



ORIGINAL ARTICLE

Parents and school children reported symptoms and treatment of allergic disease differently

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Abstract

Objective: To examine the difference between children and their parents in reporting symptoms and treatment of allergic diseases within a longitudinal birth cohort.

Study Design and Setting: Information on symptoms and treatment of asthma, rhinitis, and eczema was obtained by questionnaire from 2,744 children (mean age: 12 years) and their parents. Differences between the responses were computed, and agreement assessed both absolutely and with kappa coefficient.

Results: On 12 of the 15 questions, children's and parents' reports differed significantly. Asthma-related issues appeared significantly more prevalent in the children's reports, although kappa values were fair to very good. For symptoms of allergic rhinitis, the prevalence pattern varied, and kappa values were moderate to good. Parents reported a higher prevalence of eczema-related issues, but the children reported a significantly higher prevalence of eczema itself. Kappa values ranged from moderate to good.

Conclusion: Although reports of allergic symptoms and treatment by 12-year-old children and their parents were in moderate-to-good agreement, children reported more symptoms than their parents. Symptoms of allergic disease should be reported by children themselves, from the age of 11 years, whereas questions of prescribed pharmacological treatment could be answered either by the children or their parents. © 2013 Elsevier Inc. All rights reserved.

Keywords: Agreement; Asthma; Children; Eczema; Parents; Rhinitis; Questionnaire

1. Introduction

Allergic diseases are common during childhood and are estimated to affect approximately every third child in most Western countries [1]. Recent studies have presented divergent trends in the prevalence of symptoms of allergic diseases, although asthma and eczema are suggested to have leveled off in regions where prevalence rates have previously been high [2–4]. Most epidemiological studies of prevalence of allergic diseases in children rely on questionnaires completed by the parents. For infants and toddlers, information on symptoms and treatment of allergic disease

must be retrieved from the parents, but as the children grow older and more independent, parental reporting becomes less dependable.

Only a few studies have compared the agreement between parental and self-completed questionnaires about allergic diseases in children [5–7]. In general, these studies have shown significant differences between the children's and parents' reports, and agreement between the two sources is believed to be poor [6,7]. In contrast, a recent Swedish prospective study showed good agreement between parental and self-completed questionnaires about allergic diseases in teenagers [8]. However, it appears that the agreement between children's and parents' report differs between the various allergic diseases, with the best agreement for question about asthma [6,7].

Furthermore, it is not clear at what age the children themselves become the most reliable source for studies

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What is new?**Key findings**

- In general, there was moderate-to-good agreement between reports of allergic symptoms and treatments between parents and children. Children reported higher prevalence of symptoms than their parents, and parents reported more treatment.

What this adds to what was known?

- Although the agreement between the reports of children and their parents was good, there could be significant differences in the prevalence of symptoms or treatment as reported by the children and their parents.

What is the implication and what should change now?

- Symptoms of allergic disease should be reported by children themselves, from the age of 11 years. Questions of prescribed pharmacological treatment could still be answered by either children or their parents.

of allergic symptoms. A previous study has suggested that collecting statements from both parents and children is useful up to the age of 11 years, after which children themselves are better at reporting symptoms, whereas parental reporting provides only limited complementary information [9]. Another study by Whiteman and Green [10] conclude that agreement between responses from children and parent depends largely upon the type of information sought, rather than characteristics of the respondents. Relying solely on the children's reports is in line with the methodology used in the International Study of Asthma and Allergies in Childhood (ISAAC) where 13- to 14-year-old children completed the questionnaires at school [11].

However, it has not been evaluated how a change from parental- to child-reported symptoms may affect the apparent prevalence of allergic disease (i.e., asthma, allergic rhinitis, and eczema) in a longitudinal birth cohort. The aim of this study was to compare the information on symptoms and treatment of allergic disease retrieved from school children and their parents within such a study.

2. Material and methods

2.1. Study design

The BAMSE project (Children, Allergy, Milieu, Stockholm, Epidemiological Survey) consisted of 4,089 children

in a population-based cohort. The children were consecutively recruited to the project from the population of Stockholm between 1994 and 1996 at one of the first visits to the children's health center during their first months of life. The enrollment and inclusion criteria have been described in detail elsewhere [12]. Briefly, at a median age of 2 months, data on family history of allergic disease and various environmental exposures were obtained by parental questionnaires. When the children reached 1, 2, 4, and 8 years, the parents received a mailed questionnaire focusing on symptoms related to allergic diseases and key exposures such as diet, parental tobacco smoking, pets, dampness, and so on. At 8 years of age, 84% of the children still remained in the cohort.

The latest follow-up was performed in March–June 2008 when the children were 11–14 years old (mean age: 13 years). Parents and their children received one questionnaire each that could be completed online or in paper form. The questionnaire aimed at obtaining information on lifestyle factors and symptoms of allergic diseases. The questions on symptoms and treatments of asthma, rhinitis, and eczema were slightly modified from the ISAAC questionnaire. This was the first time the children themselves were asked about their health. In total, 82% ($n = 3,358$) of the parents completed the questionnaire. Of these responses, 76% were provided by the mothers, 14% by the fathers, and 10% by mother and father together or by another guardian. The total number of participants with questionnaires answered by a parent and the child was 2,744, thus ultimately comprising the study population.

The study was approved by the Ethical Committee of Karolinska Institutet, Stockholm, Sweden.

2.2. Health outcomes and measures

The questionnaires enquired about the occurrence of a range of symptoms and treatments, in the past 12 months, and were directed separately to the children and their parents (see Supplements 1 and 2 in Appendix at www.jclinepi.com). A few questions offered different response alternatives in the children's and the parents' questionnaires. All the answers that were not negations (no or never) were coded as affirmative (yes, maybe, rarely, now and then, frequently, or always).

Recurrent wheeze and asthma

- Wheezing or raspy breathing
- Symptoms of asthma
- Difficulties sleeping because of asthma
- Asthma medication
- Difficulties breathing when exercising
- Difficulties breathing without exercising
- Wheezing affecting daily activities

Allergic rhinitis

- Sneezing/runny/blocked nose

- Itchy watery eyes
- Allergic rhinitis medication

Eczema

- Dry skin
- Itchy rash
- Itchy rash several times
- Eczema
- Skin treatment with glucocorticoids

Based on parental reported data from the questionnaires from age 1, 2, 4, 8, and 12 years, we classified the children into different phenotypes of disease, namely transient, late-onset, and persistent disease (see below for definition).

2.3. Statistical methods

Differences between groups in categorical variables were analyzed using χ^2 test, and a *P*-value less than 0.05 was considered significant. The level of agreement between children's and their parents' responses was calculated by using absolute agreement and Cohen's kappa coefficient with 95% confidence interval [13,14]. The percentage of absolute agreement is the number of positive and negative answers from both the parent and the child divided by the total number of answers. The kappa coefficient is a statistical measure that compares agreement beyond the level of chance [13].

The kappa values were interpreted as follows: less than 0.20, slight or poor agreement; 0.21–0.40, fair agreement; 0.41–0.60, moderate agreement; 0.61–0.80, good agreement; and more than 0.81, very good agreement [15]. Stratified analyses were performed to evaluate potential explanatory variables (age and gender of the child and the person who completed the parental questionnaire).

To evaluate if the agreement was dependent of onset and persistency of disease, we created a variable based on the

study definition of asthma, eczema, and allergic rhinitis in four categories, not fulfilling the criteria's for disease at any time, transient (fulfilling criteria any time between 1 and 4 years but not later), late-onset (fulfilling criteria any time between 7 and 12 years, but not before), and persistent disease (fulfilling criteria both periods of time). The differences in kappa values between transient, late-onset, and persistent disease were assessed using a *z*-test. All statistical analyses were performed with STATA, Statistical Software: release 11.0 (StataCorp, College Station, TX).

3. Results

3.1. Study population

Background characteristics of the study population are shown in Table 1. Of the children, 1,380 (50.3%) were boys and 1,364 (49.7%) were girls. A comparison was made between the original cohort and the study population concerning selected background factors when the child was newborn. The groups were regarded as comparable (Table 1).

3.2. Prevalence of symptoms and treatments

Prevalence rates of symptoms and treatments of allergic disease according to the parents and the children are given in Fig. 1. For 12 of the 15 symptoms or treatments, there was a significant difference between the responses from parents and children.

For recurrent wheeze and asthma, there was generally a significantly higher prevalence in the children's reports—with the exception of asthma medication and breathing difficulties without exercising, where there were no significant differences. Children also reported significantly higher prevalence of breathing difficulties during exercise in the past 12 months than did their parents, 21.3% vs. 12.5%.

Table 1. Distribution of selected background factors^a at birth among children in the BAMSE cohort and in the study population

Parameters	The original cohort, <i>N</i> = 4,089		Study population, <i>N</i> = 2,744	
	<i>n</i> (%)	95% CI	<i>n</i> (%)	95% CI
Sex				
Male	2,065 (50.5)	49.0–52.0	1,380 (50.3)	48.4–52.2
Mother's age				
<26 yr	319 (7.8)	7.0–8.6	189 (6.9)	5.9–7.8
Any parent born outside Sweden				
Yes	718 (21.1)	19.7–22.4	537 (20.0)	18.5–21.6
Parental history of allergic disease ^b				
Yes	1,746 (43.2)	41.7–44.7	1,204 (44.2)	42.4–46.1
Socioeconomic status				
White collar worker	3,323 (82.7)	81.5–83.9	2,305 (85.1)	83.8–86.5
Any parental smoking at baseline				
Yes	855 (21.0)	19.8–22.3	540 (19.8)	18.3–21.3

Abbreviation: CI, confidence interval.

^a Assessed with the parental questionnaire at baseline (mean age of children: 2 months).

^b Any parent with doctor's diagnosis of asthma and asthma medication and/or doctor's diagnosis of hay fever in combination with furred pets and/or pollen allergy and/or doctor's diagnosis of eczema.

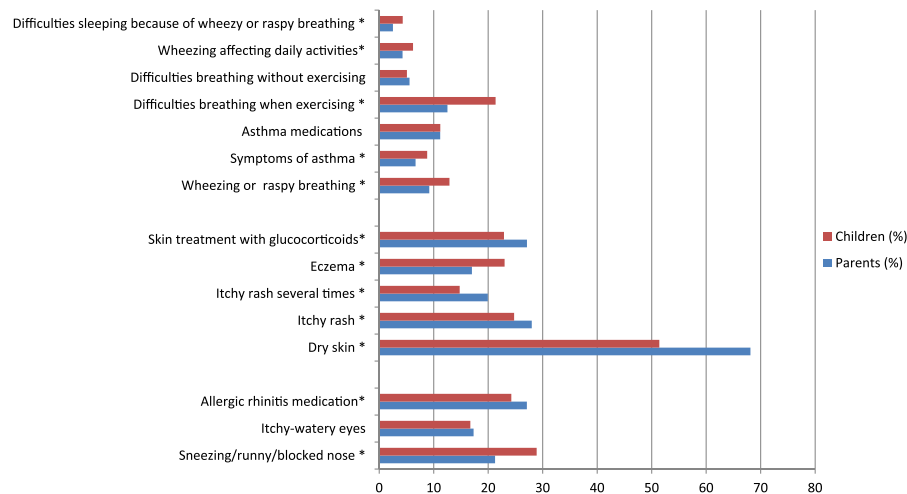


Fig. 1. Parent's and child's report of symptoms and treatment of asthma, allergic rhinitis, and eczema over the past 12 months (%). * $P < 0.05$.

For allergic rhinitis, the pattern varied. Children reported a higher prevalence of sneezing/runny/blocked nose, whereas parents more frequently reported medication for allergic rhinitis. There was no significant difference between the reports for itchy watery eyes.

The children reported a significantly higher prevalence of eczema, whereas the parents significantly more often reported other eczema-related issues such as dry skin, itchy rash, and itchy rash several times, as well as treatment with glucocorticoids.

3.3. Level of agreement

The level of agreement between parents and children in reporting symptoms of allergic disease in the past 12 months

is shown in Table 2. The level of agreement regarding asthma-related symptoms ranged from fair to very good ($\kappa = 0.40$ – 0.85). Absolute agreement ranged from 86.1% to 98.1%. Symptoms of asthma in the past 12 months had very good agreement ($\kappa = 0.85$) and high absolute agreement (98.1%). Asthma medications in the past 12 months also had a very good agreement ($\kappa = 0.87$) and high absolute agreement (97.4%). On the other hand, difficulties sleeping/waking up at night in the past 12 months showed only fair agreement ($\kappa = 0.40$) but high absolute agreement (96.1%).

Regarding allergic rhinitis-related symptoms, the level of agreement was moderate to good: kappa 0.55 (sneezing/runny/blocked nose) to 0.66 (medication for allergic rhinitis). Absolute agreement ranged from 82.9% (sneezing/runny/blocked nose) to 89.4% (itchy watery eyes). The

Table 2. Level of agreement between parents' and children's reports of symptoms and treatment of asthma, allergic rhinitis, and eczema during the past 12 months

Symptoms	Parental report, n (%)	Child report, n (%)	Absolute agreement %	Kappa value	95% CI
Recurrent wheeze and asthma					
Wheezing or raspy breathing	251 (9.2)	353 (12.9)	92.5	0.62	0.57–0.66
Symptoms of asthma	182 (6.7)	222 (8.8)	98.1	0.85	0.85–0.89
Difficulties sleeping	69 (2.5)	118 (4.3)	96.1	0.40	0.31–0.49
Asthma medication	305 (11.2)	307 (4.3)	97.4	0.87	0.84–0.90
Difficulties in breathing when exercising	340 (12.5)	582 (21.3)	86.1	0.51	0.47–0.56
Difficulties in breathing without exercising	151 (5.6)	139 (5.1)	94.7	0.47	0.40–0.54
Wheezing affecting daily activities	117 (4.3)	170 (6.2)	95.7	0.57	0.49–0.64
Allergic rhinitis					
Sneezing/runny/blocked nose	580 (21.3)	786 (28.9)	82.9	0.55	0.51–0.58
Itchy watery eyes	472 (17.3)	662 (24.2)	89.4	0.62	0.58–0.66
Allergic rhinitis medication	738 (27.1)	662 (24.2)	86.9	0.66	0.63–0.69
Eczema					
Dry skin	1,863 (68.1)	1,399 (51.4)	73.7	0.47	0.44–0.50
Itchy rash	767 (27.0)	677 (24.7)	84.8	0.61	0.57–0.64
Itchy rash several times	546 (20.0)	404 (14.8)	87.3	0.56	0.52–0.60
Eczema	465 (17.1)	581 (23.1)	89.0	0.66	0.62–0.69
Skin treatment with glucocorticoids	741 (27.1)	574 (22.9)	84.8	0.62	0.50–0.57

Abbreviation: CI, confidence interval.

question on medications for allergic rhinitis in the past 12 months had a good level of agreement ($\kappa = 0.66$) and high absolute agreement (86.9%).

Concerning eczema-related symptoms, the level of agreement ranged from moderate (dry skin, $\kappa = 0.47$) to good (eczema, $\kappa = 0.66$). Absolute agreement ranged from 73.7% (dry skin) to 89.0% (eczema in the past 12 months).

3.3.1. Level of agreement in relation to onset and persistency of disease

Onset and persistency of disease affected the level of agreement to some extent (Table 3). A statistical significant difference was seen for the question of asthma symptoms, children fulfilling the criterion for transient asthma had a good agreement ($\kappa = 0.59$) compared with children with late onset of asthma who had a very good agreement ($\kappa = 0.85$, $P = 0.006$). The same was seen for the question about disturbed sleep because of asthma and wheezing, whereas children with transient asthma and late onset of asthma had a less good agreement compared with children with persistent asthma ($P = 0.001$).

For eczema-related question, a significant level of agreement was seen for the question about dry skin. For the group of children with persistent eczema, the kappa value was poor ($\kappa = 0.16$) compared with moderate for children with transient eczema ($\kappa = 0.45$) and fair ($\kappa = 0.32$) for children with late onset of eczema.

3.4. Sex and age differences

Agreement between answers given by parents and children was calculated separately for girls and boys (see Supplement 3 in Appendix at www.jclinepi.com). No significant differences in parent–girl/parent–boy agreement were observed, except for the question regarding difficulties sleeping because of asthma in the past year, where

the agreement was fair for girls and moderate for boys ($\kappa = 0.26$ vs. 0.52 , respectively). When level of agreement between parents and children was calculated stratified by the child's year of birth, no significant differences in kappa agreement were observed (data not shown).

Comparisons between answers given by mothers or fathers and children showed a tendency to higher level of agreement for answers given by mothers than by fathers (see Supplement 4 in Appendix at www.jclinepi.com). For the question concerning breathing difficulties without exercising, the agreement was poor for the fathers and moderate for the mothers ($\kappa = 0.06$ vs. 0.50). For the question about itchy rash, the agreement was fair for the fathers and moderate for the mothers ($\kappa = 0.39$ vs. 0.58 ; see Supplement 1 in Appendix at www.jclinepi.com).

4. Discussion

This analysis of 2,744 families from a Swedish population-based cohort showed that in general there was a moderate-to-good agreement between reports of allergic symptoms and treatments between parents and children aged 11–14 years. However, children in general reported more symptoms than their parents, who in turn reported higher prevalence of treatment. The fact that the apparent prevalence of allergic disease to some extent depends on whom you ask is of importance in a longitudinal setting, where a shift from parental reporting to child reporting, may result in spurious changes in the prevalence of allergic diseases, symptoms, or treatments. Therefore, we suggest that symptoms of allergic disease should be reported by children themselves, from the age of 11 years, whereas questions of prescribed pharmacological treatment could be answered either by the children or their parents.

Table 3. Level of agreement in reports of symptoms and treatment the past 12 months between parents and their children in relation to onset and persistency of diseases

Symptoms	Transient disease, kappa (95% CI) value	Late-onset disease, kappa (95% CI) value	Persistent asthma, kappa (95% CI) value
Asthma	<i>n</i> = 159	<i>n</i> = 147	<i>n</i> = 111
Symptoms of asthma	0.59 (0.22–0.95)	0.85 (0.75–0.95)	0.55 (0.36–0.74)
Difficulties in sleeping because of asthma	0.35 (0.02–0.71)	0.36 (0.18–0.54)	0.48 (0.29–0.69)
Asthma medication	0.75 (0.57–0.93)	0.79 (0.67–0.90)	0.85 (0.74–0.96)
Difficulties in breathing when exercising	0.39 (0.18–0.59)	0.55 (0.40–0.69)	0.56 (0.41–0.72)
Wheezing affecting daily activities	0.01 (—)	0.53 (0.39–0.67)	0.49 (0.32–0.66)
Allergic rhinitis	<i>n</i> = 150	<i>n</i> = 384	<i>n</i> = 196
Sneezing/runny/blocked nose	0.33 (0.15–0.51)	0.41 (0.31–0.50)	0.59 (0.47–0.72)
Itchy–watery eyes	0.37 (0.06–0.69)	0.43 (0.35–0.52)	0.50 (0.38–0.62)
Allergic rhinitis medication	0.60 (0.43–0.76)	0.65 (0.57–0.73)	0.58 (0.45–0.71)
Eczema	<i>n</i> = 476	<i>n</i> = 171	<i>n</i> = 328
Dry skin	0.45 (0.38–0.53)	0.32 (0.17–0.47)	0.16 (0.05–0.27)
Itchy rash	0.49 (0.32–0.56)	0.44 (0.32–0.56)	0.40 (0.32–0.49)
Eczema	0.57 (0.47–0.66)	0.64 (0.52–0.76)	0.60 (0.50–0.69)
Skin treatment with glucocorticoids	0.45 (0.35–0.55)	0.39 (0.24–0.53)	0.47 (0.36–0.58)

Abbreviation: CI, confidence interval.

Significant differences are highlighted in bold.

4.1. Strength and limitations

The large sample size of 2,744 children and their parents, the relatively high response rate, and the birth cohort design all strengthen our study. As in all cohort studies, one possible limitation is that the population is somewhat more aware of symptoms than the population in general. The families included in the present study were, however, comparable with the families in the entire cohort in terms of background factors. Moreover, it is not likely that any such selection would explain the observed differences between the adolescents and parents reporting of symptoms of allergic disease. Some other limitations should also be mentioned. In our study, the questions posed to children and their parents were similar, but not identical. A few of the questions offered different response alternatives in the children's vs. the parents' questionnaires. Therefore, to enable our analyses, the responses to all questions were dichotomized into no or yes for both children and parents. Moreover, we cannot exclude the possibility of differences in understanding and interpreting the questions about symptoms of allergic disease between children and their parents [16,17]. In a future study, it could be interesting to investigate how children and their parents interpret the questions by performing interviews. This could lead to a deeper understanding of the differences and similarities of how parents and children report symptoms and treatment of allergic diseases.

4.2. Comparison of prevalence estimates

In the present study, the children generally reported higher prevalence of symptoms of allergic diseases compared with their parents. This is in line with several other observational studies, where the parents report lower prevalence of asthma [5,7,18,19], rhinitis [6], and eczema symptoms [6,7] in this age group. On the other hand, this is not a consistent finding, as studies also report a similar prevalence of asthma based on parental and self-report data [20,21], and Italian adolescents report significantly lower eczema prevalence than their parents [6].

4.3. Level of agreement between parental and child report of symptoms of asthma, eczema, and allergic rhinitis

The highest level of agreement between parental and child report was found in questions regarding asthma symptoms and asthma medications in the past 12 months. One possible explanation is that asthma medications are usually prescribed at a visit to the doctor, where both the child and the parents are present. Moreover, the parents probably purchase the medications. Parental (mother reported) use of antiasthmatics has also been found highly valid using the Norwegian Prescription Database as the reference standard [22]. Although the agreement was very good in questions about asthma medications, it was only good for the

questions regarding medications and treatment for allergic rhinitis and eczema. Parents might take the symptoms and treatment of asthma more seriously than treatment of allergic rhinitis and eczema (for which medications are often not prescribed by a doctor); it is conceivable that parents let their children take greater responsibility for the latter treatments.

The level of agreement for symptoms regarding eczema was moderate to good in the present study. We observed a higher level of agreement than previous studies in comparable age groups [6–8], which might be explained by our longitudinal study design. Parents and children included in a prospective birth cohort might be more aware of skin symptoms than participants sampled randomly from the population for the previous cross-sectional studies [8,21].

One issue on which parents' and children's reports agreed less well, both in our study and several other studies, was wheezing during or after exercise [5–7,19,21]. This ISAAC question has also been reported to have low sensitivity in a clinical validation study [23]. A possible explanation is that parents are unaware of symptoms that mainly occur when they are not together with their child.

4.4. Differences in the level of agreement between boys and girls and their parents

The agreement between children and parents has in some studies been reported to be better if the adolescent is a girl [5,24]; but in the present study, no differences in the level of agreement between boys and girls and their parents could be seen [25]. Answers given by mothers tended to agree with the child's answer better than answers given by fathers, but we have to consider that mothers completed most parental questionnaires. Interestingly, in a study evaluating the level of agreement between children and parents concerning health-related quality of life in children with asthma, a better agreement was reported between children and fathers compared with mothers [26].

Moreover, we could not find any indications of differences in agreement depending on whether the child was 11, 12, or 13 years old indicating that children from the age of 11 years are able to answer questions about symptoms and treatment of allergic disease by themselves. To let children in these age groups answer by themselves is in line with the methodology used in the ISAAC studies [11].

5. Conclusion

Although reports of allergic symptoms and treatment by 12-year-old children and their parents were in moderate-to-good agreement, children reported more symptoms than their parents. Therefore, in a longitudinal birth cohort study, a shift from parental to child reporting may result in spurious changes in the prevalence of allergic disease. We suggest that symptoms of allergic disease should be

reported by children themselves, from the age of 11 years, whereas questions of prescribed pharmacological treatment could be answered either by the children or their parents.

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Appendix

Supplementary material

Supplementary data related to this article can be found online at <http://dx.doi.org/10.1016/j.jclinepi.2013.02.006>.

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Table 1. Distribution of selected background factors¹ at birth among children in the BAMSE-cohort and in the study population.

	The original cohort N=4089			Study population N=2744		
	n	%	95% CI	n	%	95% CI
<i>Sex</i>						
Male	2065	50.5	(49.0-52.0)	1380	50.3	(48.4-52.2)
<i>Mother's age</i>						
< 26 years	319	7.8	(7.0-8.6)	189	6.9	(5.9-7.8)
<i>Any parent born outside Sweden</i>						
Yes	718	21.1	(19.7-22.4)	537	20.0	(18.5-21.6)
<i>Parental history of allergic disease²</i>						
Yes	1746	43.2	(41.7- 44.7)	1204	44.2	(42.4-46.1)
<i>Socioeconomic status</i>						
White collar worker	3323	82.7	(81.5-83.9)	2305	85.1	(83.8-86.5)
<i>Any parental smoking at baseline</i>						
Yes	855	21.0	(19.8-22.3)	540	19.8	(18.3-21.3)

¹ Assessed with the parental questionnaire at baseline (mean age of children 2 months).

² Any parent with doctor's diagnosis of asthma and asthma medication and/or doctor's diagnosis of hay fever in combination with furred pets- and/or pollen allergy and/or doctor's diagnosis of eczema.

Table 2. Level of agreement between parents' and children's reports of symptoms and treatment of asthma, allergic rhinitis and eczema during the past 12 months.

	Parental report n (%)	Child report n %	Absolute agreement %	Kappa value	95% CI
<i>Recurrent wheeze and asthma</i>					
Wheezing or raspy breathing	251 (9.2)	353 (12.9)	92.5	0.62	0.57-0.66
Symptoms of asthma	182 (6.7)	222 (8.8)	98.1	0.85	0.85-0.89
Difficulties sleeping	69 (2.5)	118 (4.3)	96.1	0.40	0.31-0.49
Asthma medication	305 (11.2)	307 (4.3)	97.4	0.87	0.84-0.90
Difficulties breathing when exercising	340 (12.5)	582 (21.3)	86.1	0.51	0.47-0.56
Difficulties breathing without exercising	151 (5.6)	139 (5.1)	94.7	0.47	0.40-0.54
Wheezing affecting daily activities	117 (4.3)	170 (6.2)	95.7	0.57	0.49-0.64
<i>Allergic Rhinitis</i>					
Sneezing/runny/blocked nose	580 (21.3)	786 (28.9)	82.9	0.55	0.51-0.58
Itchy-watery eyes	472 (17.3)	662 (24.2)	89.4	0.62	0.58-0.66
Allergic rhinitis medication	738 (27.1)	662 (24.2)	86.9	0.66	0.63-0.69
<i>Eczema</i>					
Dry skin	1863 (68.1)	1399 (51.4)	73.7	0.47	0.44-0.50
Itchy rash	767 (27.0)	677 (24.7)	84.8	0.61	0.57-0.64
Itchy rash several times	546 (20.0)	404 (14.8)	87.3	0.56	0.52-0.60
Eczema	465 (17.1)	581 (23.1)	89.0	0.66	0.62-0.69
Skin treatment with glucocorticoids	741 (27.1)	574 (22.9)	84.8	0.62	0.50-0.57

Table 3. Level of agreement in reports of symptoms and treatment the past 12 months between parents and their children in relation to onset and persistency of diseases. Significant difference highlighted in bold

	Transient disease kappa (95% CI) value	Late onset disease kappa (95% CI) value	Persistent asthma Kappa (95% CI) value
<i>Asthma</i>	<i>n = 159</i>	<i>n = 147</i>	<i>n = 111</i>
Symptoms of asthma	0.59 (0.22-0.95)	0.85 (0.75-0.95)	0.55 (0.36-0.74)
Difficulties sleeping due to asthma	0.35 (0.02-0.71)	0.36 (0.18-0.54)	0.48 (0.29-0.69)
Asthma medication	0.75 (0.57-0.93)	0.79 (0.67-0.90)	0.85 (0.74-0.96)
Difficulties breathing when exercising	0.39 (0.18-0.59)	0.55 (0.40-0.69)	0.56 (0.41-0.72)
Wheezing affecting daily activities	0.01 (-)	0.53 (0.39-0.67)	0.49 (0.32-0.66)
<i>Allergic Rhinitis</i>	<i>n = 150</i>	<i>n = 384</i>	<i>N = 196</i>
Sneezing/runny/blocked nose	0.33 (0.15-0.51)	0.41 (0.31-0.50)	0.59 (0.47-0.72)
Itchy-watery eyes	0.37 (0.06-0.69)	0.43 (0.35-0.52)	0.50 (0.38-0.62)
Allergic rhinitis medication	0.60 (0.43-0.76)	0.65 (0.57-0.73)	0.58 (0.45-0.71)
<i>Eczema</i>	<i>n = 476</i>	<i>n = 171</i>	<i>n = 328</i>
Dry skin	0.45 (0.38-0.53)	0.32 (0.17-0.47)	0.16 (0.05-0.27)
Itchy rash	0.49 (0.32-0.56)	0.44 (0.32-0.56)	0.40 (0.32-0.49)
Eczema	0.57 (0.47-0.66)	0.64 (0.52-0.76)	0.60 (0.50-0.69)
Skin treatment with glucocorticoids	0.45 (0.35-0.55)	0.39 (0.24-0.53)	0.47 (0.36-0.58)

Supplement 1. Questions on symptoms and treatments of allergic diseases answered by the children in the 12 year follow-up of the BAMSE birth cohort

Symptom or treatment	Question
<i>Recurrent wheeze and asthma</i>	
Wheezing or raspy breathing	Over the past 12 months, have you had wheezy or raspy breathing? (No; Yes)
Symptoms of asthma	Over the past 12 months, have you had symptoms of asthma? (No; Yes; Maybe)
Difficulties sleeping	Over the past 12 months, have you had trouble sleeping or woken up at night because of wheezy or raspy breathing? (No; Yes, but only when I had a cold; Yes, when I didn't have a cold)
Asthma medication	Over the past 12 months, have you taken any medicines for asthma or wheezy, raspy breathing? (No; Yes; Maybe)
Difficulties breathing when exercising	Over the past 12 months, have you had trouble breathing <u>after working hard</u> physically? (No; Yes)
Difficulties breathing without exercising	Over the past 12 months, have you had trouble breathing <u>without having done</u> hard physical work? (No; Yes)
Wheezing affecting daily activities	Over the past 12 months, have you had wheezy or raspy breathing that has affected your daily activities (school, leisure time, sports)? (No; Yes)
<i>Allergic Rhinitis</i>	
Sneezing/runny/blocked nose	Over the past 12 months, have you been sneezing, had an itchy nose, runny nose or stuffy nose for several days in a row <u>without having a cold</u> ? (No; Yes)
Itchy-watery eyes	Over the past 12 months, have you itchy, bloodshot or weepy eyes for several days in a row <u>without having a cold</u> ? (No; Yes)
Allergic rhinitis medication	Over the past 12 months, have you taken any medicines for nose or eye problems? (No; Yes, occasionally; Yes, often)
<i>Eczema</i>	
Dry skin	Over the past 12 months, have you had problems with dry skin? (No; Yes, and I apply moisturizing lotion, cream or ointment; Yes, but I don't apply moisturizing lotion, cream or ointment)
Itchy rash	Over the past 12 months, have you had an itchy rash? (No; Yes)
Itchy rash several times	Over the past 12 months, have you had an itchy rash several times? (No; Yes)
Eczema	Over the past 12 months, have you had eczema? (No; Yes; Maybe)
Skin treatment with glucocorticoids	Over the past 12 months, have you applied cortisone cream for your eczema? (Never; Rarely; Now and then; Frequently; Always)

Supplement 2. Questions on symptoms and treatments of allergic diseases answered by the parents in the 12 year follow-up of the BAMSE birth cohort

Symptom or treatment	Question
<i>Recurrent wheeze and asthma</i>	
Wheezing or raspy breathing	Has your child had wheezy or raspy breathing in the past 12 months? (No; Yes)
Symptoms of asthma	Has your child shown symptoms of asthma in the past 12 months? (No; Yes)
Difficulties sleeping	Has your child had trouble sleeping or woken up because of wheezy or raspy breathing in the past 12 months. (No; Yes)
Asthma medication	Has your child taken any medicine for asthma or wheezy, raspy breathing in the past 12 months? (No; Yes)
Difficulties breathing when exercising	Has your child had trouble breathing <u>in connection with exertion</u> in the past 12 months? (No; Yes)
Difficulties breathing without exercising	Has your child had trouble breathing <u>without having exerted</u> him/herself in the past 12 months? (No; Yes)
Wheezing affecting daily activities	Has your child had wheezy or raspy breathing that has affected his/her daily activities in the past 12 months? (No;Yes)
<i>Allergic Rhinitis</i>	
Sneezing/runny/blocked nose	Has your child suffered from sneezing, itchy nose, runny nose or stuffy nose <u>without simultaneously having a cold</u> in the past 12 months? (No; Yes)
Itchy-watery eyes	Has your child suffered from itchy, bloodshot or watery eyes <u>without simultaneously having a cold</u> in the past 12 months? (No; Yes)
Allergic rhinitis medication	Has your child used medicines against nose or eye problems in the past 12 months? (No; Yes)
<i>Eczema</i>	
Dry skin	Has your child had dry skin in the past 12 months? (Never; Rarely; Now and then; Frequently; Always)
Itchy rash	Has your child had an itchy rash in the past 12 months? (No; Yes)
Itchy rash several times	Has your child had an itchy rash several times over the past 12 months? (No; Yes)
Eczema	Has your child had eczema in the past 12 months? (No; Yes)
Skin treatment with glucocorticoids	Has your child applied a cortisone cream in the past 12 months? (Never; Rarely; Now and then; Frequently; Always)

Supplement 3. Level of agreement between parents and their children in reports of symptoms the past 12 months, with respect to sex of the child. Significant difference highlighted in bold.

	Boys (n=1380)		Girls (n=1364)	
	Kappa value	95% CI	Kappa value	95% CI
<i>Recurrent wheeze and asthma</i>				
Wheezing or raspy breathing	0.67	0.61-0.73	0.57	0.48-0.63
Symptoms of asthma	0.85	0.79-0.91	0.85	0.79-0.91
Difficulties sleeping	0.52	0.40-0.63	0.26	0.13-0.38
Asthma medications	0.90	0.87-0.94	0.82	0.76-0.87
Difficulties breathing when exercising	0.56	0.50-0.62	0.47	0.41-0.53
Difficulties breathing without exercising	0.49	0.39-0.59	0.45	0.32-0.56
Wheezing affecting daily activities	0.58	0.48-0.67	0.55	0.45-0.65
<i>Allergic Rhinitis</i>				
Sneezing/runny/blocked nose	0.58	0.53-0.63	0.51	0.46-0.56
Itchy-watery eyes	0.67	0.62-0.73	0.56	0.50-0.62
Allergic rhinitis medication	0.70	0.65-0.74	0.62	0.57-0.66
<i>Eczema</i>				
Dry skin	0.46	0.42-0.51	0.45	0.40-0.50
Itchy rash	0.61	0.56-0.66	0.60	0.56-0.65
Eczema	0.67	0.62-0.72	0.64	0.60-0.64
Skin treatment with glucocorticoids	0.57	0.51-0.62	0.50	0.50-0.56

Supplement 4. Level of agreement in reports of symptoms the past 12 months between parents and their children, with respect to sex of the responding parent. Significant difference highlighted in bold.

	<u>Mother alone</u> <u>(n=2080)</u>		<u>Father alone</u> <u>(n=385)</u>	
	Kappa value	95% CI	Kappa value	95% CI
<i>Recurrent wheeze and asthma</i>				
Symptoms of asthma	0.86	0.81-0.90	0.78	0.58-0.97
Wheezing or raspy breathing	0.63	0.58-0.68	0.52	0.35-0.68
Difficulties sleeping	0.41	0.32-0.51	0.27	0.04-0.59
Asthma medications	0.88	0.85-0.91	0.78	0.65-0.90
Difficulties breathing when exercising	0.53	0.49-0.57	0.39	0.26-0.52
Difficulties breathing without exercising	0.50	0.43-0.58	0.06	0.01-0.23
Wheezing affecting daily activities	0.58	0.51-0.65	0.41	0.13-0.69
<i>Allergic Rhinitis</i>				
Sneezing/runny/blocked nose	0.57	0.53-0.60	0.44	0.34-0.54
Itchy-watery eyes	0.63	0.59-0.67	0.60	0.48-0.71
Allergic rhinitis medication	0.67	0.63-0.70	0.56	0.46-0.67
<i>Eczema</i>				
Dry skin	0.47	0.43-0.50	0.48	0.40-0.56
Itchy rash	0.58	0.53-0.62	0.39	0.26-0.52
Eczema	0.67	0.63-0.71	0.58	0.46-0.69
Skin treatment with glucocorticoids	0.54	0.50-0.58	0.52	0.40-0.63