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Trends in the prevalence of respiratory symptoms and treatment in Dutch children over a 12 year period: results of the fourth consecutive survey

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Background: Although there is considerable evidence that the prevalence of childhood asthma has increased over the last decades, it is not clear if this trend is still ongoing. A study was undertaken to investigate whether previously observed trends in the prevalence of respiratory symptoms, physician visits, medication use, and absence from school in Dutch children aged 8–9 years persisted in 2001.
Methods: Parents of 1154 children aged 8–9 years eligible for a routine physical examination in 2001 were asked to complete a questionnaire on the respiratory health of their child.
Results: In 2001, 1102 children (95.5%) participated in the survey. Similarly high response rates were obtained in the surveys of 1989, 1993 and 1997, with 1794, 1526 and 1670 children aged 8–9 years participating in the respective surveys. The decreasing trend previously observed for recent wheeze between 1989 and 1997 persisted into 2001, particularly in boys. After increasing between 1989 and 1997, the prevalence of shortness of breath with wheeze decreased between 1997 and 2001. The proportion of wheezy children using medication increased between 1989 and 2001 in boys (42.9% *v* 64.8%; p = 0.003), but the increase was not statistically significant in girls (34.0% *v* 45.7%; p = 0.096).
Conclusion: The prevalence of recent wheeze in Dutch school children has declined steadily since 1989. The rising prevalence of medication use in symptomatic children over time may reflect better asthma control and may partly explain the concurrently decreasing trend in the prevalence of asthma symptoms in our study population.

Although there is considerable evidence that the prevalence of childhood asthma has increased over the last decades,[1] it is not clear whether or not this increase is still ongoing. In the US the number of annual physician visits related to asthma has remained stable since 1991[2] and, in the UK, new episodes of asthma reported to the general practitioner were found to have declined since 1993.[3] Very recently a Swiss study and an Australian study have reported no further increase in the prevalence of asthma in children.[4 5]

Since 1989 the Municipal Health Service of the "Westelijke Mijnstreek" (in the south-east of the Netherlands) has monitored the prevalence of respiratory symptoms in their region every 4 years using the same validated screening instrument in each survey. By combining the survey with the physical examination routinely performed on school children, each survey reached response rates of over 95%. We have previously reported that, for children living in this area, the prevalence of recent wheeze decreased between 1989 and 1997; at the same time the prevalence of recent shortness of breath increased.[6]

In 2001 the fourth consecutive survey was conducted, again among 8–9 year old children. The aim of the present study was to investigate whether the previously observed trends in prevalence of respiratory symptoms, physician visits, medication use, and school absence in Dutch school children persisted in 2001.

METHODS

In 2001 the fourth consecutive survey was conducted among 8–9 year old children in the "Westelijke Mijnstreek" located in the south-eastern part of the Netherlands. Identical surveys were conducted in 1989, 1993 and 1997 with 1794, 1526, and 1670 children aged 8–9 years participating in the respective surveys. Detailed descriptions of these previous surveys have been reported elsewhere.[6]

In brief, in 2001 the parents of all 1154 children aged 8–9 years eligible for a routine physical examination by the Youth Health Care Section of the Municipal Health Service were asked to complete a questionnaire on respiratory health for their child. In all four surveys identical questions were used. Respiratory symptoms were defined using validated questions on chronic cough (coughing 5 days a week for more than 3 months), coughing with phlegm (coughing with phlegm for more than 3 weeks in the past 12 months), wheeze (wheezing in the past 12 months), shortness of breath (shortness of breath in the past 12 months when playing or climbing the stairs), and shortness of breath with wheeze (attacks of shortness of breath with wheeze in the past 12 months). Additional questions were asked about physician visits (general practitioner) and school absence (for 1 week or more) in the past year, and medication use (prescribed by general practitioner or specialist) in the past month.

Pearson's χ^2 test was used to test the statistical significance of differences between two study years (that is, 1997 and 2001) and Mantel-Haenszel's χ^2 test for linear association was used to investigate trends in prevalence rates over the study period. To test whether the time trend for respiratory symptoms, physicians visits, medication use or school absence was modified by the sex of the child, logistic regression models including the interaction term (sex*study year) were used. A p value of <0.05 was considered statistically significant.

RESULTS

In 2001 the response rate was 95.5% (1102/1154); response rates for the three previous surveys were also over 95%.[6] Of

Table 1 Respiratory symptoms, physician visits, medication use, and school absence in 8–9 year old children by sex and year of study

	All					Boys					Girls				
	1989	1993	1997	2001	p value*	1989	1993	1997	2001	p value*	1989	1993	1997	2001	p value*
All children	N = 1794	N = 1526	N = 1670	N = 1102		N = 895	N = 777	N = 851	N = 564		N = 899	N = 749	N = 818	N = 538	
Wheezing (past year)	13.4 (240)	13.3 (203)	11.9 (198)	9.1 (100)	0.001	15.6 (140)	14.7 (114)	13.1 (111)	9.6 (54)	0.001	11.1 (100)	11.9 (89)	10.7 (87)	8.6 (46)	0.144
Shortness of breath (past year)	6.5 (116)	7.9 (121)	8.3 (138)	7.9 (87)	0.077	8.2 (73)	8.1 (63)	9.1 (77)	9.4 (53)	0.304	4.8 (43)	7.8 (58)	7.5 (61)	6.4 (34)	0.139
Shortness of breath with wheeze (past year)	5.7 (103)	7.4 (113)	7.9 (131)	5.5 (60)	0.641	7.2 (64)	7.6 (59)	8.9 (75)	6.0 (34)	0.898	4.3 (39)	7.2 (54)	6.9 (56)	4.9 (26)	0.413
Coughing with phlegm (past year)	3.9 (70)	4.4 (67)	3.8 (62)	3.0 (33)	0.210	5.0 (45)	4.3 (33)	3.9 (33)	3.4 (19)	0.117	2.8 (25)	4.5 (34)	3.6 (29)	2.6 (14)	0.886
Chronic cough	2.1 (37)	2.0 (31)	2.7 (45)	1.9 (21)	0.696	2.3 (21)	1.9 (15)	3.0 (25)	2.2 (12)	0.759	1.8 (16)	2.1 (16)	2.5 (20)	1.7 (9)	0.815
Any respiratory symptom**	17.4 (313)	17.1 (260)	16.1 (259)	13.5 (146)	0.007	19.8 (177)	18.0 (139)	17.3 (141)	15.0 (83)	0.022	15.1 (136)	16.2 (121)	14.9 (118)	11.9 (63)	0.119
Children with recent wheeze	N = 240	N = 203	N = 198	N = 100		N = 140	N = 114	N = 111	N = 54		N = 100	N = 89	N = 87	N = 46	
Physician visits (past year)†	56.7 (136)	65.0 (132)	61.9 (120)	50.0 (50)	0.589	60.0 (84)	64.9 (74)	66.7 (72)	55.6 (30)	0.961	52.0 (52)	65.2 (58)	55.8 (48)	43.5 (20)	0.437
Medication use (past month)‡	39.2 (94)	54.7 (110)	54.3 (107)	56.0 (56)	0.001	42.9 (60)	54.0 (61)	57.3 (63)	64.8 (35)	0.003	34.0 (34)	55.7 (49)	50.6 (44)	45.7 (21)	0.096
School absence (past year)¶‖	23.8 (57)	37.3 (75)	21.6 (42)	11.1 (11)	0.011	25.0 (35)	31.9 (36)	23.1 (25)	3.7 (2)	0.008	22.0 (22)	44.3 (39)	19.8 (17)	20.0 (9)	0.353

Data are presented as percentages with number of positive responses in parentheses. In the study year 1997 information on sex was not available for one child. Due to missing observations, numbers do not always add up to total.

*Mantel-Haenszel's χ^2 test for trend.

**Any one or more of the respiratory symptoms (wheezing, shortness of breath, shortness of breath with wheezing, coughing with phlegm, chronic cough) reported.

†General practitioner.

‡Prescribed by general practitioner or specialist.

¶Absence from school for 1 week or more (at least once) in the past year.

the 1102 children participating in 2001, 51.2% were boys and 99.1% were born in 1992; the sex and age distributions were similar to the distributions reported for the previous surveys.[6]

The results from the 2001 survey showed a continued decrease in recent wheeze in 8–9 year old Dutch children from 13.4% in 1989 to 9.1% in 2001 ($p = 0.001$). This decrease was seen in both boys and girls, but only reached statistical significance in boys (table 1). The effect of study year on the prevalence of wheeze did not differ significantly by sex ($p_{sex*study\ year} = 0.270$) The increase in prevalence of recent shortness of breath and recent shortness of breath with wheeze between 1989 and 1997[6] was not continued in 2001; for shortness of breath the increase levelled off (8.3% in 1997, 7.9% in 2001; $p = 0.708$), while shortness of breath with wheeze decreased from 7.9% in 1997 to 5.5% in 2001 ($p = 0.014$). Table 1 shows that the prevalence of any one or more respiratory symptoms also decreased between 1989 and 2001, which was statistically significant for boys.

For children with recent wheeze the prevalence of physician visits did not show a significant trend between 1989 and 2001 (table 1). School absence in boys was higher in 1997 than in 2001 (23.1% *v* 3.7%; $p = 0.002$). The prevalence of school absence in girls remained stable during the study period, with the exception of a high prevalence of school absence in 1993. The proportion of wheezy children using medication steadily increased between 1989 and 2001, especially for boys (table 1). The effect of study year on medication use did not differ significantly by sex ($p_{sex*study\ year} = 0.445$). The overall prevalence of medication use for respiratory symptoms remained unchanged between 1989 (9.4%) and 2001 (9.2%).

DISCUSSION

Our findings suggest that the decrease in recent wheeze previously reported for school children living in the south-east of the Netherlands[6] persisted in 2001. Others observed an increasing prevalence of wheeze in preschool children until the late 1990s,[7] but very recently the first signs indicating that the rising trend in asthma prevalence might have come to an end have been observed, at least for Australian and Swiss children.[4 5] In the present study the declining prevalence of recent wheeze was paralleled by increased medication use in wheezy boys, while the prevalence of physician visits remained relatively stable over this study period. There was also little change in the overall prevalence of medication use for respiratory symptoms (9.4% in 1989 and 9.2% in 2001). However, it is likely that medication use in wheezy children has increased proportionally, but the number of wheezy children needing medication has remained unchanged or has decreased.

Possible explanations for the decreasing prevalence of asthma symptoms include a true decrease in prevalence, influence of improved identification and treatment, and changes in environmental influences such as indoor environmental factors, outdoor air pollution, infectious burden in early childhood, and lifestyle changes such as shorter duration of breastfeeding. We have previously found that changed exposure to cigarette smoke or pets did not explain our results.[6] Likewise, the Swiss study found that none of a series of known risk factors had a significant influence on the observed time trends.[4]

Our results are more in line with the second view—namely, that the decreasing prevalence of asthma symptoms might reflect improved diagnostics followed by appropriate treatment. Moreover, the significant decrease in the prevalence of wheeze and shortness of breath with wheeze seen between 1997 and 2001 coincided with the introduction of the revised guidelines in 1998 in which the importance of corticosteroids

in asthma management was stressed,[8] and might be viewed as an indication in favour of improved treatment.

Our data are consistent with recent reports from the UK and the US[2 3] indicating no further increase in asthma visits since the early 1990s, and probably reflect improved asthma control.[2] Diagnostic changes as well as changes in underlying prevalence have been thought to play a part in the increasing prevalence in asthma symptoms seen over the last decades. The decreasing prevalence found in the present study may likewise be the result of a number of opposing forces which cannot be disentangled here. Although improved identification and treatment of asthmatic children is a likely explanation for our results, the finding that the prevalence of wheezy children not using medication also declined may suggest that improved treatment alone does not explain the whole decrease. Also, among children not reporting wheeze in the past year, the prevalence of medication use remained fairly constant (4.8% in 1989 and 4.3% in 2001, $p = 0.545$).

The 2001 survey was conducted in the same standardised way as the three previous surveys, using the same study design and questionnaire. The study population consisted of all 8–9 year old children living in the study area, excluding age as a confounder. Selection bias is unlikely to explain our results, given the high response rates of more than 95% achieved in all surveys. However, questionnaire surveys may be subject to information bias.

In conclusion, the prevalence of recent wheeze has declined steadily since 1989 in school children living in the south-east of the Netherlands, with the decline being especially prominent in boys. The rising prevalence of medication use in symptomatic children over time may reflect better asthma control and may partly explain the concurrently decreasing trend in the prevalence of asthma symptoms in our study population.

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