Differences in parental- and self-report of asthma, rhinitis and eczema among Italian adolescents

E. Renzoni*, F. Forastiere**, A. Biggeri[†], G. Viegi^{††}, L. Bisanti[‡], E. Chellini^{‡‡}, G. Ciccone[#], G. Corbo^{##}, C. Galassi[§], F. Rusconi^{§§}, P. Sestini*, on behalf of the SIDRIA collaborative group

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ABSTRACT: Epidemiological and clinical information on respiratory and allergic disorders in adolescents has been collected from the adolescents themselves or from their parents, but little is known about the differences between these two sources of information.

This study compared the responses to 10 identically worded questions from the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire on asthma, rhinitis and eczema between written self- and parent-completed questionnaires in a large sample of 21,068 adolescent Italians aged 13–14 yrs. The effects of sex, latitude of residence, urbanization, socioeconomic status, previous diagnosis of asthma, family history of allergic diseases and adolescent's smoking habits on the prevalence estimates obtained with the two questionnaires were analysed using multiple logistic regression.

Prevalence of self-reported symptoms was significantly higher in self-reported for all questions except for lifetime eczema, which was higher in parental report. Agreement between the two sources of information was poor, although it was slightly better for questions relative to clinical diagnosis of asthma, hay fever or eczema than for related symptoms, and for respiratory with respect to cutaneous disorders. When compared with self-reported, parent-reported was consistently higher in males and was more affected by socioeconomic level and by a diagnosis of asthma or family history of allergic diseases, whereas self-reported was more sensitive to the effect of the adolescent's smoking habits.

It is concluded that, in adolescents, parent- and self-reported respiratory and allergic symptoms differ significantly and are differently affected by several constitutional and environmental factors. Obtaining direct information from adolescents may be essential for a correct evaluation of respiratory symptoms.

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*Institute of Respiratory Diseases, University of Siena, **Osservatorio Epidemiologico Regione Lazio, Rome, [†]Dept of Statistics, University of Florence, ^{††}Institute of Clinical Physiology, Italian National Research Council, Pisa, [‡]Local Health Unit 32, Milan, ^{‡‡}Center for Study and Prevention of Cancer, Firenze, [#]Unit of Cancer Epidemiology, S. Giovanni Battista Hospital, Turin, ^{##}Dept of Respiratory Physiology, Catholic University, Rome, [§]Regional Health Documentation Center Emilia Romagna, Bologna, ^{§§}Dept of Pediatrics, University of Milan, Italy.

Correspondence: P. Sestini
Institute of Respiratory Diseases
Viale Bracci 3
I-53100 Siena
Italy
Fax: 39 0577280744

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Adolescence is probably a pivotal age in the natural history of asthma and other allergic diseases, but knowledge of the epidemiology of asthma at this age is still limited [1]. Among several problems in the study of health status in adolescence, particularly relevant from an epidemiological point of view, is the uncertainty about whether the parents or the adolescents themselves should be used as the preferred source of information about their health. At this age, males and females become relatively independent from their parents during daily activities, whereas they continue to depend mostly on parents for their relationships with health professionals. Furthermore, the shift from the care of a paediatrician to that of a general physician may result in a discontinuity in the monitoring of their health status [1]. These factors may result in significant differences in the data collected using self- and parent-completed questionnaires, but only a few studies exist on this topic [2–5].

In most epidemiological surveys performed on adolescents, prevalence estimates of asthmatic symptoms, as well as other allergic disorders, are derived from parent-completed questionnaires [6–9]. However, more recent stud-

ies, including the large multicentre International Study of Asthma and Allergies in Childhood (ISAAC) protocol, obtained the information directly from adolescents, inviting them to complete the questionnaire either on their own, [10, 11] or with the help of their parents if necessary [12]. However, it is not clear how different the prevalence estimates obtained from adolescents and their parents are, and to what extent the results of these studies can be compared [13].

In this paper the prevalence of asthma, rhinitis, eczema and of related symptoms is reported from a large population of Italian schoolchildren aged 13–14 yrs, obtained by both self- and parent-completed questionnaires. The factors which are associated with differences in the data obtained with the two questionnaires are also analysed.

Methods

Design

The study was carried out between October 1994 and March 1995, outside the main pollen season, in 10 centres of Northern and Central Italy. These areas were the same as

those surveyed in a parallel study on 6- and 7-yr-old school children [14], with the addition of the provinces of Trento, in the North, and of Siena, in Central Italy. The participating centres differ in geographic characteristics, climate and urbanization (table 1). In the North, the winter is colder, longer, more humid and foggy than in the Centre. Northern areas are also generally more industrialized.

The study population consisted of young adolescents aged 13–14 yrs attending the eighth grade of school [10]. Each centre was required to sample at least 1,000 subjects. A random sample was extracted from the total number of schools in each centre, weighted for the number of children attending the school. In the sampled schools, the whole eighth grade student population was studied. If the number of subjects to enrol was $\leq 25\%$ of the total schoolchildren population in eighth grade classes, or if there was marked urbanistic or geographic heterogeneity in the area under study, a stratification was performed before sampling. On the basis of these criteria, all of the schools in the province were studied in Trento, a random sample from the whole area was studied in Cremona, Siena, Viterbo, and Milan, from two strata in Empoli and Florence, and from four strata or more in Rome, Turin, and in the Emilia region.

Questionnaire and data collection

At school, adolescents completed a questionnaire containing the complete set of ISAAC modules regarding wheezing, rhinitis and eczema [10] as well as questions on other respiratory symptoms including a question about attacks of shortness of breath with wheezing in the past 12 months [15]. Adolescents were also asked whether they regularly smoked cigarettes (and if so with what frequency, *i.e.* less than 4-month⁻¹, 1–5-week⁻¹, 1–5-day⁻¹, >5-day⁻¹).

The questionnaire completed at home by the parents of adolescents also contained a subset of the ISAAC questions and questions on attacks of shortness of breath with wheezing [15]. It also contained a set of questions relative to housing, schooling, lifestyle, and other possible risk or confounding factors for asthma and other allergic diseases. The ISAAC questions on eye irritation

with nasal symptoms and on localization of skin lesions were not present in the parent's questionnaire.

Each selected school was contacted and followed by one or more trained health care workers/or physicians, who obtained informed consent from the parents of all participating adolescents and supervised the completion of the written and video questionnaires by the adolescents in the classroom. The parents' questionnaire was then given to the adolescents who took it home for their parents to complete. For those parents, who, though agreeing to participate, neglected to return the completed questionnaire, a new questionnaire together with a reminder letter was sent up to a maximum of three times. The protocol of the study was approved by the Ethical Committee of the Università Cattolica in Rome.

Statistical analysis

Ten questions that were identically worded in both the adolescent and the parent questionnaire were analysed: these included the ISAAC questions on lifetime and past-12-month wheeze (any wheezing or whistling in the chest), lifetime asthma, lifetime and past-12-month nasal symptoms (sneezing or runny or blocked nose) apart from colds, lifetime hay fever, lifetime and past-12-month eczema symptoms (itchy rash coming and going for at least 6 months), lifetime eczema, and the question about attacks of shortness of breath with wheezing in the past 12 months. Prevalence rates were computed according to a two stage clustered sampling design, where the 10 centres constituted the strata and sampling units were represented by individual schools, and weighted inversely to the sampling fraction of each centre. To maintain comparability with the ISAAC study, all of the prevalence data were computed without excluding missing answers, which were therefore counted as negative answers.

Questionnaires were completed by 21,660 adolescents in the eighth grade (11,258 males and 10,402 females, mean age 13.1 yrs) representing more than 90% of the target population in all centres. The parents of 21,410 adolescents also filled in and returned their questionnaire as required. These were filled in 45% of cases by the mother, 5% by the father, 48% by both, and in 2% by other

Table 1. – Characteristics of the areas under study, population and response rate

Centre	Characteristics of the sampled area					Target population		Sampled population		Response rate %	
	Latitude	Urbanization	Boundary	Surface km ²	Population density (n/km ²)	n total schools	n adolescents in 8th grade	n Sampled schools	n Sampled adolescents	adolescents	parents
Torino	North	Metropolitan	Municipality	129	7221	110	8169	14	1274	97.5	95.0
Milano	North	Metropolitan	Municipality	182	7611	91	8983	35	3486	96.8	96.1
Cremona	North	Urban/rural	LHU	824	188	24	1210	24	1210	99.3	99.0
Trento	North	Urban/rural	Province	6250	72	87	4429	87	4429	94.5	91.4
Emilia Romagna	North	Urban and rural	Region	22169	177	509	31203	55	4056	97.7	98.0
Firenze	Centre	Urban and rural	Municipalities	853	954	53	5450	11	1211	96.7	94.5
Prato	Centre	Urban/rural	LHU	888	249	24	2131	12	1071	97.8	94.9
Empoli	Centre	Urban/rural	Province	3788	66	48	2019	20	1212	97.4	95.9
Siena	Centre	Urban/rural	LHU	1667	75	28	3249	12	964	95.6	91.9
Viterbo	Centre	Metropolitan	Municipality	1499	1793	346	28312	40	3528	94.2	90.2
Roma	Centre	Metropolitan	Municipality	1499	1793	346	28312	40	3528	94.2	90.2
Total				38249	2861	1320	95155	310	22441	96.3	94.3

LHU: local health units.

or unspecified subjects. The present analysis was restricted to subjects for whom both questionnaires were available.

A complete pair of questionnaires from the adolescent and their parent was obtained in 21,068 cases. Three hundred and thirty nine parent questionnaires were discarded because of a missing corresponding adolescent questionnaire, and 778 adolescent questionnaires because of the lack of the corresponding parent questionnaire. Using logistic regression analysis (see below), no significant differences were observed in the distribution by sex, latitude, urbanization, or socioeconomic status, nor in the parent-reported prevalence of any of the 10 questions considered in the study, between the adolescents excluded from analysis because only the parent-completed questionnaire was available, and those for whom both questionnaires had been completed. Adolescents excluded from analysis because of a missing parent questionnaire, were significantly more likely to be males, to live in central Italy, and in areas of higher urbanization with respect to those for whom both questionnaires were available. However, after adjusting for sex, latitude and urbanization, no significant differences were observed between the two groups of adolescents in the self-reported prevalence of any of the 10 questions included in the study.

The percentage of positive and negative agreement and the Cohen coefficient (κ) are presented as a measure of concordance between the two sources [16]. To minimize the effect of differences in the prevalence of the various conditions, the raked κ was also calculated and [17] standardized for an equal prevalence (50%) of positive answers. Differences in the prevalence of symptoms reported by adolescents and by their parents were evaluated using the McNemar Chi-squared test.

It has previously been observed that the prevalence of several parent-reported symptoms in a sample of 6–7 yr-old schoolchildren from the same areas of the present study was influenced by sex, latitude, urbanization and socioeconomic status [14]. To investigate whether these factors could also affect symptom prevalence in adolescents, for each symptom two separate multiple logistic analyses were performed [18], one for the adolescents' and one for the parents' questionnaire, with the symptom as the dependent variable and simultaneously including all the above factors as independent variables. All the logistic regression analyses were performed using the *svylogit* procedure for estimation of regression models of survey data of the statistical package Stata, (Stata Statistical Software: Release 5.0; Stata Corp. College Station, TX, USA), with strata, sampling units and weights as described for prevalence estimation.

Urbanization levels were defined according to whether schools were located in a metropolitan area (cities with a population of >800,000), an urban area (cities with <800,000 and >100,000 residents) and a mixed urban/rural area (towns and municipalities with <100,000 inhabitants) (table 1). Paternal education was chosen as the closest indicator of socioeconomic status, and graded as <8 yrs of schooling, currently the limit of mandatory school in Italy, 8 yrs, high school (13 yrs of schooling) and university degree. Urbanization and socioeconomic status were analysed in logistic regression models as continuous variables.

To investigate whether a family history of allergic disease or the knowledge of a diagnostic label of asthma

attributed to the adolescent could influence the report of symptoms by the two sources, the authors further analysed, in separate logistic analysis models, the effect of a parental report of physician-diagnosed asthma, of a family history of asthma, rhinitis or eczema, and of adolescent's smoking habits. Family history of disease was defined as the parent-report of the occurrence of the condition in one of the parents or in one sibling. Adolescents were considered smokers if they admitted to regularly smoking at least 4 cigarettes a month. The models were adjusted for all of the factors used in the preliminary analyses.

Conditional logistic regression was used to investigate whether the degree of association between each symptom or condition and the various factors (sex, urbanization, *etc.*) differed between the two questionnaires. The answer of each adolescent was paired with that of their parent for the same question, according to a matched case-control design with 1:1 matching, and conditional logistic models were analysed using the *clogit* procedure of Stata. For each of the 10 questions considered, the conditional regression model included the questionnaire (self- or parent-filled) as the dependent variable, the main effect of the symptom and the interaction effect of the symptom with sex, latitude, urbanization and paternal schooling as independent variables, and an individual identification code as the matching variable [18]. The interaction effects with family history of disease, physician-diagnosed asthma, and smoking were individually added to the model as described above for logistic regression analysis.

Results

Adolescent reported yielded significantly higher prevalence estimates than parent reported for all questions except for lifetime eczema, which was reported more frequently by parents. For some of the questions, such as wheeze or nasal symptoms in the last 12 months, the self-reported prevalence was as much as 100% higher than reported by the parents of the same adolescents (fig. 1).

Fig. 1. – Prevalence of diseases and related symptoms according to adolescent (□) and parent (▨) questionnaires. Error bars represent the 95% confidence intervals. *: $p < 0.05$; **: $p < 0.01$; between the two sources, McNemar test. W: lifetime wheeze; 12 mW: wheeze in the last 12 month; DW: lifetime dyspnoea and wheeze; A: lifetime asthma; R: lifetime rhinitis; 12 mR: rhinitis in the last 12 months; HF: lifetime hayfever; IR: lifetime itchy rash; 12 mIR: rash in the last 12 months; E: lifetime eczema.

Table 2. – Agreement between self- and parent-completed questionnaires in the response to 10 identically worded questions relative to asthma, rhinitis, and eczema

Parent Adolescent	Responses to questionnaire %				Agreement %		Cohen $\kappa \pm SE$	Raked $\kappa \pm SE$
	No No	No Yes	Yes Yes	Yes No	Positive	Negative		
Question:*								
Wheeze ever	69.8	11.3	11.4	7.5	54.9	88.2	0.415 $\pm$ 0.007	0.509 $\pm$ 0.007
Wheeze in last 12 months	89.0	6.4	3.4	1.2	47.4	95.9	0.444 $\pm$ 0.014	0.724 $\pm$ 0.009
Wheeze+dyspnoea	91.5	5.1	2.1	1.2	39.7	96.9	0.404 $\pm$ 0.016	0.692 $\pm$ 0.011
Asthma	88.3	3.1	6.8	1.8	73.3	97.3	0.652 $\pm$ 0.013	0.823 $\pm$ 0.006
Rhinitis ever	52.3	23.0	17.0	7.7	52.6	77.3	0.319 $\pm$ 0.005	0.383 $\pm$ 0.007
Rhinitis in last 12 months	65.9	18.4	10.4	5.3	46.8	84.8	0.344 $\pm$ 0.007	0.453 $\pm$ 0.008
Hay fever	78.0	7.8	10.2	4.0	63.4	93.0	0.554 $\pm$ 0.01	0.697 $\pm$ 0.006
Itchy rash	77.9	8.1	6.5	7.5	45.6	90.9	0.382 $\pm$ 0.009	0.487 $\pm$ 0.009
Rash in last 12 months	87.3	6.3	3.5	3.0	42.7	94.9	0.407 $\pm$ 0.013	0.604 $\pm$ 0.01
Eczema	84.5	4.0	5.5	6.0	52.2	94.4	0.457 $\pm$ 0.011	0.628 $\pm$ 0.008

*: all questions were from the ISAAC core questionnaire [10], but wheeze with dyspnoea was derived from the ATS questionnaire [15].

The agreement between the two sources of information, as indicated by the raked κ , was always greater for questions relative to specific diagnoses (asthma, hay fever, eczema), than for related symptoms (table 2). Furthermore, the agreement on questions regarding asthmatic symptoms was consistently greater than for questions regarding nasal or cutaneous problems. Not surprisingly, given the relatively low prevalence of positive answers, negative agreement was always greater than positive agreement.

The prevalence of all wheezing symptoms and of asthma was significantly higher in males than females when

parent reported was considered. By contrast, according to adolescent reported, only the prevalence of asthma was higher in males, whereas wheezing symptoms were similar if not higher among females (table 3). Apart from the prevalence of asthma, which was slightly more frequently reported in central Italy, no consistent difference was observed with latitude and urbanization for either questionnaire. Decreasing socioeconomic level was associated with less frequent reporting of asthma but not of wheezing symptoms in the adolescent reported whereas it was associated with a lower frequency of both wheezing and asthma in the parent reported questionnaires.

Table 3. – Prevalence of asthma and of wheezing symptoms from adolescent's and parent's questionnaires according to various characteristics

	n	Wheeze						Lifetime asthma	
		Lifetime		In last 12 months		+Dyspnoea		Adolescents	Parents
		Adolescents	Parents	Adolescents	Parents	Adolescents	Parents		
Total	21068	23.5	19.6 [§]	10.3	4.8 [§]	7.8	3.5 [§]	10.3	9.1 [§]
Female	10189	23.9	17.8	10.4	4.3	8.5	3.1	8.8	7.2
Male	10879	23.0	21.3 ⁺	10.3	5.3 ^{#§}	7.2 [#]	3.9 ^{#§}	11.8 ⁺	11.0 ⁺
Latitude:									
North	13741	23.4	19.3	10.1	4.8	8.1	3.6	9.9	8.4
Centre	7327	23.6	20.1	10.7 [§]	4.8	7.4	3.3	10.9	10.1 [#]
Urbanization:									
Mixed	11314	24.2	19.6	10.7	4.5	7.7	3.1	9.9	8.5
Urban	2093	24.2	22.0	10.6	5.4	8.5	4.3	9.9	9.1
Metropolitan	7661	22.6 [#]	19.8 [*]	10.0 [*]	4.8	7.7	3.5	10.8	9.7
Paternal schooling:									
<8 yrs	4433	22.0	18.0	9.9	3.8	7.1	2.6	8.5	7.5
8 yrs	7866	23.6	19.5	10.4	4.7	8.3	3.6	10.3	9.1
13 yrs	5703	24.3	21.0	10.7	5.7	7.7	3.8	11.6	10.3
University	2400	22.5	19.6 [*]	9.5	4.4 [*]	7.3	3.6 [*]	11.1 ⁺	9.5 [#]
Physician diagnosis of asthma:									
No	19143	19.1	12.9	7.6	2.0	5.6	1.1	3.7	0.4
Yes	1685	68.8 ⁺	87.9 ⁺	39.1 ⁺	34.8 ⁺	30.5 ⁺	29.1 ⁺	79.0 ⁺	100.0 ⁺
Family history:									
No asthma	17638	22.1	17.6	9.4	3.9	7.1	2.8	9.0	7.7
Asthma	3105	30.3 ⁺	30.1 ⁺	15.0 ⁺	9.6 ⁺	11.4 ⁺	7.0 ⁺	17.6 ⁺	16.9 ⁺
Active smoker:									
No	19262	23.0	19.5	10.0	4.7	7.5	3.5	10.2	9.1
Yes	1694	28.0 ⁺	21.2	13.8 ⁺	5.7	11.2 ⁺	3.3	11.8	9.4

*: $p < 0.05$; #: $p < 0.01$; +: $p < 0.001$, multiple logistic regression adjusted for sex, latitude, and urbanization (separate analyses for each source); §: significantly greater association of symptoms with factors listed in the first column *versus* other source ($p < 0.05$), conditional logistic regression (see *Methods* section).

Table 4. — Prevalence of hay fever and of nasal symptoms apart from colds from adolescent's and parent's questionnaires according to various characteristics

	Sneezing or runny or blocked nose apart from colds				Lifetime hay fever	
	Lifetime		In last 12 month		Adolescents	Parents
	Adolescents	Parents	Adolescents	Parents		
TOTAL	41.5	25.4 [§]	31.0	16.3 [§]	17.1	14.5
Female	44.3	24.7	33.7	15.7	17.7	13.7
Male	39.0 ⁺	26.1 [§]	28.4 ⁺	16.8 [§]	16.6	15.3 ^{++§}
Latitude:						
North	41.8	25.8	30.6	16.7	17.3	14.6
Centre	41.2	24.9 [§]	31.5	15.7* [§]	16.8	14.4
Urbanization						
Mixed	41.0	24.7	30.5	15.7	16.7	14.3
Urban	44.0	28.0	32.7	18.0	16.2	14.5
Metropolitan	41.2	25.1	30.9	16.2	17.8* [§]	14.7
Paternal schooling:						
<8 yrs	42.9	23.3	31.7	14.9	17.4	13.3
8 yrs	41.7	25.9	31.2	16.7	17.8	15.5
13 yrs	41.2	25.8	30.9	16.7	16.9	14.9
University	39.7*	26.6* [§]	29.7	16.8 [§]	15.6*	13.3
Physician diagnosis of asthma:						
No	39.8	22.1	29.4	13.9	14.6	11.4
Yes	59.3 ⁺	58.3 ^{++§}	46.2 ⁺	40.5 ^{++§}	43.0 ⁺	46.5 [§]
Family history:						
No rhinitis	39.6	22.2	29.4	13.5	14.9	11.5
Rhinitis	47.3 ⁺	35.9 ⁺⁺	35.9 ⁺	25.3 ^{++§}	25.1 ⁺	24.9 ^{++§}
Active smoker:						
No	41.1	25.4	30.4	16.3	17.0	14.5
Yes	46.1 ⁺	24.7	37.2 ^{++§}	16.5	18.9 [§]	14.4

*: $p < 0.05$; +: $p < 0.001$; multiple logistic regression adjusted for sex, latitude, and urbanization (separate analyses for each source); §: significantly greater association *versus* other source ($p < 0.05$), conditional logistic regression (see *Methods* section.)

A previous physician diagnosis or a family history of asthma predictably increased the reports of wheezing symptoms both by parents and adolescents. Interestingly, the difference between parent and children mostly occurs in those without the asthma label. The prevalence of all wheezing symptoms was significantly increased in adolescents reporting tobacco smoking when symptom self-report was considered, but not in the parent report.

No sex-related differences were observed in the parental reports of nasal symptoms, while they were more frequent in females in self-reported (table 4) questionnaires. Hay fever was significantly higher in males only according to parental report. Only minor differences were seen between the two questionnaires in the distribution of nasal symptoms according to latitude and urbanization. Interestingly, an opposite effect of socioeconomic status on nasal symptoms was observed between self- and parent-reported: these symptoms showed a trend to decrease with increasing socioeconomic class in adolescent reported, while an opposite trend was observed in parent reported.

A physician diagnosis of asthma and a family history of hay fever were strongly associated with nasal symptoms and hay fever in both questionnaires. The prevalence of hay fever and of nasal symptoms was higher in adolescents who smoked according to self-, but not to parent-reported.

Eczema and related symptoms were reported more frequently in females than in males, and in the northern than in central regions, both by adolescents and by their parents (table 5). As for asthmatic and rhinitic symptoms, according to both sources their report was significantly associated with a diagnosis of asthma and to a family history of eczema. Interestingly, eczema-related symp-

toms were reported in both questionnaires to be significantly more frequent in adolescents who admitted to smoking cigarettes.

Conditional logistic regression confirmed a highly significant underrepresentation of female adolescents in parent- as compared to self-reported (tables 3–5). Even for those few questions in which both parents and adolescents agreed that the prevalence was higher in males (report of asthma), or in females (eczema and eczematous symptoms), the percentage of females reported by parents to have these conditions was nevertheless significantly lower than in adolescent reported. Similarly, even though both in parents and in adolescents a physician diagnosis of asthma or a family history of allergic disease was markedly associated with a higher prevalence of most symptoms, conditional regression analysis showed that this association was stronger in parent than in adolescent reported. The distribution of some wheezing and nasal symptoms as reported by parents turned out to be more affected by socioeconomic status than according to adolescents. Conversely, adolescent's smoking habits were significantly more associated with self-reports than with parent-reports of most allergic symptoms.

To investigate whether socioeconomic status could differently affect the reliability of self-completed and parent-completed questionnaires, data was also stratified on the mean number of questions with missing responses in the two questionnaires according to this factor. A sharp inverse relationship was observed between the number of missing questions in the parent-completed questionnaire and the level of paternal education: the mean numbers of missing answers, listed from the lowest level to the highest level of

Table 5. – Prevalence of eczema and of related symptoms from adolescent's and parent's questionnaires according to various characteristics

	Itchy rash				Lifetime eczema	
	Lifetime		In last 12 months		Adolescents	Parents
	Adolescents	Parents	Adolescents	Parents		
Total	15.0	14.1	10.0	6.6 [§]	9.1	11.1 [§]
Female	17.2	15.4	11.9	7.5	10.4	11.2
Male	13.0 ⁺	12.9 ^{±§}	8.3 ⁺	5.7 ^{±§}	7.8 ⁺	11.0 [§]
Latitude:						
North	16.5	15.1	10.9	7.2	11.6	12.1
Centre	13.0 ⁺	12.8 ⁺	8.8 ⁺	5.7 ⁺	5.6 ⁺	9.8 ⁺
Urbanization:						
Mixed	15.4	14.5	10.0	6.8	10.9	11.8
Urban	15.7	15.4	10.2	6.5	7.7	10.8
Metropolitan	14.5	13.4	10.1	6.4	8.0	10.6
Paternal schooling:						
<8 yrs	14.7	13.9	9.4	6.4	7.5	8.7
8 yrs	15.1	13.8	10.3	6.7	9.1	11.5
13 yrs	15.2	14.6	10.2	6.5	10.2	12.1
University	14.4	14.2	9.6	6.4	9.1 ⁺	12.2 ⁺
Physician diagnosis of asthma:						
No	14.4	13.1	9.8	6.2	8.5	10.2
Yes	21.3 ⁺	24.1 ^{±§}	12.9 ⁺	10.2 ^{±§}	14.9 ⁺	19.8 ⁺
Family history:						
No eczema	14.1	12.5	9.5	5.7	7.5	8.4
Eczema	19.5 ⁺	21.7 ^{±§}	13.1 ⁺	10.9 ^{±§}	16.9 ⁺	25.0 ^{±§}
Active smoker:						
No	14.5	13.9	9.6	6.5	9.0	11.1
Yes	20.0 ^{±§}	15.9 [#]	13.9 ⁺	7.5 [*]	10.0 ^{*§}	11.5

*: $p < 0.05$; #: $p < 0.01$; +: $p < 0.001$; multiple logistic regression adjusted for sex, latitude, and urbanization (separate analyses for each source); §: significantly greater association *versus* other source ($p < 0.05$), conditional logistic regression (see *Methods* section.).

education were respectively $11.3 \pm 0.8\%$ (mean $\pm$ SE), $9.7 \pm 0.5\%$, $8.0 \pm 0.6\%$ and $6.1 \pm 0.7\%$. By contrast, no differences were observed across socioeconomic classes in the adolescents' report. Mean numbers of missing answers were respectively 5.2 ± 0.4 , 5.4 ± 0.3 , 5.2 ± 0.4 , 6.3 ± 0.6 .

Discussion

The data show that, in adolescents, epidemiological surveys based on information from the adolescents themselves or from their parents may give markedly different results, with prevalence estimates differing by up to 100% for some questions. Indeed, significant differences were observed between the two sources in the reported prevalence of all of the symptoms and diseases under study, with a higher prevalence in self-completed questionnaires for all questions except for eczema, and a surprisingly poor concordance between the two sources of information. These differences should be considered when appraising different studies in adolescents, or when comparing adolescents with younger children, where information is usually obtained from the parents [14].

It is interesting to note that the differences in prevalence were smaller for questions related to diagnostic labelling (asthma, hay fever and eczema), than for individual symptoms, suggesting a better agreement when both parent and adolescent depend, for their information, on a common external source, such as the family physician. This is in agreement with previous reports on asthma and wheezing symptoms [4, 5, 19] and with observations made in other medical fields indicating that agreement varies with the type of information sought [19–22], and that parent-child

agreement is higher for conditions that are common, visible or diagnosed [19].

Reports of comparisons between adolescent and parent-reports of respiratory and allergic conditions are surprisingly very sparse and to the author's knowledge only a few studies, on considerably smaller samples and mostly limited to wheezing symptoms, are available on the subject [2, 4, 5, 19]. All reports confirm the finding that parents provide lower estimates of wheezing symptoms in the last 12 months than their adolescent children, whereas the prevalence of lifetime wheeze was higher in parent reports in one study [4].

The data tend to be in agreement with the observation that the concordance between parents and adolescents on reported respiratory symptoms increases when a family history of asthma [4] or a physician diagnosis of asthma [2] are also reported. Indeed, not only the difference in the prevalence of wheezing symptoms reported by parents and by adolescents decreased in this group as compared with adolescents without physician-diagnosed asthma, but the same occurred for wheezing, nasal and skin symptoms in relation to a reported family history of asthma, rhinitis or eczema, respectively. The authors were cautious, however, about comparing these groups in terms of agreement between the two sources, because all of the available measures of agreement are known to be unreliable in the presence of asymmetries in the prevalence between groups, between observers [16, 23, 24], or both [17]. Unfortunately, this was the case in most of the subgroup analyses of the data, where differences in prevalence are present both between the two sources (parents

and adolescents) and between different groups (for example, subjects with or without physician-diagnosed asthma). For this reason, only the Cohen's κ and the raking κ were used to describe the overall agreement between the two sources for each specific question, and logistic regression was used for subgroup analysis.

This analysis showed that not only were the overall prevalence estimates different among the two sources of information, but also that the distribution of symptoms and diseases among subgroups of adolescents varied differently according to parent- or to self-reporting. In the absence of objective measurements, it is impossible to determine with certainty which is the most reliable source of information, and the authors can only speculate on the causes of the differences observed between the two sources of information. Although inspection of tables 3–5 discloses many discrepancies between the two sources of information, there are three main differences which appear to recur consistently among different questions: these involve sex, socioeconomic status, and personal or family history of disease.

Regarding sex-related differences, it is well established that the prevalence of asthmatic and allergic symptoms is higher in males than in females during childhood, but this difference decreases with age and disappears during adolescence [25]. In the case of asthmatic symptoms, many studies have failed to detect sex-related differences among adolescents of this age [9, 26, 27]. Furthermore, in adolescents, either no differences between the two sexes in the degree of bronchial hyperresponsiveness to methacholine [28] or even an increased reactivity in females [29] have been detected, while the response to exercise was actually more frequent in females [26]. It seems likely that parents of adolescents lag somewhat behind their children, and that their information is more biased by the more frequent occurrence of asthma in males at previous ages, whereas in fact this difference no longer occurs at this age. Regarding eczema, a predominance in young females has also been recently reported in Scottish adolescents [19]. Unlike the present results, in that case the reported prevalence was higher in adolescent than in parent reports.

Conflicting results have been reported on the effect of socioeconomic status on the prevalence of asthma and of other allergic diseases [30, 31]. The current data appear to add to the confusion, since different and sometimes opposite trends were observed between parent and adolescent reports according to this factor. The observation that the number of missing responses increases with decreasing socioeconomic status in parents' but not in adolescents' questionnaires, suggests that data obtained from the latter source is less biased by this factor, and possibly more reliable [4].

A diagnostic label of asthma or the report of a history of allergic diseases in a member of the family caused a greater increase in the report of most symptoms by parents than by adolescents, suggesting that parents may be more influenced than their children by this knowledge. On the one hand, this determines a decrease in the difference between the two sources in adolescents with physician-diagnosed asthma or with a family history of allergy. On the other hand, it might cause an underestimation of parent-reported prevalences in families without a history of allergic diseases.

Finally it is interesting to note that an increased prevalence of respiratory symptoms in adolescents who smoked cigarettes was detected by the self-completed but not by parent-completed questionnaires. Although a biased report cannot be excluded, since the information on cigarette smoking was obtained from the adolescents themselves, this seems unlikely, since smokers are more likely to minimize than to amplify their respiratory symptoms [1]. Furthermore, an increased prevalence of respiratory disorders in adolescents who smoke is highly consistent with physiological studies showing precocious signs of airway damage in smokers of this age [32]. Thus, the finding is consistent with the hypothesis that adolescents fail to report (and probably tend to conceal) smoking-related symptoms to their parents, and that self-reports more closely reflect events which occur beyond the reach and the knowledge of their parents [4]. Interestingly, cutaneous manifestations were also associated with cigarette smoking (an interesting and, to the author's knowledge, previously unreported finding, whose discussion falls outside the scope of the present article), but this effect was detected by both questionnaires, possibly reflecting the fact that adolescents did not restrain from reporting these symptoms to their parents, since they were not overtly connected with the habit of smoking.

The above conjectures tend to support the hypothesis that self-reporting is more reliable than parent-reporting for the assessment of respiratory and allergic symptoms in adolescents. Interestingly, this hypothesis is also supported by the findings of a recent small and elegant clinical study [3], showing that, in asthmatic teenagers, self-reported respiratory symptoms were better correlated than parent-reported with respiratory function data and quality of life measures. However, a similar objective assessment would prove difficult in large epidemiological studies. Although bronchial hyperreactivity and peak flow variability have been proposed as markers of the asthmatic phenotype in epidemiological studies, recent studies have shown that in adolescents they do not correlate very well with each other and with questionnaire data on asthma and respiratory symptoms [11, 26]. Furthermore, the objective assessment of transient nasal and cutaneous symptoms would pose even more difficulties. Only a thorough clinical evaluation or a prospective regular monitoring from childbirth would probably provide reliable data [33, 34]. Parents remain a crucial source of information on clinical and familial history. However, the data suggest that both for epidemiological and for medical purposes, obtaining direct information from adolescents is essential for a correct evaluation of respiratory and allergic disorders.

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