



## ORIGINAL ARTICLE

# Health-related quality of life in children and adults with respiratory allergy in Colombia: Prospective study

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### KEYWORDS

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### Abstract

**Background:** Allergic diseases are very common, with the estimated cumulative prevalence in Colombia for asthma and allergic rhinitis being 22.7% and 31.3% respectively, and with a clear upward trend. A major social as well as economic impact associated with allergic disease has been described. Because in Colombia there are no studies that assess the Health-Related Quality of Life (HRQOL) in allergic respiratory diseases, our aim is to describe the HRQOL in subjects with respiratory allergy and its association with clinical control variables.

**Methods:** A prospective descriptive study was conducted among 76 Colombian subjects with rhinitis and asthma/allergic rhinitis. In order to evaluate the HRQOL, the instruments Kidscreen-27 and SF-36 were applied. The scores obtained in the HRQOL fields were correlated with the following clinical variables: peak expiratory flow (PEF) and peak nasal inspiratory flow (PNIF).

**Results:** In children, the better HRQL domain is present in the school environment (55.9) and the worst in psychological well-being (39.9). For adults the worst HRQL was found in the emotional function domain (55.6) while the physical function (81.7) had the best. There were no statistical differences between groups of asthma/allergic rhinitis and allergic rhinitis. Subjects with allergic asthma showed a strong correlation between the *mental health* domain and PEF values ( $r = -0.717$ ,  $p = 0.046$ ).

**Conclusion:** Mental health is more affected than physical health in Colombian subjects with respiratory allergy. There was a strong correlation between the *mental health* domain and the values of PEF in patients with asthma/allergic rhinitis.

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## Introduction

Allergic diseases are very common, with the estimated cumulative prevalence in Colombia for asthma and allergic rhinitis being 22.7% and 31.3% respectively, and with a clear upward trend. As these diseases are chronic disorders, they therefore represent a heavy social and economic burden.<sup>1</sup>

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In the USA, allergic rhinitis is responsible for 3.5 million lost working days and over \$6000 million dollars spent on medical formulations, without mentioning losses in productivity, numbers of medical appointments, money spent on over-the-counter medication and other additional costs.<sup>2</sup> It is important to emphasise that we are faced with a group of chronic pathologies, requiring not only objective evaluation via clinical control markers but also evaluation of treatment in terms of the impact on welfare and Health-Related Quality of Life (HRQOL). The concept of HRQOL and its determinants have evolved since the 1980s to encompass those aspects of overall quality of life that can be clearly shown to affect health – either physical or mental.<sup>3</sup> A wide range of instruments have been developed to measure HRQOL. These instruments for measuring perceived health can be sub-divided into generic – those that measure multiple dimensions or categories – and specific – those that focus on measuring particular aspects of a certain disease.<sup>4</sup> To date, our country has two transculturally adapted instruments available to evaluate the HRQOL: Kidscreen-27 for subjects aged between 8 and 18 and the SF-36 (Short-Form 36) for those aged over 18. Recent studies have reported the impact of rhinitis on quality of life as being related to asthma and asthma control.<sup>5</sup> Correlation between asthma control with the quality of life related to upper and lower airway has also been published.<sup>6</sup>

Since in Colombia there are no studies which assess the HRQOL in allergic respiratory diseases, our aim is to describe the HRQOL in subjects with respiratory allergy and its association with clinical control variables. Additionally, it is important to know the physical and mental factors related to the patient that influence the disease, to establish treatments directed specifically toward those outcomes.<sup>7</sup>

## Materials and methods

A prospective descriptive study was conducted among 76 Colombian subjects with respiratory allergy recruited by practitioners in allergy and allergist physicians. We included all patients presenting to the allergy clinic service for the first time at the University of Antioquia with rhinitis and asthma/allergic rhinitis and positive prick test to aeroallergens, diagnosed according to validated international criteria.<sup>8,9</sup> In order to evaluate the HRQOL, the instruments Kidscreen-27 and SF-36 were applied consecutively in the first visit to subjects between the ages of 8–18 and over 18, respectively. The SF-36 is a generic instrument that describes the HRQOL in the adult population and has been validated for allergic respiratory diseases.<sup>10–12</sup> It comprises 36 items, corresponding to eight fields: physical function, physical role limitation, body pain, general health, vitality, social function, emotional role limitation and mental health. The eight fields can be classified by two summarising measurements: physical components and mental components. It has been adapted to Colombia by Lugo et al.<sup>13</sup> Scores are established via graduated responses to each item, from 0 to 100, where 0 is the worst perception of the state of health and 100 the best perception. The Kidscreen-27 is the result of a reduction in the items from the original Kidscreen-52 questionnaire.<sup>14</sup> It is a questionnaire comprising 27 items that measure HRQOL via five fields: physical

well-being, psychological well-being, relationship with parents and autonomy, social support and rejection, and school environment.<sup>15</sup> The points scale is the same as that of the SF-36. The Kidscreen-27 is currently in the process of transcultural adaptation for Colombia. Both instruments were self administered in all subjects. The scores obtained in the HRQOL fields were correlated with the following clinical variables: peak expiratory flow (PEF)<sup>16</sup> and peak nasal inspiratory flow (PNIF).<sup>17</sup> The information was gathered during the period between September 2009 and September 2010. Subjects aged over eight with a diagnosis of allergic asthma according to the GINA criteria<sup>8</sup> and allergic rhinitis according to the ARIA criteria<sup>9</sup> were included. Subjects who had received specific immunotherapy with allergenic extracts were excluded. All patients signed informed consent before beginning the study.

## Analysis of the information

The variables were analysed by using measures of position, central tendency and dispersion. The Kolmogorov–Smirnov test was employed to analyse the normality of quantitative variables. The proportion of floor-ceiling responses was also calculated for the fields of the HRQOL instruments. The comparison between the diagnoses for the mean values was performed by means of the *t*-test for independent values. The Pearson correlation coefficients were calculated between the clinical variables PEF and PNIF for each of the fields in order to determine the association between these clinical variables. A confidence level of 95%, an alpha error of 5% and a statistical significance of  $p < 0.05$  were used for the analysis. This paper followed the presentation standards recently proposed by the GA2LEN.<sup>7</sup>

## Results

Sixty-five subjects were interviewed; 42 were aged between 8 and 18. Of the latter, 25 presented allergic rhinitis and 17 concomitant asthma/allergic rhinitis. The total of adults was 23, of whom 15 had a diagnosis of allergic rhinitis and eight of asthma/allergic rhinitis. The results of the clinical variables are presented in Table 1. In the subjects with allergic rhinitis, the PNIF values ranged between 47 and 330 Lt/min, while the PEF values for subjects with asthma and allergic rhinitis fell between 100 and 667 Lt/min. There were no statistically significant differences between children and adults for either the PNIF or the PEF values ( $p > 0.05$ ).

## Description of the HRQOL in children and adults

Table 2 presents the mean values for the HRQOL fields in children (Kidscreen-27) and adults (SF-36). The children's mean scores in the fields were lower than those of the adults. As different questionnaires were used for the two populations, it is not possible to establish any differences between the mean values of the HRQOL fields in children and adults.

### Children

The best HRQOL was obtained in the field *school environment* (55.9) and the worst in *psychological well-being*

**Table 1** Clinical characteristics of Colombian subjects with respiratory allergy.

	Total	Rhinitis	Asthma/rhinitis
Age (years) <sup>a</sup>	19.3 (13.1)	17.8 (9.4)	22.2 (17.7)
Peak expiratory flow (Lt/min) <sup>a</sup>	328.9 (103.4)	331.2 (94.9)	329.2 (120.3)
Children	314.9 (74.4)	323.3 (70.2)	312.2 (85.6)
Adults	357.4 (143.9)	347.2 (134.2)	363.3 (172.7)
Peak nasal inspiratory flow (Lt/min)	140.4 (65.1)	147.7 (65)	135.8 (66.8)
Children	130.9 (61.3)	146.7 (66.6)	116.7 (49.5)
Adults	159.8 (69.6)	149.7 (64.5)	174.2 (83)

<sup>a</sup> Mean and standard deviation.

(39.9). The floor effect for the questionnaire applied to this population was present in the field *physical well-being* (2.2%) and the ceiling effect in the *school environment* (15.6%).

### Adults

The worst HRQOL was found in the field *emotional performance* (55.6) while the *physical function* achieved the best (81.7). As regards summarising the classifications into *physical* and *mental components*, the lowest value was found in the *mental health* component (41.7). The floor effect for the SF-36 was obtained in the field *emotional performance* (10.1%), while the ceiling effect was in the *physical performance* (45.8%).

### Comparison of the HRQOL in subjects with rhinitis and asthma/allergic rhinitis

The subjects with asthma/allergic rhinitis presented a better HRQOL in all the fields when compared with those suffering from allergic rhinitis (Figs. 1 and 2).

In the children's population, the fields that presented the highest and lowest scores in both groups of diseases were *school environment* and *psychological well-being*, respectively. In the adult population, the subjects with asthma/allergic rhinitis had the highest scores in *physical function* and the lowest in *general health*. The subjects with allergic rhinitis had the highest scores in the field *physical function* and the lowest in *emotional performance*.

There were no statistical differences between the mean values in the domains in the asthma/allergic rhinitis and allergic rhinitis groups.

### Correlations between the HRQOL fields with PEF and PFNI

In terms of the diagnosis, the subjects with allergic asthma presented a strong correlation between the field *mental health* (from instrument SF-36) and the PEF values ( $r = -0.717$ ;  $p = 0.046$ ). There were no statistically significant correlations between the results of the other fields in either questionnaire, or in either the PEF or PNIF values (Tables 3 and 4).

**Table 2** Average values of HRQL in Colombian children and adults with respiratory allergy.

	Total	Rhinitis	Asthma/rhinitis	$p^a$
<i>Kidscreen-27</i>				
Physical well-being (PWB1)	47.5 (6.7)	47.9 (6.9)	47.2 (6.2)	0.761
Psychological well-being (PWB2)	39.9 (2.7)	39.6 (2.8)	40.6 (2.8)	0.244
Parents and autonomy (PA)	53 (9.4)	51.2 (10.4)	54.7 (8)	0.253
Social support and peers (SSP)	52.8 (8.8)	51.1 (8.5)	54.3 (9.3)	0.247
School environment (SE)	55.9 (9.9)	54.7 (9.8)	57.1 (9.9)	0.434
<i>SF-36</i>				
Physical functioning (PF)	81.7 (17.8)	80.3 (17.9)	81.9 (18.7)	0.848
Role-physical (RP)	64.6 (39)	60 (41)	71.9 (38.8)	0.508
Bodily pain (BP)	68.8 (28.2)	65.3 (29.6)	71.4 (26.4)	0.630
General health (GH)	58.8 (19.8)	56.2 (19.9)	59 (16.7)	0.738
Vitality (VT)	58.1 (16.1)	56.3 (14.9)	60.6 (19.7)	0.563
Social functioning (SF)	72.9 (23.2)	70 (25.8)	75 (17.7)	0.590
Role-emotional (RE)	55.6 (43.6)	44.4 (44.8)	75 (38.8)	0.119
Mental health (MH)	67.3 (20.3)	66.4 (22.1)	67.5 (18.8)	0.906
<i>Physical component summary (PCS)</i>	48.1 (10.2)	47.5 (10.6)	47.7 (9.9)	0.974
<i>Mental component summary (MCS)</i>	41.7 (12.2)	39.6 (13)	45.1 (11.2)	0.324

<sup>a</sup> *t*-Test for difference of means in independent samples.

Table 3 Pearson correlation coefficients between the domains of HRQOL and clinical variables in Colombian adults with respiratory allergy.

	PEF	PNIF	PF	RP	BP	GH	VT	SF	RE	MH	PCS	MCS
PEF	1											
PNIF	0.456**	1										
PF	0.028	0.179	1									
RP	0.102	0.706**	0.801**	1								
BP	0.095	0.801**	0.604**	0.801**	1							
GH	0.090	0.550**	0.550**	0.503*	0.676**	1						
VT	0.064	0.591**	0.591**	0.484*	0.529**	0.529**	1					
SF	0.060	0.300	0.300	0.395	0.749**	0.749**	0.469*	1				
RE	0.196	0.311	0.311	0.311	0.529**	0.482*	0.295	0.295	1			
MH	0.368	0.056	0.376	0.216	0.424*	0.612**	0.650**	0.788**	0.454*	1		
PCS	0.200	-0.003	0.778**	0.861**	0.742**	0.688**	0.440*	0.362	-0.059	0.128	1	
MCS	-0.334	0.075	0.109	0.091	0.393	0.300	0.579**	0.625**	0.812**	0.831**	-0.179	1

PEF: peak expiratory flow; PNIF: peak nasal inspiratory flow; PF: physical functioning; RP: role-physical; BP: bodily pain; GH: general health; VT: vitality; SF: social function; RE: role emotional; MH: mental health; PCS: physical component summary; MCS: mental component summary.

\* Correlation significant at 0.05 level.

\*\* Correlation significant at 0.001 level.

## Discussion

Patients with respiratory allergy have a significant reduction in HRQOL. The most affected field in the SF-36 questionnaire was *emotional performance*, while in the case of the Kidscreen-27 this was *psychological well-being*. There were no differences between patients with allergic rhinitis and asthma/allergic rhinitis in either children or adults as regards the effect on the quality of life. There was a strong correlation between the *mental health* field and the PEF values in subjects with asthma/allergic rhinitis. There was no correlation between the other fields and the evaluated clinical variables (PEF and PNIF).

This is the first study undertaken in Colombia to analyse HRQOL in subjects with allergic respiratory diseases. Furthermore, the application of Kidscreen-27 to evaluate the HRQOL in these diseases was itself an innovation.

In our children's population, *psychological well-being* was the dimension with the lowest values in both the subjects with asthma/allergic rhinitis and those with allergic rhinitis. This situation is different from reports on subjects with "some chronic conditions", where the highest and lowest values were in the fields of *autonomy and relationship with parents* and *physical well-being*, respectively.<sup>15</sup>

As regards the adult population, the scores obtained from SF-36 in longitudinal studies in subjects with allergic asthma support the presence of a better HRQOL in the field *physical function* and of less HRQOL in *mental health*, as seen in our population.<sup>18,19</sup> Furthermore, the scores in the *physical* and *mental components* in the adult asthmatic population were lower than the value considered as normal.<sup>20,21</sup> As for the adult subjects with allergic rhinitis, the values in the SF-36 fields presented similar distributions to those reported in the literature, with a more marked effect in the mental scales.<sup>19,22,23</sup> Contrary to Leynaert,<sup>22</sup> patients with rhinitis had more physical limitations than those with asthma and rhinitis, but no difference between these two groups for concepts related to mental/emotional health ( $p = 0.324$ ).

With respect to the behaviour of the questionnaire's floor and ceiling effect for the dimensions *emotional performance* and *physical performance*, this was similar to that of other studies; this can be explained by the fact that the items in these fields have only two reply options.<sup>24</sup> Our findings of a low degree of correlation between each of this instrument's fields and the PEF and PNIF values have also been previously described.<sup>25</sup>

Study limitations are described below. The study includes the use of generic questionnaires that could reduce the sensitivity of the results. Colombia does not have specific instruments for HRQOL in allergic diseases validated or transculturally adapted. It is necessary to initiate processes of cultural validation of questionnaires such as the Asthma Quality of Life Questionnaire (AQLQ)<sup>26</sup> and the Rhino conjunctivitis Quality of Life Questionnaire (RQLQ)<sup>27</sup> for evaluating the HRQOL in Colombian population with asthma and rhinitis, respectively.

Because the application of the questionnaire was conducted during the first visit to the allergist, it did not take into account the control variables such as the frequency of rescue medication use, the number of nocturnal

**Table 4** Pearson correlation coefficients between the domains of HRQOL and clinical variables in Colombian children with respiratory allergy.

	PEF	PNIF	PWB	PH	PA	SSP	SE
PEF	1	0.456**	0.017	-0.176	-0.023	-0.137	-0.085
PNIF	0.456**	1	0.024	0.074	0.271	0.214	0.055
PWB1	0.017	0.024	1	0.110	0.234	0.366*	0.375*
PWB2	-0.176	0.074	0.110	1	0.088	0.291	-0.078
PA	-0.023	0.271	0.234	0.088	1	0.460**	0.556**
SSP	-0.137	0.214	0.366*	0.291	0.460**	1	0.525**
SE	-0.085	0.055	0.375*	-0.078	0.556**	0.525**	1

PEF: peak expiratory flow; PNIF: peak nasal inspiratory flow; PWB1: physical well-being; PWB2: psychological well-being; PA: parents and autonomy; SSP: social support and peers; SE: school environment.

\* Correlation significant at 0.05 level.

\*\* Correlation significant at 0.001 level.

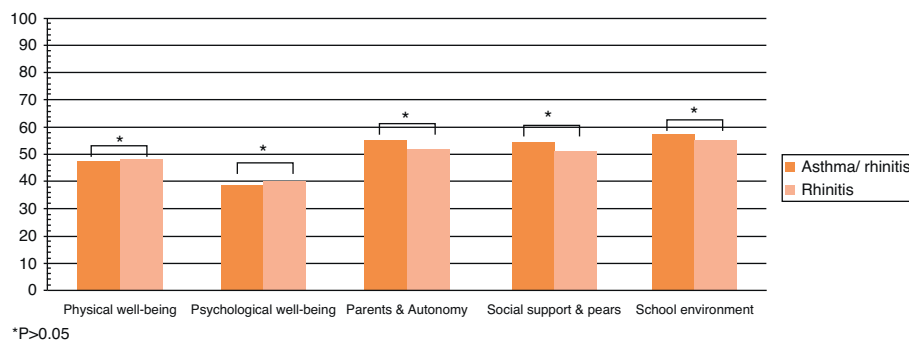
awakenings, and asthma and rhinitis symptoms. Not all patients had respiratory function tests on admission; it was decided not to make correlations between the domains of HRQOL with variables such as forced expiratory volume in one second (FEV1), functional vital capacity (FVC) or control test asthma (ACT). This limits the correlations that may have been made between HRQOL and other clinical variables.

Another limitation is the lack of Colombian normality values with respect to the HRQOL. In the future we will have normal population values for the SF-36 and the Kidscreen-27 to compare our results with healthy Colombian people.

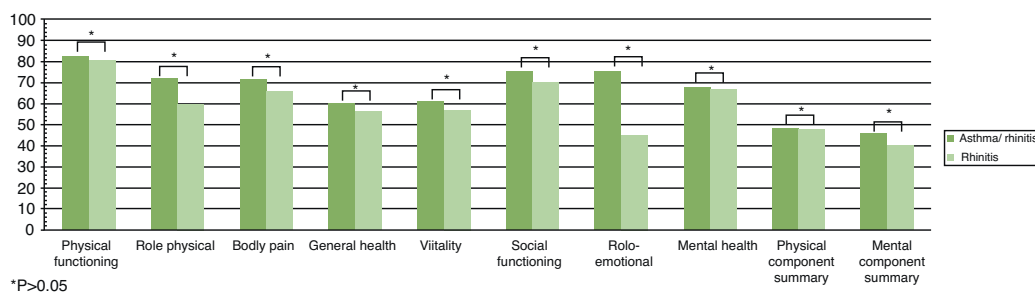
In our opinion, the main involvement in mental health reflects the real impact of allergic diseases on sufferers. It is imperative to construct health policies in this area, probably through educational programmes for allergic patients. These

programmes should be adapted to the needs of each region. In this way our attention is likely to be more comprehensive, with complementary results to the physical improvement of allergic patients.

In conclusion, mental health is more severely prejudiced than physical health in Colombian subjects with respiratory allergy. The establishment of health policies designed to affect the well-being and HRQOL of this population should be a priority. Such strategies should be constructed and executed by means of multidisciplinary teams embracing general practitioners, psychologists, paediatricians and other specialists involved with allergology. We hope for normal populations to have values for the SF-36 and the Kidscreen-27 in order to compare our results with healthy Colombian people.



**Figure 1** HRQOL scores of Colombian children with rhinitis and asthma/allergic rhinitis (Kidscreen-27).



**Figure 2** HRQOL scores in Colombian adults with rhinitis and asthma/allergic rhinitis (SF-36).

## Conflict of interest

The authors have no conflict of interest to declare.

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## References

- Dennis R, Caraballo L, Garcia E, Caballero A, Aristizabal G, Cordoba H, et al. Asthma and other allergic conditions in Colombia: a study in 6 cities. *Ann Allergy Asthma Immunol.* 2004;93:568–74.
- Franzese CB, Burkhalter NW. The patient with allergies. *Med Clin North Am.* 2010;94:891–902.
- McHorney CA. Health status assessment methods for adults: past accomplishments and future challenges. *Annu Rev Public Health.* 1999;20:309–35.
- Patrick DL, Deyo RA. Generic and disease-specific measures in assessing health status and quality of life. *Med Care.* 1989;27 Suppl. 3:S217–32.
- Vandenplas O, Dramaix M, Joos G, Louis R, Michils A, Verleden G, et al. The impact of concomitant rhinitis on asthma-related quality of life and asthma control. *Allergy.* 2010;65:1290–7.
- Braido F, Baiardini I, Balestracci S, Ghiglione V, Stagi E, Ridolo E, et al. Does asthma control correlate with quality of life related to upper and lower airways? A real life study. *Allergy.* 2009;64:937–43.
- Braido F, Bousquet PJ, Brzoza Z, Canonica GW, Compalati E, Fiocchi A, et al. Specific recommendations for PROs and HRQoL assessment in allergic rhinitis and/or asthma: a GA(2)LEN task-force position paper. *Allergy.* 2010;65:959–68.
- Kroegel C. Global Initiative for Asthma (GINA) guidelines: 15 years of application. *Expert Rev Clin Immunol.* 2009;5: 239–49.
- Bousquet J, Khaltaev N, Cruz AA, Denburg J, Fokkens WJ, Togias A, et al. Allergic Rhinitis and its Impact on Asthma (ARIA) 2008 update (in collaboration with the World Health Organization, GA(2)LEN and AllerGen). *Allergy.* 2008;63 Suppl. 86:8–160.
- Terreehorst I, Duivenvoorden HJ, Tempels-Pavlica Z, Oosting AJ, de Monchy JG, Buijnzeel-Koomen CA, et al. Comparison of a generic and a rhinitis-specific quality-of-life (QOL) instrument in patients with house dust mite allergy: relationship between the SF-36 and Rhinitis QOL Questionnaire. *Clin Exp Allergy.* 2004;34:1673–7.
- Juniper EF, Thompson AK, Roberts JN. Can the standard gamble and rating scale be used to measure quality of life in rhinoconjunctivitis? Comparison with the RQLQ and SF-36. *Allergy.* 2002;57:201–6.
- Puhan MA, Gaspoz JM, Bridevaux PO, Schindler C, Ackermann-Lieblich U, Rochat T, et al. Comparing a disease-specific and a generic health-related quality of life instrument in subjects with asthma from the general population. *Health Qual Life Outcomes.* 2008;6:15.
- Lugo ALH, García GHI, Gomez RC. Reliability of sf-36 quality of life in health questionnaire in Medellín, Colombia. *Rev Fac Nac Salud Pública.* 2006;24:37–50.
- Robitail S, Ravens-Sieberer U, Simeoni MC, Rajmil L, Bruil J, Power M, et al. Testing the structural and cross-cultural validity of the KIDSCREEN-27 quality of life questionnaire. *Qual Life Res.* 2007;16:1335–45.
- Ravens-Sieberer U, Auquier P, Erhart M, Gosch A, Rajmil L, Bruil J, et al. The KIDSCREEN-27 quality of life measure for children and adolescents: psychometric results from a cross-cultural survey in 13 European countries. *Qual Life Res.* 2007;16:1347–56.
- Quanjer PH, Lebowitz MD, Gregg I, Miller MR, Pedersen OF. Peak expiratory flow: conclusions and recommendations of a Working Party of the European Respiratory Society. *Eur Respir J Suppl.* 1997;24:2S–8S.
- Nathan RA, Eccles R, Howarth PH, Steinsvag SK, Togias A. Objective monitoring of nasal patency and nasal physiology in rhinitis. *J Allergy Clin Immunol.* 2005;115(3 Suppl. 1):S442–59.
- Sato S, Nishimura K, Tsukino M, Oga T, Hajiro T, Ikeda A, et al. Possible maximal change in the SF-36 of outpatients with chronic obstructive pulmonary disease and asthma. *J Asthma.* 2004;41:355–65.
- Larsson U, Taft C, Karlsson J, Sullivan M. Gender and age differences in the relative burden of rhinitis and asthma on health-related quality of life—a Swedish population study. *Respir Med.* 2007;101:1291–8.
- Almada Lobo F, Almada-Lobo B. Quality of life in asthmatic outpatients. *J Asthma.* 2008;45:27–32.
- King MT, Kenny PM, Marks GB. Measures of asthma control and quality of life: longitudinal data provide practical insights into their relative usefulness in different research contexts. *Qual Life Res.* 2009;18:301–12.
- Leynaert B, Neukirch C, Liard R, Bousquet J, Neukirch F. Quality of life in allergic rhinitis and asthma. A population-based study of young adults. *Am J Respir Crit Care Med.* 2000;162 4 Pt 1:1391–6.
- Lam HC, Tong MC, Van Hasselt CA. Rhinitis symptoms and quality of life in patients with chronic perennial rhinitis treated with desloratadine. *J Laryngol Otol.* 2007;121:1151–5.
- Ware Jr JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med Care.* 1992;30:473–83.
- Muraki M, Ichihashi H, Haraguchi R, Iwanaga T, Kubo H, Tohda Y. Comparison of the Asthma Health Questionnaire-33-Japan and the short-form 36-item health survey for measuring quality of life in Japanese patients with asthma. *Allergol Int.* 2008;57:339–46.
- Juniper EF, Buist AS, Cox FM, Ferrie PJ, King DR. Validation of a standardized version of the Asthma Quality of Life Questionnaire. *Chest.* 1999;115:1265–70.
- Juniper EF, Thompson AK, Ferrie PJ, Roberts JN. Validation of the standardized version of the Rhino conjunctivitis Quality of Life Questionnaire. *J Allergy Clin Immunol.* 1999;104 2 Pt 1:364–9.