

ARTICLE ORIGINAL/ORIGINAL ARTICLE  
**ASTHMA, ALLERGIC RHINITIS AND ECZEMA  
IN 13-14-YEAR-OLD SCHOOLCHILDREN ACROSS LEBANON**

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**ABSTRACT • INTRODUCTION :** Childhood asthma is one of the most important diseases of childhood. There is no known prevalence of asthma and allergic diseases in Lebanon. This study was conducted with a primary objective of finding the prevalence of asthma, allergic rhinitis and eczema in Lebanese children.

**MATERIAL AND METHODS :** It is a descriptive cross-sectional study on children in Lebanese public and private schools. A sample of 22 schools participated in the study, where standardized ISAAC written core questionnaires were distributed. 13-14-year-old students filled in the questionnaires in class.

**RESULTS :** 1613 individuals were analyzed. The prevalence of diagnosed asthma (5.6%) is the lowest in Lebanon compared to the eastern Mediterranean countries. Prevalence of • ever wheezing (21.4%) • last 12 months wheezing (19.9%) • wheezing on effort (12.7%) • night cough (22.8%) • allergic rhinitis (32.7%) and • eczema (11.5%) is on the medium prevalence trend noted all over the world, referring to ISAAC study. It also showed marked variations and differences across the governates in Lebanon, the lowest prevalence of diagnosed asthma (1.9%) but the highest prevalence of asthma symptoms like ever wheezing being in the Bekaa governate (26.8%).

**CONCLUSION :** Undiagnosed asthma, rhinitis and eczema have medium prevalence in Lebanon. Differences exist between Lebanese governates. Further studies are needed to understand the environmental, climate and socioeconomic causes of these discrepancies.

## INTRODUCTION

Childhood asthma is one of the most important diseases of childhood, causing substantial morbidity [1-2]. Trends in routine data are difficult to interpret because

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Waked M, Salameh P. Prévalence au Liban de l'asthme, de la rhinite allergique et de l'eczéma chez les écoliers de 13-14 ans. *J Med Liban* 2006 ; 54 (4) : 181-190.

**RESUME • INTRODUCTION :** L'asthme est une des pathologies les plus fréquentes chez l'enfant. La prévalence de l'asthme et des maladies allergiques reste inconnue au Liban. Cette étude a pour objectif primaire de trouver la prévalence de l'asthme, de la rhinite allergique et de l'eczéma chez les enfants libanais.

**MÉTHODES :** C'est une étude descriptive transversale chez les enfants libanais dans les écoles publiques et privées. Vingt-deux écoles ont participé à cette étude. Des questionnaires standardisés type ISAAC ont été remplis par les écoliers de 13-14 ans.

**RÉSULTATS :** 1613 individus ont été analysés ; la prévalence de l'asthme diagnostiqué (5,6%) est la plus basse comparée aux pays méditerranéens orientaux. La prévalence des symptômes évocateurs d'asthme tels les sifflements survenus au moins une fois dans la vie (21,4%), durant les 12 derniers mois (19,9%), ou à l'effort (12,7%); la toux nocturne (22,8%) ; la rhinite allergique (32,7%) et l'eczéma (11,5%) était dans les chiffres de prévalence moyenne notée dans le monde par l'étude ISAAC. Ils varient cependant entre les différents cas. La prévalence la plus basse d'asthme diagnostiqué par le médecin (1,9%) mais aussi la plus haute prévalence de sifflements dans la vie (26,8%) étaient notées dans la Békaa.

**CONCLUSION :** L'asthme non diagnostiqué, la rhinite allergique et l'eczéma ont une prévalence moyenne au Liban. Des différences existent entre les cas libanais. Des études complémentaires sont nécessaires pour comprendre le rôle de l'environnement, du climat et du niveau socioéconomique dans cette différence.

not all wheezy children receive a diagnosis of asthma, and the proportion that do, has increased substantially over recent decades [3]. Whilst genetic factors predispose to asthma, studies suggest that there is risk of asthma associated with the environment or lifestyle of an industrialized society [4-5].

There are no widely criteria for diagnosis or classification of rhinitis and surprisingly little is known about its prevalence or distribution among children [1-2]. Little is also known about the epidemiology of atopic eczema. There are currently no internationally accepted criteria for defining atopic eczema in epidemiologic surveys [1,-2].

Asthma prevalence in Lebanon is unknown. The

**TABLE I**  
GOVERNATES DISTRIBUTION OF ASTHMA STATUS AND RESPIRATORY SYMPTOMS

Disease status	PDA <sup>a</sup>	<i>p-value</i>	Allergic rhinitis	<i>p-value</i>	Atopic eczema	<i>p-value</i>	Total N (100%)
<b>GOVERNATE</b>							
Bekaa	4 (1.9%)	<i>0.04</i>	83 (39.2%)	<i>0.008</i>	38 (17.8%)	<i>0.003</i>	214
Beirut	11 (7.0%)		44 (27.8%)		10 (6.4%)		157
Mount Lebanon	35 (5.4%)		199 (30.5%)		65 (10.1%)		654
El Nabatieh	6 (6.4%)		27 (29.0%)		12 (12.9%)		94
North Lebanon	22 (6.7%)		127 (39.1%)		45 (13.9%)		327
South Lebanon	8 (4.8%)		46 (27.5%)		13 (7.8%)		167
<b>GEOGRAPHY</b>							
Sea coast	59 (6.2%)	<i>0.01</i>	290 (30.5%)	<i>0.007</i>	100 (10.6%)	<i>0.006</i>	955
Mountain	21 (5.4%)		129 (32.9%)		38 (9.7%)		393
Flat country	6 (2.3%)		107 (40.7%)		45 (17.1%)		265
<b>SCHOOL TYPE</b>							
Private	51 (5.2%)	<i>0.28</i>	321 (32.9%)	<i>0.87</i>	116 (12.0%)	<i>0.43</i>	980
Public	35 (5.5%)		205 (32.5%)		67 (10.7%)		634
<b>SEX</b>							
Males	55 (6.6%)	<i>0.005</i>	265 (32.0%)	<i>0.55</i>	84 (10.2%)	<i>0.10</i>	834
Females	31 (4.0%)		260 (33.4%)		99 (12.8%)		779
<b>Weighted<sup>b</sup></b>	<b>86</b>		<b>526</b>		<b>183</b>		<b>1613</b>
<b>prevalence</b>	<b>(5.3%)</b>		<b>(32.7%)</b>		<b>(11.5%)</b>		
<b>95% CI</b>	<b>[4.6-6.0]</b>		<b>[30.4%-35.0]</b>		<b>[9.9-13.1]</b>		

a : PDA = Physician diagnosed asthma    b : Weighting was performed according to population distribution by age group, sex and governate in Lebanon by the Central Administration of Statistics [9].

International Study of Asthma and Allergies in Childhood (ISAAC) has been developed to provide an accepted method of measuring the prevalence and other atopic diseases in children [1-2, 6]. An application of the ISAAC has been performed in 1998 on schoolchildren in Beirut, aged 12 to 14 years [7]. It reported a prevalence of 11.9% for asthma in Beirut. However, these results cannot be extrapolated to all Lebanese children. Asthma is also one of the most common chronic diseases treated in primary health care in Lebanon (2% in 1993) [8].

Our study had a primary objective of finding the prevalence of asthma, allergic rhinitis and eczema in Lebanese children aged 13 to 14 years old, and to compare the results with those of other countries in the region and the world.

## METHODS

### Study design

Our study is a descriptive cross-sectional study applied on school children in Lebanon. The dependent variables are physician-diagnosed asthma (PDA), asthma symptoms such as : wheezing ever, last 12 months wheezing, wheezing on exercise, and night cough without physician diagnosis ; allergic rhinitis and atopic eczema ; and also chronic productive cough ever, 12 months chronic cough.

Independent variables are school type, sex, dwelling governate and geography.

### Sampling methods

Since there is no available sampling frame of individuals in Lebanon, the sampling unit was a cluster of individuals : a school. Thirty schools were randomly selected from a list of schools provided by the Ministry of Education ; this number was chosen to allow for 6000 questionnaires to be distributed if we were to obtain a 66.7% response rate of schools. A permission of the Ministry of Education permitted an easy access to public schools, while private ones were free to participate or not. Contacts were made with the schools' directors to explain the objective of the study and its procedure.

Thirteen public schools were contacted : one in Beirut ; 2 in South Lebanon ; one in Nabatieh ; 3 in Mount Lebanon ; 5 in North Lebanon ; one in Bekaa. For private schools, 17 were contacted : 6 in Beirut ; 6 in Mount Lebanon ; 2 in North Lebanon ; one in Nabatieh ; 2 in Bekaa. Eight schools (1 public and 7 private) refused to participate, while 22 out of 30 (73.3%) agreed to distribute the questionnaires to their students. The study was carried out during the month of May 2005.

Standardized questionnaires were distributed to children aged 13 to 14 years who would fill the questionnaire at school, supervised by the enquirer. Absent students were given the questionnaire later on and returned to the school director. A 100% response rate was obtained because children filled the questionnaires on the spot. Inquirers were instructed not to interfere with students during data collection.

## Variables

Questions from the standardized International Study of Asthma and Allergies in Childhood (ISAAC) written core questionnaire were used, after translation into Arabic and back translation into English to ensure questions accuracy [1].

For dependent variables, PDA was assessed by the answer to the question : *“Has your doctor ever said you had asthma ?”* Rhinitis was assessed by the question : *“Have you ever had a problem with sneezing, or a runny or blocked nose when you did not have cold ?”* As for eczema, it was considered positive if the individual answered yes to one of the following questions : *“Have you ever had eczema ?”* or *“Have you ever had an itchy rash on the folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears or eyes ?”*

Questions regarding wheezing, night cough without having a cold were also asked according to the ISAAC questionnaire [1]. Questions about chronic productive cough considered not specific for asthma but more of chronic bronchitis were added : chronic productive cough ever and 12-month productive cough [10]. Regions of residence were classified according to official distribution in governates, and according to their geographical location on the seacoast, the mountain or flat country.

## Statistical analysis

Questionnaires were coded and data introduced on Statistical Package for Social Sciences (SPSS) software, version 12.0, by independent lay persons. Data entry was then controlled twice, and data analysis was performed by the same SPSS software. Missing data were overall inferior to 3% for all variables, even in subgroups. In accordance with ISAAC guidelines [1], missing values were not replaced and were included in the denominators for the univariate analysis ; this generated sums of actual percentages slightly lower than 100% in some tables. Before analysis, a weighting of cases was performed, according to the latest publication of the Central Administration of Statistics in Lebanon, showing the distribution of Lebanon residents according to age group, sex and governate [9]. Cluster effect was taken into account according to the method suggested by Rumeau-Rouquette and collaborators [11].

A p-value < 0.05 was considered significant. The Chi<sup>2</sup> test was used for comparison between categorical variables, and 95% confidence intervals were calculated for total weighted prevalences of diseases and symptoms. For multivariate analysis, a stepwise backward likelihood ratio logistic regression was performed for diseases and symptoms, taking into account the four studied sociodemographic and geographic factors, i.e. sex, public or private schools (for socioeconomic status), governate and geographic site. Adjusted odds ratios (ORa) were then calculated.

## RESULTS

In 22 schools, 1611 questionnaires were distributed and collected back in the schools to 13-14-year-old adolescents : 268 (16.6%) in the Bekaa, 75 (4.7%) in Beirut, 570 (35.4%) in Mount Lebanon, 175 (10.9%) in Nabatieh, 375 (23.5%) in North Lebanon and 144 (8.9%) in the South. After weighting, the numbers became as follows : 214 (13.3%), 157 (9.7%), 654 (40.5%), 94 (5.8%), 327 (20.3%) and 167 (10.3%) respectively, making a total of 1613 (100%).

### Prevalence of asthma, asthma symptoms, rhinitis and eczema

The prevalence of PDA overall Lebanon was of 5.3% in 13-14-y-old schoolchildren. The highest prevalence was found in Beirut (7.0%) and Northern Lebanon (6.7%), while it was the lowest in the Bekaa plain (1.9%) (p = 0.04) (Table I). We find a much higher prevalence of asthma symptoms overall Lebanon : ever wheezing (21.4%) ; last 12 months wheezing (19.9%) ; wheezing on effort (12.7%) ; night cough (22.8%). The highest prevalence of ever wheezing and last 12 months wheezing is noted in the Bekaa governate : respectively 26.8% and 25.4% ; the lowest being for North Lebanon for ever wheezing (17.2%) and the lowest for 12 months wheezing (15.6%) is in Mount Lebanon. Regarding allergic rhinitis, the overall prevalence was of 32.7%. The highest prevalence was in North Lebanon (39.2%) and Bekaa (39.1%), versus 27.8% in Beirut (p = 0.008). For atopic eczema, the overall prevalence was of 11.5%, and the highest prevalence was in Bekaa (17.8%) versus 6.4% in Beirut (p = 0.003).

Flat countries adolescents present the highest rates of wheezing, allergic rhinitis and eczema, but the lowest rate of PDA. The mountain and the seacoast share almost equal distribution of allergic rhinitis and eczema, while wheezing symptoms and diagnosis of asthma are slightly lower in the mountain. There is also a higher rate of wheezing in public schools compared with private schools, and almost equal rates of PDA. Prevalence of wheezing, night cough, rhinitis, and eczema are not different between males and females (Table I) but PDA was more frequent in males (6.6% versus 4.0% ; p = 0.005). Concerning chronic productive cough ever, no difference was found but 12 months productive cough was found more frequent in males (22.2% versus 16.0% ; p = 0.002).

### Subgroup analysis

In individuals with PDA, the most frequent symptom was ever wheezing compared to 12 months wheezing (100% versus 70.8%). Night cough was less frequent (58.5%), but productive cough for more than 4 days/week and more than 3 months/year was the less frequent (39.2%). In this group, allergic rhinitis was as frequent (59.1%) as the wheezing on effort (61.3%). Atopic eczema was reported by 26.7% of those with PDA. In the non PDA group, ever wheezing (21.4%), 12 months

**TABLE II**  
SYMPTOM DISTRIBUTION IN INDIVIDUALS WITH NON PHYSICIAN DIAGNOSED ASTHMA

Symptoms	Ever wheezing	12 months wheezing	Wheezing on effort	Night cough	Productive cough		Total N (100%)
					12 months	Chronic <sup>a</sup>	
<b>GOVERNATE</b>							
Bekaa	56 (26.8%)	53 (25.4%)	34 (16.3%)	56 (26.8%)	45 (22.0%)	19 (9.0%)	209
Beirut	30 (20.5%)	30 (20.5%)	8 (5.5%)	22 (15.2%)	22 (15.2%)	4 (2.7%)	146
Mount Lebanon	107 (17.4%)	96 (15.6%)	62 (10.1%)	133 (21.6%)	98 (15.9%)	29 (4.7%)	616
El Nabatieh	18 (20.5%)	18 (20.5%)	12 (13.6%)	16 (18.2%)	16 (18.2%)	8 (9.1%)	88
North Lebanon	77 (17.2%)	71 (23.3%)	51 (16.8%)	82 (27.0%)	73 (24.0%)	33 (10.9%)	304
South Lebanon	38 (24.1%)	35 (22.0%)	26 (16.4%)	37 (23.3%)	36 (22.6%)	16 (10.1%)	159
<i>p-value</i>	0.02	0.02	0.001	0.04	0.03	0.001	
<b>GEOGRAPHY</b>							
Seacoast	191 (21.4%)	173 (19.4%)	105 (11.8%)	208 (23.3%)	172 (19.3%)	62 (7.0%)	893
Mountain	66 (17.8%)	66 (17.8%)	46 (12.4%)	74 (19.9%)	65 (17.5%)	24 (6.5%)	371
Flat country	69 (26.7%)	63 (24.4%)	42 (16.3%)	64 (24.9%)	54 (21.4%)	22 (8.5%)	258
<i>p-value</i>	0.03	0.11	0.15	0.29	0.49	0.60	
<b>SCHOOL TYPE</b>							
Private	178 (19.2%)	166 (17.9%)	101 (11.0%)	201 (21.8%)	152 (16.5%)	51 (5.5%)	924
Public	149 (24.9%)	137 (22.9%)	91 (15.2%)	145 (24.3%)	138 (23.1%)	58 (9.7%)	598
<i>p-value</i>	0.008	0.018	0.02	0.25	0.001	0.002	
<b>SEX</b>							
Males	176 (22.7%)	160 (20.6%)	98 (12.6%)	177 (22.8%)	172 (22.2%)	56 (7.2%)	776
Females	150 (20.1%)	142 (19.0%)	94 (12.6%)	169 (22.7%)	119 (16.0%)	53 (7.1%)	744
<i>p-value</i>	0.23	0.44	0.99	0.94	0.002	0.94	
<b>Weighted<sup>b</sup></b>	<b>326</b>	<b>303</b>	<b>193</b>	<b>346</b>	<b>290</b>	<b>109</b>	<b>1522</b>
<b>prevalence</b>	<b>(21.4%)</b>	<b>(19.9%)</b>	<b>(12.7%)</b>	<b>(22.8%)</b>	<b>(19.1%)</b>	<b>(7.2%)</b>	
<b>95% CI</b>	<b>[19.3-23.5]</b>	<b>[17.9-21.9]</b>	<b>[11.0-14.4]</b>	<b>[20.7-23.9]</b>	<b>[17.3-20.9]</b>	<b>[5.9-8.5]</b>	

a : Productive cough for more than 4 days per week and more than 3 months per year    b : Weighting was performed according to population distribution by age group, sex and governate in Lebanon by the Central Administration of Statistics [9].

wheezing (19.9%) and night cough (22.8%) were almost equally frequent (Table II).

In wheezers, the most cited triggers were : effort (66.9%), the weather change (42.9%), upper respiratory tract infections (38.8%), dust (33.2%) and cigarette smoke (28.2%) ; smokes and odors (18.8%) and nervousness (16.10%) were cited less frequently. The time variation of allergic rhinitis was mainly seasonal with two peaks : in April-May (9.7%-8.1%) and in February (5.5%) ; a slight increase is also observed at the beginning of the winter in December (2.6%), in comparison with July nadir (2.10%).

#### Multivariate analysis

The governates of Bekaa and North Lebanon have the highest associations to allergic rhinitis, eczema, asthma symptoms, chronic productive cough ever and 12 months productive cough, in comparison with Beirut and other governates. For PDA, the seacoast and the mountain present the highest rates versus flat countries. Geographic location is also important for night cough, with the sea-coast carrying a higher risk than other locations. Male sex increases the risk of PDA and last 12 months productive cough, while public schools are associated with

higher rates of wheezing on effort, chronic productive cough ever and last 12 months chronic productive cough (Tables III & IV).

#### DISCUSSION

This study provides, for the first time, the prevalence of asthma, asthma symptoms, allergic rhinitis and eczema in a nationwide sample of schoolchildren in Lebanon. The prevalence of diagnosed asthma in 13-14-y-old school children was of 5.3%, whereas prevalence of asthma symptoms was 20.3% including ever wheezing, 12 months wheezing and wheezing on effort and night cough.

The use of the standard ISAAC questionnaire, a valid instrument [2], permits comparison of Lebanon with other countries. An application of the ISAAC has been performed in 1998 on schoolchildren in Beirut, aged 12 to 14 years [7]. It reported in Beirut a prevalence rate of 11.9% of asthma, 23.1% of wheezy children, 25.5% of allergic rhinitis, and 11% of eczema. However, those results could not be extrapolated to all Lebanese children. In the present study, we found in Beirut, almost the same overall prevalence of wheezing ever (20.5%) and allergic rhinitis (27.8%), but a lower prevalence of diag-

**TABLE III**  
MULTIVARIATE ANALYSIS OF ALLERGIC DISEASES

Characteristic	<i>p</i> -value ; ORa [95% CI]		
	PDA <sup>a</sup>	Allergic rhinitis	Atopic eczema
<b>GOVERNATE</b>	Not retained in the model	0.08	0.004
Bekaa vs Beirut		0.02 ; 1.68 [1.08-2.62]	0.002 ; 3.20 [1.54-6.68]
South vs Beirut		0.93 ; 0.98 [0.60-1.59]	0.58 ; 1.27 [0.54-3.00]
Mount vs Beirut		0.48 ; 1.15 [0.78-1.69]	0.14 ; 1.69 [0.84-3.38]
Nabatieh vs Beirut		0.83 ; 1.07 [0.61-1.88]	0.08 ; 2.23 [0.92-5.39]
North vs Beirut		0.02 ; 1.66 [1.10-2.52]	0.015 ; 2.43 [1.19-4.98]
<b>GEOGRAPHY</b>	0.048	Not retained in the model	Not retained in the model
Seacoast vs flat country	0.014 ; 2.85 [1.24-6.55]		
Mountain vs flat country	0.039 ; 2.61 [1.05-6.49]		
<b>SEX</b>		Not retained in the model	Not retained in the model
Male vs female	0.02 ; 1.77 [1.09-2.87]		
<b>PRIVATE VS PUBLIC SCHOOL</b>	Not retained in the model	Not retained in the model	Not retained in the model

ORa : Adjusted odds ratio    CI : Confidence interval    a : PDA = Physician diagnosed asthma

nosed asthma (7.0%) and eczema (6.4%). We note that our results are reported 7 years later, which could explain the observed differences. Another explanation would be that the low number of the 13-14 years category within Beirut in our study may account for large confidence intervals within subgroups, and this is why point estimates comparison may not be adequate. International comparisons are thus more adequate.

On an international basis, marked variations of asthma prevalence were reported from phase I of the ISAAC [2, 12]. The prevalence in older age for wheezing in the last 12 months ranged between 2.1-32.2%. We obtained a high prevalence of this symptom (19.9%), in addition to 5.3% of PDA. Lebanon harbors the lowest PDA prevalence compared to eastern Mediterranean countries except Iran. Definitely prevalence of PDA was lower than English speaking countries and Latin America [2, 12]. On the other hand, last 12 months wheezing was the highest in Lebanon compared to eastern Mediterranean countries. Intermediate prevalence for night cough was found in Lebanon compared to eastern Mediterranean countries [12]. In a recent study published about prevalence of asthma in Israel in 13-14-y-old schoolchildren [13], they found slightly the same prevalence for asthma (7.0%), wheezing ever (23.8%) and wheezing in the last 12 months (17.9%). We note that observed differences of PDA between countries could also be due to non unified diagnosis criteria used by different physicians [14]. On the other hand, the variability in the perception and interpretation of asthma symptoms among practitioners can also partially explain the difference between the percentages of PDA and asthma symptoms [14]. This difference can also be related to the fact that Lebanese physicians may prefer not to announce the diagnosis of asthma in order not to alarm the children's parents.

We found in Beirut the highest PDA prevalence.

Beirut is urbanized and has its load of outdoor pollution. Urban atmosphere can be a factor increasing the prevalence of asthma in children [4, 15]. Another explanation would be a higher access for health care in the capital than within remote regions, causing a higher diagnosis of asthma. However, in a cross-sectional study performed in Lebanon public schools, the analysis of urban versus rural area association with respiratory diseases and symptoms gave no significant results [16]. And yet the association between air pollution and asthma is not well established, and pollinosis prevalence is not higher in rural than urban areas [17]. This could underline other causes that might explain this difference.

Moreover, ISAAC study outlined the additional importance of climate, humidity, altitude and latitude on prevalence of asthma, allergic rhinitis and eczema [5]. Lebanon being known to contain variable climates by geographical location, the highest rates of allergic diseases found in flat countries can be explained by agricultural activity of Bekaa and the North plains, with special climates. In addition to climate, differences of socioeconomic status can further explain the found results : the seacoast is characterized by a higher socioeconomic status in comparison with the flat country. Differences between public and private schools further confirm the fact that a low socioeconomic status is a risk factor for asthma, particularly for symptoms with no PDA. In the multivariate analysis, the flat country was associated with lower PDA, but a low socioeconomic status was only associated with wheezing on effort and productive cough. These issues remain to be established by further geographic, climatic and weather variations data, and urbanization data of all regions in specific study designs.

Diagnosis of asthma by a physician was more frequently done in males compared to females in the 13-14-year-old schoolchildren. This is consistent with studies show-

**TABLE IV**  
MULTIVARIATE ANALYSIS OF RESPIRATORY SYMPTOMS IN INDIVIDUALS WITH NO PHYSICIAN DIAGNOSED ASTHMA

Characteristic	<i>p</i> -value ; ORa [95% CI]			
	Ever wheezing	12 months wheezing	Wheezing on effort	Night cough
<b>GOVERNATE</b>				
Bekaa vs Beirut	0.02	0.02	0.01	0.012
South vs Beirut	0.19 ; 1.41 [0.85-2.32]	0.31 ; 1.30 [0.78-2.16]	0.001 ; 4.20 [1.80-9.76]	0.002 ; 4.66 [1.75-12.41]
Mount vs Beirut	0.49 ; 1.21 [0.71-2.08]	0.81 ; 1.07 [0.62-1.85]	0.01 ; 3.26 [1.42-7.51]	0.08 ; 1.70 [0.95-3.04]
Nabatieh vs Beirut	0.33 ; 0.80 [0.51-1.26]	0.13 ; 0.70 [0.45-1.11]	0.03 ; 2.56 [1.12-5.85]	0.05 ; 1.66 [1.00-2.72]
North vs Beirut	0.91 ; 0.96 [0.50-1.86]	0.91 ; 0.96 [0.50-1.86]	0.02 ; 2.98 [1.15-7.73]	0.18 ; 1.70 [0.78-3.71]
	0.29 ; 1.29 [0.80-2.08]	0.56 ; 1.16 [0.71-1.87]	0.001 ; 3.58 [1.64-7.79]	0.001 ; 2.49 [1.46-4.27]
<b>GEOGRAPHY</b>				
Seacoast vs flat country	Not retained in the model	Not retained in the model	Not retained in the model	0.04
Mountain vs flat country	Not retained in the model	Not retained in the model	0.05 ; 2.30 [1.02-5.20]	0.05 ; 2.30 [1.02-5.20]
			0.22 ; 1.69 [0.73-3.91]	0.22 ; 1.69 [0.73-3.91]
<b>SEX</b>				
Male vs female	Not retained in the model	Not retained in the model	Not retained in the model	Not retained in the model
<b>PRIVATE vs PUBLIC SCHOOL</b>	Not retained in the model	Not retained in the model	0.08 ; 0.69 [0.45-1.05]	Not retained in the model
			0.04 ; 0.67 [0.47-0.98]	0.05 ; 0.59 [0.34-1.00]

ORa : Adjusted odds ratio CI : Confidence interval a : A chronic productive cough was one that lasted for more than 4 days/week and more than 3 months/year.

ing the male preponderance for asthma in the first decade [18]. Nevertheless, the absence of sex difference for wheezing could also be explained by the fact that at this age the preponderance is inverted in favor of females. The only difference was for the significantly higher frequency of 12 months productive cough in males (22.2% versus 16% ;  $p = 0.002$ ). This could be explained by social habits in Lebanon : due to old traditions, boys may be more taken care of than girls leading to higher diagnosis rates, and possibly more prone to early smoking behavior, causing productive cough [19]. Another issue to be taken into account is the higher rate of productive cough and wheezing on effort in public schools, the reasons of which may be the public schools possible unhealthy buildings, or the socioeconomic status and its associated behavioral and environmental factors. This remains also to be investigated by more specific studies.

In asthma diagnosed by a physician, wheezing was the most frequent symptom : it seems highly suggestive for asthma and clinicians rely mainly on it to diagnose asthma, but less on wheezing on effort and night cough [3]. The value of night cough as an indication for asthma proper diagnosis should be more emphasized especially that this may lead to under diagnosed asthma with serious health consequences [20]. The triggers for wheezing were as classically reported by patients [4, 5, 15] : effort, weather variations, upper respiratory tract infections, dust and cigarette smoke.

Studying the prevalence of allergic rhinitis is an indirect reflection of the atopic status of the defined population. Epidemiologic studies support the results of pathophysiological and clinical studies showing an association between asthma and allergic rhinitis, demonstrating that among patients with asthma, 60% to 80% also have allergic rhinitis [21-22] ; this confirms our results, where 59.1% of physician diagnosed asthmatics have allergic rhinitis. These associations reflect the shared atopy underlying allergic rhinitis and asthma, explaining at least partially, the frequent coexistence of these disorders. This might also explain results in ISAAC studies finding the same prevalence pattern for asthma and allergic rhinitis [12]. In our study, the prevalence rate for allergic rhinitis was of 32.7%, which is on the high range of international prevalences [2, 12]. It was also interesting to know that the overall prevalence of eczema was 11.5% ; especially that recent studies emphasized on the link between atopic eczema, asthma and allergic rhinitis [23]. Time variability of allergic rhinitis with a peak in spring pointed out the responsibility of pollen for those peaks, although we did not address the pollen calendar in Lebanon in this study. The peak between December and February suggests the effect of winter viral respiratory infections.

We are aware of the possible biases introduced by this study design. A selection bias is possible because of the refusal of the 8 schools to participate to the study, 7 of them being private. We would expect this to have caused the underestimation of diagnosed asthma or the overestimation of undiagnosed disease in our study. An infor-

mation bias is also possible since the use of a questionnaire in a young population may not always be accurate : problems in question understanding, recall deficiency and over- or underevaluating symptoms may still be possible. However, our methodology is that of other cross-sectional studies, including ISAAC ones, which is necessary for international comparisons.

## CONCLUSION

This is a study done across Lebanon on 13-14-y-old schoolchildren addressing prevalence of asthma, asthma symptoms, allergic rhinitis and eczema. It is the first of its kind for the whole country. It enabled us to compare Lebanon to other countries. The prevalence of diagnosed asthma was the lowest in Lebanon compared to the eastern Mediterranean countries. Prevalence of the symptoms of asthma, of allergic rhinitis and eczema is on the medium prevalence trend noted all over the world, referring to ISAAC study. It also showed marked variations and differences across the governates in Lebanon, the lowest prevalence of diagnosed asthma but the highest prevalence of asthma symptoms being in the Bekaa governate. Further studies are needed to understand the environmental, climate and socioeconomic causes of these discrepancies. Further efforts are needed not to leave asthma underdiagnosed, and to avoid consequently serious health consequences.

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الربو والتهاب الانف الالرجيائي والاكزما (النملة) عند اطفال لبنانيين في مرحلة الدراسة والعمر ١٣ . ١٤ عاما

موجز : مدخل - الربو اعتلال كثير الحدوث عند الاطفال انتشار الربو والامراض الالرجيائية تبقى مجهولة في لبنان. الغاية الاولى لهذا الموضوع هو البحث عن انتشار الربو والتهاب الانف الالرجيائي والاكزما عند الاطفال اللبنانيين .  
الطرق - دراسة وصفية معترضة عند اطفال لبنانيين في المدارس الرسمية والخاصة.

٢٢ مدرسة شاركت في هذه الدراسة واستبيانات قياسية نمط «ايزاك» ملئت من قبل التلامذة في سن ١٣ - ١٤ عاما.

**النتائج -** درست ١٦١٣ حالة وشخص انتشار الربو في ٥,٦% وهي ادنى نسبة مقارنة مع نتائج بلاد البحر المتوسط . انتشار العراض المشيرة الى الربو كالصغير التنفسي يحدث مرة واحدة على الاقل اثناء الحياة بنسبة ٢١,٤% وللصغير خلال الاشهر ١٢ الاخيرة ١٩,٩% والصغير الجهدى ١٢,٧% والسعال الليلي ٢٢,٨% والتهاب الانف الالرجيائي ٣٢,٧% والاكزما ١١,٥% وهذا نسبة الانتشار الوسطي الملاحظ عالميا على طريقة دراسة «ايزاك» ولكنها تختلف حسب الاقضية والانتشار الادنى للربو الذي شخص من قبل الطبيب ١,٩% والانتشار الاقصى للصغير خلال الحياة ٢٦,٨% لوحظت هذه النتيجة في البقاع.

**الخلاصة -** الربو والتهاب الانف الالرجيائي والاكزما انتشارهم الوسطي مرتفع في لبنان ويوجد اختلاف حسب الاقضية. ومن الضروري اجراء دراسات متممة لفهم دور البيئة والمناخ على المستوى الاجتماعي الاقتصادي لا يوضح سبب الاختلاف .

## APPENDIX

### QUESTIONNAIRE 13-14 YEARS

Thank you for taking part in our study that interests your health and that of all children and adults in Lebanon.  
The information you would give us will only be used for scientific purposes.  
Please answer the questions with precision and honesty.

#### General questions

1. Name: .....
2. Address: .....
3. Telephone: .....
4. Actual weight: .....kg
5. Actual height: .....cm
6. Sex: Boy  Girl
7. Nationality: Lebanese  Other than Lebanese
8. Birth date: ...../...../.....
9. Place of birth: .....
10. Age: .....
11. Class: .....
12. How many rooms are there in your house, except the kitchen and bathrooms? ..... rooms
13. How many people live in your house, including you? ..... persons
14. How many people smoke in your house? ..... persons
15. Is there anybody in your house that suffers from a chronic respiratory disease?  
Yes  No   
If YES, specify the problem and the person: .....
16. Do you have a pet at home? Yes  No   
If YES, specify the pet: .....

#### Questions about your health

17. Have you ever had wheezing in your chest? Yes  No   
If you answer is NO, please go to question number 21  
If your answer is YES, continue to answer the following questions.
18. How many times did you have chest wheezing during the last 12 months?  
None  once-3 times  4-12 times  more than 12 times
19. Did your doctor ever tell you that you had asthma? Yes  No
20. During the last 12 months, have you ever had chest wheezing during or after physical activity (sports, jogging, etc.)? No  Yes

21. During the last 12 months, have you ever had dry cough by night, without having a cold or acute bronchitis? Yes  No
22. During the last 12 months, have you had chest expectorations, without having a cold? Yes  No
23. Did you have these expectorations for more than 4 days a week, and for more than 3 months a year? No  Yes   
If YES, for how many years did you have this problem? ..... years
24. During the last 12 months, what were the factors that made you suffer from chest wheezing or that exacerbated your chest wheezing?  
Climate  Pollen  Stress  Smoke  Dust   
Pets  Wool  Cold  Cigarette smoke   
Sports  Some foods or drinks  Soap or detergents   
Other  ..... I never had this problem
25. In the last 12 months, have you ever used any medications for wheezing or asthma treatment, such as pills or sprays? No  Yes   
If YES, specify: .....

**The following questions regard periods where YOU DO NOT HAVE A COLD.**

26. Have you ever had sneezing, a runny or a congested nose without having a cold? Yes  No

If your answer is NO, please go to question number 29.

If your answer is YES, please continue.

27. During the past 12 months, did you have any watery or disturbed eyes, concomitant with your nose problem? No  Yes
28. In the past 12 months, when did you have your nose problem?  
January  February  March  April  May  June  July   
August  September  October  November  December
29. Did you have any skin rash on skin folds of your elbow, behind your knees, in front of your ankles, beneath your thighs, or around the neck, the ear or eye? No  Yes   
If YES, what was your age when it appeared? .....years
30. Have your doctor ever told you that you had eczema? No  Yes

**Questions regarding your childhood**

31. What was your weight at birth? ..... g I do not know
32. Were you born within 3 weeks of the birth due date specified by the doctor? Yes  No, before 3 weeks of the due date   
No, after 3 weeks of the due date  I do not know
33. Did your mother breast feed you during infancy? Yes  No
34. Did your mother take you to a daycare during infancy? Yes  No   
If YES, at what age did you start to go to daycare? .....years
35. Have you ever had the following problems:  
Measles: No  Yes  Age: ..... Do not know   
Diphtheria: No  Yes  Age: ..... Do not know
36. Did you have recurrent otitis during your childhood? No  Yes
37. Did you have recurrent pharyngitis during your childhood? No  Yes
38. Did you have a surgery for removing your tonsils? No  Yes
39. Do you have any heart problem? No  Yes
40. At your birth, did you need to stay in the hospital for a period longer than usual? No  Yes   
If YES, why? .....

### Questions regarding your home and parents

41. Is there a servant at home? No  Yes
42. Is there an electrical vacuum cleaner at home? No  Yes
43. Is there a permanent carpet in your bedroom? Yes  No
44. Do you sleep in your own bed? Yes  No
45. How do you heat your house?  
 Gaz  Electrical heater  Mazout  Wood  Coal   
 Central heating  Other : .....
46. Is there any mold visible on your bedroom walls? No  Yes
47. What type of pillow do you use for sleeping?  
 Spongy  Feathers  Cotton  Other  .....
48. What type of mattress do you sleep on?  
 Wool  Cotton  Industrial (Sleep Comfort, etc.)
49. Did you have to change anything in your house because you had asthma?  
 No  Yes
50. Is your father alive? No  Yes
- Father educational level: Illiterate  School for less than 8 years   
 School for more than 8 years  University graduate
- Father actual profession: .....
- Does he smoke regularly? Yes  No
- If YES, what does he smoke: Cigarettes  Narguileh  Other  .....
- Did the doctor ever tell him he had a respiratory problem? No  Yes
- If YES, what respiratory problem? .....
51. Is your mother alive? No  Yes
- Mother educational level: Illiterate  School for less than 8 years   
 School for more than 8 years  University graduate
- Mother actual profession: .....
- Does she smoke regularly? Yes  No
- If YES, what does she smoke: Cigarettes  Narguileh  Other  .....
- Did the doctor ever tell her she had a respiratory problem? No  Yes
- If yes, what respiratory problem? .....