ORIGINAL ARTICLE

Seasons and Other Factors Affecting the Quality of Life of Asthmatic Children

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Abstract

Objective: To study the effect of seasons on the health-related quality of life (HRQL) of asthmatic children.
Methods: Four groups of asthmatic children 7 to 14 years old were recruited by pediatricians during each season of the year. Their HRQL was assessed by means of the Paediatric Asthma Quality of Life Questionnaire (PAQLQ). Other factors surveyed were asthma severity, atopy, medical treatment, immunotherapy, obesity, parental smoking, and anti-allergic measures.
Results: The mean (SD) overall PAQLQ score was highest in summer at 6.2 (1.0) and lowest in autumn at 5.5 (1.2). The same trend was found for domains in summer and autumn, respectively: symptoms, 6.2 (1.0) vs 5.4 (1.4); emotions, 6.5 (0.8) vs 6.0 (1.0); and activities, 5.9 (1.4) vs 5.0 (1.5). Factors such as male gender (odds ratio [OR], 0.60; 95% confidence interval [CI], 0.41–0.87), being on immunotherapy (OR, 0.59; 95% CI, 0.38–0.92), living in an urban environment (OR, 0.56; 0.33–0.93), and residing on the northern coast of Spain along the Bay of Biscay (OR, 0.56; 0.36-0.89) were independent protective factors against having a total PAQLQ score in the lower tertile. Conversely, being recruited in a primary care setting (OR, 1.55; 1.01–2.38) and having more severe asthma were risks for being in the lower tertile.
Conclusions: Irrespective of the severity of the disease, season has a significant influence on the HRQL of asthmatic children.

Key words: Asthma. Children. Immunotherapy. Quality of life. Seasons.

Resumen

Objetivo: Saber cómo afectan las distintas estaciones del año a la calidad de vida (CV) de los niños asmáticos.
Métodos: Cuatro grupos distintos de niños asmáticos de 7-14 años fueron reclutados por sus pediatras durante cada estación del año. Su CV se midió por medio del Paediatric Asthma Quality of Life Questionnaire (PAQLQ). Otros factores que se recogieron fueron: gravedad del asma, atopia, tratamiento médico, inmunoterapia, obesidad, hábito de fumar en los padres y medidas ambientales de control alergénico.
Resultados: La puntuación general del PAQLQ (media ± DE) fue máxima en verano (6,2 ± 1,0) y mínima en otoño (5,5 ± 1,2). Esta misma tendencia se observó para la puntuación del dominio de síntomas (6,2 ± 1,0 vs. 5,4 ± 1,4), emociones (6,5 ± 0,8 vs. 6,0 ± 1,0) y actividades (5,9 ± 1,4 vs. 5,0 ± 1,5). Determinados factores como el sexo masculino (OR, 95%IC, 0,60, 0,41-0,87), estar tratado con inmunoterapia (0,59, 0,38-0,92), vivir en un entorno rural (0,56, 0,33-0,93) y residir en la costa Cantábrica (0,56, 0,36-0,89), fueron protectores de manera independiente frente a encontrarse en el tercil inferior de la puntuación general del PQALQ. Al contrario, haber sido reclutado en un centro de atención primaria (1,55, 1,61-3,67) y padecer un asma más grave fueron factores de riesgo de encontrarse en el tercil inferior de esta puntuación.
Conclusiones: Independientemente de la gravedad de la enfermedad, la estación del año tiene una influencia significativa en la CV de los niños asmáticos.

Palabras clave: Asma. Niños. Inmunoterapia. Calidad de vida. Estaciones del año.

Introduction

Health-related quality of life (HRQL) has become an increasingly important issue in the management of asthma and it is now often used to evaluate the effectiveness of antiasthma drugs [1]; self-management, educational, and fitness programs [2]; allergen avoidance measures [3]; or degree of specialization of the physician taking care of the asthmatic child [4]. As expected, HRQL is worse among asthmatic than among nonasthmatic children [5].

There are several specific questionnaires for estimating the HRQL of children with asthma, which can be answered either by the children themselves or by their parents. One of the most frequently used is the Paediatric Asthma Quality of Life Questionnaire (PAQLQ), which has shown good measurement properties, proving valid and able to discriminate [6]. It has been tested in children 7 to 17 years of age and minimal skills are needed for children to complete it correctly [7]. Moreover, this is the only HRQL questionnaire for asthmatic children that has been validated in Spanish [8].

Although the severity of asthma is a factor affecting HRQL [9], there seem to be other relevant factors. For example, in the study by Moy et al [10] in young adults, although lung function was not an independent predictor of HRQL at any level of asthma severity, shortness of breath was associated with HRQL at all levels. On the other hand, the use of rescue β-agonists predicted HRQL score only in the individuals with mild asthma. Thus, it seems that HRQL determinants vary according to asthma severity, at least in children. Furthermore, lung function improvements do not have a clear impact on changes in HRQL, at least in adults with persistent asthma [11]. HRQL measured by the Pediatric Allergic Disease Quality of Life Questionnaire is also affected by allergen exposure [12]. This questionnaire was developed to assess HRQL in the child with a multisystem allergic disease [13]. Furthermore, HRQL measured by the PAQLQ reflects not only medical variables but also psychological factors [14].

Asthma severity can be much influenced by the environment (allergens, infections, air pollution, etc), which in turn can undergo dramatic seasonal changes in some countries: the visits of asthmatic children to emergency departments are most numerous during autumn and least numerous during summer [15]. Furthermore, asthma hospitalizations and deaths have clear seasonal variation [16-18]. Thus, it is of interest to know how seasonal variations can affect the HRQL of asthmatic children. The main aim of the present study is to evaluate how the HRQL of asthmatic children is affected by the season of the year and to know which additional factors can modify it.

Methods

Population

The asthmatic children (as diagnosed by their pediatricians) included in the present study were recruited in the clinics of primary care pediatricians, pediatric pulmonologists, and pediatric allergists. Each pediatrician evaluated the HRQL of the first 3 asthmatic patients between 7 and 14 years of age attending for any reason at the beginning of each season, starting in autumn. After a prior training session in which 150 pediatricians were instructed in how to administer the PAQLQ, recruitment period started. This period lasted for one month in each season: October 2003, January 2004, April 2004, and July 2004. The aim was to have a complete data set for at least 300 children per season. Children were considered eligible to enter the study when their asthma was active, that is when they had had symptoms, had used short-acting β_2-agonists, or had been on long-term antiasthmatic treatment during the previous year. The children's parents or guardians were requested to give their written consent prior to enrolling a child in the study.

Measurements

HRQL was assessed with the validated Spanish version of the PAQLQ [8,19]. An additional questionnaire included demographic and environmental factors (pets, bedroom characteristics, smoking habits at home) and also questions on allergen reactivity (either by skin prick test or by allergen-specific serum immunoglobulin E titer), asthma maintenance medication, and immunotherapy. Pediatricians were also asked to report the children's asthma severity prior to treatment according to the Spanish guidelines for the management of pediatric asthma [20]. Those guidelines, which are similar to those of the Third International Pediatric Consensus Group's statement on the treatment of childhood asthma [21], called for classification as occasional episodic, frequent episodic, moderate persistent, and severe persistent.

Data Collection and Statistics

For a child's data to enter the analysis, he or she had to meet the inclusion criteria and have completed the PAQLQ. Loss of 10% of the questionnaires due to incorrect completion was expected. For an α level of .05 and a power of 90% for contrast between 4 seasonal data sets, it was calculated that 308 individuals per group would be necessary to detect a difference of 0.5 points, a figure assumed to be clinically significant [22] in the PAQLQ score. A SD of 1.5 points was allowed.

Comparisons between the 4 seasons and also between the different asthma types were made by means of χ^2 tests when variables were qualitative. When they were quantitative, the comparison was performed using Kruskal–Wallis analysis of variance for a single factor (either season or asthma severity). Calculations were made with SPSS software, version 12.0 (Chicago, Illinois, USA). A logistic regression model was built using the PAQLQ score as the dependent variable and the following independent variables: gender, residence (rural, urban, intermediate), geographical area of residence (central plateau, Mediterranean coast, or northern coast along the Bay of Biscay [North Coast]), setting where the child received health care (primary care vs hospital outpatient clinic), sensitization (not sensitized or sensitized to mite, pollen, molds, or multiple allergens), season (autumn, winter, spring, summer), immunotherapy (yes, no), asthma severity (occasional episodic, frequent episodic, moderate persistent, severe persistent), inhaled corticosteroids (yes, no), pets (dog, cat, hamster), preventive measures in the bedroom (antiallergy pillow, mattress covers) and smoking at home (any smoker vs no smoker). The first tertile of the PAQLQ score was tested against the third tertile and factors with an odds ratio that was significantly less than 1 were considered to be associated with a better PAQLQ score (protection against a lower HQRL). This logistic regression analysis was performed with the Intercooled Stata version 7 software (College Station, Texas, USA). The graphs of the global PAQLQ score and of the 3 different domains (symptoms, emotions, and activities) were drawn, according to asthma severity, with the Sigma Plot software package, version 9.0 (Systat Software Inc, Erkrath, Germany). The significance of the trend of the mean PAQLQ score from autumn to summer was estimated by means of the Cuzick test.

Results

The number of pediatricians who recruited children varied throughout the study period: 132 in autumn, 128 in winter, 89 in spring and 74 in summer. This represents an approximate loss of 44% in recruiting pediatricians, although there was a certain turnover. The numbers of children with valid data (ie, who had complete information related to HRQL variables included and to allergy tests) were 352 in autumn, 339 in winter, 234 in spring and 178 in summer (total, 1103). A total of 658 children were excluded from the analysis because of missing variables. The demographic characteristics of the whole population and of each group of children in every season are shown in Table 1.

Table 1. Demographic Characteristics of the Participants*

	Autumn, n=352	Winter, n=339	Spring, n=234	Summer, n=178	All Seasons, n=1103
Age, y, mean (SD)	10.4 (2.0)	10.2 (2.0)	10.3 (2.1)	10.6 (2.1)	10.3 (2.0)
Male gender	216 (62.6)	208 (62.3)	153 (65.9)	99 (56.3)	676 (62.2)
Weight, kg	41.5 (12.8)	40.9 (13.0)	41.2 (13.3)	43.0 (13.6)	41.5 (13.1)
Height, cm	144.5 (13.7)	143.2 (13.0)	143.4 (13.3)	145.4 (14.0)	144.0 (13.5)
Residence, n (%)					
Rural	63 (18.7)	70 (21.1)	38 (16.7)	22 (12.9)	193 (18.1)
Intermediate	87 (25.8)	77 (23.3)	44 (19.4)	45 (26.5)	253 (23.8)
Urban	187 (55.5)	184 (55.6)	145 (63.9)	103 (60.6)	619 (58.1)
Climatic zone					
Plateau	182 (51.7)	165 (48.7)	109 (46.6)	89 (50.0)	545 (49.4)
Mediterranean, coastal	74 (21.0)	70 (20.6)	40 (17.1)	23 (12.9)	207 (18.8)
North Coast	96 (27.3)	104 (30.7)	85 (36.3)	66 (37.1)	351 (31.8)
Type of Allergen					
Mites	86 (24.4)	72 (21.2)	49 (20.9)	54 (30.3)	261 (23.7)
Pollen	31 (8.8)	29 (8.6)	21 (9.0)	30 (16.9)	111 (10.1)
Molds	13 (3.7)	12 (3.5)	8 (3.4)	5 (2.8)	38 (3.4)
Multiple	156 (44.3)	150 (44.2)	107 (45.7)	53 (29.8)	466 (42.2)
Health care setting					
Outpatient hospital clinic	93 (26.6)	88 (26.0)	67 (28.9)	52 (29.4)	300 (27.3)
Primary care clinic	257 (73.4)	250 (74.0)	165 (71.1)	125 (70.6)	797 (72.7)
Immunotherapy	261 (23.7)	106 (30.1)	74 (21.8)	41 (17.5)	40 (22.5)
Treatment with ICS	394 (35.7)	135 (38.4)	122 (36.0)	74 (31.6)	63 (35.4)
Asthma severity					
Infrequent episodic	121 (37.1)	143 (46.7)	105 (47.9)	68 (42.0)	437 (43.1)
Frequent episodic	123 (37.7)	97 (31.7)	71 (32.4)	71 (43.8)	362 (35.7)
Moderate persistent	78 (23.9)	60 (19.6)	41 (18.7)	23 (14.2)	202 (19.9)
Severe persistent	4 (1.2)	6 (2.0)	2 (0.9)	0 (0.0)	12 (1.2)
Obesity	32 (9.7)	26 (8.3)	24 (10.8)	15 (8.8)	97 (9.3)
Pets					
Dog	56 (16.2)	61 (18.2)	36 (15.9)	33 (18.5)	186 (17.1)
Cat	22 (6.4%)	26 (7.8%)	11 (4.8%)	11 (6.2%)	70 (6.5%)
Antiallergy covers					
Pillow	69 (19.6%)	79 (23.3%)	59 (25.2%)	34 (19.1%)	241 (21.8%)
Mattress	87 (24.7%)	87 (25.7%)	63 (26.9%)	44 (24.7%)	281 (25.5%)
Smoking at home	163 (46.8%)	156 (46.2%)	113 (48.3%)	78 (44.1%)	510 (46.5%)

* Data are shown as number (%), except age, which is indicated as mean (SD). Because of missing values, the total sum of children in particular seasons might be less than the total number of children. North Coast indicates the zone along the Bay of Biscay; ICS, inhaled corticosteroids.

Table 2. Overall and Domain PAQLQ Scores According to Severity of Asthma*

	Domain			Overall
	Symptoms	Emotional	Activities	
Infrequent episodic	5.9 (1.2)	6.5 (0.8)	5.6 (1.4)	6.0 (1.0)
Frequent episodic	5.6 (1.3)	6.2 (0.9)	5.1 (1.5)	5.7 (1.1)
Moderate persistent	5.4 (1.3)	6.0 (1.1)	4.9 (1.5)	5.5 (1.2)
Severe persistent	4.7 (1.4)	5.8 (1.1)	4.2 (1.6)	5.0 (1.3)
P†	<.001	<.001	<.001	<.001

*Data are shown as means (SD). PAQLQ indicates Paediatric Asthma Quality of Life Questionnaire.
† Analysis of variance.

Table 3. Overall and Domain PAQLQ Scores by Seasons*

	Domain			Overall
	Symptoms	Emotions	Activities	
Autumn	5.4 (1.4)	6.0 (1.1)	5.0 (1.5)	5.5 (1.2)
Winter	5.6 (1.3)	6.2 (0.9)	5.2 (1.5)	5.8 (1.1)
Spring	5.8 (1.2)	6.3 (0.9)	5.4 (1.5)	5.9 (1.0)
Summer	6.2 (1.0)	6.5 (0.8)	5.9 (1.4)	6.2 (1.0)
P†	<.001	<.001	<.001	<.001

*Data are shown as means (SD). PAQLQ indicates Paediatric Asthma Quality of Life Questionnaire
† Analysis of variance.

There were statistically significant HQRL differences according to asthma severity both in the overall PAQLQ score and in the 3 domain scores (Table 2). The difference between scores of children with the mildest and the most severe asthma types was highest in the activities domain (1.4 points) and lowest in the emotional domain (0.7 points). The overall score difference was 1.0 points, twice the amount considered clinically significant.

The PAQLQ scores underwent statistically significant seasonal variation (Table 3). The overall score was worst in autumn (5.5 [1.2]) and best in summer (6.2 [1.0]). Again, the highest difference was in the activities domain (0.9 points). Those figures refer to the mean score for each season's group, irrespective of the severity of their asthma. The seasonal changes of the PAQLQ score according to asthma severity are shown in the figure.

Girls had a slightly lower mean PAQLQ score than boys when the severity of asthma was not taken into account. The overall score for girls was 5.7 (1.2) points while for boys it was 5.9 (1.1) points (P = .006). In spite of girls' lower scores in every strata, the only difference that was statistically significant, and very close to being clinically significant when the data was stratified by asthma severity, was found between children with moderate persistent asthma (6.0 [1.1] for girls vs 5.7 [1.2] for boys, P = .01).

Children on immunotherapy had a better overall mean PAQLQ score than children who were not: 6.0 (1.1) vs 5.7 (1.2) (P = .002), considering the population as a whole. When the children were stratified by asthma severity, the only significant difference was between children with infrequent asthma (6.3 [1.0] on immunotherapy vs 6.0 [0.9] not on therapy, P = .012) although in the rest of the strata children on immunotherapy scored better. Among the sensitized children in the sample, those on immunotherapy again had a significantly better overall PAQLQ score than those who were not, and the figures were equivalent to those obtained in the whole population (6.0 [1.0] on immunotherapy vs 5.7 [1.2] not on therapy, P = .009).

The highest tertile PAQLQ score cutoff points were 6.6, 6.9, and 6.4 for the symptoms, emotions, and activities domains, respectively, and 6.5 for the overall score. The corresponding figures for the lowest tertile were 5.2, 6.1, and 4.6 for the 3 domains, respectively, and 5.4 for the overall score. The results of logistic regression are shown in Table 4. Male gender, immunotherapy and, to a lesser degree, urban residence, living on the North Coast, and being recruited in a hospital outpatient clinic were independently and significantly associated with a higher PAQLQ score. As found in the univariate analysis, autumn was the worst season in terms of HRQL, while summer was the best; and the more severe the asthma the worse the HRQL.

Discussion

The results of the present study show that independent variables that affect HRQL along with asthma severity are male gender, seasonal variations, immunotherapy, urban residence,

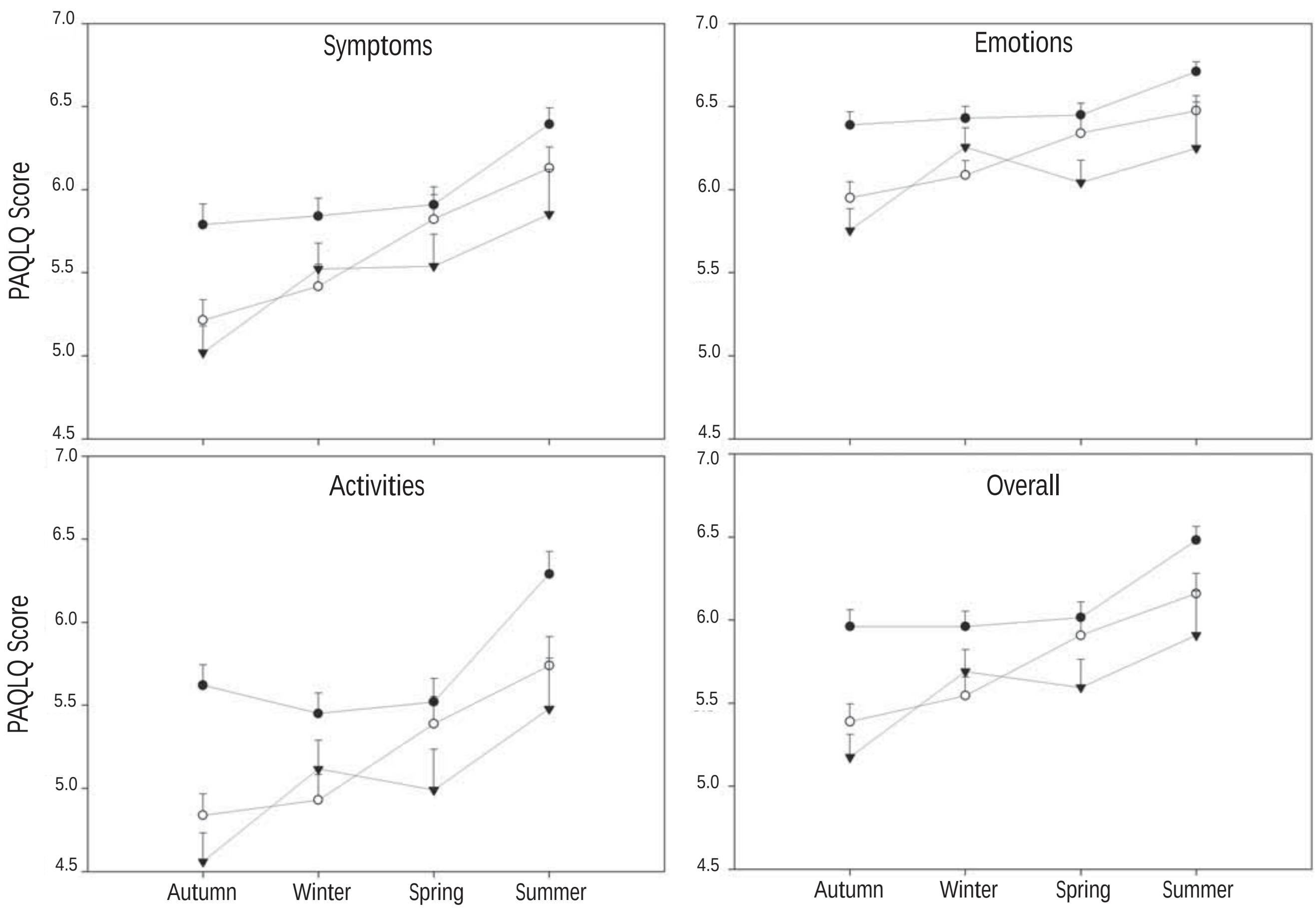
Table 4. Association Between the Studied Factors and the PAQLQ score*

	Domain			Overall
	Symptoms	Emotions	Activities	
Male gender	0.75 (0.52–1.07)	0.67 (0.48–0.94)	0.56 (0.39–0.81)	0.60 (0.41–0.87)
Residence				
Rural	1	1	1	1
Intermediate	0.75 (0.42–1.34)	0.89 (0.52–1.54)	0.99 (0.56–1.74)	0.73 (0.41–1.32)
Urban	0.64 (0.38–1.05)	0.65 (0.41–1.04)	0.68 (0.42–1.11)	0.56 (0.33–0.93)
Climatic Zone				
Plateau	1	1	1	1
Mediterranean, coastal	0.86 (0.52–1.42)	1.17 (0.73–1.88)	0.99 (0.60–1.61)	0.97 (0.57–1.64)
North Coast	0.57 (0.37–0.89)	0.61 (0.40–0.94)	0.60 (0.38–0.93)	0.56 (0.36–0.89)
Atopy				
Nonatopic	1	1	1	1
Mite	0.77 (0.44–1.38)	1.15 (0.66–2.01)	0.84 (0.48–1.47)	0.75 (0.42–1.35)
Pollen	0.64 (0.32–1.30)	0.98 (0.50–1.92)	0.61 (0.30–1.23)	0.62 (0.30–1.26)
Molds	0.84 (0.33–2.18)	1.26 (0.47–3.40)	0.85 (0.34–2.16)	0.88 (0.33–2.33)
Multiple	1.01 (0.60–1.67)	1.15 (0.71–1.86)	1.04 (0.63–1.71)	1.09 (0.65–1.83)
Season				
Autumn	1	1	1	1
Winter	0.75 (0.49–1.15)	0.76 (0.51–1.16)	0.78 (0.50–1.22)	0.75 (0.47–1.17)
Spring	0.57 (0.35–0.94)	0.68 (0.43–1.08)	0.60 (0.37–0.97)	0.63 (0.38–1.03)
Summer	0.20 (0.11–0.35)	0.27 (0.15–0.46)	0.23 (0.13–0.41)	0.17 (0.09–0.32)
Health care setting				
Hospital outpatient clinic	1	1	1	1
Primary care clinic	1.76 (1.16–2.69)	1.57 (1.06–2.31)	1.29 (0.86–1.94)	1.55 (1.01–2.38)
Inhaled corticosteroids	0.84 (0.58–1.23)	0.94 (0.66–1.34)	1.04 (0.73–1.51)	0.88 (0.60–1.29)
Immunotherapy	0.65 (0.42–0.98)	0.50 (0.33–0.75)	0.54 (0.35–0.83)	0.59 (0.38–0.92)
Asthma severity				
Occasional episodic	1	1	1	1
Frequent episodic	2.27 (1.51–3.39)	2.51 (1.71–3.70)	2.27 (1.53–3.37)	2.43 (1.61–3.67)
Moderate persistent	2.88 (1.73–4.79)	2.67 (1.69–4.24)	2.60 (1.58–4.27)	2.90 (1.71–4.91)
Severe persistent	9.24 (1.00–85.6)	5.96 (1.04–33.9)	9.96 (1.10–89.5)	9.03 (0.77–69.6)
Obesity	0.99 (0.53–1.87)	1.57 (0.88–2.81)	1.41 (0.77–2.56)	0.96 (1.00–85.5)
Pets at home				
Dog	0.95 (0.57–1.59)	1.03 (0.65–1.62)	0.85 (0.52–1.39)	0.88 (0.52–1.51)
Cat	0.85 (0.39–1.86)	0.83 (0.41–1.70)	0.80 (0.40–1.61)	0.76 (0.35–1.65)
Antiallergic covers				
Pillow	1.02 (0.53–1.99)	0.89 (0.47–1.69)	0.78 (0.40–1.50)	0.82 (0.42–1.61)
Mattress	0.71 (0.37–1.33)	1.08 (0.59–1.99)	1.03 (0.55–1.91)	0.88 (0.47–1.66)
Smoking at home	1.12 (0.78–1.61)	1.19 (0.85–1.66)	1.19 (0.83–1.70)	1.26 (0.87–1.82)

* Data are adjusted odds ratio (95% confidence interval). North Coast indicates the zone along the Bay of Biscay.

living on the North Coast, and being recruited in a hospital outpatient clinic. This is not the first study that has detected an influence of gender on the HRQL of asthmatic children measured by means of the PAQLQ. Warschburger et al [23] found that girls aged 8 to 16 years had a slightly lower HRQL than boys of the same age with the same degree of asthma severity attending an inpatient rehabilitation program. Previously, the same trend was observed in a group of individuals aged 16 to 34 years old [24]. This lower HRQL for females was not attributable to more severe disease as evidenced by lung function tests, but rather to a more severe subjective disease state in the females. The mean age of the children included in the present study (10.3 years) is a moment at which girls are much more aware of everything, and a possible hypothesis would be that this explains the observed difference in scores by gender. Although lung function was not measured in our study, the association of male gender with a better HRQL score is independent of the pediatrician-assessed severity of the disease.

Being recruited in a primary care setting rather than in a hospital outpatient clinic was associated with HRQL in the lower tertile. This is most probably because mild or moderate asthma exacerbations are usually treated in the primary care setting and do not reach the hospital unless treated in the emergency department.



Overall and domain scores on the Paediatric Asthma Quality of Life Questionnaire (PAQLQ) in each season according to asthma severity. Data points show means and whisker bars show SEMs: ● infrequent episodic, ○ frequent episodic, ▼ moderate persistent.

The asthmatic child recruited in a hospital outpatient clinic usually attends a scheduled visit. Furthermore, it should be emphasized that most children followed in hospital outpatient clinics also visit their primary care pediatricians, whereas not all asthmatic children followed in the primary care setting are seen in the hospital. Thus, the distinction between children visiting primary care or hospital outpatient clinics is not straightforward.

Seasonal variations of HRQL are not an unexpected finding: there are numerous studies showing that several markers of asthma severity are more frequent in certain seasons of the year. Quite recently, Silverman et al [15], in a large population of individuals attending emergency departments in New York City concluded that the highest number of visits occurred in the autumn and the lowest in the summer. Furthermore, seasonal fluctuations in visits were highest in children aged 13 years or younger, with a peak occurring at approximately the age of 7 years. The so-called September asthma epidemic has also been described in Canada and has been mainly related to respiratory viruses [18]. In Finland, Harju et al [16] described a double peak of hospital admissions for asthmatic children under the age of 15 years in spring and in autumn, probably reflecting variations in trigger factors according to those authors. As the severity of the disease is the most important factor influencing HRQL among asthmatics, it is quite reasonable that they have a better HRQL when allergen contact and respiratory viral infections are less prevalent. In Spain, as in many other countries, the main allergen related to asthma in children is mite [25-27], so it is to be expected that the worst season in terms of HRQL measures would be autumn, when the environmental conditions for mites are best and when respiratory viral infections are also frequent. The same trend toward the best HRQL in summer and the worst in autumn was found for all asthma severity strata.

Another finding of the present study is the association between better HRQL and immunotherapy, in contrast with the apparent lack of effect of inhaled corticosteroids on the PAQLQ score. However, certain considerations should be taken into account. Firstly, asthma severity was classified prior to the recruiting visit; that is, children had already been on treatment for months or years: it is quite possible that inhaled corticosteroids with or without other drugs had improved the disease previously. In other words, the effect of such treatment would have to have been tested against a group of children on placebo to conclude that inhaled corticosteroids do or do not have an impact on the HRQL of asthmatics, but numerous studies have shown this effect both in children and in caregivers [28,29]. Secondly, most uncontrolled children are put on inhaled corticosteroids regardless of whether or not they are undergoing immunotherapy. The provision of immunotherapy in Spain depends on the pediatrician to whom the child is referred: most pediatric allergists use immunotherapy while most pediatric pulmonologists do not. The referral criteria vary widely between health areas and depend mainly on the local or regional health facilities. Thus, to a certain extent, the allocation to immunotherapy is random.

Immunotherapy, which could also have contributed to the enhancement of HRQL prior to recruitment by improving asthma, was independently associated with a better PAQLQ score. This association seems mostly attributable to the effect of immunotherapy on the less severe asthma forms and might be related to a better effect on the early stages of the disease [30-34]. It could also be hypothesized that children on immunotherapy are less vulnerable to the changes in allergen concentration in their environment. Thus, a more frequent adjustment of the corticosteroid dosage for children who are not on immunotherapy might be needed to maintain a more stable HRQL throughout the year. It is not likely that a selection bias would explain this finding (ie, that children on immunotherapy would have been selected from among the ones with a less severe asthma), as the severity of the disease is a factor included in the analysis. Another possible explanation is that children on immunotherapy are better assessed and more closely followed: this could in turn allow protective measures to be stricter and, therefore, more effective. It is not likely that children on immunotherapy were recruited when attending to receive a dose (a stable situation) while children not on it were recruited when they attended for an asthma exacerbation. Although this explanation cannot be totally ruled out, children attending to receive an immunotherapy shot are usually not seen by doctors but by nurses. It is also possible that the effect of immunotherapy is related more to the improvement of the rhinitis—which co-occurs with asthma in many allergic children—than to a better lung function, although it does not seem to be the case that it had any relationship with the HRQL of these children [10].

With respect to our finding of a lack of effect of inhaled corticosteroids, a type II error is always a possibility. That seems unlikely, however, as there does not seem to be any trend of effect of those drugs on HRQL, and the number of children is relatively high. A waning effect of inhaled corticosteroids, low compliance, spontaneous disease progression or a ceiling effect of those drugs on childhood asthma could be potential additional explanations.

Another unexpected finding is that urban, as opposed to rural, residence is independently associated with having an upper tertile PAQLQ score: urban children can probably attend medical facilities more easily and thus receive better care of their asthma. Furthermore, it was not anticipated that living along the North Coast would be associated with better HRQL. This is inconsistent with the fact that asthma is more prevalent and probably more severe in that area [35]. It is quite possible that precisely because of that, pediatricians there are better prepared to treat the disease more effectively.

The present study has an important limitation: there was no follow-up of the same children throughout the year. The data comes from different groups of children recruited in the different seasons. However, the large number of children in each group together with random selection probably overcomes this limitation.

In summary, the results of the present study suggest that independently of the severity of asthma, which could have been previously modified by medical treatment, the HRQL of asthmatic children aged 7 to 14 years old is affected by seasonal variation, gender, immunotherapy and, to a lesser degree, urban residence and climatic zone.

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