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ORIGINAL ARTICLE

Prevalence of Asthma Symptoms and Atopic Disorders in Preschool Children and the Trend over a Decade

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Objectives. Over the last few decades, there have been substantial publications on the prevalence and trends of asthma in school-age children and adolescents. There has been a scarcity of reports on asthma prevalence and trends in preschool children. This study was performed to measure the prevalence of symptoms of asthma, allergic rhinitis, and eczema in preschool (4- and 5-year-old) children and the trend over a decade. **Study design.** A cross-sectional questionnaire based survey using the International Study of Asthma and Allergy in Childhood (ISAAC) was performed on South Australian preschool children in 2006. The results were compared to a previous survey conducted in 1993. **Results.** The 12-month period prevalence of reported wheeze, allergic rhinitis, and eczema was 23.7%, 20.8%, and 18.8%, respectively. The prevalence of wheeze symptoms was higher in males than females. There was a decline in the prevalence of "wheeze in the last 12 months" (25.2% to 23.7%) and in "asthma ever" (22.5% to 19.0%, $p < 0.05$) from 1993 to 2006. **Conclusion.** There is a burden in the symptoms of asthma, allergic rhinitis, and eczema in preschool children. There is a declining trend in the prevalence of "current wheeze" and "asthma ever" in South Australian preschool children over a decade.

Keywords asthma, preschool children

INTRODUCTION

Asthma is a clinical diagnosis made on the basis of patient's history, physical examination, assessment of airway obstruction or reversibility, and response to bronchodilator medication. In epidemiological studies, the International Study of Asthma and Allergy in Childhood (ISAAC) questionnaire has been developed as a standardized instrument to measure the prevalence of asthma and atopic disorders in school-age children and adolescents (1, 2).

The prevalence of asthma increased globally throughout the latter half of the 20th century (3, 4). This trend has been extensively reported among school-age children and adolescents in both cross-sectional and longitudinal studies throughout the world (5–10). In contrast, since the 21st century, there have been studies that report a plateau or decrease in asthma prevalence (11–17). Recent publications of the ISAAC Phase III study indicate that current asthma symptoms in children are on the decline in English-speaking countries, particularly in Western European countries and the region of Oceania (18, 19).

There has been a paucity of epidemiological studies looking at the prevalence of asthma in preschool children. A study involving 974 preschool (3 to 5 years of age) children in two cities of New South Wales, Australia during 1995 reported asthma prevalence of 22% and 18% (20). There has only been one study that compared the changing prevalence of asthma in preschool children (1 to 5 years of age). This study was conducted in the county of Leicestershire, United Kingdom, involving 1,422 (in 1990) and 2,127 (in 1998) subjects. From

1990 to 1998, there was a significant increase in prevalence of "current wheeze" (12% to 26%) and diagnosis of asthma (11% to 19%) (21).

A previous cross-sectional survey of 14,124 South Australian preschool children was performed in 1993 which reported a prevalence of "wheeze in the last 12 months", "wheeze ever" and "asthma ever" to be 25.2%, 38.6% and 22.5% respectively (22). The questionnaire, which was based on the Tasmanian Asthma Foundation Questionnaire (23, 24) and the International Union Against Tuberculosis and Lung Disease (IUALTD) bronchial symptom questionnaire (25), contained the core wheeze questions that are identical to those used in the current ISAAC questionnaire.

The primary aim of the study was to determine the prevalence of asthma symptoms and other atopic disorders in a preschool age population using the ISAAC questionnaire. The secondary aim was to compare the change in prevalence over a 13-year period (1993 to 2006).

METHODS

Study Design, Setting and Subjects

The study was cross-sectional in design and conducted between August to December 2006 in South Australia, one of the states of Australia.

The Children, Youth and Women's Health Service (CY-WHS) (Child and Youth Health Campus) has a state-based community health service that routinely conducts a school entry health check for all preschool (4- to 5-year-old) children in South Australia. The health check is conducted by a total of 18 child health nurses who visit kindergartens and child health clinics throughout the state. The nurses were available to answer any questions parents had in completing the questionnaire. In the period of recruitment, it was anticipated that approximately 5,000 health checks would

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have been performed throughout the state. A total of 4,200 questionnaires were sent out to the child health nurses based on the hours they worked and anticipated number of patients they would review in the time period.

A parent or caregiver was asked to complete the ISAAC questionnaire plus additional questions on the postcode and gender while the child was undergoing his or her health check. A parent or caregiver who had a limited understanding of the English language was excluded from the study. ISAAC questions are presented in Appendix 1. In the initial 1993 survey, the questions regarding allergic rhinitis and eczema were dissimilar to the current ISAAC questionnaire and therefore could not form a basis for prevalence comparison.

Data were collated and entered by a project officer using SPSS database software program (version 14). Chi-square tests were used to compare prevalence. Significance was taken at $p < 0.05$.

Approval for the study was obtained from the human research ethics committee of the Children, Youth and Women's Health Service, South Australia.

RESULTS

A total of 11,190 preschool (4- to 5-year-old) children underwent preschool checks during the calendar year of 2006 reflecting a 65% capture rate of the entire preschool population. In the months of August to December 2006, approximately 5,000 preschool children had health checks. A total of 1,509 questionnaires were returned, reflecting a response rate of at least 36%. Of the respondents, 772 were males (51%) and 737 were females (49%). The mean age of the children was 4.6 years.

The prevalence of "wheeze in the last 12 months," "wheeze ever," and "asthma ever" was 23.7%, 37.9%, and 19.0%, respectively. The prevalence for each of the wheeze variable was higher in males than females (Table 1).

Of the children who had ever reported wheeze, the prevalence of wheeze episodes in the past year was 32.4% (0 episodes), 46.8% (1 to 3 episodes), 14.6% (4 to 12 episodes), and 6.1% (>12 episodes). When combining the groups of 4 to 12 episodes and more than 12 episodes, the prevalence in males were higher than females (24.4% compared to 16.4%). The prevalence of "severe episodes in the past 12 months" was 14.3% with a higher prevalence in males than in females (Table 2).

The prevalence of current eczema was 18.8% with a higher prevalence in females than in males. The prevalence of current rhinitis was 20.7% with a higher prevalence in males than in females (Table 3).

TABLE 1.—Prevalence (95% CI) of wheeze symptoms among South Australian preschool children by gender in 2006.

	Total (n=1509)	Boys (n=772)	Girls (n=737)
Wheeze in the last 12 months	23.7% (21.5%–25.9%)	26.0% (22.9%–29.1%)	21.3% (18.3%–24.3%)
Wheeze ever	37.9% (35.5%–40.3%)	40.9% (37.4%–44.4%)	34.9% (31.4%–38.4%)
Asthma ever	19.0% (17.0%–21.0%)	21.2% (18.3%–24.1%)	16.8% (14.1%–19.5%)

TABLE 2.—Prevalence (95% CI) of wheeze frequency and severity among South Australian preschool children by gender in 2006.

Wheeze episodes in past year	Total (521)	Boys (286)	Girls (233)
0	32.4% (28.4%–36.4%)	31.8% (26.4%–37.2%)	33.0% (27.0%–39.0%)
1–3	46.8% (42.5%–51.1%)	43.7% (38.0%–49.4%)	50.6% (44.2%–57.0%)
4–12	14.6% (11.6%–17.6%)	17.1% (12.7%–21.5%)	11.6% (7.5%–15.7%)
>12	6.1% (4.0%–8.2%)	7.3% (4.3%–10.3%)	4.7% (2.0%–7.4%)
Severe episode in past year	14.3% (11.4%–17.2%)	16.8% (12.6%–21.0%)	11.6% (7.6%–15.6%)

The prevalence of "wheeze in the last 12 months" had decreased from 25.2% in 1993 to 23.7% in 2006 ($p = 0.2$). This was accompanied by a decrease in "asthma ever" from 22.5% in 1993 to 19.0% in 2006 ($p < 0.01$). There was also a small reduction in the prevalence of "wheeze ever" from 38.6% in 1993 to 37.9% in 2006 ($p = 0.6$) (Table 4).

DISCUSSION

This study indicates that a significant burden of asthma, allergic rhinitis, and eczema continues in the preschool (4- to 5-year-old) children. The prevalence of wheeze is higher in males than in females, which reflects the pattern observed in school-age children as well (26).

There has been no universal "asthma" definition used in epidemiological studies of preschool-age children. In the study by Haby et al., "recent asthma" was defined as "ever having been diagnosed with asthma" and "having cough or wheeze in the last 12 months" and "having used asthma medication in the last 12 months" (20). In the study by Kuehni et al., "current wheeze" was defined by "Has your child ever had attacks of wheezing in the past 12 months?" (21). This study is the first to use the core questions of the ISAAC questionnaire as a means to measuring prevalence of symptoms of asthma and atopic disorders in this age group. The ISAAC core wheezing questions demonstrate acceptable sensitivity and specificity in school-age children and adolescents when compared with other indicators of asthma, including physician diagnosis, other questionnaires, and physiological measures (19).

The results of this study indicate a decreasing trend in the symptoms of wheeze, and asthma continues into the 4- to 5-year-old preschool children. The average age group and gender ratio of this study's population was similar to that of the previous study. This is a pattern that is recognized in studies of school-age children in the latter parts of the 20th century (12, 14, 16, 17). We were not able to compare changes in allergic rhinitis or eczema between the two

TABLE 3.—The prevalence (95% CI) of current atopic disorders among South Australian preschool children by gender in 2006.

	Total (1509)	Boys (772)	Girls (737)
Current rhinitis	20.8% (18.8%–22.8%)	23.4% (20.4%–26.4%)	17.9% (15.1%–20.7%)
Current eczema	18.8% (16.8%–20.8%)	17.5% (14.8%–20.2%)	19.9% (17.0%–22.8%)

TABLE 4.—Prevalence rates (%) and 95% confidence intervals for wheeze symptoms in South Australian preschool-age children between 1993 and 2006.

Symptom	1993 (n=14124)	2006 (n=1509)	Absolute change	p value
Wheeze in last 12 months	25.2% (24.8%–25.6%)	23.7% (21.5%–25.9%)	–1.5%	P = 0.2
Wheeze ever	38.6% (38.2%–39.0%)	37.9% (35.5%–40.3%)	–0.7%	p = 0.6
Asthma ever	22.5% (22.1%–22.9%)	19.0% (17.0%–21.0%)	–3.5%	p < 0.01

periods owing to the dissimilarity of wording between the two questionnaires.

The upward trend in asthma prevalence throughout the world in the latter half of the 20th century has never been explained. It is likely that multiple environmental factors contribute to this pattern. The increased prevalence reported during the 1980s and 1990s may also have reflected increased professional awareness or diagnosis and increased public awareness. Without ever fully understanding the reasons for the global increase in the prevalence of asthma during the later part of the 20th century, we are now faced with the dilemma of explaining an apparent decrease in prevalence across the pediatric age groups. One may speculate that the decrease in “asthma ever” in our study may reflect changing practice in diagnosis by health practitioners over time, such as overall reduction in asthma diagnosis by proper assessment of children with cough or use of other terms to describe wheeze phenotype (e.g., transient infant wheeze, viral associated wheeze). Could the decrease also be explained by changing rates of atopy, smoking exposure in pregnancy, or other lifestyle influence? These would be important areas of research in future studies of the preschool age group.

The present study has several limitations. (1) The ISAAC questionnaire has not been validated in the preschool-age children. (2) The response rate was suboptimal, which may therefore lead to selection bias. This was compounded by the lack of data on the children whose parent/caregiver declined apart from knowing that they were of the preschool (4- to 5-year-old) age group. (3) The use of a self-report questionnaire subjects the study to recall bias. (4) The prevalence comparison between the two studies needs to be interpreted with caution as the recent study only captured a small fraction of the total preschool population, whereas the study in 1993 sampled 73% of the entire preschool population. (5) We have not controlled for confounding variables, such as parental smoking, family history of asthma, duration of breastfeeding, socioeconomic status, and the effect of treatments on current wheeze. (6) We have not used objective methods, such as skin prick testing as a measure of atopic assessment.

In conclusion, our study provides evidence of a significant burden of symptoms of asthma, allergic rhinitis, and eczema in the preschool (4- to 5-year-old) children of South Australia. At this stage, conclusions about change in trend need to be interpreted with caution owing to the limitations of the study and varying populations. We would recommend validation of the ISAAC questionnaire for the detection of asthma and other atopic diseases in the preschool age group as this may prove to be an equally useful method of

measuring and comparing prevalence around the world. Finally, we need to identify plausible reasons for the change in prevalence rates into the 21st century.

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APPENDIX I. KEY ISAAC QUESTIONS.

1. Has your child had wheezing or whistling in the chest in the last 12 months (wheeze in the last 12 months)?
2. Has your child ever had wheezing or whistling in the chest at any time in the past (wheeze ever)?
3. Has your child ever had asthma (asthma ever)?
4. How many attacks of wheezing has your child had in the last 12 months? Options 0, 1–3, 4–12, >12 (measure of wheeze episodes in the past 12 months).
5. In the last 12 months, has wheezing ever been severe enough to limit your child's speech to only one or two words a time between breaths (severe episode in the past year)?
6. In the past 12 months, has your child had a problem with sneezing, or a runny, or blocked nose when he/ she DID NOT have a cold or the flu (current rhinitis)?
7. Has your child ever had an itchy rash which was coming and going for at least 6 months?
8. Has your child had this itchy rash at any time in the last 12 months (current eczema)?