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ORIGINAL RESEARCH

Differences in asthma diagnosis and medication use in children living in Germany and the Netherlands

M. Mommers^{a,c,*}, G.M.H. Swaen^{b,c}, M. Weishoff-Houben^a,
W. Dott^a, C.P. van Schayck^c

^a Institute for Hygiene and Environmental Medicine, RWTH Aachen, Pauwelsstraße 30, 52074 Aachen, Germany

^b Department of Epidemiology, Care and Public Health Research Institute, Maastricht University, The Netherlands

^c Department of General Practice, Care and Public Health Research Institute, Maastricht University, The Netherlands

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Abstract

Aim: To compare diagnosis and treatment between German and Dutch children with asthmatic symptoms at the age of 5–6 and 7–8 years, and the use of anti-asthma medication at 7–8 years of age.

Methods: Parents of 4462 children participated in two surveys, in 1995 and 1997. All 465 children identified with current asthmatic symptoms at the age of 5–6 (May 1995) or at 7–8 years of age (May 1997) were sent a third more detailed questionnaire (October 1997).

Results: Asthma diagnosis was more prevalent in Dutch children with current asthmatic complaints (50–60%), whereas over 90% of the German children with current asthmatic complaints had been diagnosed with bronchitis. Inhaled β_2 -agonists were more frequently used by Dutch children compared to German children (67.3% vs. 45.6% $p < 0.01$) as were inhaled steroids (38.9% vs. 7.0% $p < 0.01$). Instead, German children more often used sodium cromoglycate or nedocromil as anti-inflammatory medication as compared with Dutch children (42.1% vs. 11.5% $p < 0.01$).

Conclusions: Differences in diagnosis rates for asthma and bronchitis between German and Dutch children most likely result from differential labelling of complaints, and probably lead to differences in treatment practice, indicating possible under-treatment of German children with inhaled steroids.

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* Corresponding author. Tel.: +49 241 8088520; fax: +49 241 8082477.

E-mail address: monique.mommers@post.rwth-aachen.de (M. Mommers).

Introduction

Asthma is a common disease in childhood with a large social and economic burden. Developed countries might expect to spend an estimated one to two percent of their total health care expenditures on asthma [1]. In children, asthma is an important cause for school absence. School absence in the past year due to asthma was reported for 40–50% of German and Dutch children [2]. Early diagnosis and appropriate treatment are vital to reduce the burden asthma puts on society and on the individual.

Several national and international guidelines for the diagnosis and management of asthma have been published in recent years [1,3–6]. Current recommendations stress the early introduction of anti-inflammatory agents because asthma is considered a chronic inflammatory disorder. Although some earlier guidelines recommended the use of sodium cromoglycate as maintenance treatment for children with moderate asthma [3,4] more recent guidelines stress the importance of inhaled corticosteroids [1,5]. Inhaled steroid use has been shown to improve symptom control and lung function [7] and to reduce the risk of hospital admission [8]. A recent study reported substantial underuse of preventive therapy, specifically inhaled steroids [9]. The use of inhaled anti-inflammatory medication remains low even for children using large amounts of inhaled β_2 agonists [10]. A large European survey concluded that the current level of asthma control falls far short of the goals for long-term asthma management as put forward in current guidelines [11].

The incorporation of the guideline recommendations into daily medical practice may depend on factors such as the organisation of health care, health insurance systems, and costs of medical treatment, but probably (and most importantly) it may well depend on doctors' views on asthma diagnosis and management. Many of these factors differ between Germany and the Netherlands, and it is possible that asthma care between German and Dutch children differs likewise. In the Dutch system, general practitioners serve as gate keepers, whereas in Germany patients have open access to physicians or specialists. Moreover, asthma symptom prevalence rates in the Dutch borderland regions were among the highest in the Netherlands [12]; given the lack of information about respiratory health in the adjoining German region, this led the local health authorities to conduct a large Dutch-German study on respiratory health, diagnosis, treatment and risk factors, involving Mu-

nicipal Health Services and Universities from both countries. The present study represents the first part of this Dutch-German study, aiming to gain more insight into asthma diagnosis and prescription of anti-asthma medication in German and Dutch children. We investigated whether differences existed in prevalence rates of diagnosis and treatment between Dutch and German children with current asthmatic symptoms. Whereas most studies on asthma control are cross-sectional, our data presented the opportunity to study diagnosis and treatment in the same group of children at different ages. Early recognition of asthmatic symptoms, early diagnosis, and early treatment might prevent disease progression, and willingness to diagnose asthma at an early age might differ between Germany and the Netherlands. Moreover, the design of the study enabled a more accurate assessment of asthmatic status (asthmatic symptoms present on more than one occasion) for studying medication use in these children.

This study therefore compares the prevalence rates of asthma diagnosis and treatment between German and Dutch children with asthmatic symptoms at the age of 5–6 years and again at 7–8 years, and the use of anti-asthma medication at 7–8 years of age.

Methods

Respiratory symptoms, diagnosis and treatment were assessed at three different time points in a period of 2.5 years, among children living in the Dutch-German borderland (Figure 1). This region covers the geographic area consisting of the municipal health regions Kreis Heinsberg (Germany), Midden-Limburg and the Westelijke Mijnstreek (The Netherlands). Together, the two Dutch regions have approximately 380,000 inhabitants, while Heinsberg has approximately 250,000 inhabitants.

In May 1995, the parents of all 7201 children living in the study area who were born between November 30th 1989 and December 1st 1990 were invited to complete a questionnaire that included the WHO questions about respiratory symptoms [13] and questions about allergies, diagnosis and treatment. Parents of 5692 children (79.0%), who turned 5–6 years in the study year, participated in 1995. In spring 1997, it was possible to trace 5459 of these children for participation in the second survey, using the same parental questionnaire; the remaining 233 children had moved out of the study area or their forwarding address was unknown.

We studied differences in diagnosis and treatment rates among German and Dutch children with

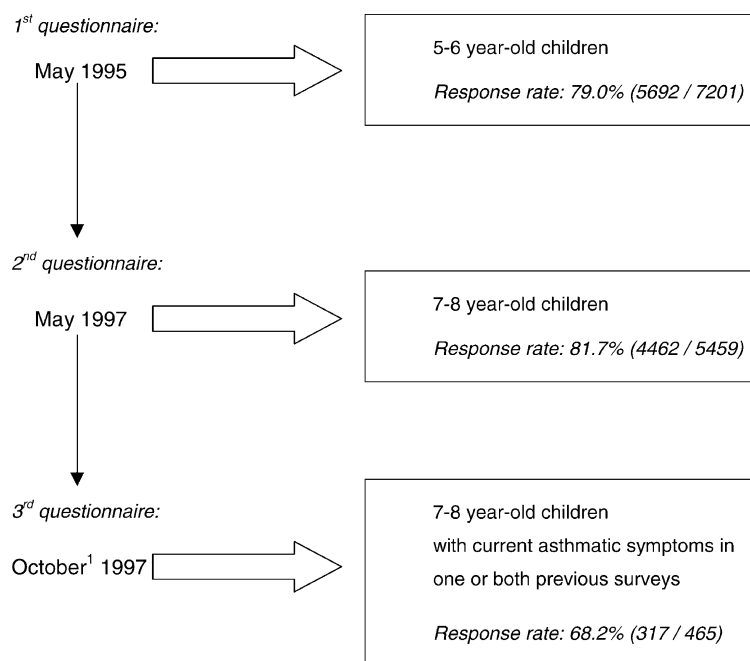


Figure 1 Response rates of the different parts of the study ¹(from September 29th to November 7th).

reported current asthmatic symptoms. Current asthmatic symptoms were defined as reported wheezing and attacks of shortness of breath with wheezing in the respective year preceding the surveys of 1995 and 1997. For the purpose of defining current asthmatic symptoms in the present study we used what is, to our knowledge, an unvalidated definition. Although our definition of current asthmatic symptoms - positive response to both questions about wheezing and shortness of breath with wheezing in the past 12 months - had not been validated in this combination, each question separately has been found to have both high sensitivity and specificity in relation to clinical asthma [14]. In all, 465 children had current asthmatic symptoms either at 5–6 years of age (in May 1995) or at 7–8 years of age (in May 1997), or at both ages. In October (from September 29th to November 7th) 1997, the parents of these 465 children were asked to complete a third, more detailed questionnaire, which included ISAAC questions on occurrence and severity of wheezing [15] (different questions regarding wheezing or whistling in the child's chest, number of attacks of wheezing, sleep disturbance due to wheezing and wheezing severe enough to limit the child's speech to only one or two words at a time between breaths) and management (questions regarding medication use (tablets, sprays etc.) against wheezing or asthma in the last 12 months, number of visits to a general practitioner, pulmonologist, paediatrician or hospital emergency department for a regular

check up or acute attack of wheezing or asthma in the last 12 months), as well as questions on indoor environment. Questionnaires were checked for completeness by an assistant of the Municipal Health Service in the presence of one or both parents. Because of the time frame of the study (from May 1995 through to October 1997) for some children current asthmatic symptoms had only been reported in 1995, whereas for others current asthmatic symptoms had been reported in May 1997. For the purpose of describing medication use in the past 12 months in children with current symptoms, we used the question 'Has your child had wheezing or whistling in the chest in the last 12 months?' from the third, more detailed questionnaire to identify children with current symptoms in October 1997.

The study was approved by the medical ethics committee of the "Arztekammer Nordrhein" in Germany.

Statistical analysis

Prevalence rates were calculated by dividing the number of positive responses to each question by the total number of responses to that question. Data are presented stratified by country and age group. Chi-square tests were used to analyse differences in prevalence rates between the two countries. Fisher's exact test was used when the expected frequency of any cell was less than 5.

Results

Response rates

The overall response rates of the study are outlined in Figure 1. In 1997, 1402 (74.8%) German and 3060 (85.4%) Dutch participants of the 1995 survey took part in the second survey. The proportion of boys was slightly larger in the German compared to the Dutch region: 52.9% versus 51.0% respectively.

Of the 4462 children participating in both surveys, 341 children (7.6%) had current asthmatic symptoms at the age of 5–6 years (in 1995) and 240 (5.4%) had current asthmatic symptoms at the age of 7–8 (in 1997); 465 children had current symptoms either at 5–6 years of age or at 7–8 years of age, or at both ages. The additional questionnaire was completed for 68.2% (317/465) of these children, showing minimal differences in response rates between German (67.7%) and Dutch children (68.4%). Again, the proportion of German boys (68.5%) was slightly larger than for Dutch boys (64.6%).

Diagnosis rates in German and Dutch children with current asthmatic symptoms

Among 5–6 year-olds with current asthmatic symptoms, proportionally more Dutch than German chil-

dren were diagnosed with asthma (Table 1). Two years later, this difference was still present but somewhat smaller: 59.7% for Dutch and 37.2% for German children ($p < 0.01$). Among 7–8 year-old children diagnosed with asthma, 77.3% of the Dutch children and 31.0% of the German children already had an asthma diagnosis at the age of 5–6 ($p < 0.01$). Bronchitis was diagnosed in more than 90% of the German children with current asthmatic complaints (Table 1). On the other hand, more than 40% of the German children without any reported respiratory symptom at 5–6 years of age as well as at 7–8 years of age, were also reported to have ever been diagnosed with bronchitis.

Allergies were diagnosed more often in Dutch compared to German children with asthmatic complaints, especially at the age of 5–6 years (Table 1).

Anti-asthma medication use in German and Dutch children with current asthmatic symptoms

We identified 175 children with current asthmatic symptoms at the third assessment of the study for describing severity of symptoms (Table 2) and anti-asthma medication use in the past year (Table 3). Wheezing attacks were more frequently reported for Dutch children, whereas speech-

Table 1 Prevalence of diagnosis and treatment for asthma, bronchitis and allergies in children with current asthmatic symptoms at different ages by country.

	5–6 year-olds (n = 341)			7–8 year-olds (n = 240)		
	German % (n)	Dutch% (n)	p-value	German% (n)	Dutch% (n)	p-value
Physician-diagnosed asthma (lifetime)	21.2 (21)	52.2 (117)	<0.01	37.2 (32)	59.7 (89)	<0.01
Physician-diagnosed bronchitis (lifetime)	95.2 (99)	65.7 (151)	<0.01	93.3 (83)	56.5 (83)	<0.01
Physician-diagnosed allergies (all):	37.6 (38)	54.2 (128)	0.01	57.3 (47)	65.5 (93)	0.22
House dust mite allergy	18.0 (16)	32.5 (68)	0.01	40.3 (27)	52.5 (64)	0.11
Grass/pollen allergy	19.3 (17)	24.0 (48)	0.38	48.7 (37)	45.0 (49)	0.62
Cow's milk allergy	5.9 (5)	23.4 (47)	<0.01	3.5 (2)	26.0 (27)	<0.01
Chicken egg allergy	4.8 (4)	10.9 (21)	0.10	3.6 (2)	20.2 (21)	<0.01
Mould allergy	4.8 (4)	5.9 (11)	1.00	19.0 (11)	10.3 (9)	0.14
Pet allergy	17.2 (15)	32.0 (66)	0.01	34.3 (23)	47.1 (57)	0.09
Other allergies	14.9 (13)	23.9 (47)	0.09	36.4 (24)	34.7 (33)	0.83
Treatment (by a specialist) for asthma in the past 12 months	19.4 (19)	27.5 (61)	0.12	29.8 (25)	30.2 (45)	0.94
Treatment (by a specialist) for bronchitis in the past 12 months	89.4 (93)	27.0 (61)	<0.01	78.2 (68)	19.2 (28)	<0.01

Table 2 Frequency of wheezing attacks, sleep disturbance due to wheeze and speech limiting wheeze in the past year in children with current asthmatic symptoms by country.

	7–8 year-old children with asthmatic complaints (n = 175)		
	German% (n)	Dutch% (n)	p-value
Wheezing attacks (≥ 1)	89.7 (52)	97.4 (114)	0.06
Sleep disturbance due to wheeze	60.0 (33)	68.4 (78)	0.28
Speech limiting wheeze	36.8 (21)	21.9 (25)	0.04

limiting wheeze was more prevalent in German children with current asthmatic symptoms (Table 2).

Overall, for 80% of the 7–8 year-old German and Dutch children with current asthmatic symptoms, any medication use for their complaints in the past 12 months was reported (Table 3). Anti-asthma medication, as listed in Table 3, had been used by 63.8% of the German children and by 72.6% of the Dutch children. Inhaled β_2 -agonists were used by more of the Dutch children compared to German children as were inhaled steroids. Instead, German children more often used sodium cromoglycate or nedocromil as anti-inflammatory medication compared with Dutch children. Inhaled β_2 -agonists were used by 15.8% of the German children and by 26.5% of the Dutch children as monotherapy (Table 4). In combination with inhaled β_2 -agonists German children most frequently used sodium cromoglycate or nedocromil, whereas in Dutch children inhaled β_2 -agonists were more frequently combined with inhaled steroids.

Discussion

The results of the present study show differences between German and Dutch asthmatic chil-

dren with respect to diagnosis and treatment. Almost all German children had been diagnosed with bronchitis. Asthma diagnosis was more frequent in Dutch than in German children. Inhaled β_2 -agonists and inhaled steroids were more frequently used by Dutch children, whereas more German children used inhaled sodium cromoglycate or nedocromil.

Diagnosis rates differ between German and Dutch children with current asthmatic symptoms

The large difference in diagnosis rates by country probably originated from differential labelling of respiratory symptoms. German physicians may have preferred the label bronchitis because (in the parents' view) it is a less threatening and stigmatising diagnosis than asthma. In Germany the label bronchitis includes respiratory symptoms ranging from mild coughing symptoms to more severe asthmatic symptoms. In line with this, the variation in prevalence rates for allergy diagnoses by country might well reflect differences in diagnostics rather than a real difference in atopic predisposition.

Table 3 Medical care use in the past year in children with current asthmatic symptoms by country.

	7–8 year-old children with asthmatic complaints (n = 175)		
	German% (n)	Dutch% (n)	p-value
Medication use in the past 12 months	80.7 (46)	80.0 (92)	0.91
Inhaled β_2 -agonists	45.6 (26)	67.3 (76)	<0.01
Inhaled anticholinergic agents	3.5 (2)	6.2 (7)	0.72
Inhaled steroids	7.0 (4)	38.9 (44)	<0.01
Sodium cromoglycate/nedocromil	42.1 (24)	11.5 (13)	<0.01
Oral β_2 -agonists	8.8 (5)	–	<0.01
Theophylline	1.8 (1)	–	0.34
Ketotifen	5.3 (3)	–	0.04
Corticosteroids (oral)	7.0 (4)	0.9 (1)	0.04
Corticosteroids (rectal)	17.5 (10)	–	<0.01
Physician's visit for acute asthmatic problems in the past 12 months	84.9 (45)	72.5 (79)	0.08
Physician's visit for a regular check-up in the past 12 months	38.3 (18)	49.1 (52)	0.22

Table 4 Percentage of German and Dutch children with current asthmatic symptoms using β_2 -agonists as monotherapy or in combination with anti-inflammatory medication.

	7–8 year-old children with asthmatic complaints (<i>n</i> = 175)		
	German% (<i>n</i>)	Dutch% (<i>n</i>)	<i>p</i> -value
β_2 -agonists as monotherapy	15.8 (9)	26.5 (30)	0.12
β_2 -agonists with inhaled steroids	1.8 (1)	33.6 (38)	<0.01
β_2 -agonists with sodium cromoglycate/nedocromil	26.3 (15)	6.2 (7)	<0.01
β_2 -agonists with inhaled steroids and sodium cromoglycate/nedocromil	1.8 (1)	0.9 (1)	1.00

Therapeutic regimes differ between German and Dutch children with current asthmatic symptoms

Fewer German than Dutch children with current asthmatic symptoms reported the use of anti-asthma medication in the past year. The rate of anti-asthma medication use in German children (64%) was similar to the rate previously reported for German children [16]. Most guidelines recommend the use of β_2 -agonists in children with mild asthma [3–6]. Our results indicate that β_2 -agonists were used more frequently in Dutch children than in German children. Also, proportionally more Dutch than German children used β_2 -agonists as monotherapy. It is possible that Dutch physicians adhered more strictly to the guidelines and prescribed β_2 -agonists to children with mild intermittent asthmatic symptoms (step one in the GINA guidelines [1]). Another explanation could be that among Dutch children mild asthmatic symptoms are more prevalent than among German children, or that parents of Dutch children more readily report their child's complaints to a physician. The latter is less likely because underrepresentation of respiratory symptoms to the general practitioner is a large problem among Dutch adult asthmatic patients [17].

In addition, more of the Dutch children used inhaled steroids as maintenance treatment, whereas most German children in this study used sodium cromoglycate or nedocromil. Our results are consistent with recent reports of lower use of inhaled steroids in Germany [16, 18] and in other countries [2, 9]. Low steroid use in German children may have resulted from parents' or physicians' fear of side effects of treatment with steroids, or from different recommendations in national guidelines. For instance, the 1998 German national guidelines [6] recommend the use of sodium cromoglycate as an alternative to inhaled steroids in children with mild asthma whereas the 1998 Dutch guidelines recommend inhaled steroids as the prophylactic treatment of first choice [5]. The use of steroids largely

depends on the degree of asthma severity. As our definition of asthmatic symptoms was based solely on questionnaire reports and did not include more objective clinical diagnostic methods, it was not possible to determine accurately the severity of the asthmatic symptoms. It is therefore possible that most of the children in this study only had mild complaints not requiring treatment with steroids. We studied medication use among children who had had at least two periods of wheezing or attacks of shortness of breath with wheezing at two different time points. In about half of these children asthma had been diagnosed.

Adequate treatment may have affected the frequency and improved the severity of symptoms in these children. We have no information on treatment compliance: low compliance has been reported worldwide and is, on average, not strongly influenced by disease severity [19]. In children with asthma, adherence rates to prescribed treatment regimens are often below 50% [20].

Possible limitations of the study

We cannot address a possible responder bias because we have no information on the children who did not participate in both 1995 and 1997. Possibly parents of children with symptoms were more likely to participate than parents of children without symptoms, leading to overrepresentation of symptomatic children in our study. In line with this, children with asthmatic symptoms whose parents had completed the third, more detailed questionnaire were more frequently found to have reported symptoms in the second survey (in 1997) than non-participants for the third questionnaire. Since we only selected children with current asthmatic symptoms for the analysis of treatment, this differential response probably did not influence the main outcomes of this study. However, based on our data, we cannot irrefutably exclude a real difference in prevalence of asthmatic symptoms between the

two countries but it seems likely that different diagnostic labelling plays a major role in explaining these data.

Conclusions

The study results show differences in diagnostic labelling of asthmatic symptoms between countries, possibly leading to the observed differences in asthma management. In Dutch children asthmatic symptoms were more often labelled as asthma, whereas in German children they were more often labelled as bronchitis. Although this did not result in large differences in prevalence of overall anti-asthma medication use between German and Dutch children living in the study area, differences in the use of specific anti-asthma medication were found. Most Dutch children used inhaled steroids as anti-inflammatory treatment, whereas only a minority of German children used inhaled steroids. Most German children were treated with sodium cromoglycate or nedocromil, possibly indicating undertreatment of German children with steroids. It seems feasible that German physicians have to overcome their reluctance to diagnose children with asthma symptoms as having asthma, in order to increase the use of inhaled corticosteroids as the most appropriate treatment in respect to the underlying pathophysiology of this disease.

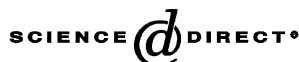
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