Asthma prevalence in Melbourne schoolchildren: have we reached the peak?

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ABSTRACT

Objective: To determine the change in prevalence of asthma, eczema and allergic rhinitis in Australian schoolchildren between 1993 and 2002.

Design: Questionnaire-based survey, using the protocol of the International Study of Asthma and Allergy in Childhood.

Setting: Metropolitan Melbourne primary schools within a 20 km radius of the GPO in 1993 and 2002.

Subjects: All children in school years 1 and 2 (ages 6 and 7) attending a random sample of 84 schools in 1993 and 63 schools in 2002.

Main outcome measures: Parent-reported symptoms of atopic disease; treatment for asthma; country of birth.

Results: There was a 26% reduction in the 12-month period prevalence of reported wheeze, from 27.2% in 1993 to 20.0% in 2002. The magnitude of reduction was similar for boys (27%) and girls (25%). The 12-month period prevalence of reported eczema increased from 11.1% in 1993 to 17.2% in 2002, and rhinitis increased from 9.7% to 12.7%. There were reductions in the proportion of children attending an emergency department for asthma in the previous year (3.6% to 2.3%), the proportion admitted to hospital (1.7% to 1.1%) and the proportion taking asthma medication (18.5% to 13.4%). Of those who reported frequent wheeze, there was an increase in the proportion taking regular inhaled steroids (34.5% to 40.9%).

Conclusion: There has been a significant reduction in the prevalence of reported asthma in Melbourne schoolchildren, whereas the prevalence of eczema and allergic rhinitis has continued to increase.

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THE PREVALENCE OF reported asthma increased worldwide through the latter half of the 20th century.[1] In Australia, there were at least 26 population-based studies measuring self-reported symptoms of asthma. These identified an overall increase in prevalence of 1.4% per year,[2] with the most recent survey in 1997.[3] Variation in methods and lack of uniform diagnostic criteria make direct comparisons between the studies difficult.

The International Study of Asthma and Allergy in Childhood (ISAAC) developed a standardised method for describing the prevalence of asthma and other atopic disorders to allow comparison between centres and to monitor changes over time. The first ISAAC survey in Australia was performed in 1993, and showed the prevalence of asthma for 6–7-year-old schoolchildren to be uniform throughout Australia.[4] In the international ISAAC survey of 6–7-year-old children in 38 countries, Australia had the second-highest prevalence.[5]

Our aim was to determine the change in prevalence of asthma and other atopic disorders in Melbourne schoolchildren over a 9-year period (from 1993 to 2002) and to describe the changes in management of asthma over the same period.

METHODS

We used the ISAAC protocol to survey 6–7-year-old children.[6] Subjects were from a random sample of primary schools (government, Catholic and independent) within 20 km of the GPO in Melbourne. The original survey was undertaken in 1993 and the follow-up in 2002.

A five-page questionnaire was issued by teachers for completion by parents. The questionnaire contained the three standard ISAAC modules asking about symptoms of asthma, eczema and allergic rhinitis. An additional module asking about treatment of asthma and two questions about the child's and mother's country of birth were added. No translations were provided. If the first questionnaire was not returned, a second was issued. The same method was used for each survey.

Data were analysed with the statistical package Stata 8.[7] Results were adjusted for cluster effect at the school level, and χ^2 tests were used to compare prevalences. Significance of odds ratios (ORs) was assessed with 95% confidence intervals.

Approval for the study was obtained from the human research ethics committee of the Royal Children's Hospital and the Victorian Department of Education.

RESULTS

In 1993, 84 schools were surveyed, representing 17% of schools in the survey area. Of the schools approached, 1.4% declined to participate. Questionnaires were issued to 3157 subjects, and 2843 were returned (response rate, 90%).[4] In

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1: Prevalence of (95% CI) atopic disease among Melbourne schoolchildren aged 6–7 years: 1993 and 2002

	Boys		Girls		Total	
	1993 (*n*=1480)	2002 (*n*=1523)	1993 (*n*=1360)	2002 (*n*=1445)	1993 (*n*=2843)	2002 (*n*=2968)
Current wheeze	31.6% (28.7%–34.6%)	23.2% (20.9%–25.6%)	22.4% (19.9%–25.2%)	16.7% (14.6%–19.0%)	27.2% (25.0%–29.4%)	20.0% (18.4%–21.8%)
Severe wheeze episode	5.5% (4.4%–6.8%)	3.6% (2.7%–4.8%)	2.5% (1.7%–3.7%)	2.5% (1.8%–3.5%)	4.0% (3.4%–4.9%)	3.1% (2.5%–3.8%)
Wheeze ever	46.9% (43.8%–50.0%)	41.8% (39.0%–44.8%)	34.0% (31.2%–37.0%)	32.2% (29.2%–35.3%)	40.7% (38.3%–43.1%)	37.1% (34.8%–39.5%)
Asthma ever	33.1% (30.2%–36.1%)	29.9% (27.2%–32.7%)	23.7% (21.3%–26.2%)	20.8% (18.6%–23.3%)	28.6% (26.5%–30.7%)	25.5% (23.7%–27.4%)
Current eczema	9.9% (8.6%–11.3%)	16.0% (14.0%–18.2%)	12.4% (10.6%–14.5%)	18.4% (16.5%–20.5%)	11.1% (10.0%–12.3%)	17.2% (15.7%–18.8%)
Severe eczema	0.6% (0.3%–1.1%)	1.4% (1.0%–2.1%)	0.9% (0.5%–1.6%)	2.6% (1.9%–3.5%)	0.7% (0.5%–1.1%)	2.0% (1.6%–2.5%)
Eczema ever	22.8% (20.7%–25.2%)	31.3% (28.7%–34.0%)	22.4% (19.8%–25.3%)	33.4% (30.9%–35.9%)	22.6% (20.8%–24.6%)	32.3% (30.4%–34.2%)
Current rhinitis	10.1% (8.7%–11.8%)	13.6% (11.5%–16.0%)	9.2% (7.8%–10.8%)	11.7% (9.8%–13.9%)	9.7% (8.7%–10.8%)	12.7% (11.1%–14.5%)
Troublesome rhinitis	7.5% (6.3%–8.9%)	8.6% (7.3%–10.1%)	6.3% (5.2%–7.6%)	7.9% (6.5%–9.5%)	6.9% (6.0%–7.9%)	8.3% (7.3%–9.4%)
Hayfever ever	15.6% (13.6%–17.8%)	20.9% (18.7%–23.3%)	14.1% (12.2%–16.3%)	18.6% (16.3%–21.2%)	14.9% (13.5%–16.4%)	19.8% (18.0%–21.7%)

2002, 63 schools were surveyed (19% of schools in the survey area), 3625 questionnaires were issued and 2968 returned (response rate, 82%). The mean age of the children was 6.2 years in 1993 and 6.3 years in 2002.

The prevalence of reported current wheeze decreased by 26% between 1993 and 2002 (Box 1). The magnitude of the reduction was the same for boys and girls. However, the prevalence of other atopic diseases, eczema and rhinitis, increased (Box 1). The increase in these other atopic conditions was the same for both sexes. In 2002, the proportion of children and mothers born outside Australia was lower than in 1993, and the protective effect of being born outside Australia appears to have lessened since 1993 (Box 2).

The reduction in prevalence of current wheeze was similar for each of the wheeze frequency categories, although there was no difference in the number of respondents reporting sleep disturbance due to asthma (Box 3). Although there was an overall reduction in the proportion of children who reported having a severe episode, attending an emergency department for asthma and requiring admission to hospital, the proportion of children with current wheeze who reported these markers of asthma severity did not change.

Fewer children were taking asthma medication in 2002 (13.4%) than in 1993 (18.5%) (Box 4). Most children reporting current wheeze were taking intermittent treatment only. More than half the group with frequent symptoms (>12 wheeze episodes in the previous year) were still not taking regular preventive medication. More children reported having a written asthma management plan in 2002 than 1993; nevertheless, only 50% of respondents with frequent symptoms had a written plan. Overall, the proportion reporting a visit to the doctor for a wheezy episode fell from 21.5% to 14.4%, similar to the fall in those reporting current wheeze. The number reporting visits for a regular check-up fell overall, but not within the symptomatic group.

DISCUSSION

We found the prevalence of reported current wheeze fell by 26% over 9 years, from 27.2% in 1993 to 20.0% in 2002. The fall in reported symptoms was matched by a similar fall in the proportion of children reporting attendance at an emergency department or hospital admission for acute asthma, visiting their doctor for asthma (both for a wheezy episode and a regular check-up), and taking asthma medication.

A review of the records of the Emergency Department of the Royal Children's Hospital, Melbourne, revealed that the number of 5–9-year-old children attending for acute asthma has fallen from 728 in 1997 to 533 in 2002 (27%), and, throughout Victoria, the rate of hospital admissions for asthma in children aged 5–9 years has fallen from 10 per 1000 children in 1992–93 to 3.9 per 1000 children in 2001–02 (Janelle Blythe, Health Department, Victoria, personal communication). The reduction in prevalence of reported symptoms suggestive of asthma seen in our study is supported by data from other recent studies of 6–7-year-old children that used the ISAAC questionnaire. In New South Wales, the proportion of children with diagnosed asthma fell from 38% in 1992 to 32% in 2002.[8] Similar changes have been reported for the prevalence of current wheeze among schoolchildren in Singapore (16.6% in 1994 to 10.2% in 2001)[9] and Hong Kong (12.4% in 1994 to 8.6% in 2002).[10]

Many hypotheses have been proposed to explain the consistent increase in prevalence of asthma reported over the second half of last century,[11] but the cause of this epidemic remains largely unknown. One contributing factor may be an increased awareness of asthma and interpretation of respiratory symptoms

2: Atopic disease among children of Australian versus non-Australian birth: 1993 and 2002

	Child born outside Australia		Mother born outside Australia	
	1993	2002	1993	2002
Proportion with atopic disease	12.0%	6.3%	41.9%	35.5%
Current wheeze (OR [95% CI])	0.5 (0.3–0.7)	0.8 (0.5–1.3)	0.7 (0.5–0.9)	0.8 (0.6–0.9)
Current eczema (OR [95% CI])	1.0 (0.5–1.7)	1.0 (0.5–2.0)	0.8 (0.6–1.1)	1.0 (0.8–1.3)
Current rhinitis (OR [95% CI])	0.7 (0.4–1.1)	0.9 (0.5–1.5)	0.7 (0.5–0.9)	1.0 (0.8–1.4)

OR = Odds ratio for atopic disease in child or mother born outside Australia compared with child or mother born in Australia.

3: Proportion (95% CI) of children reporting different frequencies of symptoms

	1993		2002	
	Current wheeze (*n*=772)	Total group (*n*=2843)	Current wheeze (*n*=594)	Total group (*n*=2968)
Wheeze episodes in past year				
1–3	63.3% (59.8%–66.7%)	17.2% (15.6%–18.9%)	66.2% (61.2%–70.8%)	13.2% (11.7%–14.9%)
4–12	25.5% (22.8%–28.5%)	6.9% (6.0%–8.0%)	23.2% (19.6%–27.4%)	4.7% (3.9%–5.6%)
> 12	7.1% (5.5%–9.2%)	1.9% (1.5%–2.5%)	7.4% (5.5%–9.9%)	1.5% (1.1%–2.0%)
Sleep disturbance due to asthma				
Never	48.3% (44.3%–52.4%)	13.1% (11.7%–14.7%)	45.0% (40.9%–49.1%)	9.0% (7.9%–10.3%)
< 1 night per week	41.7% (38.1%–45.5%)	11.3% (10.0%–12.8%)	42.9% (39.2%–46.8%)	8.6% (7.7%–9.6%)
⩾ 1 night per week	8.9% (6.8%–11.6%)	2.4% (1.9%–3.2%)	10.9% (8.2%–14.5%)	2.2% (1.6%–2.9%)
Severe episode in past year	14.9% (12.5%–17.7%)	4.0% (3.4%–4.9%)	15.3% (12.4%–18.8%)	3.1% (2.5%–3.8%)
Emergency department attendance	13.3% (11.0%–16.2%)	3.6% (2.9%–4.5%)	11.3% (8.7%–14.5%)	2.3% (1.8%–2.9%)
Hospital admission	6.2% (4.7%–8.3%)	1.7% (1.3%–2.2%)	5.4% (3.8%–7.7%)	1.1% (0.8%–1.5%)

as asthma as a result of the plethora of public awareness campaigns during that period. A survey of adolescents in 1993 suggested that there was significant over-reporting of wheeze.[12] In that study, about 25% of subjects who reported current wheeze were thought not to have asthma after a detailed interview by a paediatric respiratory physician.

Evidence for change in more objective factors that may influence the prevalence of asthma is also lacking. There is no evidence to suggest that established risk factors for the development of asthma in childhood (which include genetic influences, environmental tobacco smoke exposure, sensitisation to environmental allergens and respiratory syncytial virus infection in early life) changed over that period. In the absence of a clear explanation for the increase in reported asthma that occurred, it is difficult to explain the decrease over the period 1993–2002. One possible factor may be the increased attendance at childcare facilities, which has been associated with a reduced risk of developing asthma.[13]

The prevalence of eczema and allergic rhinitis, which are major risk factors for asthma, increased while the prevalence of asthma fell. This paradox is difficult to explain, but other investigators have identified a similar lack of association between changes in prevalence of asthma and other atopic conditions. In the study of children in Singapore, where the prevalence of asthma decreased, there was no change in the prevalence of the other atopic conditions, eczema and allergic rhinitis.[9] In a study of schoolchildren in Leipzig, there was an increase in the prevalence of hay fever and atopy between 1991 and 1996, with no change in the prevalence of apparent asthma or airway hyperresponsiveness,[14] and, in a previous study of Australian schoolchildren through the 1980s, there was a more than twofold increase in the prevalence of asthma over a 10-year period, with no change in the prevalence of atopy.[15]

The small magnitude of change in the management of children with asthma over the 9-year period studied is rather disappointing given the intensity of strategies designed to improve management during that period. Overall, there was a 27% reduction in the number of children taking asthma medication, which is proportional to the reduction in those reporting symptoms. However, within the asthma group, there was no change in the proportion taking regular preventive therapy or in the proportion who attended their doctor for a regular check-up. Of those who reported frequent wheeze (> 12 episodes in the previous year), only 45% reported taking regular preventive medication, a proportion virtually unchanged from 44% in 1993. In other words, 55% of children with troublesome asthma are not regularly taking any preventive therapy.

The reduction in asthma prevalence has resulted in a reduced burden for the community, with a 36% reduction in children requiring attendance at an emergency department and a 35% reduction in those requiring admission to hospital. However, the burden for the individual has been reduced to a lesser extent.

Surveys of asthma prevalence in children are plagued by the lack of a clear definition of asthma and the lack of a reliable and reproducible objective gold standard. The ISAAC questionnaire has been developed as a standardised instrument that is sensitive, specific and reproducible in English-speaking, developed

4: Proportions of children reporting use of different treatments

	Number of wheeze episodes in past year									
	1–3		4–12		>12		Total current wheeze		Total group	
	1993 (*n*=489)	2002 (*n*=393)	1993 (*n*=197)	2002 (*n*=138)	1993 (*n*=55)	2002 (*n*=44)	1993 (*n*=772)	2002 (*n*=594)	1993 (*n*=2843)	2002 (*n*=2968)
No treatment	17.4% (14.3%–21.0%)	21.4% (17.7%–25.5%)	2.5% (1.1%–6.0%)	7.2% (4.3%–11.9%)	7.3% (2.8%–17.6%)	4.5% (1.1%–17%)	12.7% (10.6%–15.2%)	16.7% (14.1%–19.7%)	75.9% (73.9%–77.9%)	82.6% (80.8%–84.2%)
Intermittent treatment only	51.9% (47.3%–56.5%)	47.8% (42.9%–52.9%)	41.1% (33.3%–49.4%)	51.5% (43.0%–59.9%)	29.1% (17.7%–43.9%)	31.8% (17.3%–51.0%)	47.4% (43.5%–51.2%)	47.5% (43.2%–51.8%)	12.4% (11.0%–13.8%)	9.2% (8.0%–10.5%)
Regular treatment										
β-Agonist only	3.7% (2.1%–6.3%)	4.1% (2.6%–6.4%)	10.7% (7.6%–14.8%)	8.7% (5.0%–14.8%)	5.5% (1.8%–15.3%)	15.9% (6.4%–34.4%)	5.7% (4.1%–7.8%)	6.1% (4.4%–8.3%)	1.5% (1.1%–2.1%)	1.2% (0.9%–1.6%)
Sodium cromoglycate	2.5% (1.3%–4.6%)	1.3% (0.5%–3.0%)	7.1% (4.2%–11.7%)	2.2% (0.7%–6.4%)	9.1% (3.9%–19.6%)	4.5% (1.1%–17.5%)	4.2% (2.9%–6.0%)	1.7% (1.0%–3.1%)	1.1% (0.7%–1.6%)	0.3% (0.2%–0.6%)
Inhaled steroid	7.2% (5.2%–9.7%)	9.2% (6.9%–12.1%)	23.4% (18.1%–29.7%)	19.6% (14.0%–26.7%)	34.6% (23.8%–47.2%)	40.9% (24.5%–59.7%)	13.5% (11.1%–16.3%)	14.1% (11.5%–17.2%)	3.5% (2.8%–4.4%)	2.7% (2.2%–3.4%)
Written asthma plan	18.6% (15.6%–22.0%)	23.7% (20.0%–27.8%)	34.0% (27.8%–40.9%)	44.2% (36.4%–52.3%)	45.5% (32.4%–59.2%)	50.0% (34.1%–65.9%)	24.7% (22.0%–27.6%)	30.6% (26.6%–34.9%)	6.4% (5.6%–7.4%)	5.9% (5.0%–7.0%)
Visited doctor in past year										
For wheezy episode	78.3% (73.9%–82.2%)	70.2% (65.6%–74.5%)	90.9% (85.8%–94.2%)	83.3% (76.9%–88.3%)	85.5% (72.2%–93.0%)	81.8% (67.7%–90.6%)	82.2% (78.8%–85.1%)	74.3% (70.0%–78.1%)	21.4% (19.5%–23.5%)	14.4% (12.9%–16.0%)
For regular check-up	28.8% (24.1%–32.8%)	29.5% (25.0%–34.5%)	57.9% (49.7%–65.6%)	52.2% (42.9%–61.3%)	61.8% (48.6%–73.5%)	59.1% (44.1%–72.6%)	38.6% (34.6%–42.8%)	37.2% (32.5%–42.2%)	10.1% (8.7%–11.6%)	7.2% (6.1%–8.5%)

countries.[5,6] One potential weakness of such studies is the influence of the level of awareness of the symptom complex in the community. However, this is unlikely to have changed significantly over the study period. Further strength has been given to the validity of our findings by the reduction in emergency department attendances for asthma and in state-wide hospital admissions for this age group.

CONCLUSION

Our study provides evidence of a significant reduction in the prevalence of asthma in Melbourne schoolchildren over the past 9 years, after a continuing increase throughout the second half of last century. There has been little improvement in the proportion of children with troublesome asthma receiving appropriate treatment, suggesting a need to improve strategies to ensure accurate diagnosis and adherence to therapy.

COMPETING INTERESTS

None identified.

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