Do regular check ups and preventive drug use reduce asthma severity in school children?

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OBJECTIVE

To investigate whether regular check ups and preventive drug use reduce asthma symptoms in school children.

METHOD

Cross sectional retrospective questionnaire responses obtained from 2193 children aged 6–7 years in 34 primary schools, and 3650 children aged 13–14 years in nine secondary schools, selected at random by cluster sampling.

Main outcome measures

Asthma severity in the past 12 months as measured by the number of attacks of wheezing, visits to a doctor, visits to a hospital emergency department, and hospital admissions, all for wheezing or asthma.

Analysis

Multivariate ordinal logistic regression.

RESULTS

Regular general practitioner check ups were associated with reduced asthma severity. Regular use of prophylactic and bronchodilator medications was associated with reduced symptoms. Asthma action plans and peak flow meter usage were associated with reduced hospital admissions.

DISCUSSION

If these associations are causal, then regular GP check ups are effective in reducing the health consequences of asthma in children.

Asthma is the single most common chronic childhood disease in developed nations.[1,2] In Australia, asthma is a major public health problem affecting more than 20% of the paediatric population and 5–10% of adults.[3–5] It is associated with substantial morbidity during infancy and childhood, and is the most common cause of paediatric hospital admissions.[6] In addition, it carries very substantial direct and indirect economic costs worldwide.[2,7] In Australia, this cost is estimated to be more than $769 per asthmatic person per year.[8,9] The prevalence of asthma in children may be increasing.[10]

Effective preventive measures are being sought worldwide. They include the appropriate use of medications, general practitioner check ups, asthma action plans, and the use of peak flow meters. While Australian studies have shown the severity of asthma and frequency of attacks may be reduced by various prophylactic treatments, the benefits of several of these are unknown. For example, reports of the benefits of prophylactic medication alone compared with written action plans and regular medical review are inconsistent.[12,13]

We aimed to investigate the associations between severity of asthma symptoms and the use of current preventive measures over a 12 month period in school children.

Method

Sources of data

The names of all state and primary and secondary schools in the Perth (Western Australia) metropolitan area were obtained from the Education Department of the Government of Western Australia. Primary and secondary schools were then randomly chosen from this list. Questionnaires were sent to 2979 families with children aged 6–7 years in 34 primary schools, and 3296 children aged 13–14 years in nine secondary schools. Parents of 6–7 year olds, and children themselves aged 13–14 years, completed the written questionnaire that identified both symptoms and the use of different treatment and preventive regimens over the preceding 12 months (*Table 1*).[11]

Consent was obtained from the Education Department of Western Australia and the schools and parents of all subjects participating. The study was approved by the Ethics Committees of the University of Western Australia and the Princess Margaret Hospital for Children.

Statistical analysis

We used ordinal logistic regression to model the effects of multiple covariates on the categorical outcomes of asthma severity, taking statistical significance at 5%. The primary outcome variables of the analyses were measures of asthma severity. The principal explanatory variables analysed were reported measures used in the past 12 months by the child. All models were adjusted for the influence of various potential confounders by age, gender, country of birth of

Table 1. Definition of asthma

Wheeze (ever): 'Has your child ever had wheezing or whistling in the chest at any time in the past?'

Wheezing in the past 12 months: 'Has your child had wheezing or whistling in the chest in the past 12 months?'

Asthma (ever): 'Has your child ever had asthma?'

'Have you ever had asthma?' (in children aged 13–14 years)

Definition of outcome variables

Severity of asthma symptoms in children who had wheezed in the past 12 months

Number of attacks of wheezing

Number of visits to a doctor for a wheezy episode

Number of visits to a hospital emergency department for wheezing or asthma

Number of hospital admissions due to wheezing or asthma

Definition of explanatory variables

Questions regarding use of treatments and prophylactic measures in the preceding 12 months asked if the child reported having wheezed in the past 12 months

Regular use of medication (every day for at least 2 months in the preceding 12 months)

Regularity of GP check ups without wheezing

Having a written asthma action plan

Use of a peak flow meter in the home

Medication included 'bronchodilators' (ß2-adrenergic receptor agonists) and medications commonly defined as 'prophylactic', comprising sodium cromoglycate and inhaled corticosteroids

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child, and school attended.

Asthma severity indices were coded as ordinal categorical variables (*Table 2*). Variables were coded as dichotomous (yes/no) covariates, except for age and regularity of GP check ups in the previous 12 months, which were analysed as continuous covariates.

Results

Complete questionnaire responses were obtained from 2193 children aged 6–7 years in 34 primary schools, and 3065 children aged 13–14 years in nine secondary schools, response rates of 74% and 93% respectively.

Characteristics of study populations

Most children aged 6–7 years were born in Australia (90%, n=1975), 36% (n=780) reported having wheezed, (22% n=484) had wheezed in the past 12 months, and 28% (n=622) reported having had asthma.

Bronchodilator medication was regularly used by 29% (n=139) of those who had wheezed in the past 12 months, and 4% (n=20) were regular users of sodium cromoglycate or corticosteroids in the preceding 12 months.

Similarly, most children aged 13–14 years were born in Australia (82%, n=2994), 41% (n=1497) reported having wheezed, 29% (n=1075) had wheezed in the past 12 months, and 30% (n=1102) reported having had asthma. Bronchodilator medication was regularly used by 14% (n=164) of those who had wheezed in the past 12 months, and 6% (71) were regular users of sodium cromoglycate or corticosteroids in the preceding 12 months.

Most children who had wheezed in the previous 12 months in both age cohorts appeared to have infrequent symptoms (*Table 2*). Only 6% of children who had wheezed in the previous 12 months had attended or been admitted to hospital.

Associations with explanatory variables

We used logistic regressions to study the association of preventive measures on the outcomes of asthma severity (*Table 3*). Increasing regularity of GP check ups was closely associated with significant reductions in asthma severity (however measured) in both age cohorts. Regular use of bronchodilator only or 'prophylactic' medication was associated with reduced number of wheezing attacks in both cohorts, and with reduced number of visits to a GP for a wheezy episode in the 13–14 year old cohort. Asthma action plans and the use of peak flow meters were associated with moderately reduced wheeze frequency; and more closely associated with reduced numbers of hospital attendance or admissions from wheezing or asthma. All associations of outcomes with explanatory covariates were independent of the effects of gender, country of birth of child, and school attended.

Discussion

We found the prevalence of asthma symptoms was similar to that found in a 6–7 year old cohort Australian population based sample, and in Australian, British and New Zealand population based samples of 12–15 year old school children.[15]

Selection bias was likely to be minimal because of the high response rates. We attempted to adjust potential confounders: younger age,[16–18] male gender,[19–23] and Australian birth,[24] which are associated with increased asthma prevalence. School attended by the child was included, which in addition to having a clustering effect may also be a crude proxy for socioeconomic status.

Questionnaire based studies of asthma are subject to limitations.[25] However, the questions regarding wheeze and asthma correlate well with objective physiological measures of bronchial hyper-responsiveness.[14,26]

It is important to beware of retrospective data implying a causal relationship, ie. that the more intense care yielded better outcomes. However, alternative explanations are possible. Frequency of symptoms may reflect both severity and control.

Table 2. Frequency of measures of asthma severity (past 12 months) in school children who had ever wheezed

Cohort	Attacks of wheezing		Visits to GP for wheezy episode		Visits to emergency department for wheezing or asthma		Hospital admissions due to wheezing or asthma	
		n (%)		n (%)		n (%)		n (%)
6–7 years	0	296 (38)	0	280 (41)	0	634 (91)	0	655 (94)
	1–3	287 (37)	1–3	288 (41)	1	38 (6)	1	28 (4)
	4–12	148 (19)	4–12	111 (16)	2	15 (2)	2	6 (1)
	>12	49 (6)	>12	7 (1)	>2	9 (1)	>2	5 (1)
13–14 years	0	422 (28)	0	890 (62)	0	1310 (91)	0	1347 (94)
	1–3	724 (48)	1–3	442 (31)	1	86 (6)	1	59 (4)
	4–12	223 (15)	4–12	83 (6)	2	16 (1)	2	11 (1)
	>12	128 (9)	>12	13 (1)	>2	22 (2)	>2	14 (1)

Table 3. Association of preventive measures with asthma severity outcomes in (OR: 95% CI)

Severity measures (outcomes past 12 months)	Regular use of prophylactic medication	Regular use of bronchodilator	Regularity of GP check up/visits when well*	Use of asthma action plans	Peak flow meter use in the home
No. of wheezing attacks					
(6–7 years)	OR=0.24 (0.09–0.69)**	OR=0.31(0.21–0.50)**	OR=0.31(0.23–0.42)**	OR=0.72(0.46–1.13)	OR=0.63(0.37–1.07)
(13–14 years)	OR=0.25 (0.15–0.41)**	OR=0.26(0.18–0.37)**	OR=0.76(0.62–0.94)***	OR=1.16(0.83–1.61)	OR=0.81(0.60–1.10)
No. of visits to GP for a wheezy episode					
(6–7 years)	OR=0.68(0.23–2.00)	OR=0.40(0.25–0.63)**	OR=0.19(0.14–0.27)**	OR=0.81(0.52–1.26)	OR=0.52(0.31–0.88)***
(13–14 years)	OR=0.33(0.20–0.55)**	OR=0.40(0.19–0.49)**	OR=0.28(0.22–0.34)**	OR=0.70(0.58–0.98)***	OR=0.92(0.70–1.33)
No. of visits to hospital emergency department for wheezing or asthma					
(6–7 years)	OR=0.68(0.15–3.06)	OR=0.58(0.30–1.11)	OR=0.41(0.27–0.60)**	OR=0.44(0.23–0.83)***	OR=0.62(0.31–1.24)
(13–14 years)	OR=0.98(0.45–2.17)	OR=0.55(0.32–0.92)***	OR=0.28(0.21–0.38)**	OR=0.73(0.45–1.18)	OR=0.38(0.24–0.62)**
No. of times admitted to hospital due to wheezing or asthma					
(6–7 years)	OR=1.17(0.17–8.17)	OR=1.57(0.68–3.59)	OR=0.35(0.22–0.57)**	OR=0.39(0.18–0.88)***	OR=0.38(0.17–0.84)***
(13–14 years)	OR=0.89(0.36–2.20)	OR=0.73(0.38–1.39)	OR=0.30(0.22–0.41)**	OR=0.58(0.33–1.01)	OR=0.37(0.21–0.66)**

* Entered as a continuous covariate, ie. OR is multiplicative increase in risk per unit increase in number of GP check ups
** $p<0.01$
*** $p<0.05$

Nevertheless, the significant associations we found were all negative, suggesting that were they causal, than factors associated with more intense GP care produces better health outcomes.

Regular GP check ups were associated with the most substantial reductions in asthma severity. Reasons might include increased symptom awareness and compliance and greater use of prophylactic medication during GP visits, or that the less severe (the 'worried well') were more likely to seek prophylaxis.

The regular use of prophylactic and bronchodilator medication was also associated with reduced symptoms, the former being of particular interest to the current debate about the use of corticosteroids in mild asthma.[27]

Effects on school children with more severe symptoms (ie. those attending hospital emergency departments or admitted to hospital) were more difficult to demonstrate. If the association of asthma action plans and peak flow meters with reduced hospital visits and admission was causal, then they may be very cost effective for children with severe asthma. These results suggest that these prophylactic measures are very cost effective in school children with severe asthma.

Acknowledgments

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