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Childhood asthma in Batumi, Georgia: Prevalence and environmental correlates

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ABSTRACT

Objective: A relative lack of data for Eastern Europe and unknown epidemiology of childhood asthma in Batumi (Georgia) justified a study aimed at determining the prevalence of physician-diagnosed asthma and related respiratory conditions, a comparison of the prevalence of these conditions between urban and rural children, and identification of their environmental correlates. **Methods:** Subjects of the cross-sectional population-based study were 3238 urban and 2081 rural children aged 5–17 years whose respiratory status was assessed using the ISAAC questionnaire. **Results:** The overall prevalence of asthma was larger in rural children than in urban children (2.8% vs. 1.8%, respectively; $p = 0.01$). Spastic bronchitis occurred with similar frequency in urban (7.8%) and rural children (6.5%). Compared with urban children, rural subjects had dry cough at night (13.1 vs 8.2%, $p < 0.001$) and attacks of dyspnea (4.7 vs 2.4%, $p < 0.001$) more often. The prevalence of other symptoms did not differ significantly between urban and rural subjects. Results of multivariate analyses showed that both asthma and spastic bronchitis were associated ($p < 0.05$) with parental history of asthma, dampness in the house, and poor financial standing of the family. In addition, asthma was related to coal/wood-based heating whereas spastic bronchitis was associated with passive smoking and lower parental education. **Conclusions:** The findings show a low prevalence of ever-diagnosed asthma in the examined population. Nosological tradition and similar correlates of asthma and spastic bronchitis suggest that some cases of asthma might be included in the diagnostic category of spastic bronchitis.

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Introduction

There is geographic variation in asthma prevalence throughout the world with higher prevalence observed in Westernized nations [1]. However, even within more localized regions such as Eastern Europe, asthma prevalence can vary [2,3]. In addition, there has been evidence of increasing asthma prevalence in regions of previously low asthma prevalence [4,5]. Given that asthma has huge burden implications for the individual and society, assessment of the disease at the local level is important as it can aid in health care planning and etiologic investigation, especially if the burden of disease has the potential to rise within a region. In addition to international geographic variation in asthma prevalence, differences in asthma prevalence between urban and rural children have been reported with generally lower prevalence in rural or farming children [6,7].

Geographic variation is known to be associated with differences in the environment and socioeconomic status. Environmental factors involved in the etiopathogenesis of

childhood asthma, including exposure to aeroallergens, tobacco smoke and lifestyle factors, as well as viral infections vary according to climatic condition and socioeconomic standing of the populations [1,4,5,8–10]. From this perspective, the results of Europe-wide comparative studies should add to the body of knowledge regarding of environmental influences in childhood asthma. A large number of epidemiological findings have provided a good description of the problem in Western Europe but less is known regarding Eastern Europe.

Recently performed respiratory health surveys in ex-Soviet Republics revealed a low prevalence of the disease (less than 2.5%) [3]. However, there is a paucity of data on childhood asthma from the Republic of Georgia. As part of the International Study of Asthma and Allergies in Children (ISAAC) studies, it was found that while the prevalence of asthma was relatively low in two large urban centers, the capital city (Tbilisi) and the second largest city (Kutaisi), there was an increase in asthma prevalence between 1996 and 2003 but only within Tbilisi [11,12].

The authors noted that the differences could be due to the increased urbanization and Westernization of Tbilisi but no sound evidence supported that claim [13].

The factors mentioned above are of potential importance to the epidemiology of childhood asthma in another large Georgian center: Batumi (the capital of Adjara, an autonomous republic in southwest Georgia). This city, with a population of 150,000, is situated on the Black Sea. Its climatic conditions, with a high relative humidity between 70%-80%, are related to its seaside location in a subtropical zone. The city is surrounded by well-developed agricultural areas. As a result children's exposure to moulds and house dust mites may play an important role in childhood asthma etiology. However, no data on the epidemiology of children's respiratory disorders are available for Batumi and the surrounding area nor has an investigation of the rural-urban differences in asthma prevalence within the country of Georgia been completed. An investigation within this region would allow further assessment into childhood asthma in Georgia and the first investigation of asthma in a rural region of the country providing insight into urban-rural differences in the occurrence of childhood asthma.

Urbanization and Westernization have been suggested as one reason for the patterns of asthma in Georgia [12,13] while other reasons for geographic differences could be environmental. Another explanation is that of diagnostic labeling differences. This has been a suggested explanation of the low estimates of childhood asthma prevalence in Eastern Europe where a traditional term 'spastic or asthmatic bronchitis' is not infrequently used as a substitute for the diagnosis of asthma. This diagnostic label has persisted through nosologic tradition. Not infrequently, spastic or asthmatic bronchitis is diagnosed in children with a chronic noninflammatory condition characterized by recurrent cough, episodes of chest wheeze and attacks of dyspnea. Although not focused specifically on spastic bronchitis, a study from Poland based on specialist assessment and objective tests found underdiagnosis of asthma [14].

The same diagnostic preference could be responsible for the low occurrence of questionnaire-derived asthma in Georgian children yet this has not been studied to date. To investigate this explanation and expand on the previous research conducted in Georgia, we analyzed data obtained from a cross-sectional study of urban and rural areas in the Batumi region that were not included in the earlier ISAAC surveys. The objective of our study was to 1) determine the prevalence of physician-diagnosed asthma and related respiratory conditions; 2) compare the prevalence of these conditions between urban and rural children; 3) identify environmental correlates of the conditions.

Methods

Study design and population

The study was performed as a population-based cross-sectional respiratory health survey in urban and rural children of the Batumi region, Georgia. All children aged 5–17 years attending 6 randomly selected out of 54 primary schools in the urban region (total number of students: 26746) and 10 randomly selected out of 82 primary schools in the rural region (total number of students: 18564) were invited to participate. The urban region was defined by the location of a school within the Batumi city administrative limits and the rural region was defined by the location of a school in a village. Completed questionnaires were received from 3238 urban and 2081 rural children resulting in a participation rate that was larger in the urban than in rural region (91.2% vs 72.8%). The study protocol was approved by a local Ethics Committee at the Batumi Shota Rustaveli State University.

Survey and operational definitions

Respiratory status of the children was assessed using questions from the ISAAC questionnaire, previously used in Georgia [11]. Respiratory conditions and symptoms of interest included diagnoses of asthma and spastic bronchitis diagnosed in the past, as well as asthma symptoms occurring outside of infections (chronic cough, chest wheeze in the last year, attacks of dyspnea in the last year, shortness of breath after exercise). The primary outcome variable (asthma) was based on the question: "Has a doctor ever diagnosed asthma in this child?" Similarly, spastic bronchitis was identified by the answer to the question: "Has a doctor ever diagnosed spastic bronchitis in this child?"

Statistical analyses

Initially, we describe the population in terms of socio-demographic, personal, and environmental characteristics using frequencies (proportions) and means (standard deviations) as appropriate. Differences between those in the rural and urban areas were assessed using a *t*-test (means) and chi-squared test (proportions). Descriptive results were also stratified by sex given the importance of sex in the prevalence and development of asthma. Comparisons in the prevalence of respiratory conditions and symptoms were then made between urban and rural dwellers using the independent samples chi-squared tests and stratified by sex.

Explanatory variables of asthma and spastic bronchitis were examined using multivariable logistic regression

Table 1. Environmental characteristics of urban and rural children living in the Batumi region (Georgia), overall and by sex.

	Urban Children (n = 3238) n (%)			Rural Children (n = 2081) n (%)			P value ^a
	Boys ^b	Girls ^b	Total	Boys ^b	Girls ^b	Total	
Good financial standing of family	575 (37.8%)	622 (36.1%)	1197 (36.9%)	373 (38.1%)	420 (38.0%)	793 (38.1%)	0.3
Above secondary school (both parents)	726 (47.7%)	860 (50.0%)	1653 (51.0%)	232 (23.7%)	240 (21.7%)	472 (22.6%)	< 0.001
Dampness in the house	328 (21.5%)	335 (19.4%)	663 (20.4%)	232 (23.7%)	262 (23.6%)	494 (23.7%)	0.004
Coal/wood-based heating	553 (36.3%)	608 (35.3%)	1161 (35.8%)	679 (69.4%)	788 (71.4%)	1467 (70.4%)	< 0.001
Pets (dog/cat) at home	264 (17.3%)	313 (18.2%)	577 (17.8%)	426 (43.5%)	478 (43.3%)	904 (43.4%)	< 0.001
Contact with farm animals	217 (14.2%)	270 (15.7%)	487 (15.0%)	292 (29.8%)	303 (27.4%)	595 (28.5%)	< 0.001
Exposure to tobacco smoke at home	828 (54.5%)	926 (53.8%)	1754 (54.1%)	610 (62.3%)	669 (60.5%)	1279 (61.4%)	< 0.001

Note. ^aUrban-rural difference (total vs total) assessed by chi-squared test. ^bNo statistically significant differences ($p > 0.05$) between boys and girls (each variable, both locations).

to adjust for potential confounders. Based on the published evidence regarding potential risk factors and availability of data, the following set of independent variables was selected for the final adjusted model: age, sex, residential area (urban/rural), family financial standing (self-assessed as good or poor), parental education (secondary or university/otherwise), pets at home (yes/no), dampness in house (yes/no), type of fuel for heating (coal or wood/other), exposure to farm animals (yes/no), exposure to tobacco smoke at home (yes/no), history of asthma in mother or father (yes/no), history of chronic bronchitis in mother or father (yes/no) and history of any allergic disease in mother or father (yes/no). Parametrization of the model was performed after analysis of potential collinearity. Statistical inference was based on criterion $p < 0.05$ (simple and multivariate analyses).

Results

The mean age of urban children was lower compared to rural children (9.5 ± 2.5 years vs. 11.0 ± 2.1 years, respectively; $p < 0.0001$). Boys constituted 47% of subjects and the sex composition was similar in both areas ($p = 0.9$). Both in urban and in rural populations, boys and girls did not differ in terms of age distribution ($p = 0.5$, $p = 0.3$, respectively).

Tables 1 and 2 describe the study group in terms of basic environmental and family related-characteristics.

Compared with rural children, urban children had better educated parents and were less likely to live in damp houses. Compared with urban children, rural children were more likely to have contact with animals, exposure to tobacco smoke at home, and to live in houses heated by combustion of coal or wood. However, the prevalence of a family history of asthma and allergic conditions did not differ between urban and rural dwellers except for any allergy in the mother or father. In both locations boys and girls did not differ in term of the examined characteristics.

Among boys, rural subjects had more parents with lower education, more frequently lived in houses heated by coal/wood, more frequently had pets and contact with farm animals, and more frequently were exposed to tobacco smoke at home – all mentioned differences were statistically significant ($p < 0.0001$). Urban and rural boys did not differ in terms of parental history of asthma and allergic diseases ($p > 0.05$). Compared with urban girls, rural girls were more likely to have parents with lower education ($p < 0.0001$), lived more often in damp houses ($p = 0.006$) heated with coal/wood ($p < 0.0001$) and had more frequent contact with pets and farm animals ($p < 0.0001$), and with tobacco smoke at home ($p = 0.0004$). Urban and rural boys as well as urban girls and rural girls did not differ in terms of parental history of asthma and allergic diseases ($p > 0.05$).

Table 3 shows the occurrence of asthma and spastic bronchitis diagnosed by a physician as well as the

Table 2. Parental history of asthma and allergic diseases in urban and rural children living in the Batumi region (Georgia), overall and by sex.

	Urban Children (n = 3238) n (%)			Rural Children (n = 2081) n (%)			P value ^a
	Boys ^b	Girls ^b	Total	Boys ^b	Girls ^b	Total	
Chronic bronchitis in mother or father	51 (3.3%)	61 (3.5%)	112 (3.4%)	34 (3.4%)	27 (2.4%)	61 (2.9%)	0.2
Asthma in mother or father	9 (0.5%)	17 (0.9%)	26 (0.8%)	8 (0.8%)	8 (0.7%)	16 (0.7%)	0.8
Hay fever in mother or father	55 (3.6%)	57 (3.3%)	112 (3.4%)	48 (4.9%)	37 (3.3%)	85 (4.0%)	0.2
Eczema in mother or father	12 (0.7%)	26 (1.5%)	38 (1.1%)	14 (1.4%)	10 (0.9%)	24 (1.1%)	0.9
Any allergy in mother or father	145 (9.5%)	170 (9.8%)	315 (9.7%)	84 (8.5%)	85 (7.7%)	169 (8.1%)	0.04

Note. ^aUrban-rural difference (total vs total) assessed by chi-squared test. ^bNo statistically significant differences ($p > 0.05$) between boys and girls (each variable, both locations).

Table 3. Prevalence of physician diagnosed asthma, spastic bronchitis and respiratory symptoms in children of the Batumi region (Georgia), by location of dwelling and sex.

Disease	Urban Children <i>N</i> = 3238 <i>n</i> (%)			Rural Children <i>N</i> = 2081 <i>n</i> (%)			<i>p</i> value ^a
	Boys ^b	Girls ^b	Total	Boys ^c	Girls ^c	Total	
Asthma	19 (1.2%)	40 (2.3%)	59 (1.8%)	32 (3.2%)	28 (2.5%)	60 (2.8%)	0.01
Spastic bronchitis	101 (6.6%)	152 (8.8%)	253 (7.8%)	69 (7.0%)	68 (6.1%)	137 (6.5%)	0.09
Cough at night	128 (8.4%)	140 (8.1%)	268 (8.2%)	134 (13.7%)	139 (12.6%)	273 (13.1%)	<0.001
Productive cough (phlegm/mucus)	77 (5.0%)	111 (6.4%)	188 (5.8%)	62 (6.3%)	66 (5.9%)	128 (6.1%)	0.6
Chest wheezing	51 (3.3%)	64 (3.7%)	115 (3.5%)	32 (3.2%)	31 (2.8%)	63 (3.0%)	0.3
Attacks of dyspnea	29 (1.9%)	51 (2.9%)	80 (2.4%)	44 (4.5%)	54 (4.9%)	98 (4.7%)	<0.001
Exercise-induced shortness of breath	25 (1.6%)	46 (2.6%)	71 (2.1%)	35 (3.5%)	28 (2.5%)	63 (3.0%)	0.05

Note. ^aUrban-rural difference (total vs total) assessed by chi-squared test. ^bStatistically significant 'boys-girls' difference ($p < 0.05$) for asthma and spastic bronchitis. ^cNo statistically significant differences ($p > 0.05$) between boys and girls (each variable).

occurrence of respiratory symptoms. The overall prevalence of asthma was larger in rural children than in urban children (2.8% vs. 1.8%, respectively; $p = 0.01$). Asthma was more frequent ($p = 0.02$) in urban girls compared to urban boys whereas the opposite sex-related difference was not statistically significant in rural children. However, rural boys were more frequently diagnosed for asthma than urban boys ($p = 0.0005$).

Spastic bronchitis occurred with similar frequency in urban and rural children but in urban subjects it was more frequent in girls than in boys ($p = 0.02$) and among girls it was more frequent in the urban than in the rural population ($p = 0.009$). Compared with urban children, dry cough at night in the last 12 months was more frequent in rural children ($p < 0.001$) and a similar direction of difference was found in relation to attacks of dyspnea ($p < 0.001$). However, compared with urban boys, rural boys had more prevalent physician diagnosed asthma ($p = 0.0005$) and more symptoms of cough at night ($p < 0.0001$), attacks of dyspnea ($p = 0.0002$) and exercise-induced shortness of breath ($p = 0.002$). Among girls, rural subjects had less frequent diagnoses of spastic bronchitis ($p = 0.009$), more frequent cough at night ($p = 0.0001$) and attacks of dyspnea ($p = 0.008$) than urban girls. Other differences were not statistically significant.

Host and environmental correlates of the diseases diagnosed in children (asthma, spastic bronchitis) were assessed using multivariate logistic regression. Contact with farm animals was associated ($p < 0.0001$) with residential area, exposure to tobacco smoke and parental education. As such, this variable ('farm animals') was not used in the model in order to avoid co-linearity. All variables expressing a parental history of asthma, chronic bronchitis, hay fever, eczema and any allergy diagnosed in parents were correlated with each other ($p < 0.0001$). Because of this, the tested model included only parental asthma as the explanatory variable reflecting history of allergic disorders in parents.

Table 4 shows the results of multivariate analysis. Both asthma and spastic bronchitis in children were associated ($p < 0.05$) with parental history of asthma, dampness in the house, poor financial standing of family. In addition, asthma was related to coal/wood-based heating, whereas spastic bronchitis was associated with exposure to tobacco smoke at home and lower parental education. With the exception of parental education and the use of coal or wood for heating, the interpretations of the results would be similar for the outcome of asthma and spastic bronchitis.

Although a parental history of asthma was associated with both asthma and spastic bronchitis, it was much stronger for the outcome of asthma. When the models with asthma and spastic bronchitis as dependent variables included parental history of chronic bronchitis instead of parental asthma among explanatory variables, all statistical conclusions were the same but the effect of parental chronic bronchitis was larger compared to the effect of parental asthma (effect of parental chronic bronchitis on asthma in children: OR = 7.82, 95%CI: 4.51–13.60; effect of parental chronic bronchitis on spastic bronchitis in children: OR = 4.73, 95%CI: 3.26–6.92). Similar statistical conclusions were obtained with any parental allergy

Table 4. Host-related and environmental correlates of physician diagnosed asthma and spastic bronchitis in children of the Batumi region (Georgia)^a.

Explanatory Variable	Asthma OR [95%CI]	Spastic Bronchitis OR [95%CI]
Sex	0.80 [0.55,1.17]	0.85 [0.69,1.05]
Age	0.97 [0.90,1.05]	0.93 [0.89,0.97]
Rural residence	1.46 [0.94,2.25]	1.06 [0.82,1.37]
Poor financial status of family	1.50 [0.99,2.28]	1.51 [1.19,1.87]
Lower education of parents	1.00 [0.66,1.52]	1.51 [1.20,1.82]
Dampness in the house	1.52 [1.03,2.27]	1.32 [1.05,1.70]
Coal/wood used for heating	1.57 [1.04,2.36]	1.00 [0.80,1.26]
Contact with pets at home	0.74 [0.48,1.16]	0.97 [0.75,1.25]
Exposure to tobacco smoke	1.39 [0.77,1.66]	1.31 [1.06,1.63]
Asthma in parents	6.92 [3.28,14.61]	3.20 [1.74,5.90]

Note. ^a Results of multivariable analysis; ORs adjusted for each of the variables in the table.

among explanatory variables of childhood asthma and of spastic bronchitis.

Discussion

The results of this large cross-sectional survey show a low prevalence of childhood asthma in Batumi, Georgia, 1.8% in urban and 2.8% in rural children aged 5–17 years. In our study, asthma was related to factors that have been previously described in the literature. In addition to this, the predictors of asthma and spastic bronchitis were, in general, similar in strength of association and interpretation.

The obtained prevalence of asthma can be compared with the figures recently obtained in Belarus (1.5% and 1.4% in urban and rural children) and Ukraine (1.4% and 2.1% in urban and rural children) [3]. In 2003 two urban populations of children in Georgia (Tbilisi and Kutaisi) were included in the ISAAC project [12]. These studies showed that asthma was diagnosed in 4.1% of children aged 13–14 years. The latter figure is close to that recently obtained in Poland, showing asthma in 4.1% of urban and 3.5% of rural children [3]. Larger estimates of asthma prevalence in Tbilisi and Kutaisi than in urban centers of Belarus and Ukraine could reflect difference in population-specific risk factors but the impact of nosologic preferences as well as differences in access to diagnostic infrastructure must also be taken into account.

Our results did not confirm, in a convincing way, a sex-related difference in the occurrence of ever-diagnosed childhood asthma, that is one of the key characteristics of the pediatric asthma phenotype [15,16]. Moreover no apparent sex-related effects were found in the case of ever-diagnosed spastic bronchitis. However, lack of a sex difference in childhood asthma has been observed previously in Eastern Europe [17]. These findings are not easy to interpret especially that in a multivariable analysis sex was no longer an explanatory variable for asthma and spastic bronchitis.

Lack of a convincing sex difference may be due to the age group of the study population (5–17 years). Given that the gender reversal for asthma prevalence typically occurs in the early to mid teens, inclusion of adolescents may have diluted this effect. An alternate explanation could be differential response to environmental exposures. It has been previously observed that females may respond differently to environmental stimuli [18–20]. In addition to this, while personal factors (history of allergy, family history of asthma) are generally consistent risk factors for asthma, associations with environmental exposures can vary by region and that these can also vary by sex. Regardless, it is of interest that both respiratory diseases,

asthma and spastic bronchitis, follow the same pattern of distribution among boys and girls in urban and rural populations.

The lifetime prevalence of childhood asthma is characterized by large between-population variation [1]. In Europe, one of the most intriguing findings is an apparent East-to-West difference in asthma prevalence. In recent years its magnitude has diminished mostly due to an increase in prevalence of childhood asthma in some Eastern European countries [5,21]. The latter effect is discussed in terms of changing lifestyle and environmental factors [22]. However because of the questionnaire-derived source of data, the impact of improved diagnostic measures and changing nosologic practices (“diagnostic labeling”) resulting in variability in the labeling of asthma among pediatricians cannot be excluded [23]. Both issues deserve more attention and above all there is a need for continuing Europe-wide monitoring of asthma prevalence in children, as recommended in a European Respiratory Society European Lung White Book [24].

Another pertinent finding of our study was a relatively large prevalence of ever-diagnosed spastic bronchitis (7.8% in urban and 6.5% in rural children). The figure can be compared with analogous findings recently obtained in Belarus (7.9% and 6.4%, respectively) and Ukraine (6.5% and 7.5%, respectively) [3]. The low prevalence of childhood asthma along with the high prevalence of spastic bronchitis can reflect ‘underdiagnosis’ of the disease. It could reflect so called labeling effect linked with region-specific diagnostic practices, also discussed by others [5,23].

Similar conclusions were put forward in the case of earlier studies of childhood asthma performed in various populations [25–27]. It cannot be excluded that in Eastern European countries some children with overt asthma are included in the diagnostic category of spastic bronchitis [14,28,29]. Compared to Western European nations [1,5,20], the prevalence of asthma in Batumi is low. It is similar to the prevalence found in Ukraine and Belarus from the BUPAS study, a previous Eastern European study, yet lower than that found in Poland from the same study [3].

Reasons for the variation in prevalence could be due to environmental differences, which can vary by region. However, multiple risk factors that would be expected to increase asthma prevalence were higher in Batumi than observed in the BUPAS study. Also, after statistical adjustment for environmental and personal correlates, there was still an increased risk of asthma and reduced risk of spastic bronchitis in Poland compared to the other regions thus it is unlikely that the environment alone is explaining the

differences in prevalence. This leads us to consider the potential of asthma underdiagnosis.

Diagnostic difficulties, especially in the case of pediatric asthma, are well known – not only ‘underdiagnosis’ but also the issue of ‘overdiagnosis’ are dealt with in some publications. Indeed, because of insufficient knowledge of the diagnostic criteria of asthma among pediatricians in Georgia and/or because of a will to avoid “stigmatization” of children such an interpretation seems justified. Moreover, in this country, a restricted access to public specialized health services is likely to hamper case assessment procedures that are necessary to complete diagnosis of asthma. These facts along with previous evidence from the literature, the apparent inverse association between asthma and spastic bronchitis prevalence, and common risk factors suggest the presence of asthma underdiagnosis.

Moreover, such a suspicion is supported by the finding that not parental asthma but chronic bronchitis in parents was a strong explanatory factor for both diseases in children. Perhaps some parents with a past diagnosis of chronic bronchitis may have been actually cases of asthma (our questionnaire did not ask about spastic bronchitis in parents).

There are some limitations to consider with this research. First, the most important limitations result from the cross-sectional design of the study. This limits the causal interpretations, especially due to the lack of temporality assessment. However, as one of the primary objectives of this study was to assess the prevalence of asthma and related conditions, the cross-sectional study design was an appropriate design to use. The association analyses in this study were used to complement the interpretations obtained from the prevalence investigation. Second, the prevalence of asthma was based on self-report. This could result in some recall issues. Despite this, in large epidemiological studies, this is considered the method of choice to assess asthma prevalence as it has acceptable accuracy and maximizes practicality. We also used survey questions based on standardized and validated questionnaires.

Although there were some limitations, our study had several strengths. We had a high participation rate with a large sample size allowing for increased validity of prevalence estimates and generalizability. In addition to this, we used standardized questionnaires allowing comparisons to other studies in the region and internationally. Finally, we were able to expand on previous Georgian studies by going beyond univariate analyses and investigating urban-rural differences in a previously unstudied region.

Conclusions

In conclusion our study provides, for the first time, standard epidemiological assessment of the occurrence of

childhood asthma in Batumi region, Georgia. Diagnoses of asthma in this region are not frequent. A larger prevalence of diagnosed spastic bronchitis along with similar host and environmental correlates of both asthma and spastic bronchitis suggest that the latter condition may include some overt cases of asthma. It is probable that the questionnaire-based assessment of the prevalence of childhood asthma in the examined region is likely to result in underdiagnosis of the disease. Such a suspicion should be verified by investigations into clinical presentation of asthma in subjects with diagnosis of spastic bronchitis. At the same time this suspicion should stimulate the promotion of current diagnostic standards of respiratory medicine among physicians in the region. Epidemiological evidence on asthma prevalence provided by our study can form a baseline for follow-up studies addressing long-term time trends in childhood asthma in the region, also in relation to changing nosologic practices.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing the article.

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