Changing prevalence of respiratory symptoms and treatment in Dutch school children: 1989-1997

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Abstract

Aim:

To investigate whether the prevalence of respiratory symptoms, physicians visits, medication use and school absence in Dutch children changed between 1989 and 1997, and whether respiratory symptoms are related to changed exposure to tobacco smoke and pets.

Methods:

Parents of children eligible for a routine physical examination in 1989 (3176 children), 1993 (3491 children) or 1997 (4776 children) were asked to complete a questionnaire about respiratory symptoms for their child.

Results:

Response rates were almost 100%. Between 1989 and 1997 the prevalence of shortness of breath increased from 7.4% to 9.3%

($p=0.056$) in 5-6 year olds, whereas the prevalence of wheezing decreased (from 22.1% to 18.3%, $p=0.002$). The same trend was seen in 8-9 year-old children. The proportion of asthmatic children consulting their physician or using medication increased (from 55.9% to 63.3% and from 38.7% to 47.4%, respectively), whereas cigarette smoking (from 60.8% to 48.5%) and pet ownership (from 55.1% to 47.0%) decreased.

Conclusion

Our findings support other reports of an increasing prevalence of asthma and treatment. However, this could not be explained by increased exposure to cigarette smoke or pets.

Key words

respiratory symptoms, asthma, prevalence, children

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Introduction

Respiratory symptoms are a major health burden; for Dutch school children it was reported that of the children with asthmatic complaints 38% were using medication and 22% had missed school for at least one week in the past year.¹

Large geographic differences in asthma symptom prevalence have been reported, with the highest prevalence rates in Anglo-Saxon countries.² Also shortly after the reunification of East and West Germany, a higher prevalence of atopic sensitisation, asthma and hay fever was found in former West German children compared to East German children.⁴ Regional differences in asthma symptom prevalence have also been reported for the Netherlands.⁵ As in other countries,⁶ rising asthma symptom prevalence has also been observed in the Netherlands in recent years.⁹ The causes of these geographical and temporal differences remain largely unexplained. The aim of the present study was to investigate whether the prevalence of respiratory symptoms, physicians visits, medication use and school absenteeism due to respiratory complaints, in Dutch school children changed between 1989 and 1997. In addition, we studied whether respiratory symptoms were associated with changed exposure to tobacco smoke and pets, in order to explain underlying mechanisms of possible changes in asthma prevalence.

Method

Study area and population

The Westelijke Mijnstreek is located in the southern part of the Netherlands (Limburg) and has approximately 170,000 inhabitants.

The survey was performed among children that were eligible for their routine physical examination by the

Youth Health Care Section of the Municipal Health Service in 1989, 1993 or 1997. Figure 1 shows that children were invited according to year of birth. For example, from October 1988 through March 1989 all 5-6 year-olds, born in 1983 were invited, followed by 8-9 year-olds born in 1980 (from April 1989 through September 1989). Consequently, this approach ensured enrolment of all 8-9 year-olds born in 1980 and 5-year-olds born in two consecutive years (i.e., 1983 and 1984) in the survey of 1989. In 1997 we extended the recruitment through March 1998 to include all 5-year-olds born in 1992 in the study (the study years 1997-1998 will further be denoted as 1997).

Questionnaire

In 1989, 1993 and 1997 the same validated questionnaire was used.^{10,11} This questionnaire has been used widely in the Netherlands and includes questions on respiratory symptoms which were derived from internationally used standard children's questionnaires. Questions were asked about chronic cough (coughing five days a week for more than three months a year), coughing with phlegm (coughing with phlegm for more than three weeks a year), wheezing, shortness of breath and shortness of breath with wheezing. Additional questions were asked about physicians visits, medication use, school absenteeism and indoor environment.

Data analysis

For each of the respiratory symptoms, the prevalence was calculated by dividing the number of positive responses to each question by the total number of responses to that question. To restrict the number of questions, respiratory symptoms were subdivided into asthmatic symptoms (one or more positive answers to the questions about recent wheezing, shortness of breath and shortness of breath with wheezing) and coughing (a positive answer to one or both questions about coughing). Questions on wheezing and shortness

Figure 1. Outline of the study. Grey and white areas represent the time periods in which 5-6 year olds (grey areas: October through March) and 8-9 year-olds (white areas: April through September) respectively, were invited for a routine physical examination. The year mentioned in grey and white areas represents the year of birth of the children

of breath were previously found to be more discriminative when using the history by a doctor as an independent criterion than were questions asking about coughing.¹

Data are presented by age group and study year. Mantel-Haenszel's χ^2 test for linear association was used to test differences in prevalence rates between the three study years for linear association.

Result

By combining the survey with the physical examination routinely performed on school children, high response rates were attained. In 1989 the questionnaire was completed for 3176 (97.3%) children, in 1993 for 3491 (97.5%) children and in 1997 for 4776 children. Due to a technical problem the list of children invited in 1997 could not be completely retrieved. Therefore, the response rate could only be calculated for 2032 of the invited children; for 97.7% of these children the questionnaire was completed. In view of the high response rates, selective non-response is not likely. The boys to girls ratio was similar for the three study years (Table 1). In 1989 the proportion of 5-6 year-olds was somewhat lower within the 4-7 age group as was the proportion 8-9 year-olds within the 8-12 age group, compared to 1993 and 1997.

Wheezing was the most frequently reported complaint in both age groups, followed by shortness of breath and shortness of breath with wheezing (Table 2). Chronic cough was the least prevalent respiratory symptom.

In all three years of observation the prevalence of respiratory symptoms was generally higher at the age of 5-6 years than at the age of 8-9 years. In both age groups, the prevalence of recent shortness of breath and recent shortness of breath with wheezing increased during the study period. Also, the prevalence of chronic cough showed a small, statistically not significant increase. At the same time the prevalence of recent wheezing decreased; which reached statistical significance in the younger age group.

The frequency of school absence decreased during the study period, although in 8-9 year-old children the

decline was not seen until 1993. The prevalence of school absence due to respiratory symptoms was virtually the same in 1989 and 1997, but was higher in 1993. The proportion of children consulting their physician or using medication for respiratory complaints remained unchanged between 1989 and 1997.

In children who coughed as well as in asthmatic children, the prevalence of physician visits and medication use increased from 1989 to 1997 (Fig. 2). During the same time period, the prevalence of pet keeping and smoking indoors decreased. The same trend was seen for asymptomatic children. In asymptomatic children exposure to cigarette smoke in the home decreased from 57.2% in 1989 to 43.9% in 1997. Pet ownership decreased from 56.0% in 1993 to 49.6% in 1997.

Discussion

The results of the present study are consistent with other reports of a rising trend in asthma prevalence in the Netherlands and other countries worldwide.^{3-8,12,13} The increase in recent wheezing and the large increase in the prevalence of chronic cough previously described in Dutch children⁵ could not be confirmed by our results. In the present study the prevalence of recent wheezing decreased in 5-6 year-olds from 22.1% in 1989 to 18.3% in 1997, whereas the prevalence of chronic cough increased only slightly.

Table 1. Sex and age distribution of the participating children in 1989, 1993 and 1997

	1989		1993		1997	
	n	%	n	%	n	%
4-7 year-old children						
4 year	64	60.	72	6.	3	1.
5-6 year	922	98.	979	93.	986	98.
7 year	7	0.	8	0.	1	0.0
8-12 year-old children						
8-9 year	657	87.	848	89.	760	89.
≥9 year	81	12.	6	0.	3	0.
Sex						
Male	961	30.	980	31.	244	31.
Female	656	39.	268	28.	832	48.
Study years 1997-1999						

Table 2. Prevalence of respiratory symptoms, physicians visits and school absence in the past 12 months and medication use in the past month by age group and year of study

	1998		1999		5-6 year-old 1997		p-value*	1998		1999		8-9 year-old 1999 *		p-value *
Wheezing	22.1	1305	20.6	1402	18.3	1559	0.00	13.4	1240	13.3	1203	11.9	1198	0.216 N
Shortness of breath with wheezing	7.4	1102	8.1	1159	9.1	1281	0.044 <0.0	5.7	1103	7.4	1113	7.9	1131	0.013 <0.0
Shortness of breath	4.1	1102	9.1	1177	9.3	1283	0.056 N	6.5	1116	7.9	1121	8.1	1138	0.037 <0.0
Coughing with phlegm	7.9	1109	7.3	1142	7.3	1221	0.532 N	3.9	1170	4.1	1167	3.8	1162	0.852 N
Chronic cough	4.0	1155	4.5	1188	4.5	1137	0.502 N	2.1	1137	2.0	1131	2.7	1145	0.198 N
General														
Physicians visit	75.9	11049	78.8	11531	75.3	12300	0.279 N	58.1	11043	64.6	11983	57.4	11937	0.771 N
Medication use	30.0	11415	34.2	11662	29.1	11891	0.152 N	19.6	11351	24.4	11368	19.3	11318	0.912 N
School absence	39.6	11547	35.0	11685	38.1	11868	0.000 <0.00	22.2	11398	24.2	11369	23.1	11230	0.000 <0.00
For respiratory complaints														
Physicians visit	22.7	11314	23.6	11459	21.8	11664	0.340 N	16.2	11226	14.4	11219	11.1	11197	0.594 N
Medication use	14.0	11193	14.9	11288	14.8	11453	0.555 N	9.4	11169	11.2	11169	10.5	11174	0.268 N
School absence	8.1	11118	13.4	11262	9.1	11293	0.902 N	8.1	11186	9.1	11120	9.1	11164	0.288 N

Data are presented as percentages with the number of positive responses between parentheses

* study years 1997-1998 ** Mantel-Haenszels χ^2 test

The exact causes of the increasing asthma prevalence remain largely unexplained. In explaining this trend different factors should be considered, such as changes in indoor and outdoor environmental factors, diagnostics and the possibility of an artefactual finding. Considering the spatial pattern of asthma prevalence, outdoor air pollution is probably not a major factor² for regions with a high level of air pollution, the lowest rates of asthma prevalence were reported, whereas some regions with the lowest

degrees of air pollution had high asthma prevalences.² The Westelijke Mijnstreek has an airport, a large chemical industry and heavy traffic which could have had some influence on the prevalence rates in the present study.

The association between indoor risk factors such as environmental tobacco smoke, pet ownership and presence of dampness or moulds and respiratory symptoms has been established in several studies.⁶⁻¹ However, the increased prevalence of wheezing found in an English study could not be explained by changes in indoor factors.⁷ Exposure to environmental tobacco smoke or pet allergens was also unlikely to explain the increased prevalence of respiratory symptoms found in the present study. Because the same trend in smoking behaviour and pet ownership was also seen in asymptomatic children, information bias is unlikely to explain this finding.

Increased frequency of asthma diagnoses has been reported.^{3,1} Correspondingly, in the present study physicians visits and medication use increased in symptomatic children. Better diagnostics of asthmatic children probably only partly explain the increase in asthma prevalence.⁷ Better treatment may however reduce asthma morbidity. In the present study no questions on severity of asthma symptoms were included.

Another possible explanation may lie in an increased recognition and tendency to report symptoms as a consequence of rising publicity and professional concern in recent years.² The decreasing prevalence of wheezing and at the same time increasing prevalence of shortness of breath, might be explained in terms of labelling differences between the study years. This is however unlikely, since the proportion of wheezy children additionally reporting shortness of breath, also increased from 1989 to 1997. Therefore

Figure 2. Prevalence of physicians visits and school absence in the past year, medication use in the past month, smoking and pet keeping indoors in children with asthmatic symptoms and in children with coughing (*Pearsons χ^2 test, ≤ 0.01 ; ** Mantel-Haenszels χ^2 test, ≤ 0.01)

the increase in shortness of breath with wheezing can probably be explained in terms of an increase in prevalence of shortness of breath. Furthermore, considering the increased frequency of medication use, it is likely that the severity of illness has increased. In the present study no objective measures were included to ascertain whether the observed trend was the true one. The results from the few studies that have used more clinical diagnostic methods support a true increase in asthma prevalence.^{8,10} It was also concluded for the increasing asthma prevalence in the Netherlands.⁹

Because the survey was performed in the same standardised way in all three study years the results are highly comparable between the study years. In table 1 we presented 22 tests of significance, with seven reaching statistical significance. We should however be aware that in view of the 95% confidence limits we assumed when performing the tests, we accepted the probability that five out of 100 confidence intervals miss their true value. When performing 22 tests, one is expected to be a false positive result (Type I error).

In conclusion, our findings are in line with earlier reports of a rising trend in asthma prevalence and treatment. These changes however, can not be explained in terms of changed exposure to cigarette smoke or pets. We were unable to determine whether increased treatment resulted in lesser morbidity in symptomatic children.

The Municipal Health Service Westelijke Mijnstreek will continue to monitor the prevalence of respiratory symptoms in their region, and in the fourth survey (in 2001) the questionnaire was extended with items on severity of symptoms. ■

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