11.4	2.4

Questions: Do you ususally become breathless, wheezy in the chest or get severe cough: 1) during physical exercise outdoors in cold weather? 2) in dusty or smoky environments? 3) from motor-car exhaust or other kinds of air-pollution? 4) from strong scents, perfumes, spices, detergents, printing ink, *etc.* *: $p\leq0.05$; **: $p\leq0.01$; †: $p\leq0.001$ *vs* Gävleborg.

Nonspecific symptoms

The frequency of positive answers to the question on nonspecific airway symptoms was significantly higher in Jämtland (table 5). In all parts of the question and in all age groups there was a statistically significant female dominance, especially in the youngest group.

Medication

In all age-groups the proportion of individuals using anti-asthmatic medication was higher in Jämtland (fig. 3). The frequency of drug users among individuals with a diagnosis of obstructive disease was higher in Jämtland than in Gävleborg. This was also true in the group with nonspecific airway symptoms but without diagnosis of asthma or chronic bronchitis (table 6).

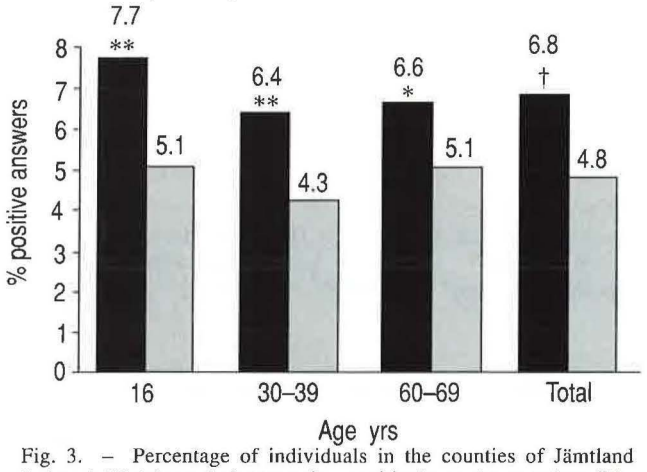

Fig. 3. – Percentage of individuals in the counties of Jämtland (■) and Gävleborg (▭) answering positively to the question: "Do you use any anti-asthmatic medication, regularly or as needed?" *: p≤0.05; **: p≤0.01; †: p≤0.001

Table 6. – Pecentage of positive answers regarding anti-asthmatic medication in individuals of all age groups with symptoms/diagnosis of obstructive lung disease

	Symptom/diagnosis	County	
		Jämtland	Gävleborg
1	Asthma diagnosed by physician	74	70
2	Chronic bronchitis diagnosed by physician	43	36
3	Breathless, wheezy in cool weather, but no diagnosis of obstructive lung disease.	10	8
4	Long-standing cough but no diagnosis of obstructive lung disease.	6	3

Discussion

In published studies, there are considerable variations in the prevalence of obstructive airways disease, probably partly due to differences in methodology. To make a direct comparison possible, this study was performed simultaneously, using the same method, in the two adjacent counties.

The differences between the regions studied were constant in all questions on asthma and may reflect a difference in asthma prevalence. Such a geographical difference has been reported previously. By studying the compulsory conscript examination records of Swedish men, ÅBERG [7] found a higher asthma prevalence in the northern part of Sweden than in southern parts. The geographical pattern of sales data on anti-asthma drugs does not, however, support the belief that asthma morbidity gradually increases from south to north [1].

In 1981, the asthma prevalence in the industrial community of Hörnefors in the north of Sweden was 3.6% [8]. LUNDBÄCK *et al.* [9] reported in Sweden's most northerly province, in 1986, a frequency of 5.9% of subjects stating that they had at some time had asthma. This figure - the cumulative prevalence rate [11] - was 7.2% in Jämtland and is, thus, the highest reported so far in Sweden.

Recent reports from other parts of Europe show a lower cumulative asthma prevalence: 5.2% in Denmark [12]; 5% in Italy [13]; and 2.4–4.1% in southern France [5]. The high cumulative asthma prevalence found in our study supports earlier reports of a high asthma prevalence in northern Sweden and is consistent with the hypothesis of an increasing asthma prevalence over time. The established differences between the two provinces, however, contradict the findings of several studies in which a higher asthma prevalence was seen in warmer or more urban areas [4, 5, 14–17].

The reason for the differences between Jämtland and Gävleborg in the prevalence of self-reported asthma and symptoms of asthma is unknown.

The prevalence of asthma has been reported to be higher in urban than in rural areas [15–17]. The higher degree of industrialisation and urbanisation in Gävleborg indicates that these factors are less important in explaining the differences that we have observed. A harmful indoor climate has been suggested to be a risk factor for the development of allergic disease and asthma, particularly in a cold climate [7]. The hypothesis is, that in a colder climate more time is spent indoors, while at the same time energy conservation plans have often led to poorer ventilation. This would result in a greater exposure to indoor allergens and "chemical pollution" from building materials in the colder district. More studies have to be done to evaluate this hypothesis.

Several groups have studied the influence of meteorological factors on asthma, and found that cooling of weather [18], and dry air [19], may be triggering factors. Several studies from Europe, the USA, Australia and New Zealand, however, all indicate that asthma is more prevalent in warmer climes [4, 5, 14].

The correlation between medication with anti-asthmatic drugs and symptoms and diagnoses gave few

statistically significant differences between the provinces. A somewhat higher proportion of individuals with symptoms, but without a physician's diagnosis of asthma or chronic bronchitis, was treated in Jämtland. The number of individuals was small in this group, however, and it can only account for a small part of the marked differences in consumption.

A clinical investigation of symptomatic individuals in Jämtland and Gävleborg is underway, to determine diagnosis, medication, environmental factors, atopy, lung function and sense of well-being.

Drug sales data provide an inexpensive source for epidemiological studies of differences in the use of drugs between areas or over time. Attempts to evaluate the significance of such differences are necessary for both medical and economic reasons - newly developed preparations, in this context anti-asthmatic inhalants, constitute an increasingly expensive treatment. Studies aiming to evaluate how these and other drugs are used are urgently needed.

In conclusion, the differences between the provinces of Jämtland and Gävleborg in utilization of anti-asthmatic medication reflect a difference in the prevalence of asthmatic symptoms. The reasons for these differences are still unknown, as are the potential effects of the differences in drug use.

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