ARTICLE ORIGINAL/ORIGINAL ARTICLE

SYMPTOMS, SEVERITY AND ASTHMA CONTROL IN 5-14 Y-OLD LEBANON SCHOOL CHILDREN

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Waked M, Salameh P. Symptoms, severity and asthma control in 5-14 y-old Lebanon school children. J Med Liban 2007 ; 55 (3) : 145-151.

ABSTRACT • BACKGROUND : This study addressed symptoms' profile, severity and determinants of asthma control in school-aged patients (5-14 y) across Lebanon.

METHODS : It is a cross-sectional study, applied on school children with physician-diagnosed asthma (PDA), divided into two groups : those who were on controllers (C+) and those who were not (NC).

RESULTS : Out of 5544 children, 275 (4.96%) had PDA. The C+ group (32.7%) had higher mother's education than the NC group (45.9%) (p = 0.037). NC children were more frequently found in public versus private schools (p = 0.0001). Higher frequencies of regular visits to the doctor were noted in the C+ compared to NC group. In C+ group, 90% were on reliever and controller, and 10% just on one controller. A trend for more severity in the C+ group was noted compared to the NC group. An impact of asthma on daily activities was reported by 40% in the C+ group versus 34% in the NC group.

CONCLUSION : Treatment of PDA in 5-14 y school children was quite adapted according to the recommendations. However, total control was reported in low percentages of patients reflecting universal discrepancy between evidence base medicine and real life.

Waked M, Salameh P. Symptômes, sévérité et contrôle de l'asthme chez les élèves de 5 à 14 ans au Liban. J Med Liban 2007 ; 55 (3) : 145-151.

RÉSUMÉ • INTRODUCTION : Notre étude s'intéresse aux symptômes, à l'index de sévérité, et au contrôle de l'asthme chez les élèves de 5 à 14 ans au Liban.

MÉTHODES : C'est une étude transversale, appliquée aux asthmatiques diagnostiqués par un médecin, divisés en deux groupes : avec traitement préventif (C+) et sans traitement préventif (NC).

RÉSULTATS : Sur 5544 enfants, 275 (4,96%) sont asthmatiques. L'éducation maternelle est supérieure dans le groupe C+ (32,7%), comparée à celle des NC (45,9%) (p = 0,037). Ceux du groupe NC sont plus dans des écoles publiques que privées (p = 0,0001). Les visites au médecin sont plus fréquentes dans le groupe C+ comparé au groupe NC. 90% des C+ prennent un traitement préventif et symptomatique, 10% un seul préventif. Une tendance supérieure à la sévérité se retrouve dans le groupe C+ comparé au NC. Chez 40% du groupe C+ versus 34% du groupe NC, l'asthme a un impact sur leurs activités quotidiennes.

CONCLUSION : L'asthme chez des élèves libanais de 5-14 ans est traité adéquatement. Néanmoins, le décalage universel entre les traitements recommandés et la vie réelle était constaté puisque peu de patients rapportaient un contrôle total de la maladie.

INTRODUCTION

Asthma is a chronic inflammatory disease of the airways and despite the progress in the diagnosis and treatment, it still represents a heavy burden for the patients and their families [1-2].

Prevalence of asthma in childhood may have reached a plateau for many reasons [3-4] ; but recommended treatment guidelines are constantly changed and revised. The Global Initiative for Asthma (GINA) guidelines, in particular, have been recently updated to allow better asthma control [5]. Asthma in these guidelines is no longer classified in classes of severity but in classes of control (controlled, partly controlled and uncontrolled). Nevertheless, international surveys provide direct evidence for suboptimal asthma control in many countries, despite the availability of effective therapies [5-7]. Defining severity and control of asthma has always been a matter of challenge because of the lack of ideal criteria, reflecting the "real world" and broad enough to include both objective and subjective measures, knowing that relying only on the guidelines can be insufficiently representative [8-10].

The treatment targets two features of asthma : airways' acute obstruction which is the apparent part of the disease and the underlying inflammation which is not perceived by the patient [5]. Relievers are recommended as bronchodilators in asthma patients, whereas preventers, mainly inhaled corticosteroids (ICS), are the cornerstone of the treatment of the underlying inflammation in the airways [5]. Patients' adherence to ICS is generally poor and

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many rely alternatively on short-action beta2-agonists because of their fast relief of dyspnea [11]. Determinants of poor adherence are believed to include poor perception by patients of their asthma severity, concerns about the safety and efficacy of medication and low treatment expectations [6, 7, 11].

The asthma prevalence in Lebanon in 2006 was estimated at 5.2% for PDA in 13-14 years school children, which is on the medium range worldwide [12]. An earlier prevalence study done in Beirut only, showed a PDA prevalence of 12% [13]. In another type of study, addressing the profile of asthmatic children in Beirut, Torbey and al. [14] found in 1999 that the perception of childhood asthma by Lebanese physicians and parents was still suboptimal.

The aim of this study was to further examine symptoms' profile, index of severity, determinants of asthma control and treatment in school-aged physician-diagnosed asthmatic patients (5-14 y) across Lebanon.

MATERIAL AND METHODS

Study design

This cross-sectional study was conducted on school children in Lebanon. Methodology details were described in a previous paper [12]. (Data on 5-12 years submitted to publication in a separate paper, under press). In children with physician-diagnosed asthma (PDA), data about asthma symptoms, treatment and severity were collected.

Sampling methods

Thirty schools were randomly selected from a list of schools provided by the Ministry of Education, to allow the distribution of 6000 questionnaires. Out of 5544 returned questionnaires, 275 (4.96%) revealed PDA children. A subgroup analysis was conducted on this category of individuals.

Variables

Questions from the standardized International Study of Asthma and Allergies in Childhood (ISAAC) written core questionnaire [15] were used to characterize symptoms in children who suffered from PDA. Those children were further divided into two groups : those who were taking controllers (C+) and those who were not (NC). Inhaled steroids, oral steroids, or leukotriene receptor antagonists (LTRA) were considered controllers of asthma, while short acting beta agonists (SABA), long acting beta agonists (LABA), or theophyllin were considered relievers (R) [5, 16].

A severity index was created, composed of three

TABLE I
CHARACTERISTICS OF INDIVIDUALS WITH PHYSICIAN-DIAGNOSED ASTHMA (PDA)

CHARACTERISTIC	Controller Users (C+)		Non Controller Users (NC)		*p-value* [b]	TOTAL	
NUMBER (%)	90	(32.7) [a]	126	(45.9) [a]		275	(100.0) [c]
GENDER							
Male	52	(41.9)	72	(58.1)	0.93	168	(61.3)
Female	38	(41.3)	54	(58.7)		106	(38.7)
AGE CLASSES							
5-9 years	36	(50.7)	35	(49.3)	0.25	85	(30.8)
9.1-11 years	20	(37.0)	34	(63.0)		64	(23.2)
11.1-13 years	20	(39.2)	31	(60.8)		68	(24.9)
13.1-14 years	13	(33.3)	26	(66.7)		58	(21.1)
PUBLIC SCHOOL	27	(26.5)	75	(73.5)	$< 10^{-4}$	125	(45.5)
PRIVATE SCHOOL	63	(55.3)	51	(44.7)		150	(55.5)
FATHER EDUCATION							
Illiterate or school < 8 years	25	(38.5)	40	(61.5)	0.076	84	(32.2)
School for 8 years or more	36	(36.0)	64	(64.0)		118	(45.5)
University education	25	(55.6)	20	(44.4)		58	(22.3)
MOTHER EDUCATION							
Illiterate or school < 8 years	16	(28.1)	41	(71.9)	0.037	64	(24.6)
School for 8 years or more	48	(47.1)	54	(52.9)		132	(51.2)
University education	25	(49.0)	26	(51.0)		62	(24.2)
SMOKING FATHER	48	(41.0)	69	(59.0)	0.99	143	(52.1)
NON SMOKING FATHER	39	(41.1)	56	(58.9)		132	(47.9)
SMOKING MOTHER	37	(39.8)	56	(60.2)	0.57	110	(39.9)
NON SMOKING MOTHER	52	(43.7)	67	(56.3)		165	(60.1)

a : Row percentage **b** : Chi^2 test **c** : Column percentage

TABLE II
SYMPTOMS DISTRIBUTION IN CHILDREN WITH PHYSICIAN-DIAGNOSED ASTHMA (N = 275)

SYMPTOMS	Nombre	%
12 MONTHS WHEEZING		
None	92	*33.5*
1-3 times/week	123	*44.8*
4-12 times/week	25	*9.0*
> 12 times/week	35	*12.7*
WHEEZING ON EXERCISE LAST 12 MONTHS	155	56.2
NIGHT COUGH LAST 12 MONTHS	178	*64.6*
EXPECTORATIONS LAST 12 MONTHS	150	*54.5*
EXPECTORATIONS FOR more than 4 days a week and more than 3 months/year	129	*47.2*
ALLERGIC RHINITIS IN THE LAST 12 MONTHS	167	*60.8*
ATOPIC ECZEMA	78	*28.4*

items, adapted from previous studies [6, 9-10, 17]. These were : the number of times the SABA was used, the number of times the patient could not perform daily activities and the number of times he could not practice his preferred sport, all in the week preceding the survey. The number of times a SABA was used was scored 0 if "none", 1 if "one day", 2 if "two days", 3 if "three days" and 4 if "four days or more". The other items were measured on a 4-point Likert scale where 0 corresponds to "never", 1 to "one day", 2 to "two days or more", and 3 to "every day". The severity index was determined according to the highest score on any one of the three items. It could therefore have ranged from 0 to 4.

Independent variables used were : gender, public or private schools (as a surrogate for socioeconomic status), father and mother education level (illiterate or < 8 years of school, school for 8 years and more, and university education), father and mother smoking status (current regular smoker of cigarettes or narghile).

TABLE III
TREATMENT CHARACTERISTICS OF ASTHMA WITH PHYSICIAN-DIAGNOSED ASTHMA

VARIABLE	Controller Users		Non Controller Users		*p-value*[f]	TOTAL	
NUMBER (%)	90	(32.7)	126	(45.9)		275	(100)
EVER HAD SPIROMETRY	33	(37.5)	45	(36.6)	0.89	97	(35.2)
EVERHAD MONTHLY SUBCUTANEOUS INJECTIONS TO DECREASE ALLERGY	19	(21.3)	20	(15.9)	0.31	49	(17.7)
TREATMENT DURING LAST 12 MONTHS	82	(91.1)	87	(69.0)	< 0.0001	169	(78.2)
REGULARLY VISITS THE DOCTOR	62	(70.5)	64	(50.4)	0.003	129	(47.0)
DOCTOR'S VISITS LAST 12 MONTHS							
None	21	(25.6)	58	(46.0)	0.005	82	(29.9)
1-2 visits	24	(29.3)	35	(27.8)		60	(21.7)
3-4 visits	21	(25.6)	24	(19.0)		44	(16.0)
5 or more visits	16	(19.5)	9	(7.1)		25	(9.0)
EMERGENCY VISITS LAST 12 MONTHS							
None	53	(65.4)	96	(76.2)	0.19	153	(55.8)
1 visit	8	(9.9)	13	(10.3)		21	(7.6)
2 visits	8	(9.9)	5	(4.0)		12	(4.5)
3 or more visits	12	(14.8)	12	(9.5)		24	(8.8)
TREATED WITH							
SABA[a]	79	(87.8)	94	(74.0)	0.01	172	(79.8)
LABA[b]	19	(21.1)	0		NA[g]	19	(9.2)
Inhaled steroid	6	(71.1)	0		NA[g]	64	(31.0)
LTRA[c]	42	(46.7)	0		NA[g]	42	(20.4)
Oral steroid	11	(12.2)	0		NA[g]	11	(5.2)
Theophyllin	7	(7.8)	11	(9.2)	0.71	18	(8.8)
Antihistamines	11	(12.2)	10	(8.3)	0.35	20	(9.7)
TREATMENT TYPE							
Reliever[d] alone	0		96	(75.6)	NA[g]	96	(44.2)
Controller[e] alone	9	(10.0)	0		NA[g]	9	(4.3)
Reliever[d] & Controller[e]	81	(90.0)	0		NA[g]	81	(37.3)
No treatment	0		31	(24.4)	NA[g]	31	(14.2)
HAD SIDE EFFECTS DUE TO ASTHMA TREATMENT	6	(6.6)	5	(3.9)	0.59	10	(3.7)

a : Short-acting beta agonists **b** : Long-acting beta agonists **c** : Leukotriene receptors antagonists **d** : Reliever/SABA, LABA, or theophyllin
e : Controller/Inhaled steroid, oral steroid, or LTRA **f** : Chi^2 test **g** : Not applicable

Statistical analysis

Questionnaires were coded and data entered using the Statistical Package for Social Sciences (SPSS) software, version 12.0. An association with a p-value < 0.05 was considered significant. The Chi^2 test was used for comparisons between categorical variables, while the Student t-test was used for comparisons of means. For multivariate analysis, a stepwise backward multiple regression was performed with the asthma severity index as a dependent variable and treatment type as an independent variable, controlling for other variables.

RESULTS

Characteristics of PDA patients are presented in table I. Treatment information was not available for 59 patients (21.5%), while treatment comparison was performed on 216 patients. There was no difference between the C+ (32.7%) and the NC (45.9%) groups regarding gender and age distributions, smoking habits of the mother and father, and father's education. However, the C+ group had a significantly higher maternal education than the NC group (p = 0.037). Interestingly enough, patients with PDA taking no controllers were significantly more frequent in public schools versus private schools (p < 0.01).

Symptoms did not differ in PDA children in either treatment groups. The most frequently reported symptoms were 12 months wheezing (66.5%), followed by night cough (64.6%). Results are represented in table II.

There was no difference in spirometry screening, subcutaneous injections for allergic desensitization or emergency visits in the last 12 months between the two treatment groups. Significantly higher treatment rates during the last 12 months and regular visits to the doctor were found in the C+ compared to NC group. No differences were found in the use of SABA, theophylline or antihistamine. LABA were not used at all in the NC group and this was a significant difference compared to C+ group (Table III).

The NC group used SABA in 75% of the cases and the remaining 25% had no treatment at all. In the C+ group, 70% were taking one controller and 30% were taking two (typically ICS + LTRA) ; 90% were having combined therapy (reliever and controller : R + C). No difference in side effects due to medications was found between the two groups (Table III).

There were no differences on the severity index, although a trend for more severity in the C+ group was noted. At the severity level 4, 70% were treated by controllers, while 30% were NC users. Moreover, a significantly higher severity index mean was found in the controllers' group (p = 0.027). Results are presented in table IV.

In figure 1 are presented the distribution of the severity index according to each detailed treatment. In the patients with no treatment, 75% were in the level 0 of severity, while 12.5% had a severity index of 3 and 9.4% a severity index of 2. In the combined therapy group (R + C), 26% only were in the 0 severity level and 12% were in the severity level 4.

In the multivariate analysis, age, the use of SABA, oral steroids, and the mother's education were independent determinants of asthma severity, while school type, father's education and parental smoking were not retained in the models. Results are presented in table V.

DISCUSSION

This epidemiologic research conducted on school aged patients (5-14 years old) across Lebanon found a PDA prevalence of 4.96%. Age classes and sex ratio were the same in those taking and those not taking controllers. There were clear indications in this study which confirmed that asthma control is affected by lower socio-economic status as indicated by use of public schools or by lower maternal education [20-21].

Symptoms that define asthma diagnosed by a physician had the same distribution in the two groups of treatment, but 12 months wheezing was the most frequent symptom that served as a basis for the diagnosis of asthma, followed by allergic rhinitis and night cough. This emphasizes the pathognomonic value of wheezing for

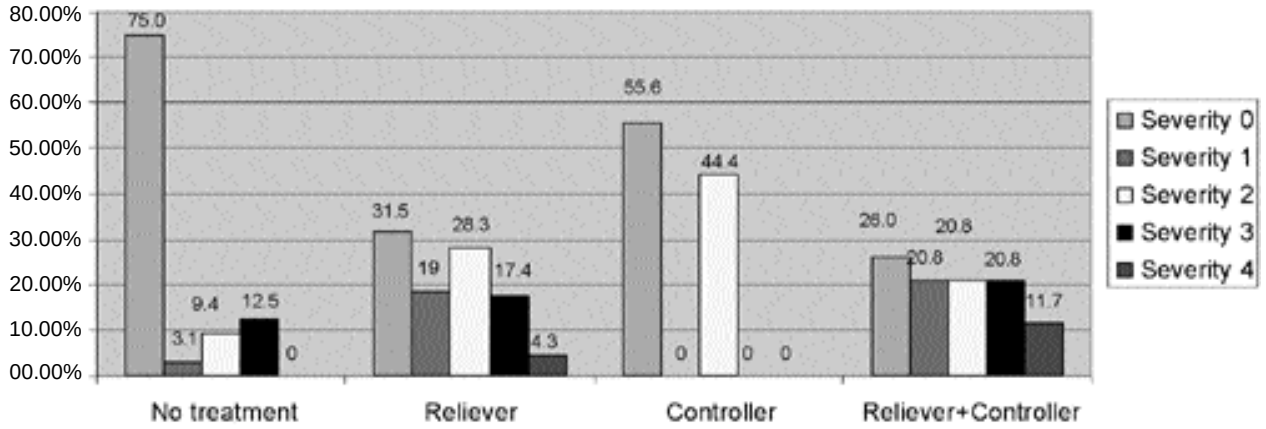

FIGURE 1. Severity index and type of actual treatment in asthma patients

TABLE IV
ASTHMA EVALUATION AND SEVERITY INDEX BY PATIENT

EVALUATION CRITERION	Controller Users		Non Controller Users		p-value	TOTAL	
NUMBER (%)	90	(32.7)	126	(45.9)		275	(100)
NUMBER OF SABA USE LAST WEEK							
None	25	(29.1)	42	(35.9)	0.09[a]	69	(33.6)
Once	13	(15.1)	18	(15.4)		32	(15.3)
Twice	14	(16.3)	12	(10.3)		26	(12.4)
Three times	13	(15.1)	15	(12.8)		28	(13.7)
Four times or more	10	(11.6)	4	(3.4)		14	(7.0)
Does not know	11	(12.8)	26	(22.2)		37	(17.9)
NUMBER OF TIMES YOU COULD NOT PERFORM DAILY ACTIVITIES LAST WEEK							
Never	51	(59.3)	81	(66.4)	0.21[a]	136	(63.8)
One day	21	(24.4)	18	(14.8)		40	(18.7)
Two days or more	13	(15.1)	17	(13.9)		30	(14.2)
Every day	1	(1.2)	6	(4.9)		7	(3.2)
NUMBER OF TIMES YOU COULD NOT PRACTICE PREFERRED SPORT LAST WEEK							
Never	50	(58.1)	83	(66.9)	0.40[b]	135	(63.6)
One day	14	(16.3)	21	(16.9)		36	(17.0)
Two days or more	15	(17.4)	14	(11.3)		29	(13.4)
Every day	7	(8.1)	6	(4.8)		13	(6.0)
SEVERITYINDEX (mean, SD)	1.64	(1.34)	1.24	(1.26)	0.027[c]	1.38	(1.30)
0	25	(32.1)	53	(67.9)	0.10 [a]	80	(29.0)
1	16	(47.1)	18	(52.9)		37	(13.4)
2	21	(42.9)	28	(57.1)		49	(17.9)
3	16	(44.4)	20	(55.6)		36	(13.2)
4	9	(69.2)	4	(30.8)		14	(4.9)

a : Chi^2 test **b** : The last two rows were collapsed before Chi^2 test application **c** : Student test for comparison of means

TABLE V
MULTIVARIATE ANALYSIS FOR DETERMINANTS OF ASTHMA SEVERITY INDEX

FACTOR	Beta [95% CI]	*p-value*
Analysis 1: R = 0.46 ; F = 6.12 ; $p < 10^{-4}$		
Age	**0.14 [0.08 ; 0.21]**	***< 10 $^{-4}$***
Mother education	- 0.19 [- 0.44 ; 0.05]	*0.13*
SABA[a]	**0.92 [0.49 ; 1.35]**	***< 10 $^{-4}$***
LABA[b]	0.08 [- 0.55 ; 0.73]	*0.79*
Inhaled steroids	0.17 [- 0.25 ; 0.59]	*0.42*
Theophyllin	0.31 [- 0.31 ; 0.92]	*0.32*
Oral steroids	**1.06 [0.28 ; 1.84]**	***0.008***
LTRA[c]	0.09 [- 0.35 ; 0.53]	*0.69*
Constant	- 1.42 [- 2.37 ; - 0.48]	*0.003*
Analysis 2: R = 0.42 ; F = 10.40 ; $p < 10^{-4}$		
Age	**0.13 [0.06 ; 0.19]**	***< 10 $^{-4}$***
Mother education	**- 0.25 [- 0.49 ; - 0.02]**	***0.037***
Reliever	**0.98 [0.55 ; 1.41]**	***< 10 $^{-4}$***
Controller	0.29 [- 0.06 ; 0.64]	*0.10*
Constant	- 1.35 [- 2.28 ; - 0.41]	*0.01*

a : Short-acting beta agonists
b : Long-acting beta agonists
c : Leukotriene receptors antagonists

asthma. It suggests that asthma may be underdiagnosed if wheezing is not clinically predominant [20-23]. PDA patients on C+ visited more frequently their doctors, probably reflecting the higher severity of their disease and as a consequence an adjusted prescribed treatment [11, 17].

This severity in the C+ group is also reflected by the use in 12% of the cases of oral steroids and by the use in 90% of the cases of combined therapy. The difference between the types of therapy was probably due to the fact that this population was a pediatric one. If the recommendations for the use of LABA as add on therapy to ICS for adults is rather clear [5], it remains sparse concerning pediatric population [24-25].

Defining severity and control of asthma has always been a matter of challenge [8]. In our study, the severity index was a compilation of SABA use, impact of asthma on daily activities, and exercise capacity. Those criteria have been considered for the evaluation of asthma in real life in the literature [8, 11, 17]. The difference in severity in both treatment groups might reflect that the treatment was adapted to each category [5] ; however, it was not meeting their demand or matching adequately their stages of severity. The goal of total control was not reached as it is recommended in the guidelines [5] : 40% of the C+ group versus 34% in the NC group reported an

impact of their asthma on daily activities and only 28% of the patients on combined therapy reported being totally controlled. These results highlight the complexity of defining asthma control [26-27] and the difficulty in assessing asthma severity [9-10, 28].

In the multivariate analysis, age, the use of SABA, oral steroids, were independent determinants of asthma severity. This was shown in previous studies [8-10].

The cross-sectional nature of the study makes it difficult to assess temporality between asthma severity and treatment. It is also difficult to rule out an information bias, particularly when parents are surrogate responders of their children. This information bias is also possible since the use of a questionnaire may not always be accurate : problems in question understanding, recall deficiency and over or under evaluating symptoms may still be possible. However, we have no reason to believe that this bias is differential between the two groups of comparison. Moreover, our methodology is that of cross-sectional studies, including ISAAC ones, necessary for international comparisons.

Although PDA was low in this population compared to the symptoms suggestive of asthma [12], the treatment was generally well adapted and in conformity with the recommendations. As indicated by severity scores, the use of controllers was done in moderate to severe cases and relievers or no treatment in mild cases. However there was a universal discrepancy between the recommended treatments and their results in real life, because total control was reported in relatively low percentages of diagnosed patients.

CONCLUSION

Greater efforts are needed to better diagnose asthma in children, and to reach a concordance between the guidelines of evidence-based medicine and their goal in "real world".

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اعراض الربو وشدة السيطرة عليه عند اطفال ٥-١٤ عاما من تلامذة المدارس اللبنانيين

موجز : مدخل - دراستنا تهتم بالاعراض استنادا الى المعلم المشدد لمراقبة الربو عند اطفال ٥-١٤ عاما اللبنانيين
الطرق : دراسة مستعرضة تطبق على الذين جرى تشخيص الربو عندهم من قبل طبيب وهم قسمان : مع معالجة واقية، وبدون معالجة واقية.
النتائج - ٥٥٤٤ طفلا، ٤،٩٪ مصابون بالربو امهات الاطفال في فئة الوقاية (٢،٧٠ ٪) الثرتقافة من امهات الاطفال في فئة دون الوقاية (٤٥،٩٪) (احتمال ٠،٠٠٣٧).
فئة دون وقاية هم اكثر في المدارس العامة مقابل المدارس الخاصة (احتمال ٠،٠٠٠١) زيارة الطبيب هي اكثر في فئة الوقاية مقارنة مع دون الوقاية. ٩٠٪ من فئة الوقاية يتعالجون بدواء وقائي للاعراض، ١٠٪ وقاية واحدة فقط .اتجاه مرتفع لشدة المرض موجود في فئة الوقاية مقارنة مع فئة دون وقاية. ٤٠٪ من فئة الوقاية مقابل ٣٤٪ من فئة دون وقاية يتأثر نشاطهم اليومي بسبب الربو.
الخلاصة - الربو عند الاطفال اللبنانيين بعمر ٥-١٤ عاما يتعالجون بشكل صحيح وبحسب الإرشادات الطبية العالمية بين العلاجات المقررة ونتائجها على الحياة والحياة العادية تلاحظ كما في بقية العالم.