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## Address:

Clinical Centre of Allergology  
1 St. G. Sofiysky Str., 1431 Sofia, Bulgaria

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Association "Asthma" 1 St. G. Sofiysky Str. 1431 Sofia Bulgaria

For subscription call: +359 2/9230715

or write to E-mail: ahajournal@gmail.com

Vlaski E<sup>1</sup>, Stavric K<sup>2</sup>,  
Isjanovska R<sup>3</sup>, Seckova  
L<sup>1</sup>, Kimovska M<sup>1</sup>

<sup>1</sup>Department of  
Pulmonology and  
Allergology, Pediatric  
Clinic

<sup>2</sup>Department of  
Immunology, Pediatric  
Clinic

<sup>3</sup>Institute of Epidemiology  
with Biostatistics and  
Medical Informatics,  
Faculty of Medicine,  
Skopje, FYROM

## Socioeconomic Status Hypothesis in Asthma and Eczema in Young Adolescents

### Summary

**Background:** As studies in different populations have shown conflicting results about the relationship between asthma and socioeconomic status and its association with eczema has been less extensively studied, the study was aimed to explore the socioeconomic status hypothesis in asthma and eczema in young adolescents in the Republic of Macedonia.

**Methods:** The self-reported data from 3026 children aged 13/14 years from randomly selected schools in Skopje, the capital of Macedonia, were obtained through the standardized International Study of Asthma and Allergies in Childhood Phase Three written questionnaires. Family size, mother's educational level, tobacco smoke at home, wood/coal/oil heating at home and body mass index, as some socioeconomic status measures, were statistically correlated to asthma and eczema symptoms by odds ratios with 95% confidence interval (OR, 95% CI) in binary logistic regression.

**Results:** Small families and overweight significantly increased the risk of ever-diagnosed asthma (OR 2.160, 95% CI 1.110-4.203  $P=0.023$  and OR 2.085, 95% CI 1.109-3.922  $P=0.023$ , respectively). As well overweight was significantly associated with increased risk of current night cough (OR 1.365, 95% CI 1.053-1.771  $P=0.019$ ), while mother's university education with decreased risk of the same symptom (OR 0.759, 95% CI 0.620-0.930  $P=0.008$ ). A significant association between the severity of asthma, eczema and investigated measures of socioeconomic status was not found.

**Conclusion:** The results support the positive association between socioeconomic status and asthma only, without any effect of socioeconomic status on asthma severity and eczema.

**Key words:** adolescent; asthma; eczema; socioeconomic factors

### Introduction

There is conflicting information about the relationship between asthma and socioeconomic status (SES), with studies in different populations reporting no (1-3), positive (4), or negative (5, 6) association. SES is multi-dimensional, incorporating elements of parental occupational characteristics, educational level, income, wealth and residential characteristics. The possible explanation of the positive association between SES and allergic diseases is the preventive effect of infections in early life, associated with larger families and poverty, which may preferentially stimulate Th1 cell proliferation and subsequently inhibit allergen sensitization, thereby reducing the likelihood of asthma and other allergic diseases in low SES groups (4). Contrary to the asthma prevalence, asthma severity has been found to be determined by factors associated with poverty (4, 6, 7). Considering eczema, its association with SES has been less extensively studied and has not been established (3) or more frequent eczema in higher social classes has been reported (8, 9).

The objective of the study was to examine the relationship between socioeconomic status and the prevalence of asthma and eczema, as well as their severity in young adolescents from Skopje, the Republic of Macedonia as a developing country, using data obtained in the Macedonian arm of the third phase of the International Study of Asthma and Allergies in Childhood (ISAAC).

### Subjects and methods

This epidemiological cross-sectional study was conducted in accordance with the ISAAC Phase Three protocol that is outlined in the Phase Three manual (10) and in the Phase Three rationale and methods (11).

With a passive consent from the parents, 3026 out of the approached 3330 young adolescents 13/14 year old from 17 randomly selected primary schools in Skopje self-completed the ISAAC written core questionnaires on asthma, eczema and the environmental questionnaire. The follow-up visit of each school where absentees were registered on the first visit, after a period of 2-3 weeks was realized. A high response rate of 90.9% was achieved. As an inclusion criterion the age group of 13/14 year olds was used. The data collection was carried out of the main pollen season (10), during the period from December 2001 to March 2002.

Out of all respondents, 1568 (51.8%) were boys and 1458 (48.2%) were girls. Their mean age was 13.5

years (SD 0.5), 13.5 years (SD 0.5) in boys and 13.4 years (SD 0.5) in girls.

### Questionnaires

Outcome measures used in this study were 12-month prevalence of symptoms of asthma (current wheeze, current night dry cough) and symptoms of atopic eczema (current itchy rash). These outcome measures were obtained from core questions in asthma and eczema questionnaires about the presence of wheezing or whistling in the chest in the last 12 months, night dry cough not due to cold or chest infection in the last 12 months and about the presence of an itchy rash which was coming and going for at least 6 months at any time in the last 12 months. Severity of asthma and atopic eczema symptoms was assessed among respondents with current wheeze or current itchy rash based on the responses to questions about sleep disturbance due to wheeze (current sleep-disturbing wheeze) or interference with sleeping because of the itchy rash (current sleep-disturbing itchy rash). Severity indices were subcategorized into 'none' and 'any'. Finally, information related to lifetime diagnosis of asthma and atopic eczema was obtained from answers to questions about ever having had asthma or eczema (asthma 'ever' or eczema 'ever') (10, 12-14).

The existence of siblings (younger and older) as a measure of family size and SES was used. Mother's educational level was subcategorized into 'primary and secondary' (8-12 years of education) and 'tertiary' (university or more as an advanced education). Indoor air pollution was assessed based on the responses to questions from the environmental questionnaire about smokers (one or more) in the house and wood/coal/oil as fuel usually used for heating in the house.

Self-reported weight and height obtained through the environmental questionnaire or, where unknown, their measured values during the data collection were used for calculation of body mass index (BMI) for each respondent as weight (kg)/height (m)<sup>2</sup>. The WHO cut off points for BMI for underweight and International ones for overweight and obesity by sex between 2 and 18 years, defined to pass through BMI of 25 kg/m<sup>2</sup> for overweight and 30 kg/m<sup>2</sup> for obesity at age 18 were used (15). The group of children with obesity consisted of 45 children (1.5%) only and these were included in the overweight group.

### Ethical approval

The Ethics Committee at the Medical Faculty and

The Ministry of Education and Science, Skopje, FYROM, approved the conduction of ISAAC Phase Three in FYROM.

#### Statistical analysis

The SES factors (presence of siblings, mother's educational level, passive smoking at home, wood/coal/oil heating at home, BMI) were correlated to asthma and eczema symptoms, as dependent variables, by odds ratios with 95% confidence interval (OR, 95% CI) in binary logistic regression in SPSS 11.0 for Windows. The presence of siblings, mother's secondary and primary educational level, passive smoking at home, wood/coal/oil heating at home and normal BMI as referent categories in statistic analysis were used. A resulting *P*-value <0.05 was considered significant.

#### Results

The prevalence of self-reported asthma 'ever' (1.7%) was much lower than the prevalence of current wheeze (8.8%), current night dry cough (16.5%) and even

lower than the prevalence of current sleep-disturbing wheeze, as a parameter of asthma severity (2.9%). Regarding the corresponding prevalence rates of eczema (eczema 'ever' of 3.7%, current itchy rash of 4.3%, current sleep-disturbing itchy rash of 1.5%), such differences were not found.

The most of the respondents had siblings, were exposed to passive smoking at home and not exposed to indoor air pollution by wood/coal/oil heating at home, and had normal BMI. Almost the equal proportion of mothers with and without tertiary educational level was found (Table 1).

Small families and overweight, as SES factors, were significantly associated with ever-diagnosed asthma (*P*=0.023 for both of them). Overweight significantly increased the risk of current night cough (*P*<sub>2</sub>=0.019), while advanced mother's education decreased its risk (*P*=0.008). Overweight tended to increase the risk of current wheeze (*P*=0.060) (Table 2). A significant association between investigated SES factors and atopic eczema was not determined (Table 3).

**Table 1. Prevalence of socioeconomic status factors (written questionnaire) in 3026 adolescents aged 13-14 yrs in Skopje, FYROM, 2002**

SES factors	No. (%) of subjects
Number of siblings	
No siblings	407 (13.0)
One or more	2619 (86.5)
Mother's educational level	
Primary and secondary	1471 (48.6)
Tertiary	1546 (51.1)
Passive smoking at home	
No	813 (26.9)
Yes	2211 (73.1)
Wood/coal/oil heating at home	
No	2480 (82.0)
Yes	546 (18.0)
BMI	
Normal	2378 (78.6)
Underweight	107 (3.5)
Overweight	443 (14.6)

SES = socioeconomic status; BMI = body mass index.

**Table 2. Relationship between socioeconomic status factors and asthma symptoms (written questionnaire) in 3026 adolescents aged 13-14 yrs in Skopje**

Asthma symptom / SES factors	OR	95% CI	P
<b>Current wheeze</b>			
Siblings*	1.229	0.853-1.771	0.268
Mother's educational level†	0.915	0.702-1.194	0.514
Passive smoking at home‡	0.868	0.641-1.176	0.361
Wood/coal/oil heating at home‡	0.792	0.574-1.094	0.157
Underweight§	1.703	0.950-3.051	0.074
Overweight§	1.380	0.987-1.929	0.060
<b>Current sleep-disturbing wheeze</b>			
Siblings	1.166	0.608-2.233	0.644
Mother's educational level	1.173	0.726-1.897	0.514
Passive smoking at home	0.861	0.493-1.502	0.597
Wood/coal/oil heating at home	0.933	0.515-1.689	0.818
Underweight	1.520	0.598-3.862	0.378
Overweight	0.969	0.526-1.782	0.918
<b>Current night dry cough</b>			
Siblings	0.920	0.680-1.245	0.590
Mother's educational level	0.759	0.620-0.930	0.008
Passive smoking at home	0.833	0.660-1.052	0.124
Wood/coal/oil heating at home	0.979	0.757-1.265	0.870
Underweight	1.242	0.753-2.051	0.396
Overweight	1.365	1.053-1.771	0.019
<b>Asthma 'ever'</b>			
Siblings	2.160	1.110-4.203	0.023
Mother's educational level	0.886	0.497-1.580	0.682
Passive smoking at home	0.627	0.301-1.306	0.212
Wood/coal/oil heating at home	1.105	0.508-2.402	0.801
Underweight	0.007	0.000-1084465	0.607
Overweight	2.085	1.109-3.922	0.023

SES = socioeconomic status; OR = Odds ratio; CI = confidence interval.

\* No vs. one or more siblings.

† Tertiary vs. primary and secondary mother's educational level.

‡ No vs. Yes passive smoking and wood/coal/oil heating at home.

§ Underweight, overweight vs. normal body mass index.

**Table 3. Relationship between socioeconomic status factors and atopic eczema (written questionnaire) in 3026 adolescents aged 13-14 yrs in Skopje**

Eczema symptom / SES factors	OR	95% CI	P
<b>Current itchy rash</b>			
Siblings*	1.391	0.857-2.259	0.181
Mother's educational level†	0.860	0.596-1.241	0.419
Passive smoking at home‡	0.743	0.480-1.151	0.184
Wood/coal/oil heating at home‡	1.288	0.776-2.136	0.328
Underweight§	1.702	0.768-3.771	0.190
Overweight§	1.146	0.706-1.860	0.582
<b>Current sleep-disturbing itchy rash</b>			
Siblings	0.881	0.342-2.270	0.794
Mother's educational level	1.112	0.569-2.173	0.755
Passive smoking at home	0.726	0.315-1.669	0.450
Wood/coal/oil heating at home	1.081	0.444-2.631	0.865
Underweight	1.426	0.376-5.413	0.602
Overweight	0.761	0.300-1.934	0.566
<b>Eczema 'ever'</b>			
Siblings	0.871	0.482-1.573	0.647
Mother's educational level	1.310	0.882-1.945	0.181
Passive smoking at home	0.888	0.572-1.379	0.596
Wood/coal/oil heating at home	1.199	0.693-2.077	0.516
Underweight	0.234	0.033-1.652	0.145
Overweight	0.594	0.316-1.119	0.107

SES = socioeconomic status; OR = Odds ratio; CI = confidence interval.

\* No vs. one or more siblings.

† Tertiary vs. primary and secondary mother's educational level.

‡ No vs. Yes passive smoking and wood/coal/oil heating at home.

§ Underweight, overweight vs. normal body mass index.

### Discussion

The present study suggests that increased SES is associated with an increased risk of asthma. It was found that absence of siblings *i.e.* small families significantly increased the risk of ever-diagnosed asthma and that overweight significantly increased the risk of ever-diagnosed asthma and current night dry cough apart from a chest infection. While big families are generally considered as a characteristic of a lower standard of living, overweight is a characteristic of poverty in developed countries but not essential condition of being poor (16). In developing countries such as Macedonia, it may be more common in higher social classes.

A significant association between SES and asthma

severity *i.e.* current sleep-disturbing wheeze was not determined. As well mother's educational level, as a measure of SES, was not established to be associated with asthma symptoms other than current night dry cough. However, night dry cough is considered to be a non-specific asthma symptom (17) and there is a possibility that our respondents misunderstood it as a symptom of sinusitis or other upper respiratory infection. On the other hand, in Macedonia the mother's advanced education is not always associated with higher household income, wealth or better housing conditions.

Other studies that have considered the possible relation between social class and asthma have given conflicting results. Wijga *et al* (2) and Hijazi *et al* (18) have not

determined a significant association of mother's educational level (2) or parental educational level (18) with asthma and current wheeze in their offspring. Also, recently published longitudinal study of 980 individuals followed up from the age of 3 years to the age of 26 years reported no consistent association between childhood or adult SES and asthma prevalence, lung function or airway responsiveness at any age. Occupation based on the educational level and income as measures of SES were used (1).

Our results of a positive association between SES and ever-diagnosed asthma are in consent with the results of Poyser *et al* (4) who, using the same ISAAC questionnaires in the same age group of children from Cape Town, South Africa have found that the least socioeconomically deprived pupils have reported higher prevalence of ever-diagnosed asthma and recent wheeze. In contrast, the most socioeconomically deprived pupils have reported higher asthma-symptom occurrence monthly. A local index of socioeconomic deprivation, based on household income, parental education, unemployment, overcrowding and welfare was used. The more frequent respiratory infections associated with crowded homes, lower parental educational level, under-recognition and consequent under treatment of asthma, poor medical care and compliance in low SES groups might be the explanations of such an association between severity of asthma and poverty (16).

Contrary, Litonjua *et al* (5) have reported that the lower total family income, lower parental educational level and residence in high poverty areas have been all associated with an increased risk for asthma in subjects from the Boston, Massachusetts's area. As well, Lindbæk *et al* (19) have found more than three episodes of fever during the last year and low number of rooms in the home to be significantly associated with doctor-confirmed asthma in the investigated group of 4-5-year-old children in Norway.

A relationship between eczema and the investigated measures of SES was not established in our study as in the study of Suárez-Varela *et al* (3). Mercer *et al* (8), in a study with the same methodology and on the same group of respondents as Poyser *et al* (4), have found a positive association between SES and ever-diagnosed eczema only. Additionally, in an ecological analysis using ISAAC Phase One data a significant positive association between gross national product per capita and eczema being of only moderate strength has been detected (9).

There may be several explanations for all these

conflicting findings, including the methodology of the studies. SES has been measured in a variety of ways in the studies published. There is a possibility of information and diagnostic bias between socioeconomic groups (4). The nature and intensity of poverty differ between societies. It is possible that SES interacts with specific environmental factors and has different effects on asthma and eczema prevalence in different populations (1). Rona (16) in his review about asthma and poverty has considered a possibility of historical perspective related to their association.

The usage of the standardized ISAAC questionnaires and protocol, a large sample of children investigated and a high response rate are all advantages of the present study. However, the study has several potential limitations. Like in other questionnaire-based studies there is a possibility of information bias. Better-educated and more informed parents and children with superior access to medical care may adopt the diagnosis of asthma earlier, accounting for its apparently higher prevalence among higher social classes (4). Although several studies in adolescents have demonstrated a low correlation between self-reported and measured height and weight (20, 21), highly correlated self-reported and measured weights, heights and body mass indexes in Mexican-American adolescents (22) and in a large sample of American teenagers (23) have been reported, with a conclusion that studies can use self-reported height and weight to understand teen obesity and its correlates/sequelae. Furthermore, most asthma epidemiological studies have used data obtained from written questionnaires. ISAAC written questionnaire is a standardized and validated questionnaire to be completed by young adolescents or parents of 6-7 year old children (24). As Macedonia has not its own reference curves, the WHO cut off points for BMI for underweight and International ones for overweight and obesity were used, which may differ from the real ones in our country. Data regarding the families' income, parental occupation and employment were lacking in the ISAAC environmental questionnaire and we have used the available data related to SES from the questionnaire as its measures.

In conclusion, the findings of this questionnaire-based study in young adolescents in FYROM, as a developing country with relatively low asthma prevalence, support the hypothesis in which factors associated with higher standard of living such as overweight and small families increase asthma. The latter finding

contributes to the preventive effect of infections on the development of asthma as the proposed explanation of the positive association between socioeconomic status and allergic diseases *i.e.* supports the controversial hygiene hypothesis as well. Socioeconomic status was not found to be associated with asthma severity nor with eczema.

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