



Trends in eczema, rhinitis, and rye grass sensitization in a longitudinal asthma cohort

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ABSTRACT

Background: Atopic conditions are prevalent in the Western world, with limited long-term data on atopic trends in patients with asthma.

Objective: To describe the trends in eczema, rhinitis, and allergic sensitization in a longitudinal childhood asthma cohort.

Methods: Four hundred eighty-four patients were recruited at 7 years of age and followed regularly to 50 years of age. Subjects completed an interviewer-administered questionnaire to define current eczema and rhinitis. Skin prick testing to rye grass also was performed.

Results: The participation rate over the past 4 decades has been maintained at 72% to 91%. There was a decrease in the prevalence of eczema in the past 12 months in groups with viral-associated wheeze (21% to 8%, $P = .002$), asthma (47% to 18%, $P < .001$), and severe asthma (69% to 28%, $P < .001$) from 14 to 21 years of age. Conversely, there was an increase in the prevalence of rhinitis in the previous 12 months in groups without asthma (1% to 6%, $P = .04$; 1% to 20%, $P = .008$), with viral-associated wheeze (16% to 28%, $P = .006$; 16% to 49%, $P < .001$), and with asthma (45% to 56%, $P = .2$; 45% to 73%, $P = .014$) from recruitment to 10 and 14 years of age, respectively. There were 2 peaks in prevalence in the sensitization to rye grass in this cohort from 7 to 10 years of age and from 14 to 21 years of age in all groups.

Conclusion: The adolescence phase appears to be an important period in the body's response to allergens whereby eczema decreases in prevalence, whereas rhinitis and rye grass sensitization increase in prevalence.

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Introduction

Atopy or allergic disorders are common and have been closely related to the increase in asthma in the past few decades.^{1–3} A recent study of a Tasmanian birth cohort showed an association between childhood allergic rhinitis and an increased risk of developing new-onset asthma in preadolescence, adolescence, and adulthood.⁴ There have been several cross-sectional studies that have described an increase in atopic prevalence,^{1,2} and it is notably highest in Western developed countries.⁵ Longitudinal studies on the natural progression of atopy from birth cohorts to childhood years^{6,7} and to early adult life⁸ have been described. There are currently no studies to describe the outcome of atopy and allergic disorders from childhood well into adulthood.

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The Melbourne Asthma Study was commenced in 1964 to describe the spectrum and natural outcome of childhood asthma and wheezy bronchitis.⁹ This study has been conducted at 7-year intervals from 7 to 42 years of age^{9–15} and to the current follow-up at 50 years of age. As part of the study, measurements of atopy have been consistently evaluated, which include the presence of rhinitis, eczema, and skin prick testing as an objective measurement of atopy. Data on atopy have been presented at 7 and 35 years of age,^{9,16} but there has been no longitudinal analysis of the data published to date. In the original study, it was not surprising that the prevalence of eczema, rhinitis, and rye grass sensitization was highest in the severe asthma group compared with those with mild or no asthma.⁹ In the assessment at 35 years of age, the presence of an atopic condition defined by the presence of rhinitis, eczema, or skin test reactivity (rye grass) was found to increase the odds of more severe asthma in later life.¹⁶

Therefore, the aim of this study was to describe the longitudinal prevalence of eczema, rhinitis, and rye grass sensitization from childhood into adulthood in this prospective asthma cohort.

Table 1
Participation rate of subjects from recruitment, at varying ages to 50 years old

Groups	Recruitment, n (%)	Subjects at each age of participation, n (% total)						
		10 y	14 y	21 y	28 y	35 y	42 y	50 y
C	105 (22)	83 (19)	78 (22)	81 (20)	72 (20)	85 (22)	86 (21)	77 (22)
VAW	178 (37)	170 (39)	130 (37)	151 (38)	136 (38)	141 (39)	149 (37)	128 (36)
A	113 (24)	100 (23)	84 (24)	98 (25)	92 (25)	94 (24)	98 (24)	81 (23)
SA	83 (17)	83 (19)	61 (17)	69 (17)	61 (17)	63 (16)	70 (17)	60 (17)
	479 ^a	436 (91)	353 (74)	399 (83)	361 (75)	393 (82)	403 (84)	346 (72)

Abbreviations: A, asthma; C, control (no asthma); SA, severe asthma; VAW, viral-associated wheeze.

^aFive original records lost.

Methods

Cohort

A modified random sampling strategy was used to select 401 subjects after a survey of 30,000 grade 2 Melbourne primary school children in 1963 to 1964. The survey included a parent-completed questionnaire, which was followed by a parent interview and physical examination of the child by members of the research team. All those children with a history of asthma or wheezy bronchitis were included in the study, and 1 in 2 with mild wheezy bronchitis and 1 in 20 controls were included. When the children were reviewed at 10 years of age, it was realized that there were very few with severe asthma, and a further sampling of 21,000 children was performed from the same birth cohort to establish a severe asthma group.

The original groups were classified as follows:

1. Control (without asthma)—105 children who had never wheezed.
2. Mild wheezy bronchitis—74 children with fewer than 5 episodes of wheezing associated with bronchitis or respiratory tract infection.
3. Wheezy bronchitis—104 children with at least 5 episodes of wheezing associated with bronchitis or respiratory tract infection.
4. Asthma—113 children with wheezing not associated with respiratory tract infection.
5. Severe asthma (SA)—83 children with onset of symptoms before 3 years of age; at least 10 attacks in the 2 years before 10 years of age or persistent symptoms at 10 years of age; and barrel-chest deformity and/or decrease of the ratio of forced expiratory volume in 1 second to forced vital capacity to 50% or less or some combination of these factors. For this study, the mild wheezy bronchitis and wheezy bronchitis groups were combined because they represented children with viral-associated wheeze (VAW).

All surviving members from the original cohort were contacted and asked to present to the Royal Children's Hospital respiratory department to complete an assessment consisting of an interviewer-administered questionnaire, lung function testing, and skin prick testing. These assessments have occurred at 7-year intervals from 7 to 42 years of age and then to the present study, when subjects were 50 years of age.

Interviewer-Administered Questionnaire

An interviewer-administered questionnaire performed during the study periods collected details on the frequency of wheeze, frequency of rhinitis, and eczema symptoms. Eczema was defined in children or adults as symptoms of dry, itchy rash localized to flexural regions (such as folds of the elbows, behind the knees), facial, or generalized to the body in the past 12 months. Rhinitis was defined in children or adults as symptoms of sneezing, nasal itching, or a runny or blocked nose in the absence of a cold or flu in the

past 12 months. Patients who were not able to present to the hospital had the questionnaire administered by telephone. The questionnaire was applied in person or by telephone by a consistent member of the research team at each study review.

Skin Prick Test Assessment

Skin prick testing was performed as an objective measurement of atopic status. A positive response to a particular challenge was defined as a wheal with a diameter at least 3 mm larger than the diameter of a wheal from a negative control. The allergen that was consistently used throughout the study periods was rye grass. Other allergens were used at varying assessments but excluded from the analysis owing to a lack of consistency. Positive (histamine) and negative (saline/glycerin) controls also were tested. Before testing, antihistamines were withheld for 72 hours.

Statistical Analysis

Data analysis was performed using Stata 10.0 for Windows (Stata Corp, College Station, Texas). Clinical outcomes and prevalence measurements were described as percentages over the different study periods. Chi-square testing was applied to measure the change in prevalence between 2 subsequent time points. This study was approved by the human research ethics committee at the Royal Children's Hospital Melbourne. Oral and written consents were obtained from participating subjects.

Results

Participation Rate at Each Assessment Period from Recruitment to 50 Years of Age

The participation rate over the course of the study has ranged from 72% to 91% (Table 1), with good representation of the original groups at each review. Of the original 484 participants, 5 original records were lost.

Trend in Eczema over Study Periods by Recruitment Groups

At the time of recruitment, the prevalence of eczema in the previous 12 months was least in the control group (10%), with increases in the VAW (17%) and asthma (41%) groups. At 10 years of age, the prevalence in the SA group was 67%. The prevalence of eczema in the nonasthmatic group remained similar throughout the study periods (range 8%–14%). From 14 to 21 years of age, there was a decrease in the prevalence of eczema in the VAW (21% to 8%, $P = .002$), asthma (47% to 18%, $P < .001$), and SA (69% to 28%, $P < .001$) groups. The prevalence of eczema appeared to plateau in all groups after 21 years of age (Fig 1).

Trend in Rhinitis over Study Periods by Recruitment Groups

At the time of recruitment, the prevalence of rhinitis in the previous 12 months was least in the control group (1%), with increases in the VAW (16%) and asthma (45%) groups. At 10 years of age, the prevalence in the SA group was 65%. In the nonasthmatic

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