



# Prevalence of Asthma Control in Iran, Assessing Asthma Control Test Running Head: Asthma Control in Iran

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## Abstract

**Background:** Asthma treatment guidelines suggest the target of treatment ought to be optimal control. Asthma control test questionnaire alongside pulmonary function tests, is validated guideline for asthma control worldwide. Current study headed to evaluate correlations between asthma control and pulmonary function test results.

**Components and Techniques:** Two hundred fifty five asthma respondents enrolled in the current study. Asthma control was estimated by asthma control test questionnaire and lung function test was assessed by spirometer. Statistical analysis was performed and results comparison was obtained.

**Outcome:** One hundred thirty nine patients (54.7%) were classified in the controlled asthma group (asthma score obtained 20 or higher). Fifty seven patients (22.4%) and 58 patients (22.8%) were categorized as the partially and poorly controlled asthma groups respectively (15 < asthma score < 20, asthma score < 15). Significant relationship was demonstrated between asthma control test and forced expiratory volume in one second pulmonary function parameters (P < 0.001). A highly significant correlation was obtained between forced expiratory volume in one second and the four last questions of asthma control test (r = 0.19, P value < 0.001).

**Conclusion:** Asthma control test questionnaire is considered to be a reliable test in everyday asthma treatment guide in Iran. Asthma score  $\geq 20$  is proposed to be adequate for detecting controlled asthma in Iran with no obligatory additional pulmonary functioning test.

**Keywords:** Asthma (C08.127.108); Questionnaire (E05.318.308.980); Lung (A04.411); Prevalence (E05.318.308.985.525.750); Asthma control test

## Introduction

Asthma is a chronic inflammatory disease of the lungs with an estimation to grow to 400 million around the world in 2025. Asthma possesses a prevalence of 5.5% in Iran [1-4]. The recent guideline on asthma therapy implies accomplishing patient's asthma control [5-8]. A worldwide validated procedure to determine asthma control is the Global Initiative for Asthma (GINA) guideline which includes planned six standards as considering asthma control [6,7]. The asthma control test (ACT) is a GINA provided, self-report descriptive questionnaire administered for ACT. ACT is composed of five items, with the last four week recall on symptoms and daily functioning objects: dyspnea frequency, utilization of relief medicines, asthma impact on everyday functions, frequency of night symptoms and self-assessment of asthma control [7,9,10]. Asthmatic patients determine their symptoms subjective notion on a five-point range, for every item. The scaling total score stages from 0 to 25, with a greater score suggesting the better controlled status [8-11]. In addition, items are presented as controlled asthma in ACT  $\geq 20$ , partially controlled asthma in ACT = 16-19 and uncontrolled asthma in ACT  $\leq 15$  (5-7). Overall, ACT questionnaire alongside pulmonary function tests (PFT) is today applied for asthma control status determination worldwide. Spirometry method mostly is applied to analyze PFT in chronic pulmonary diseases such as asthma. Spirometry assesses forced expiratory volume in one second (FEV1), indicating as a percentage of predicted value. A reduced FEV1 relates to improved risk of asthma exacerbations [6,7]. Typically, FEV1 correlates with the ACT in asthmatic participants, as reported in former studies [12,13]. Despite the advances in asthma therapies, asthma control stands a strict target to achieve in Iran. To the best of our knowledge, no studies have been conducted in Iran, applying ACT and PFT to evaluate asthma control. Thereby, current survey headed to evaluate the asthma control in the referral respiratory hospital of Iran, assessing ACT questionnaire and PFT results.

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**Table 1:** Asthma control test questionnaire score of 254 components. 5-point scale (Symptoms and activities: 1=all the time to 5=not at all; Asthma control rating: 1=not controlled at all to 5=completely controlled).

| Asthma control test questions during the last month           | 1   | 2  | 3  | 4                                  | 5                                   | Total      |
|---|---|--|--|------------------------------------|-------------------------------------|------------|
| How often were you unable to continue the daily routine work? | All the time<br>4 people (1.6%)                 | Most of the time<br>27 (10.6%)           | Sometimes<br>41 (16.1%)                  | A little time<br>42 (16.5%)        | Never<br>140 (55.1%)                | 254 (100%) |
| How often have you had dyspnea?                               | More than once a day<br>47 people (18.5%)       | once a day<br>23 (9.1%)                  | Three to six times a week<br>26 (10.2%)  | Once or twice a week<br>65 (25.6%) | Not at all<br>93 (36.6%)            | 254 (100%) |
| How often have you had sleep disorder due to asthma?          | Four or more nights a week<br>48 people (18.9%) | Two or three nights a week<br>27 (10.6%) | Once a week<br>15 (5.9%)                 | Once or twice<br>26 (10.2%)        | Not at all<br>138 (54.3%)           | 254 (100%) |
| How many times have you used relief inhaler medications?      | Three or more times per day<br>24 people (9.4%) | One or two times per day<br>31 (12.2%)   | Two or three times per week<br>11 (4.3%) | Once a week or less<br>15 (5.9%)   | Not at all<br>173 (68.1%)           | 254 (100%) |
| How do you assess your asthma overall rate?                   | Not controlled<br>16 people (6.3%)              | Poorly controlled<br>42 (16.5%)          | Somewhat controlled<br>68 (26.8%)        | Well controlled<br>73 (28.7%)      | Completely controlled<br>55 (21.7%) | 254 (100%) |

**Table 2:** The correlation of asthma control and low and high forced expiratory volume in one second.

| Asthma control |                    | Forced expiratory volume in one second |                             |
|----------------|--------------------|--|-----------------------------|
|                |                    | High predictive value (>70%)           | Low predictive value (<70%) |
| Total score    | controlled         | 139                                    | 0                           |
|                | partial controlled | 53                                     | 4                           |
|                | poor controlled    | 43                                     | 15                          |
| Total          |                    | 235                                    | 19                          |

**Table 3:** Pearson chi-Square test indicating the relationship between asthma control test and forced expiratory volume in one second.

|                              | Value               | Degrees of freedom | asymptotic significance (Two-sided) |
|------------------------------|---------------------|--------------------|-------------------------------------|
| Pearson Chi-Square           | 39.573 <sup>a</sup> | 2                  | 0.000                               |
| Likelihood Ratio             | 39.799              | 2                  | 0.000                               |
| Linear-by-Linear Association | 37.289              | 1                  | 0.000                               |
| Number of Valid Cases        | 254                 |                    |                                     |

## Clinical and Findings

### Study design

Statistical analysis for study design was performed by expert methodologist and the study population was estimated to be in range of 240-260 patients. Therefore, 254 asthmatic patients who attended in the referral respiratory hospital of Iran from January 2011 to May 2012, contributed in the current cross-sectional prospective study, conducted. Asthma was diagnosed in the patients by an expert pulmonologist. Both newly diagnosed asthmatic males and females were included in the study. Lack of asthma control treatment history and patient's inclining, were also as inclusion criteria. Pregnant ladies and patient's with unwillingness to continue the study. Authors state that the research project has been approved by national research institute of tuberculosis and lung diseases constituted ethics committee of the institution (IR.SBMU.MSP.REC.1395.218) and it conforms to the provisions of the declaration of Helsinki. Informed writing consents were signed by patients. Complying with the health insurance portability, the principle of secrecy of patient information was taken into consideration. Current survey was approved by the institutional review board of the National Research Center of Tuberculosis and Lung Diseases. Ethical clearance was also obtained by Ethical Committee of Shahid Beheshti University.

### PFT and ACT questionnaire

FEV1 pulmonary function parameter was assessed by Spirometer (DATOSPIR-120) on the day of the appointment. According to European respiratory society guidelines, FEV1 capacity >80% was considered as mild asthma. Moderate and severe asthma were considered as FEV1 capacity more than 60% and less than 80% and

FEV1 capacity <60% respectively [11]. After performing primary tests patients received asthma treatment. Validated version of ACT questionnaire in Persian was used to assess asthma control status, four weeks later in the next appointment. ACT score <15, 15-19 and 20-25 were defined as uncontrolled, partly controlled and controlled asthma, respectively.

### Statistical analysis

Data were analyzed by Statistical Package for the Social Sciences (SPSS) software (Version 22.0; IBM). Nominal data analysis such as ACT and FEV1 were reported by frequency, mean, moderate and standard deviation. Two tailed analysis of variance (ANOVA) and Chi-square tests were used to determine the independent ACT and FEV1 variables relationship with significance point of 0.05. Cut-off points were administered to represent asthma control value in the ACT questionnaire.

## Results

Two hundred fifty five patients were included in the current study, aged 11-90 years old (45.5 ± 15.5). The percentage of male components (51.6%) and female components (48.4%) were almost equal. In the case of education, 55 (21.77%) components were illiterate and 107 (42.1%) held their high school diploma. Forty three patients (16.9%) were educated to achieve academic degree and 19.33% of components had quitted education in primary school. None of the 254 asthmatic patients refused answering the ACT questionnaire. In response to ACT questionnaire, 140 (55.1%) patients noted they have never left daily routine work during the last four weeks of treatment. 62.2% of patients showed no exacerbations in the past four weeks and 54.3% never experienced sleep disorder or asthma exacerbation

in the last four week nights. One hundred seventy three (68.1%) patients never needed a lifesaving asthma inhaler (beta-blocker such as Salbutamol) and more than 50% of patients felt satisfied with their asthma control status, during last four weeks (Table 1). The total score of ACT was obtained 18.8 ( $\pm$  5.2) (mean ( $\pm$  SD)) with the range of 5-25 and FEV1 total value was assessed 83.5 ( $\pm$  49.1) with the range of 65-86.3. ACT score obtained 20 or higher in 139 patients (54.7%) who were classified in the controlled asthma group. Fifty seven patients (22.4%) showed ACT score greater than 15 and less than 20, categorized as the partially controlled asthma group and 58 patients (22.8%) who showed ACT score less than 15 were classified in the poorly controlled asthma group. No significant differences were recognized in the three groups due to the distribution of gender ( $p=0.33$ ) and age ( $p=0.23$ ). Nineteen patients revealed FEV1 less than 78%, among asthmatic patients, indicating presence of Chronic Obstructive Pulmonary Disease (COPD) (Table 2). Significant two tailed ANOVA and chi-square tests relationship was demonstrated between ACT and FEV1 pulmonary function parameters ( $P<0.001$ ) (Table 3). ACT separate questions comparison with the FEV1 values displayed a highly significant correlation between FEV1 and the four last questions ( $r=0.19$ ,  $P$  value  $<0.001$ ). However, no association was confirmed between first question and FEV1. The ACT scores revealed no significant correlation between the FEV1 percent predicted in male sex group ( $P=0.35$ ,  $r=0.081$ ). In contrast, there was provided a significant strong association between ACT score and FEV1 capacity in female sex group ( $P=0.00$ ,  $r=0.46$ ). Moreover, the ACT scores showed there was no significant correlation with the age in male ( $P=0.12$ ,  $r=-0.136$ ), and female sex groups ( $P=0.41$ ,  $r=0.074$ ). Cut-off points are  $\geq 20$  (area under the curve 0.791) and  $\leq 14$  (AUC 0.774) in ACT defined the well-controlled asthma and poorly controlled asthma respectively. None of the patients with  $ACT \geq 20$  showed  $FEV1 < 80\%$ . Moreover, 0.7% of components with  $15 > ACT > 20$  and 25.9% of components with  $ACT \leq 15$ , represented a  $FEV1 < 80\%$ . Finally,  $ACT > 20$  scores revealed a sensitivity of 93.2% and specificity of 91.4% in identifying controlled asthma status based on the PFT.

## Discussion

Current survey headed to evaluate asthma control status in Iran. ACT questionnaire appliance documented controlled asthma in 54.7% of the components. More than 50% of patients felt satisfied with their asthma control status. The results represented a great amount of controlled as TMA respondents which is an acceptable result for the national size, but very imperfect for a respiratory referral hospital with the most known tactics of disease control. Similarly, a former study obtained 52.2% of controlled asthma participants in an international study population [14]. In addition, our findings are similar to a pan-European study, with 57% of well-controlled asthma components ( $ACT$  score  $<15$ ) [15]. However, the amount of uncontrolled asthma patients revealed a higher amount than our assumptions which is in line with previous studies [16]. This finding confirms a previous worldwide survey which showed a little controlled asthma in 10,939 patients from 29 countries [17]. Similarly, another GINA based study, represented only 50.9% of uncontrolled asthma population, in Africa [18]. A significant relationship between ACT clinical parameter and FEV1 physiological parameter was determined in the current study. Moreover, no significant relationship was obtained between ACT score or FEV1 and age or gender parameters ( $P<0.001$ ). Results showed 92.5% of participants obtained FEV1 upper than 78%, representing a mild asthma status, which was not as precise as the ACT results. As a result,  $FEV1 < 80\%$  in

spirometry test, was not characterized to be a unique distinguishable parameter. Also a previous study with 64% of international study population possessing FEV1 upper than 78% showed similar results to current study [14,17]. FEV1 eventuated higher results in controlled asthma group comparing to the uncontrolled asthma group which is similar to Shirai et al. [18] study results. Interestingly,  $FEV1 < 80\%$  was determined in none of the patients with  $ACT \geq 20$  which makes  $ACT \geq 20$  considered to be adequate for detecting controlled asthma without any additional PFT to be obligatory. The potential limitation of the study was the difficulty in performing pirometry due to the patient's fear of accelerating asthma exacerbation by taking a deep breath. Indeed, another drawback fact was reduced statistical potency of small 254 participants studied group. Thus, asthma control developments in Iran, require future widespread studies on larger samples.

## Conclusions

A worldwide validated procedure to determine asthma control is assessing ACT questionnaire alongside the PFT. Current survey headed to evaluate the asthma control status in the 254 asthmatic patients of Iran. Significant two tailed ANOVA and chi-square tests relationship was demonstrated between ACT and FEV1 pulmonary function parameters. The results represented more than 50% of patients with satisfied controlled asthma in studied group. Based on the results, ACT questionnaire seems to be a reliable test in everyday asthma treatment guide. In conclusion,  $ACT \geq 20$  is proposed to be adequate for detecting controlled asthma in Iran with no obligatory additional PFT.

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## Conflict of Interests

Authors have no conflicts of interest to declare. Authors give consent to submission and publication of the work. Authors disclose no relationship with any organization or industrial manufacture in any material discussed.

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