Factors associated with health-related quality of life in adults with asthma. A cross-sectional study

Francisco-Javier Gonzalez-Barcala1*, Ramon de la Fuente-Cid2, Mónica Tafalla3, Javier Nuevo3 and Francisco Caamaño-Isorna4

Abstract
Background: The measurement of health-related quality of life (HRQoL) is increasingly recognized as an important endpoint, as a reflection of the effects of the disease from a patient perspective. Our aim was to evaluate the factors determining the HRQoL in patients with asthma, according to the EQ-5D questionnaire.

Methods: Patients were included using multi-stage sampling, from Primary Care clinics from all the Autonomous Communities in Spain. The patients included were: over 18 years-old, with a confirmed diagnosis of asthma for at least one year, and had visited a Health Centre in the previous 2 years. The characteristics of the asthma disease, the adherence to treatment, the socio-demographic variables, the smoking habits, and the asthma control were collected using a questionnaire. The influence of the different variables included in the study on the EQ-5D was evaluated using multivariate logistic regression analysis.

Results: A total of 2,125 patients were finally included (57.7% females, mean age 48 years). The response rate was 95.4%. Some factors showed a considerable detrimental effect on the HRQoL of asthmatics. Advanced age, lower educational level and poor control of asthma are significantly associated with a worse quality of life in all the dimensions assessed by the EQ-5D scale. The baseline severity of the asthma, and having been admitted to hospital are related to a worse quality of life in 5 of the 6 dimensions analyzed.

Conclusion: In our study, we could identify some factors related to quality of life in asthma patients. The most important were advanced age, lower education level, and poor control of the asthma.

Keywords: Asthma, Quality of life, Risk factors, Adults

Background
The measurement of health-related quality of life (HRQoL) is increasingly recognized as an important endpoint, a reflection of the effects of the disease from a patient’s perspective. It covers a multidimensional concept, not only associated with the disease itself and the medical actions developed for its management, but also with the physical, social and psychological functioning of the patient [1-5]. Although clinical and physiological parameters are needed to evaluate the disease, these are not sufficient to understand and assess how the patients perceive their state of health [6,7].

It is known that asthma negatively influences the quality of life of the patients who suffer from it, but the determining factors are not fully understood. In fact, the most severe forms of the disease are associated with a worse quality of life, but this relationship is not linear [8,9]. The factors related to this aspect of the disease need to be identified in order to improve the quality of life of the patients [7-9]. Several questionnaires have been developed to assess HRQoL. Some are used for specific diseases, while others are generic [7].

The EuroQol-5D (EQ-5D) questionnaire is a generic tool for measuring HRQoL, applicable in healthy individuals as well as in patients with a specific disease, which seems to have demonstrated validity and reliability in asthma [7]. In this, five health dimensions, stratified into 3 levels, as well as visual analogue scale (VAS) are descriptively evaluated [7].
The EQ-5D is a generic HRQoL questionnaire, and although not specific for asthma, it is considered valid for cross-sectional population studies of patients with this disease [2].

Our aim was to evaluate the factors associated with HRQoL in patients with asthma, from a multidimensional perspective.

Methods

Patients were included, using multi-stage sampling, from Primary Care clinics from all the Autonomous Communities in Spain. The first sampling unit was the Family Doctors, with 182 doctors being selected. They, in turn, included between 12 and 20 consecutive patients who were seen at their clinics, and who met with the previously defined criteria [10]. The patients were contacted by telephone from the clinic by their own doctor, and the data was collected by personal interview between November 2007 and March 2008.

The patients included were those who were over 18 years old (adult legal age in Spain), with a confirmed diagnosis of asthma for at least one year according to GINA criteria [11], who had visited a Health Centre in the previous 2 years, and signed the informed consent. Those individuals who, in the investigator’s opinion, were unable to read or understand the questionnaires, or had Chronic Obstructive Pulmonary Disease, were excluded [10].

Data were collected by personal interview, carried out by the Family Doctors themselves, with no specific training for this study.

The HRQoL was assessed using the EQ-5D questionnaire, where the patients themselves evaluated their state of health in severity levels by dimensions (including the 5 dimensions: mobility, personal care, daily activities, pain/discomfort, anxiety/depression) which were assessed at three levels (no problems, moderate problems, serious problems). An assessment was also made on a more general VAS scale ranging from 0 (worst state of health) to 100 (better state of health) [12].

Control of the asthma was determined using the Asthma Control Questionnaire (ACQ) [13]. Those patients who obtained an ACQ score lower than 0.75 were considered as well controlled, and those with a score ≥ 0.75 as not well controlled [10,13].

Using a questionnaire specifically designed for the study, the characteristics of the asthma disease were collected, as well as the adherence to treatment, and the socio-demographic variables, including: age, gender, place of residence (rural/urban), and educational levels (primary school, secondary school, university).

As regards smoking, they were classified into never smokers (means never having smoked habitually, no more than an occasional cigarette), ex-smokers (have been active smokers, but have not smoked for at least 6 months), or active smokers (smoke habitually every day).

Obesity was classified based on the body mass index (BMI), establishing 3 groups, normal weight (less than 25 kg/m²), overweight (between 25 and 30 kg/m²) and obese (more than 30 kg/m²).

The incidence of stressful events in the 15 days prior to completing the questionnaire was evaluated based on self-reporting by the patients, by asking them if they had suffered a stressful event in the previous 15 days, in general, without suggesting specific examples of a stressful event, with two response options, yes or no.

Treatment adherence was determined based on 3 variables: 1) level of therapeutic adherence according to the doctor; 2) frequency of forgetting the medication according to the patient; 3) importance of adherence according to the patient [10]. This last variable was determined by asking the patients about their level of agreement (from 0 = disagree completely, to 10 = agree completely) with the following sentence “Strict adherence to the medication prescribed by my doctor should improve my asthma symptoms”; and was stratified, by research team consensus, into two categories: < 8 and ≥ 8 [10].

The severity of the asthma (intermittent, mild persistent, moderate persistent, severe persistent) was determined in accordance with the criteria in the Global Initiative for Asthma guide (GINA) 2006, based on the condition of the patient before treatment was started [11].

The presence of allergy sensitization was reported by the patients themselves. Questions on going to an Emergency unit, to their Family Doctor or any hospital admissions during the year prior to the study were included in the questionnaire.

The basic treatment was classified into four, mutually exclusive, categories: 1) patients treated with oral corticosteroids in the previous year; 2) those treated with any combination of long-acting beta-2 agonists and inhaled corticosteroids, with any other drug but without oral corticosteroids; 3) treated with inhaled corticosteroids without continually taking long-acting beta-2 agonists, although they may take beta-2 agonists on demand; 4) only beta-2 agonists [10].

Statistical analysis

The mean, median, standard deviation, maximum and minimum values were calculated for the continuous variables, and the absolute and relative frequencies for the categorical variables.

The influence of the different variables included in the study on the 5 dimensions of the EQ-5D recorded dichotomically (without problems versus with problems) and the probability of obtaining values greater than the mean.
on the VAS scale were evaluated using multivariate logistic regression analysis. For the logistic regression model, all variables with a significance value of $P < 0.2$ in the univariate analysis were used as predictive variables in the multivariate analysis. The level of significance in the multivariate analysis was defined based on the confidence interval with an alpha error less than 0.05. The software SAS v8.2 was used. The study was approved by the Hospital Clínico San Carlos de Madrid Clinical Research Ethics Committee.

Results
A total of 2,125 patients were finally included, with 57.7% females, and a mean age of 48 years. The response rate was 95.4%. The main characteristics of the patients included are summarized in Table 1.

Through the analysis of the different dimensions evaluated with the EQ-5D questionnaire, the worst results corresponded to anxiety/depression, where 32% of asthmatics were shown to have problems. On the other hand, asthma seemed to have little effect on personal care, as only 8% mentioned problems on this aspect (Table 2).

Advanced age, a lower education level, greater baseline severity of the asthma, poor control of the asthma, and the need to be admitted to hospital had a detrimental effect on at least 4 of the 5 EQ-5D dimensions (Table 2). Analyzing the quality of life according to the VAS and with the EQ-5D index, the characteristics with the most significant influence on analyzing the QoL by dimensions maintained their impact. Other factors also demonstrated an independent effect, amongst which the most significant one corresponded to patients who had some recent stressful events, or who gave little importance to adherence to treatment (Table 3).

Discussion
It appears to be a current need to assess HRQoL in asthma, although it is still not clear which is the most suitable tool for assessing it [14]. EQ-5D is a generic HRQoL questionnaire that correlates well with asthma specific questionnaires. Also, the broader approach of generic questionnaires can give them a higher potential to pick up unexpected aspects or collateral effects of the disease. These two factors make it reasonably valid for population studies with asthmatic patients [5,15-17]. Furthermore, being a generic questionnaire, it helps in making the cost comparison with other chronic illnesses [14]. The response rate obtained in our study was relatively high (95.4%), and probably associated, at least partly, with the simplicity and rapidity in completing the EQ-5D questionnaire; which also makes it easier to use in daily practice [18].

Our results appear to confirm the negative effect of asthma on HRQoL when assessed with the EQ-5D questionnaire, and this effect appears worse than that reported in the general Spanish population [19]. Only the pain/discomfort dimension and the values obtained on the VAS for the general population are similar to those of our asthmatic population, but there are significant differences in the rest of the dimensions [19].

Increasing age, lower educational level, poorer asthma control and requiring hospital admissions were significant determining factors of a poorer HRQoL in asthmatic patients in all the dimensions analyzed, as well as in the general HRQoL analyzed using the VAS.

Although in some studies with few patients [20], or with a relatively young population [21] no association was seen between age and HRQoL, the majority of authors mention a deterioration in HRQoL with increasing age [5,8,22]. Some factors associated with ageing could explain this result. On the one hand, there are changes in lung function, such as an increase in airway hyper-responsiveness, accelerated decline in forced expiratory volume in one second, higher prevalence of irreversible airway obstruction, increased air trapping, reduction in chest wall compliance, a decrease in static elastic recoil pressure of the lung, reduction in respiratory muscle strength, as well as changes in chest configuration which make respiratory movements difficult [23,24]. There are also changes in the immune system, immunosenescence, which increases susceptibility to infections and malignancy rates [25]. Likewise, a deterioration in sight and hearing, in motor abilities, or even incipient cognitive impairment, can make adherence to treatment difficult [23]. Finally, comorbidity is more frequent in advanced age, as such that it may increase the symptomatology, and even make it difficult to indicate some treatments that may be suitable for asthma, but contraindicated by some of the respiratory comorbidities [23,24].

Lower health literacy has been reported in patients with a lower education level, as well as, lower mathematical skills, more delayed diagnosis of asthma, poorer access to health care or less adherence to healthy lifestyles, which could contribute to the worsening of HRQoL observed in these patients [26-29].

Hospital admissions are a major predictor of a worse HRQoL in asthma [8]; but a worse HRQoL is also associated with a higher probability of hospital admissions [30].

Good control of the disease has a significant effect on a better HRQoL, which is in agreement with other authors [5,31]. However, to achieve good control of the disease does not imply obtaining an optimum HRQoL, as other factors, such as the presence of the disease itself, or the need for treatment and medical care,
Table 1 Factors associated with health-related quality of life (n = 2,125)

| Factor                                      | % patients without problems |
|---------------------------------------------|----------------------------|
| **Gender**                                  |                            |
| Female                                      | 883/1,227 (72.0%)           |
| Male                                        | 726/898 (80.8%)             |
| **Age**                                     |                            |
| ≥ 60 years                                  | 335/638 (52.5%)             |
| 40 to 59 years                              | 551/704 (78.3%)             |
| 18 to 39 years                              | 723/783 (92.3%)             |
| **BMI (Kg/m²)**                             |                            |
| ≥ 30                                        | 243/424 (57.3%)             |
| ≥ 25 to 30                                  | 656/873 (75.1%)             |
| < 25                                        | 709/826 (85.8%)             |
| **Educational level**                       |                            |
| None                                        | 74/170 (43.5%)              |
| Primary                                     | 613/900 (68.1%)             |
| Secondary                                   | 600/706 (85.0%)             |
| University                                  | 319/345 (92.5%)             |
| **Occupation**                              |                            |
| Non active worker                           | 648/1,029 (63.0%)           |
| Active worker                               | 960/1,094 (87.7%)           |
| **Living status**                           |                            |
| Lives alone                                 | 145/237 (61.2%)             |
| Lives with someone                          | 1461/1,885 (77.5%)         |
| **Place of residence**                      |                            |
| Rural                                       | 632/859 (73.6%)             |
| Urban                                       | 977/1,265 (77.2%)           |
| **Family history of asthma**                |                            |
| Yes                                         | 744/984 (75.6%)             |
| No                                          | 865/1,141 (75.8%)           |
| **Asthma severity**                         |                            |
| Severe persistent                           | 28/90 (31.1%)               |
| Moderate persistent                         | 449/706 (63.6%)             |
| Mild persistent                             | 655/774 (84.6%)             |
| Intermittent                                | 476/554 (85.9%)             |
| **Smoking habit**                           |                            |
| Never                                       | 1006/1,339 (75.1%)          |
| Current or former                           | 601/784 (76.7%)             |
| **Alcohol intake**                          |                            |
| ≤ 22.5 grams                                | 705/940 (75.0%)             |
| > 22.5 grams                                | 732/944 (77.5%)             |
| **Pets at home**                            |                            |
| Yes                                         | 473/626 (75.6%)             |
| No                                          | 1,134/1,497 (75.7%)         |

Table 1 Factors associated with health-related quality of life (n = 2,125) (Continued)

| Factor                                      | % patients without problems |
|---------------------------------------------|----------------------------|
| Allergy sensitization                       |                            |
| No                                          | 871/1,201 (72.5%)           |
| Yes                                         | 738/924 (79.9%)             |
| **Stressful event last 15 days**             |                            |
| Yes                                         | 207/307 (67.4%)             |
| No                                          | 1,394/1,810 (77.0%)         |
| **Adherence to treatment (physician’s point of view):** |               |
| Very poor                                   | 31/40 (77.5%)               |
| Poor                                        | 224/313 (71.6%)             |
| Acceptable                                  | 624/805 (77.5%)             |
| Good                                        | 562/743 (75.6%)             |
| Very good                                   | 168/224 (75.0%)             |
| **How often do you forget your medication?** |                           |
| >10 times every month                       | 51/76 (67.1%)               |
| 6-10 times every month                      | 163/223 (73.1%)             |
| 1-5 times every month                       | 764/999 (76.5%)             |
| Never                                       | 631/827 (76.3)              |
| **Adherence is important (score, patient’s point of view):** |         |
| < 8                                         | 388/531 (73.1%)             |
| ≥ 8                                         | 1,220/1,591 (76.7%)         |
| **Asthma treatment**                        |                            |
| Oral corticosteroids                        | 62/158 (39.2%)              |
| LABA + IC                                   | 1,114/1,476 (75.5%)         |
| Inhaled corticosteroids                     | 180/209 (86.1%)             |
| SABA or LABA                                | 230/255 (90.2%)             |
| **ACQ score**                               |                            |
| >1.50                                       | 437/792 (55.2%)             |
| 0.75-1.50                                   | 464/561 (82.7%)             |
| <0.75                                       | 708/772 (91.7%)             |
| **Asthma control(physician’s point of view):** |                  |
| Very poor                                   | 43/83 (51.8%)               |
| Poor                                        | 172/322 (53.4%)             |
| Controlled                                  | 504/721 (69.9%)             |
| Total control                               | 889/997 (89.2%)             |
| **Asthma control (patient’s point of view) ** |                      |
| Very poor                                   | 11/41 (26.8%)               |
| Poor                                        | 97/191 (50.8%)              |
| Controlled                                  | 432/666 (64.9%)             |
| Total control                               | 1,060/1,217 (87.1%)         |
| **Hospital admissions**                     |                            |
| Yes                                         | 54/179 (30.2%)              |
| No                                          | 1,555/1,946 (79.9%)         |

Gonzalez-Barcala et al. Multidisciplinary Respiratory Medicine 2012, 7:32
http://www.mrmjournal.com/content/7/1/32
although improving control of the asthma, have an effect on the HRQoL [31].

Although there is a known relationship between asthma and psychological factors, the impact of psychological distress on the health of asthmatics and its determinating factors are not well described [32]. Some authors observed a worse quality of life in asthmatics with anxiety and/or depression [33-35]. On the other hand, Heaney et al., observed that the improvement in asthma control led to a better quality of life, but did not change the psychiatric symptoms. [36]. Furthermore, there is no single method to assess negative life events (NLE), understood as events that occur in the patient’s life that lead to stress, such as financial losses, work difficulties, death of a close friend or family, or other family problems [3]. In our case, this information was provided by the patients themselves. Behavioural and pathophysiological changes have been reported as determining factors in these NLE on asthma. For the former aspect, self-care could be reduced, or inadequate use of the medication [32,37], and for the latter, an increase in airway inflammation has recently been demonstrated in asthmatic patients after stressful events [38].

Patients with more severe forms of asthma have a worse HRQoL, both in our population and in others [8,39]. However, a recent population study in the USA did not see a relationship between severity and the HRQoL [5]. Another study in a Japanese population,

| Table 1 Factors associated with health-related quality of life (n = 2,125) (Continued) |
|---------------------------------------------------------------|
| **Number of hospital admissions**                            |
| ≥2               10/52 (19.2%)                                  |
| 1                44/127 (34.6%)                                  |
| 0                1,555/1,946 (79.9%)                             |
| **Emergency visits**                                         |
| Yes              503/810 (62.1%)                                 |
| No               1,106/1,315 (84.1%)                              |
| **Number of emergency visits**                               |
| ≥3               84/213 (39.0%)                                 |
| 1-2              419/596 (70.3%)                                 |
| 0                1,106/1,315 (84.1%)                              |
| **Family physician visits**                                  |
| No               97/112 (86.6%)                                 |
| Yes              1,506/2,012 (75.1%)                             |
| **Number of family physician visits**                        |
| 0                97/112 (86.6%)                                 |
| < 4              675/786 (85.9%)                                 |
| ≥ 4              831/1,221 (68.1%)                               |


| Table 2 Factors associated with health-related quality of life, according dimensions of EuroQol-5D questionnaire (n = 2,125) |
|------------------------------------------------------------------------------------------------------------------|
| **A**                                                                                                             |
| % patients without problems                                                                                       |
| **Gender**                                                                                                        |
| Female                                                           883/1,227 (72.0%)                                              |
| Male                                                             726/898 (80.8%)                                               |
| **Age**                                                                                                          |
| ≥ 60 years                                                       335/638 (52.5%)                                                |
| 40 to 59 years                                                   551/704 (78.3%)                                               |
| 18 to 39 years                                                   723/783 (92.3%)                                               |
| **BMI (Kg/m²)**                                                  |
| ≥ 30                                                             243/424 (57.3%)                                               |
| ≥ 25 to 30                                                       656/873 (75.1%)                                               |
| < 25                                                             709/826 (85.8%)                                               |
| **Educational level**                                           |
| None                                                             74/170 (43.5%)                                                |
| Primary                                                          613/900 (68.1%)                                               |
| Secondary                                                        600/706 (85.0%)                                               |
| University                                                       319/345 (92.5%)                                               |
| **ACQ score**                                                    |
| >1.50                                                            437/792 (55.2%)                                                |
| 0.75-1.50                                                       464/561 (82.7%)                                               |
| <0.75                                                            708/772 (91.7%)                                               |
| **Hospital admissions**                                         |
| Yes                                                              54/179 (30.2%)                                                |
| No                                                               1,555/1,946 (79.9%)                                            |
| **B**                                                                                                           |
| % patients without problems                                      |
| **Self-care**                                                    |
| **Age**                                                                                                          |
| ≥ 60 years                                                       335/638 (52.5%)                                                |
| 40 to 59 years                                                   551/704 (78.3%)                                               |
| 18 to 39 years                                                   723/783 (92.3%)                                               |
| **Educational level**                                           |
| None                                                             74/170 (43.5%)                                                |
| Primary                                                          613/900 (68.1%)                                               |
| Secondary                                                        600/706 (85.0%)                                               |
| University                                                       319/345 (92.5%)                                               |
Table 2 Factors associated with health-related quality of life, according dimensions of EuroQol-5D questionnaire (n = 2,125) (Continued)

| Occupation          | Non active worker 648/1,029 (63.0%) | 1         |
|---------------------|-------------------------------------|-----------|
|                     | Active worker 960/1,094 (87.7%)     | 2.77 (1.52,5.04) |

| Living status       | Lives alone 145/237 (61.2%)         | 1         |
|---------------------|-------------------------------------|-----------|
|                     | Lives with someone 1,461/1,885 (77.5%) | 1.70 (1.03,2.80) |

| Asthma severity     | Severe persistent 28/90 (31.1%)     | 1         |
|---------------------|-------------------------------------|-----------|
|                     | Moderate persistent 449/706 (63.6%)  | 1.81 (0.98,3.34) |
|                     | Mild persistent 655/774 (84.6%)     | 3.21 (1.38,7.46) |
|                     | Intermittent 476/554 (85.9%)        | 3.32 (1.61,6.85) |

| Stressful event last 15 days | Yes 207/307 (67.4%) | 1         |
|-----------------------------|---------------------|-----------|
|                             | No 1,394/1,810 (77.0%) | 1.99 (1.22,2.62) |

| Asthma treatment           | Oral corticosteroids 62/158 (39.2%) | 1         |
|-----------------------------|-------------------------------------|-----------|
|                             | LABA + IC 1,114/1,476 (75.5%)       | 1.34 (0.77,2.32) |
|                             | Inhaled corticosteroids 180/209 (86.1%) | 4.07 (1.07,15.48) |
|                             | SABA or LABA 230/255 (90.2%)        | 1.76 (0.58,5.33) |

| ACQ score                  | >1.50 437/792 (55.2%) | 1         |
|-----------------------------|-----------------------|-----------|
|                             | 0.75-1.50 464/561 (82.7%) | 2.49 (1.43,4.36) |
|                             | <0.75 708/772 (91.7%) | 2.69 (1.41,5.14) |

| Hospital admissions        | Yes 54/179 (30.2%) | 1         |
|-----------------------------|---------------------|-----------|
|                             | No 1,555/1,946 (79.9%) | 2.52 (1.52,4.17) |

| % patients without problems | Usual activities Adjusted OR (95%CI)* |
|-----------------------------|--------------------------------------|

| C Age                       | 335/638 (52.5%) | 1         |
|-----------------------------|-----------------|-----------|
| ≥ 60 years                  | 551/704 (78.3%) | 2.27 (1.63,3.16) |
| 40 to 59 years              | 723/783 (92.3%) | 2.67 (1.80,3.95) |
| 18 to 39 years              | 238/344 (68.1%) | 2.02 (1.36,2.96) |

| BMI (Kg/m²)                | 243/424 (57.3%) | 1         |
|-----------------------------|-----------------|-----------|
| ≥ 30                        | 656/873 (75.1%) | 1.27 (0.93,1.73) |
| ≥ 25 to 30                  | 709/826 (85.8%) | 1.43 (1.02,2.02) |
| < 25                        | 723/783 (92.3%) | 5.27 (3.52,7.88) |

| Educational level           | None 74/170 (43.5%) | 1         |
|-----------------------------|---------------------|-----------|
| Primary                     | 613/900 (68.1%)     | 1.51 (0.99,2.31) |
| Secondary                   | 600/706 (85.0%)     | 1.86 (1.16,2.99) |
| University                  | 319/345 (92.5%)     | 2.62 (1.49,4.60) |

Table 2 Factors associated with health-related quality of life, according dimensions of EuroQol-5D questionnaire (n = 2,125) (Continued)

| Living status               | Lives alone 145/237 (61.2%) | 1         |
|-----------------------------|-----------------------------|-----------|
|                             | Lives with someone 1,461/1,885 (77.5%) | 1.76 (1.23,2.53) |

| Asthma severity             | Severe persistent 28/90 (31.1%) | 1         |
|-----------------------------|--------------------------------|-----------|
|                             | Moderate persistent 449/706 (63.6%) | 1.75 (0.95,3.24) |
|                             | Mild persistent 655/774 (84.6%) | 1.97 (1.04,3.74) |
|                             | Intermittent 476/554 (85.9%) | 1.76 (0.90,3.45) |

| Asthma treatment            | Oral corticosteroids 62/158 (39.2%) | 1         |
|-----------------------------|-------------------------------------|-----------|
|                             | LABA + IC 1,114/1,476 (75.5%)       | 1.41 (0.88,2.23) |
|                             | Inhaled corticosteroids 180/209 (86.1%) | 2.43 (1.27,4.62) |
|                             | SABA or LABA 230/255 (90.2%)        | 1.97 (1.05,3.71) |

| ACQ score                  | >1.50 437/792 (55.2%) | 1         |
|-----------------------------|-----------------------|-----------|
|                             | 0.75-1.50 464/561 (82.7%) | 3.74 (2.79,5.09) |
|                             | <0.75 708/772 (91.7%) | 7.48 (5.29,10.58) |

| Hospital admissions        | Yes 54/179 (30.2%) | 1         |
|-----------------------------|---------------------|-----------|
|                             | No 1,555/1,946 (79.9%) | 1.75 (1.14,2.68) |

| Emergency visits           | Yes 503/810 (62.1%) | 1         |
|-----------------------------|---------------------|-----------|
|                             | No 1,106/1,315 (84.1%) | 1.67 (1.28,2.17) |

| % patients without problems | Pain/Discomfort Adjusted OR (95%CI)* |
|-----------------------------|--------------------------------------|

| Gender                      | Female 883/1,227 (72.0%) | 1         |
|-----------------------------|--------------------------|-----------|
|                             | Male 726/898 (80.8%)     | 1.55 (1.17,2.06) |

| C Age                       | 335/638 (52.5%) | 1         |
|-----------------------------|-----------------|-----------|
| ≥ 60 years                  | 551/704 (78.3%) | 2.32 (1.68,3.22) |
| 40 to 59 years              | 723/783 (92.3%) | 5.27 (3.52,7.88) |
| 18 to 39 years              | 238/344 (68.1%) | 1.56 (1.05,2.32) |

| BMI (Kg/m²)                | 243/424 (57.3%) | 1         |
|-----------------------------|-----------------|-----------|
| ≥ 30                        | 656/873 (75.1%) | 1.36 (1.00,1.85) |
| ≥ 25 to 30                  | 709/826 (85.8%) | 1.75 (1.25,2.47) |
| < 25                        | 723/783 (92.3%) | 3.52 (2.31,5.19) |

| Educational level           | None 74/170 (43.5%) | 1         |
|-----------------------------|---------------------|-----------|
| Primary                     | 613/900 (68.1%)     | 1.59 (1.02,2.49) |
| Secondary                   | 600/706 (85.0%)     | 1.88 (1.14,3.09) |
| University                  | 319/345 (92.5%)     | 2.23 (1.25,3.99) |
observed deterioration in the HRQoL with the increasing severity of asthma in males, but not in females, establishing the possibility of different “coping styles” between the sexes [40].

Patients who remain in active employment have a better QoL, a similar finding to that of Siroux in a multicentre European study [8]. Lack of occupational activity is associated with a lower socio-economic income and greater psychological distress, which could be determining factors in the deterioration of the QoL [3,41].

Living in an urban setting is associated with a better HRQoL. The same relationship was observed in a large study with Spanish children, suggesting the possibility that urban areas could have better access to the health system [42]. Other differences have also been identified in the management of the disease, with a lower likelihood of scheduled follow up or a greater underdiagnosis in patients in rural areas [43,44].

The damaging effect of living alone appears to be confirmed, given that it is associated to a worse QoL. This is in agreement with other studies, where to live alone was a predictive factor of more visits to the Emergency Department, worse mental health or longer delay in the diagnosis [29,45,46].

In other aspects analyzed, our findings agree with those mentioned in the literature, showing more exacerbations [8,30]; female sex [8,47]; less adherence to treatment [48]; being someone who never smoked [5,49]; and obesity [8,50] are determining factors of a worse quality of life.

Our study may have some limitations. Firstly, being a cross-sectional study causality relationships cannot be

Table 2 Factors associated with health-related quality of life, according dimensions of EuroQol-5D questionnaire (n = 2,125) (Continued)

| Occupation | Non active worker | 648/1029 (63.0%) | 1 |
|------------|------------------|------------------|---|
| Active worker | 960/1094 (87.7%) | 1.43 (1.06,1.93) | |
| Asthma severity | | | |
| Severe persistent | 28/90 (31.1%) | 1 |
| Moderate persistent | 449/706 (63.6%) | 2.24 (1.14,4.41) |
| Mild persistent | 655/774 (84.6%) | 3.35 (1.66,6.75) |
| Intermittent | 476/554 (85.9%) | 2.65 (1.28,5.48) |
| Stressful event last 15 days | Yes | 207/307 (67.4%) | 1 |
| No | 1,394/1,810 (77.0%) | 2.04 (1.46,2.83) |
| ACQ score | >1.50 | 437/792 (55.2%) | 1 |
| 0.75-1.50 | 464/561 (82.7%) | 1.80 (1.33,2.44) |
| <0.75 | 708/772 (91.7%) | 2.78 (1.99,3.88) |
| Hospital admissions | Yes | 54/179 (30.2%) | 1 |
| No | 1,555/1,946 (79.9%) | 2.05 (1.30,3.25) |
| Emergency visits | Yes | 503/810 (62.1%) | 1 |
| No | 1,106/1,315 (84.1%) | 1.37 (1.03,1.81) |
| E % patients without problems | Anxiety/Depression | Adjusted OR (95%CI)* |

Table 2 Factors associated with health-related quality of life, according dimensions of EuroQol-5D questionnaire (n = 2,125) (Continued)

| Stressful event last 15 days | Yes | 207/307 (67.4%) | 1 |
| No | 1,394/1,810 (77.0%) | 5.57 (4.08,7.59) |
| ACQ score | >1.50 | 437/792 (55.2%) | 1 |
| 0.75-1.50 | 464/561 (82.7%) | 1.36 (1.01,1.83) |
| <0.75 | 708/772 (91.7%) | 1.66 (1.21,2.28) |
| Hospital admissions | Yes | 54/179 (30.2%) | 1 |
| No | 1,555/1,946 (79.9%) | 2.09 (1.36,3.22) |
| Emergency visits | Yes | 503/810 (62.1%) | 1 |
| No | 1,106/1,315 (84.1%) | 1.32 (1.02,1.72) |

*Adjusted Odds Ratio (Adjusted by all the variables in the Table 1). NS, Crude Odds Ratio non significant; BMI, Body mass index; SABA, Short-acting beta2 agonists; LABA, Long-acting beta2 agonists; SD, Standard Deviation; IC, Inhaled corticosteroids.
defined. Secondly, the reference NLE is by self-report, as such any influence of the personality of the patients cannot be excluded. Thirdly, the selection of the participating doctors was not strictly randomized. However, given the high number of participating doctors and the distribution over the whole country, as well as the collection of data with validated tools like the EQ-5D questionnaire, the inclusion of a significant number of co-variables that could have an influence on the quality of life, and the high number of patients analyzed, these results should be reasonably valid as representative of the reality of the QoL of asthmatics in Spain and its determining factors.

Conclusions
In our study, we could identify some factors related to worst quality of life in asthma patients.

The most significant were advanced age, lower education level, greater baseline severity of the asthma, presence of stressful events, poor control of the asthma, and need to be admitted to hospital.

We believe that the identification of factors related to poor asthma control, and particularly those that could be changed by the health care system [10], could lead to an improvement in the situation of asthmatic patients. Thus, the prevention and treatment of obesity and smoking, as well as reinforcing health education, seem

---

Table 3 Factors associated with health-related quality of life: VAS scale (0 = worst health state, 100 = best health state); (n = 2034)

|                              | N    | Mean (SD)   | Adjusted mean differences (CI 95 %)*  |
|------------------------------|------|-------------|-------------------------------------|
| **Age**                      |      |             |                                     |
| ≥ 60 years                   | 609  | 62.38 (17.46)| 1.78 (−0.38,3.94)                  |
| 40 to 59 years               | 675  | 68.93 (16.66)| 4.99 (2.63,7.37)                   |
| 18 to 39 years               | 750  | 76.34 (15.33)|                                     |
| **Educational level**        |      |             |                                     |
| None                         | 162  | 58.57 (18.52)|                                     |
| Primary                      | 865  | 66.12 (17.18)| 2.41 (−0.63,5.44)                  |
| Secondary                    | 667  | 73.48 (16.02)| 4.96 (1.64,8.28)                   |
| University                   | 336  | 76.87 (14.92)| 6.30 (2.69,9.90)                   |
| **Asthma severity**          |      |             |                                     |
| Severe persistent            | 87   | 46.78 (17.21)|                                     |
| Moderate persistent          | 672  | 65.45 (16.86)| 9.01 (5.07,12.96)                  |
| Mild persistent              | 754  | 72.97 (15.12)| 11.40 (7.28,15.52)                 |
| Intermittent                 | 520  | 74.26 (16.96)| 9.49 (5.22,13.76)                  |
| **Smoking habit**            |      |             |                                     |
| Current or former            | 753  | 68.47 (17.02)|                                     |
| Never                        | 1,279| 70.43 (17.58)| 2.51 (1.13,3.89)                   |
| **Stressful event last 15 days** |   |             |                                     |
| Yes                          | 296  | 61.47 (18.61)|                                     |
| No                           | 1,731| 71.10 (16.75)| 6.17 (4.31,8.03)                   |
| **Adherence is important (score, patient’s point of view):** | | | |
| < 8                          | 511  | 65.25 (17.78)| 4.02 (2.54,5.50)                   |
| ≥ 8                          | 1,521| 71.23 (16.98)|                                     |
| **ACQ score**                |      |             |                                     |
| >1.50                        | 762  | 58.94 (16.38)|                                     |
| 0.75-1.50                    | 541  | 72.59 (13.89)| 9.48 (7.53,11.44)                  |
| <0.75                        | 731  | 78.79 (14.48)| 13.26 (11.22,15.29)                |

Score of VAS scale, and probability of obtaining values greater than the mean on the VAS. Multivariate analysis.

*Adjusted by all the variables in the Table 1.

N, number of cases; VAS, Visual Analogue Scale; CI, Confidence interval; BMI, Body mass index; SABA, Short-acting beta2 agonists; LABA, Long-acting beta2 agonists; IC, Inhaled corticosteroids.
to be basic aspects that could be performed by the health care system.

Abbreviations
HRQoL: Health-related quality of life; EQ-SD: EuroQol-SD; VAS: Visual analogue scale; BMI: Body mass index; GINA: Global Initiative for Asthma guide.

Competing interests
Mónica Tafalla and Javier Nuevo are employees of AstraZeneca Spain. The study was funded by AstraZeneca Spain.

Authors' contributions
Designed research/study: Mónica Tafalla, Javier Nuevo, Francisco Caamaño-Isorna. Performed research/study: Mónica Tafalla, Javier Nuevo, Francisco Caamaño-Isorna. Collected data: Mónica Tafalla, Javier Nuevo, Francisco Caamaño-Isorna. Analyzed data: Francisco-Javier Gonzalez-Barcala, Ramon de la Fuente-Cid, Mónica Tafalla, Javier Nuevo, Francisco Caamaño-Isorna. Wrote paper: Francisco-Javier Gonzalez-Barcala, Ramon de la Fuente-Cid. All authors read and approved the final manuscript.

Author details
1. Pneumology Department, Clinic University Hospital, C/Choupana SN 15706, Santiago de Compostela, Spain. 2. Internal Medicine Department, Clinic University Hospital, Santiago de Compostela, Spain. 3. Medical Department, AstraZenea Farmacéutica, Madrid, Spain. 4. CIBER of Epidemiology and Public Health (CIBERESP), Preventive Medicine Department, University of Santiago de Compostela, Santiago de Compostela, Spain.

Received: 2 May 2012 Accepted: 25 July 2012

References
1. Braido F, Bousquet PJ, Brozza Z, et al. Specific recommendations for PROs and HRQoL assessment in allergic rhinitis and/or asthma: a GA(2)LEN taskforce position paper. Allergy 2010, 65(8):959–968. 2. Baardin I, Braido F, Brandi S, Tarantini F, Bonini S, Bousquet PJ, Zuberbier T, Demoly P, Canonica GW: The impact of GINA suggested drugs for the treatment of asthma on Health-Related Quality of Life: a GA(2)LEN review. Allergy 2008, 63(8):1015–1030. 3. Archea C, Yen HY, Chen HY, Eisner MD, Katz PP, Masharani U, Yelin EH, Earnest G, Blanc PD. Negative life events and quality of life in adults with asthma. Thorax 2007, 62(2):139–146. 4. Bateman ED, Bousquet J, Kecht ML, Busse WW, Clark TJ, Pedersen SE: The correlation between asthma control and health status: the GOAL study. Eur Respir J 2007, 29(5):56–62. 5. Chen H, Gould MK, Blanc PD, Miller DP, Kannath TV, Lee JH, Sullivan SD, for the TENOR Study Group: Asthma control, severity, and quality of life: quantifying the effect of uncontrolled disease. J Allergy Clin Immunol 2007, 120(2):396–402. 6. Juniper EF, Wisienski ME, Cox FM, Emmett AH, Nielsen KE, O’Byrne PM: Relationship between quality of life and clinical status in asthma: a factor analysis. Eur Respir J 2004, 23(2):287–291. 7. Pickard JS, Wilkie C, Jung E, Patel S, Staven K, Lee TA. Use of a preference-based measure of health (EQ-SD) in COPD and asthma. Respir Med 2008, 102(4):519–536. 8. Siroux V, Boudier A, Anto JM, et al: Quality-of-life and asthma-severity in general population asthmatics: results of the ECRRH II study. Allergy 2008, 63(5):547–554. 9. Ford ES, Mannino DM, Redd SC, Moriarty DG, Mokdad AH: Determinants of quality of life among people with asthma: findings from the Behavioral Risk Factor Surveillance System. J Asthma 2004, 41(3):327–336. 10. Gonzalez-Barcala FJ, de la Fuente-Cid R, Alvarez-Gil R, Tafalla M, Nuevo J, Caamaño-Isorna F: Factors associated with asthma control in primary care patients: the CHAS study. Arch Bronconeumol 2010, 46(7):358–363. 11. Global strategy for asthma management and prevention (updated 2006). Retrieved 15 July, 2010, from http://www.ginasthma.org. 12. McGattag-Cowan HM, Mara CA, Yang Y, Brazier JE, Kopeck JA, FitzGerald JM, Anis AH, Lynd LD. The validity of generic and condition-specific preference-based instruments: the ability to discriminate asthma control status. Qual Life Res 2006, 17(3):453–462. 13. Juniper EF, Bousquet J, Abetz L, Bateman ED. GOAL Committee. Identifying ‘well-controlled’ and ‘not well-controlled’ asthma using the Asthma Control Questionnaire. Respir Med 2006, 100(4):616–621. 14. Reddel HK, Taylor DR, Bateman ED, et al. An official American Thoracic Society/European Respiratory Society statement: asthma control and exacerbations: standardizing endpoints for clinical asthma trials and clinical practice. Am J Respir Crit Care Med 2009, 180(1):55–92. 15. Garatt AM, Hutchinson A, Russell I: Patient-assessed measures of health outcome in asthma: a comparison of four approaches. Respir Med 2000, 94(6):597–606. 16. Hazell M, Frank T, Frank P. Health related quality of life in individuals with asthma related symptoms. Respir Med 2003, 97(1):1211–1218. 17. Stenke A, Svensson K, Stahl E, Melzaros A, Berta GY: Psychometric and utility-based measures of health status of asthmatic patients with different disease control level. Pharmacoeconomics 2004, 22(8):537–547. 18. Ferrer A, Formiga F, Almedia J, Alonso J, Brotons C, Pujol R. Calidad de vida en nonagenarios: género, funcionalidad y riesgonutricionalcomofactoresasociados. Med Clin (Barc) 2010, 134(7):303–306. 19. Badia X, Roset M, Montserrat S, Hermand M, Segura A: A versionespanoladelEuroQol: descripción y aplicaciones. Med Clin 1999, 112(Suppl 1):79–86. 20. Porter AJ, Reeves ST, Affleck G, Barrows E, ZuWallack RL. The influence of demographic and socioeconomic factors on health-related quality of life in asthma. J Allergy Clin Immunol 1999, 103(1 Pt 1):72–78. 21. Erickson SR, Christian RD Jr, Kirking DM, Hallman LJ: Relationship between patient and disease characteristics, and health-related quality of life in adults with asthma. Respir Med 2002, 96(6):450–460. 22. Plaza V, Serra-Batlles J, Ferrer M, Morejon E. Quality of life and economic features in elderly asthmatics. Respiracion 2000, 67(1):65–70. 23. Gibson PG, McDonald VM, Marks GB. Asthma in older adults. Lancet 2010, 376:803–813. 24. Bella V, Scichilone N, Battaglia S: Asthma in the elderly. Eur Respir Mon 2009, 43:56–76. 25. Busse PJ, Mathur SK. Age-related changes in immune function: effect on airway inflammation. J Allergy Clin Immunol 2010, 126:690–699. 26. Mancuso CA, Rincon M. Impact of health literacy on longitudinal asthma outcomes. J Gen Intern Med 2006, 21(8):813–817. 27. Porter AJ, Wang X, Bogen D, Bennett JM, Jennings RM, Garcia L, Sharpe T, Frazier C, Ten Have T: Linking numeracy and asthma-related quality of life. Patient Educ Couns 2009, 75(3):386–391. 28. Mangan JM, Wittich AR, Gerald LB. The potential for reducing asthma disparities through improved family and social function and modified health behaviors. Chest 2007, 132(5):Suppl:795S–805S. 29. Santos MS, Jung H, Peytov J, Liu W, Lis GM, Tarso SM: Occupational asthma and work-exacerbated asthma: factors associated with time to diagnostic tests. Chest 2007, 131(4):1768–1775. 30. Schatz M, Zeiger RS, Mosen D, Vollmer WM. Asthma-specific quality of life and subsequent asthma emergency hospital care. Am J Manag Care 2008, 14:206–211. 31. Braido F, Bialardini I, Balestracci S, Ghiglione V, Stagi E, Ridolo E, Nathan R, Canonica GW: Does asthma control correlate with quality of life related to upper and lower Airways? A real life study. Allergy 2009, 64(1):937–943. 32. Schmitz N, Wang J, Malla A, Lesage A: The impact of psychological distress on functional disability in asthma: results from the Canadian community health survey. Psychosomatics 2009, 50(1):42–49. 33. Wang G, Zhou T, Wang L, Wang F, Fu J, Zhang HP, Ji YL: Relationship between current psychological symptoms and future risk of asthma outcomes: a 12-month prospective cohort study. J Asthma 2011 Dec, 48(10):1041–1050. 34. Avalone KM, McLeish AC, Luberto CM, Bernstein JA: Anxiety sensitivity, asthma control, and quality of life in adults with asthma. J Asthma 2012 Feb, 49:1537–62. 35. Lavoie ML, Bacon SL, Barone S, Cartier A, Ditto B, Labrecque M: What is worse for asthma control and quality of life: depressive disorders, anxiety disorders, or both? Chest 2006, 130(4):1039–1047. 36. Heaney LG, Conway E, Kelly C, Gamble J. Prevalence of psychiatric morbidity in a difficult asthma population: relationship to asthma outcome. Respir Med 2005, 99(9):1152–1159. 37. Wright RI: Further evidence that the wealthier are healthier: negative life events and asthma-specific quality of life. Thorax 2007, 62:106–108.
38. Ritz T, Ayala ES, Trueba AF, Vance CD, Auchus RJ. Acute Stress-Induced Increases in Exhaled Nitric Oxide in Asthma and their Association with Endogenous Cortisol. *Am J Respir Crit Care Med.* in press.

39. Lavoie KL, Bouthillier D, Bacon SL, Lemière C, Martin J, Hamid Q, Ludwig M, Olivenstein R, Ernst P. Psychologic distress and maladaptive coping styles in patients with severe vs moderate asthma. *Chest* 2010, 137(6):1334–1331.

40. Kimura T, Yokoyama A, Kohno N, Nakamura H, Eboshida A. Perceived stress, severity of asthma, and quality of life in young adults with asthma. *Allergol Int* 2009, 58(1):71–79.

41. Oraio E, King ME, Callahan DB. Asthma and serious psychological distress: prevalence and risk factors among US adults, 2001–2007. *Chest* 2010, 137(3):609–616.

42. García-Marcos L, Canvajal-Ruera I, EscibanoMontaner A, FernándezBenítez M, García de la Rubia S, Taurer Toro E, Pérez Fernández V, Bacina Sánchez C. Seasons and other factors affecting the quality of life of asthmatic children. *J Investig Allergol Clin Immunol* 2007, 17(4):249–256.

43. Withy K, Davis J. Followup after an emergency department visit for asthma: urban/rural patterns. *Ethn Dis* 2008, 18(2 Suppl 2):S2–247–251.

44. Ownby DR. Asthma in rural America. *Ann Allergy Asthma Immunol* 2005, 95(S Suppl 1):S17–S22.

45. Hanania NA, David-Wang A, Kesten S, Chapman KR. Factors associated with emergency department dependence of patients with asthma. *Chest* 1997, 111(2):290–295.

46. Chun HC, Weitzen SH, Fritz GK. The asthma/mental health nexus in a population-based sample of the United States. *Chest* 2008, 134(6):1176–1182.

47. Sundberg R, Palmqvist M, Tunsäter A, Torén K. Health-related quality of life in young adults with asthma. *Respir Med* 2009, 103(10):1580–1585.

48. Gamble J, Stevenson M, McClean E, Heaney LG. The prevalence of nonadherence in difficult asthma. *Am J Respir Crit Care Med* 2009, 180(9):817–822.

49. Lazarus SC, Chinchilli VM, Rollings NJ, et al. Smoking affects response to inhaled corticosteroids or leukotriene receptor antagonists in asthma. *Am J Respir Crit Care Med* 2007, 175(8):783–790.

50. Sutherland ER, Lehman EB, Teodorescu M, Wechsler ME. National Heart, Lung, and Blood Institute’s Asthma Clinical Research Network. Body mass index and phenotype in subjects with mild-to-moderate persistent asthma. *J Allergy Clin Immunol* 2009, 123(6):1328–1334.