

Factors influencing asthma control: results of a real-life prospective observational asthma inhaler treatment (ASIT) study

Füsun Yıldız

On behalf of the ASIT Study Group

Department of Pulmonary Disease,
Kocaeli University School of Medicine,
Kocaeli, Turkey

Background: Despite the availability of new pharmacological options and novel combinations of existing drug therapies, the rate of suboptimal asthma control is still high. Therefore, early identification of the clinical and behavioral factors responsible for poor asthma control, and interventions during routine outpatient visits to improve asthma trigger management, are strongly recommended. This study was designed to evaluate the profiles of asthmatic patients and their inhaler treatment devices in relation to asthma control in Turkey.

Methods: A total of 572 patients with persistent asthma (mean [standard deviation] age: 42.7 [12.1] years; 76% female) were included in this prospective observational study. A baseline visit (0 month, visit 1) and three follow-up visits (1, 3 and 6 months after enrolment) were conducted to collect data on demographics, past medical and asthma history, and inhaler device use.

Results: Asthma control was identified in 61.5% of patients at visit 1 and increased to 87.3% at visit 4 ($P < 0.001$), regardless of sociodemographics, asthma duration, body mass index or smoking status. The presence of asthma-related comorbidity had a significantly negative effect on asthma control ($P = 0.004$). A significant decrease was determined, in the rate of uncontrolled asthma, upon follow-up among patients who were using a variety of fixed dose combination inhalers ($P < 0.001$ for each). Logistic regression analysis was used to show that the presence of asthma-related comorbidity (odds ratio [OR], 0.602; 95% confidence interval [CI], 0.419; 0.863, $P = 0.006$) and active smoking (OR, 0.522; 95% CI, 0.330; 0.825, $P = 0.005$) were significant predictors of asthma control.

Conclusion: Our findings indicate that, despite ongoing treatment, asthma control rate was 61.5% at visit 1 in adult outpatients with persistent asthma. However, by the final follow-up 6 months later, this had increased to 87.3%, independent of sociodemographic and clinical characteristics. Poor asthma control was associated with asthma-related comorbid diseases, while the efficacy of fixed dose combinations was evident in the achievement of asthma control.

Keywords: persistent asthma, patient profile, asthma control, inhaler treatment, adults, Turkey

Introduction

As a common chronic disease that substantially burdens both patients' lives and health economics,^{1,2} asthma has 300 million sufferers worldwide, with an additional 100 million people estimated to be affected by 2025.³ The number of patients diagnosed with asthma in Turkey was estimated at 3–4 million,⁴ while the prevalence proportion was reported at 7.4% by the Global Initiative for Asthma (GINA) – Global Burden of Asthma Report.⁵

Correspondence: Füsun Yıldız
Kocaeli Üniversitesi Tıp Fakültesi
Göğüs Hastalıkları Anabilim Dalı,
Umuttepe Merkez Yerleşkesi, 41380,
Kocaeli, Turkey
Tel +90 262 303 7513
Fax +90 262 303 7003
Email fusun.yildiz@gmail.com

Although the results of clinical trials suggest that asthma control can be reached in most patients,⁶ the epidemiologic evidence suggests a low level of disease control in many countries including Turkey,⁷⁻⁹ despite the availability of international and national asthma guidelines, and effective medications that would enable optimum control of the disease.^{5,10}

Therefore, the challenge to find the best way to assess asthma control and define management strategies to ensure that this control is achieved and maintained, still remains.¹¹ The update of the GINA 2006 guidelines recommends a newly introduced asthma management approach, based on the monitoring of disease control, to facilitate the acceptance and use of asthma guidelines in clinical practice.⁵ This approach is based on the use of combined therapies in which inhaled corticosteroids (ICS) are given, mainly in combination with long-acting beta-2-adrenoceptor agonists (LABA).¹²⁻¹⁴ However, despite this availability of new pharmacological options and novel combinations of existing drug therapies, suboptimal asthma control rates are persistently high.¹⁵

In order to tackle this, early identification of the clinical and behavioral factors responsible for poor asthma control,¹⁶ and interventions during routine outpatient visits for improving asthma trigger management,¹⁷ have been recommended. In addition, follow-up consultations including checking the patients' adherence to their medication plan, and measures to reduce the exposure to risk factors have also been strongly recommended.¹⁸

Clinicians and general practitioners must be aware of the levels and determinants of asthma control in order to reflect and improve on the implementation of the asthma guidelines.^{5,19} Therefore this real-life prospective ASIT (Asthma Inhaler Treatment) study, conducted at 31 secondary and tertiary centers across Turkey, was designed to evaluate the profiles of persistent-asthma patients and their inhaler treatment devices in relation to asthma control, through a series of follow-ups.

Material and Methods

Study population

A total of 572 patients with persistent asthma were included in this multi-center, non-interventional, single arm prospective observational study, conducted at 31 pneumology outpatient clinics across Turkey. The study was based on four consecutive visits, the first performed at the study enrolment (month 0, visit 1), and then follow-ups at 1, 3, and 6 months. Female or male outpatients older than 18 years and diagnosed with persistent asthma according to the GINA criteria¹² at

least 6 months previously, and who had received at least one dose of ICS + LABA either in separate or fixed combinations irrespective of pharmacological agent(s), were included. The exclusion criteria were: confirmed or suspected pregnancy; breastfeeding; comorbid COPD; allergy/sensitivity or intolerance to any kind of asthma treatment; anti-immunoglobulin E treatment within the last 4 months; treatment with leukotriene receptor antagonists; hospitalization due to symptomatic respiratory infection of asthma within the last 8 weeks; chronic diseases that were likely to negatively affect the prognosis (eg, carcinoma); chronic alcohol consumption; and substance abuse.

Following detailed explanation of the objectives and protocol of the study, written informed consent was obtained from each subject. The study was conducted in accordance with the ethical principles stated in the "Declaration of Helsinki" and approved by the Kocaeli University Research Ethics Committee.

Data collection

After certifying the patients' eligibility against the inclusion/exclusion criteria, data on sociodemographic characteristics (age, gender, educational status, and occupation), vital signs, physical examination findings, medical history, comorbid disorders, concomitant treatments, characteristics and clinical course of asthma disease, asthma control, and asthma treatment via inhaler device were collected at the initial enrollment visit. At each follow up visit, patients were evaluated for vital signs, physical examination findings, concomitant treatments, characteristics and clinical course of asthma disease, asthma control, and asthma treatment via inhaler device.

The Asthma Control Test (ACT), a standard test developed for reflecting the patient's perspective of his/her disease,²⁰ helps determine asthma control levels, predict exacerbations, and optimize therapy for the patients.^{21,22} The ACTTM has been translated into Turkish and cultural adaptation has been completed.²³

In the present study, the ACTTM filled in by patients was used to assess their level of asthma control in the 4 weeks preceding the enrollment, considering an overall score of 20 or higher as controlled asthma, and a score less than 20 as uncontrolled asthma.

Statistical analysis

Sample size was calculated to include at least 1050 patients to be able to observe 40% of the difference between two different treatment alternatives or inhaler devices and standard

error of 2%, confidence level of >95%, and statistical power of 90%. However, only 572 patients were enrolled in the study.

Stata Data Analysis and Statistical Software (Version 10, StataCorp LP, College Station, TX, USA) was used for statistical analysis. Data were expressed as “mean (standard deviation [SD])”, percent (%) and 95% confidence interval where appropriate. Significance levels during the categorical comparison of the groups were evaluated by the Chi-square test using cross table statistics. The Kruskal–Wallis and Mann–Whitney U tests were used for independent groups without normal distribution, while Student’s *t*-test was used for comparison of two independent groups. The ANOVA test and post-hoc Tukey’s HSD test were used for more than two independent groups with normal distribution. Logistic regression analysis was performed with asthma control (categorical) as the dependent variable while “Enter” was selected as the method and “simple first” as the categorical variable coding scheme. Predictors with possible influence on dependent variable were added as covariates. All tests were two-sided and $P < 0.05$ was considered statistically significant.

Results

Baseline demographic, clinical and asthma-related characteristics

The mean (SD) age of the 572 patients in the ASIT study was 42.7 (12.1) years and 76% ($n = 435$) were females. The majority of the patients ($n = 440$; 76.9%) were secondary school graduates and 61.9% were unemployed (55.8% housewives) (Table 1). Mean (SD) time from asthma onset was 8.0 (8.3) years while less than or equal to 5 years in 53.3% of the patients (Table 1). Active smokers represented 18.2% ($n = 104$) of the patients (Table 1).

Among the 530 patients with comorbidities, 56.1% ($n = 321$) had asthma-related disorders, and a single asthma-related comorbidity was noted in 67.9% of the patients (Table 1).

The evaluation of vital signs showed mean (SD) systolic blood pressure (BP) as 121.1 (15.6) mmHg, diastolic BP as 75.6 (8.9) mmHg, pulse as 81.2 (8.9)/min, and respiratory rate as 16.8 (3.2)/min. Mean (SD) body mass index (BMI) was 28.0 (5.4) (kg/m^2).

Baseline characteristics associated with asthma control status

Overall, asthma was determined to be controlled in 61.5% ($n = 352$) of the patients, with no statistical difference in control level with respect to mean age, gender,

asthma duration, educational, or employment status. The uncontrolled asthma group had a significantly higher number of active smokers (23.2%) versus 15.1% in the controlled asthma group ($P = 0.015$) (Table 1).

The presence of asthma-related comorbidities had significantly negative effects on asthma control (Table 1). Half (51.4%) of the patients with controlled asthma had asthma-related comorbidities, while this percentage rose to 63.6% (140/220) in the uncontrolled asthma group ($P = 0.004$). The most common asthma-related comorbidity was rhinitis, and this was significantly more frequent among uncontrolled asthma group ($P = 0.009$).

Asthma control status throughout the study visits

Overall, the ratio of patients with controlled asthma was significantly higher (61.5% at visit 1, 82.0% at visit 2, 84.8% at visit 3 and 87.3% at visit 4; $P < 0.001$ for each) than that of uncontrolled asthma at each study visit and there was a significant progressive decrease in the ratio of uncontrolled patients at the follow-up visits compared to baseline ($P < 0.001$ for each) from 38.5% to 12.7% at the end of the study (Figure 1).

Asthma control status from visit 1 to visit 4: asthma duration, BMI, smoking status and comorbid disorders

When asthma control status from visit 1 to visit 4 was evaluated in terms of time from asthma onset (0–15 versus more than 15 years), BMI (30 kg/m^2 or higher versus less than 30 kg/m^2), and smoking status (smoker versus non-smoker), a significant decrease in the ratio of patients with uncontrolled asthma was found in each case, regardless of the grouping (Table 2). Significantly higher rates of asthma control at visit 4 compared to visit 1 were detected even in patients with time from asthma onset more than 15 years (Table 2). On the other hand, the asthma control rate was significantly higher at all visits, both among nonsmokers compared to active smokers (64% versus 51%, $P = 0.010$ and 89% versus 78%; $P = 0.030$, respectively); and among patients with BMI lower than 30 kg/m^2 compared to those with BMI 30 kg/m^2 or higher at visit 4 (88.5% versus 81.8%, $P = 0.009$) (Table 2).

Patients with one ($P < 0.001$), two ($P = 0.004$) and three ($P = 0.021$) comorbidities had significantly higher ACT scores at visit 4 compared to visit 1, while baseline ACT scores of patients with three comorbidities were significantly lower than baseline scores of patients with a single comorbidity ($P = 0.007$) (Table 2).

Table 1 Sociodemographic characteristics of patients according to asthma control at baseline

	Overall (n = 572)	Asthma control status		P value
		Controlled (ACT \geq 20, n = 352)	Uncontrolled (ACT < 20, n = 220)	
	Mean (SD)			
Age (year)	42.7 (12.2)	43.6 (12.1)	41.3 (12.2)	0.061
Age categories (year)	n (%)			
18–40	252 (44.1)	144 (40.9)	108 (49.1)	0.055
41–60	272 (47.6)	175 (49.7)	97 (44.1)	0.192
>60	48 (8.4)	33 (9.4)	15 (6.8)	0.276
Gender	n (%)			
Male	137 (24.0)	92 (26.1)	45 (20.5)	0.127
Female	435 (76.0)	260 (73.9)	175 (79.5)	0.127
	Mean (SD)			
Time from asthma onset (years)	8.0 (8.3)	8.0 (8.3)	8.0 (8.2)	1.00
	n (%)			
≤ 5	305 (53.3)	191 (54.3)	114 (51.8)	0.560
>5 to ≤ 10	118 (20.6)	68 (19.3)	50 (22.7)	0.328
>10 to ≤ 15	59 (10.3)	36 (10.2)	23 (10.5)	0.909
>15	90 (15.7)	57 (16.2)	33 (15.0)	0.701
Comorbidities	n (%)			
None	162 (28.3)	115 (32.7)	47 (21.4)	0.003
Non-asthma related	209 (36.5)	126 (35.8)	83 (37.7)	0.646
Asthma related	321 (56.1)	181 (51.4)	140 (63.6)	0.004
Rhinitis*	219 (68.2)	120 (66.3)	99 (70.7)	0.009
Sinusitis*	105 (32.7)	57 (31.5)	48 (34.3)	0.092
GERD*	106 (33.0)	59 (32.6)	47 (33.6)	0.169
Number of comorbidities	n (%)			
1 comorbidity	218 (67.9)	109 (31)	109 (62.5)	<0.001
2 comorbidities	69 (21.5)	35 (9.9)	34 (15.5)	0.045
3 comorbidities	34 (10.6)	19 (5.4)	15 (6.8)	0.491
Active smoking	104 (18.2)	53 (15.1)	51 (23.2)	0.015
Educational status	n (%)			
Illiterate	28 (4.9)	14 (4.0)	14 (6.4)	0.197
Secondary school	440 (76.9)	279 (79.3)	161 (73.2)	0.092
University	104 (18.2)	59 (16.8)	48 (21.8)	0.139
Employment status	n (%)			
Unemployed	354 (61.9)	223 (63.4)	131 (59.5)	0.350
Employed	210 (36.7)	126 (35.8)	84 (38.2)	0.562
Missing	8	3	5	

Note: *Percent of patients with asthma-related comorbidities.

Abbreviation: ACT, asthma control test; n, number; SD, standard deviation.

Asthma control status from visit 1 to visit 4: inhaler treatment

Significant improvement in asthma control status during follow-up was observed in patients using fixed dose ICS/LABA combination inhalers (Table 3). There was a significant decrease in the ratio of patients with uncontrolled asthma from visit 1 to visit 4 for patients who received: ‘fluticasone propionate/salmeterol discus’ (38.2% versus 11.4%, $P < 0.001$); ‘extra fine beclomethasone/formoterol solution spray’ (32.7% versus 10.0%, $P < 0.001$); and ‘budesonide/formoterol turbuhaler’ (41.7% to 14.9%, $P < 0.001$). There were no significant changes in the ratio of uncontrolled

asthma observed in patients receiving ‘budesonide and formoterol aerolizer’ (42.9% to 23.5%, $P = 0.131$) (Table 3). Overall, the ratio of patients with uncontrolled asthma was decreased by 45.2%–70.2%, depending on the inhaler type (Figure 2).

Logistic regression analysis for predictors of asthma control

Using asthma control (categorical) as the dependent variable, logistic regression analysis showed that the presence of asthma-related comorbidity (odds ratio [OR], 0.602; 95% CI, 0.419;0.863, $P = 0.006$) and active smoking (OR, 0.522;

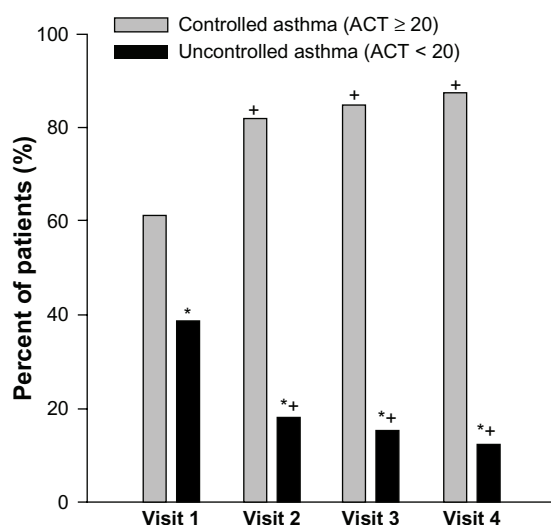


Figure 1 Asthma control improvement between visits.

Note: * $P < 0.001$, compared to rate of controlled asthma at the same visit; + $P < 0.001$ compared to visit 1.

Abbreviation: ACT, asthma control test.

95% CI, 0.330; 0.825, $P = 0.005$) were significant predictors of asthma control (Table 4).

Discussion

The principal findings of this real-life prospective ASIT study showed that the asthma control rate increased during

follow up in adult outpatients with persistent asthma, moving from 61.5% to 87.0% after 6 months, regardless of patient demographics, smoking, educational, or employment status. Notably, the incidence of comorbid diseases was associated with poor asthma control, while fixed dose combinations proved highly effective in asthma control.

Failure in asthma control has been reported in several studies, despite variations in selected populations and methodology,¹⁹ while objectives for good control proposed by international reference guidelines are still far from being met.^{7,24–26} National and international asthma management guidelines recommend continuous, preventive rather than symptom-driven and crisis-oriented care.^{27,28} In this regard, justifying emphasis on asthma control versus asthma severity in the guidelines, our finding of asthma control (ACT score of ≥ 20) in 87.3% of patients promisingly highlights the role of patient monitoring via close follow up in the achievement of better asthma control.

The Asthma Insights and Reality in Europe (AIRE) Study, a multinational, population-based telephone survey, showed that 94.7% of all patients fail to achieve proper control of their disease.²⁴ The ASES Study, an office-based study conducted in Spain, confirmed that the percentage of patients at primary care and pneumologist office visits who

Table 2 Change in asthma control status from Visit 1–Visit 4 in terms of asthma duration, BMI, smoking status, and comorbid disorders

	Asthma control status					
	Controlled (ACT ≥ 20)			Uncontrolled (ACT < 20)		
	Visit 1 n (%)	Visit 4 n (%)	P value*	Visit 1 n (%)	Visit 4 n (%)	P value*
All patients	352 (61.5)	269 (87.3)	<0.001	220 (38.5)	39 (12.7)	<0.001
Time from asthma onset (years) ^a						
0–15 years (V1: n = 482; V4: n = 251)	294 (61.0)	215 (86.0)	<0.001	187 (39.0)	35 (14.0)	<0.001
≥ 15 years (V1: n = 90; V4: n = 57)	57 (63.0)	52 (91.0)	<0.001	33 (37.0)	4 (9.0)	<0.001
BMI (kg/m ²) ^b						
≥ 30 (V1: n = 180; V4: n = 88)	107 (59.4)	72 (81.8)	0.0003	73 (40.6)	16 (18.2)	<0.001
<30 (V1: n = 363; V4: n = 131)	226 (62.3)	116 (88.5)	<0.001	137 (37.7)	15 (11.5)	<0.001
Smoking ^c						
Smoker (V1: n = 104; V4: n = 50)	52 (51.0)	39 (78.0)	0.0014	51 (49.0)	11 (22.0)	0.001
Non-smoker (V1: n = 468; V4: n = 258)	300 (64.0)	230 (89.0)	<0.001	168 (36.0)	28 (11.0)	<0.001
Comorbid disorder #	ACT score			P value**		
	Visit 1 Mean (SD)	Visit 4 Mean (SD)				
1 (V1: n = 218; V4: n = 117)	19.9 (4.4)	22.6 (3.3)		<0.001		
2 (V1: n = 69; V4: n = 33)	19.3 (4.7)	22.0 (4.1)		0.004		
3 (V1: n = 34; V4: n = 20)	16.9 (6.1)**	20.4 (4.6)		0.021		

Notes: ^aVersus visit 1. ** $P = 0.007$, compared to patients with 1 comorbid disorder. Comparison of asthma control rate: ^atime from asthma onset of 0–15 years versus ≥ 15 years at visit 1: $P = 0.692$; and at visit 4: $P = 0.1643$. ^bBMI of ≥ 30 kg/m² versus <30 kg/m² at visit 1: $P = 0.526$; and at visit 4: $P = 0.009$. ^csmokers versus non-smokers at visit 1: $P = 0.010$; and at visit 4: $P = 0.030$.

Abbreviations: ACT, asthma control test; BMI, body mass index; n, number; SD, standard deviation; V, visits.

Table 3 Asthma control level according to inhaler device as assessed by the physicians

	Total (n = 572)	Visit 1 (Month 0)		Total (n = 308)	Visit 4 (Month 6)		P value*
		Asthma control status			Asthma control status		
		Controlled (ACT ≥ 20, n = 352)	Uncontrolled (ACT < 20, n = 220)		Controlled (ACT ≥ 20, n = 269)	Uncontrolled (ACT < 20, n = 39)	
According to inhaler types used							
Fixed dose combinations	n (%)						
FP/S Discus	152 (26.6)	94 (61.8)	58 (38.2)	79 (25.6)	70 (88.6)	9 (11.4)	<0.001
BDP/F Solution spray	107 (18.7)	72 (67.3)	35 (32.7)	60 (19.5)	54 (90.0)	6 (10.0)	<0.001
B/F Turbuhaler	156 (27.3)	91 (58.3)	65 (41.7)	87 (28.2)	74 (85.1)	13 (14.9)	<0.001
Separate combinations	n (%)						
B + F Aerolizer	84 (14.7)	48 (57.1)	36 (42.9)	51 (16.6)	39 (76.5)	12 (23.5)	0.131
B + F Easyhaler**	21 (3.8)	14 (66.7)	7 (33.3)	8 (2.6)	8 (100.0)	0 (0.0)	**

Notes: *Rate of uncontrolled asthma visit 1 versus visit 4. **No statistical analysis was done because of small number of patients.

Abbreviations: ACT, asthma control test; B, budesonide; BDP, beclomethasone dipropionate; F, formoterol; FP, fluticasone propionate; S, salmeterol; n, number.

reported suffering symptoms more than once a week was 24% and 32%, respectively.²⁹ In a population-based screening conducted in eleven European countries within the scope of European Respiratory Health Survey (ERCHS) II, overall asthma control rate was reported to be 32%, while the proportion of uncontrolled asthma in ICS users greatly varied by country, ranging from 20% (Iceland) to 67% (Italy).¹⁹ Recently, a survey conducted in five European countries indicated that 50.4% of asthmatics had low levels of control;³⁰ this percentage increased to 56.6% in a more recent survey conducted in the same countries.³¹

A cross-sectional study of 1188 patients with asthma from 28 centers in Turkey indicated controlled asthma in 51.5% of the patients (ACT \geq 20),⁹ while the Asthma Insights and

Reality in Turkey (AIRET) study,⁸ consistent with other international AIR surveys, demonstrated achievement of guideline-based asthma control in only 1.3% of participants, despite the availability of effective therapies.

The inconsistency of data on asthma control has been associated with the varied implementations of the asthma treatment guidelines in different countries, different treatment regimens, and geographic variation in asthma severity.¹⁹ Moreover, comparison of data from different studies is difficult due to different asthma control measures and data collection methods adopted. For example, the higher proportion of controlled patients in our study compared to the ECRHS II survey¹⁹ may be linked to the fact that in the latter, asthma control was evaluated with the GINA guidelines composite measure, including lung function, whereas the former used ACT, which excludes lung function; therefore a higher rate of asthma control is to be expected.¹⁵

The combined effects of failure to comply with recommendations and poor patient adherence to treatment, along with low usage of preventive medicine and low expectations of treatment, can be considered as the leading causes of poor

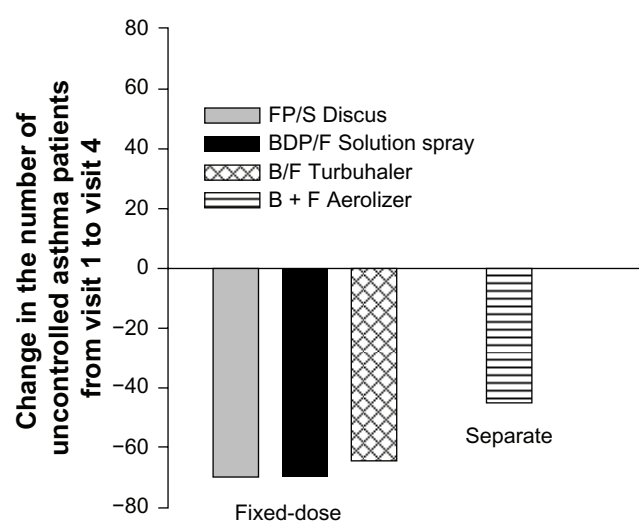


Figure 2 Change in percentage of uncontrolled asthma patients (n = 220) with fixed dose and separate combination inhaler treatments from visit 1 to visit 4.

Abbreviations: FP/S, fluticasone propionate/salmeterol; BDP/F, beclomethasone/formoterol; B/F, budesonide/formoterol; B + F, budesonide + formoterol.

Table 4 Logistic regression analysis for predictors of asthma control

	OR	95% CI	P value
Female	1.351	0.876; 2.085	0.173
Asthma related comorbidity present	0.602	0.419; 0.863	0.006
Asthma unrelated comorbidity present	0.926	0.624; 1.373	0.700
Smoking	0.522	0.330; 0.825	0.005
Patient age >60 years	1.456	0.735; 2.883	0.281
BMI \geq 30 kg/m ²	0.926	0.628; 1.367	0.700
Disease duration \geq 10 years	1.070	0.710; 1.612	0.748
Educated (literate)	0.533	0.229; 1.238	0.143

Abbreviations: BMI, body mass index; CI, confidence interval; OR, odds ratio.

disease control.³² Given the positive influence of close patient monitoring on asthma control rates in our study, we consider better implementation of asthma management guidelines and patient education to raise awareness and expectations as crucial to improving asthma outcomes in Turkey.⁸

The majority (79.5%) of patients with persistent asthma in our study were receiving fixed combination therapy. SABA was used in 32.5%, ICS in 20.3%, and LABA in 13.6% of patients, while spray (31.5%), turbuhaler (29.9%) and discus (26.6%) were the most frequently used inhaler types, with a high level (>94%) of overall satisfaction from inhaler therapy. Likewise, data from a past study concerning determinants of asthma control at tertiary healthcare level in Turkey indicated use of ICS and LABA combination in 57% of the 900 patients surveyed.⁹

The use of fixed combination therapy in the majority of our patients is consistent with the remarkable alteration in practice patterns of asthma management in the last decade. There has been an increase in the prescription rate of controller medications, including multiple controllers for ICS + LABA, after Asthma Insights and Reality (AIR) surveys in the US, Europe, Asia-Pacific, Japan and Latin America populations reported low levels of asthma control.^{24,33–36}

Our findings found asthma control to be negatively associated with the incidence of comorbidities such as rhinitis, sinusitis and GERD, while it was positively associated with the use of fixed dose combination treatments. Significantly higher rates of asthma control were achieved by visit 4 compared to visit 1, even in patients with ≥ 15 years of asthma duration, and irrespective of age, gender, asthma duration, smoking status or BMI. However the presence of asthma-related comorbidity and active smoking were found to be significant predictors of worse asthma control.

ICS/LABA fixed combinations are reportedly the most commonly used anti-asthmatic medications¹⁵ and the most effective treatment choice.^{15,32} Our findings confirmed this, with 61.5% of patients using fixed dose combination treatment achieving asthma control.

Indeed, the use of fixed dose combination therapy (ICS/LABA) was among the factors associated with optimal control of asthma in a study from France,³⁷ along with normal BMI, non-smoker status, age <50 and good compliance. On the other hand, exacerbation, use of reliever medication, switch of therapy and smoking have been listed as the factors for poor control in a Swiss study.³⁸ In another study from France, lack of asthma control in 41.1% of 4362 patients with persistent asthma was associated with patient-related factors including smoking, poor compliance and critical errors in device manipulation.³⁹

Our study is also in line with the international population-based ECRHS II Survey conducted in 11 countries,¹⁹ which reported no differences based on gender or age in categories of asthma control.

Asthma-related comorbidities were identified in 56.1% of patients overall in our study population, with rhinitis in 38.3%, GERD in 18.5% and sinusitis in 18.4%. This is in accordance with the most common comorbidities reported in asthma, including rhinitis, sinusitis, GERD, obstructive sleep apnea, hormonal disorders and psychiatric disorders.⁴⁰ Our findings that higher scores of ACT and higher likelihood of asthma control were linked with a lesser number of comorbidities, support the evidence that various comorbid conditions such as rhino-sinusitis, GERD, psychological disturbances, and respiratory infections, are often observed in asthmatic patients⁴⁰ and will place greater burden on healthcare systems unless taken into consideration in asthma treatment.⁴¹

In accordance with the data³¹ that indicate smoking is a critical factor in the risk of poor asthma control^{42,43} and impaired corticosteroid response,⁴⁴ there was a significantly lower percentage of smokers classified under the controlled asthma category at visit 1 (51.0% versus 64.0% non-smokers, $P = 0.010$) and visit 4 (78.0% versus 89% non-smokers, $P = 0.030$) in our study population.

Our study's greatest value is in being the first large-scale, detailed survey conducted across Turkey using a patient evaluation questionnaire. The limitations are the lack of data on asthma severity and also the high drop-out rate (46.0%) from visit 1 to visit 4.

Conclusion

In conclusion, our findings in this real-life prospective ASIT study revealed an asthma control rate of 61.5% in adult outpatients with persistent asthma in Turkey, which increased upon each follow-up, regardless of the smoking, educational and employment status of the patients. Fixed dose combinations proved superior in the achievement of asthma control. However, poor asthma control was associated with the incidence of comorbid diseases. Our findings have provided valuable data on the positive role of regular monitoring in disease control. We therefore advocate regular patient monitoring and patient education to raise awareness and therapeutic expectations, in order to better implement asthma management guidelines and achieve better control of the disease.

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1. Yıldız F, Study Coordinator (Department of Pulmonary Diseases, Kocaeli University School of Medicine, Kocaeli)
2. Erbagci A (Zonguldak Uzun Mehmet Chest Diseases Hospital, Zonguldak)
3. Demirel YS (Department of Chest Diseases, Ankara University, School of Medicine, Ankara)
4. Akcalı SD (Chest Diseases Clinic, Ankara Dışkapı Yıldırım Beyazıt Hospital, Ankara)
5. Ekici A (Department of Chest Diseases, Kirikkale University, School of Medicine, Kirikkale)
6. Dursunoglu N (Department of Chest Diseases, Pamukkale University School of Medicine, Denizli)
7. Ediger D (Department of Chest Diseases, Uludag University, School of Medicine, Bursa)
8. Erdinc M (Department of Chest Diseases, Ege University, School of Medicine, Izmir)
9. Cemri SC (Chest Diseases Clinic, Mersin State Hospital, Mersin)
10. Kalyoncu AF (Department of Chest Diseases, Hacettepe University, School of Medicine, Ankara)
11. Guclu SZ (Dr. Suat Seren Chest Diseases Hospital, Izmir)
12. Aktogu S (Dr. Suat Seren Chest Diseases Hospital, Izmir)
13. Bayramgurler B (Chest Diseases Clinic, Derince Research and Training Hospital, Kocaeli)
14. Bayram M (Chest Diseases Clinic, Sivas Numune Research and Training Hospital, Sivas)
15. Akgun M (Department of Chest Diseases, Erzurum Atatürk University, School of Medicine, Erzurum)
16. Mirici A (Department of Chest Diseases, Canakkale 18 March University, School of Medicine, Canakkale)
17. Akyildiz L (Chest Diseases Clinic, Private Park Hospital, Mardin)
18. Celik P (Department of Chest Diseases, Celal Bayar University, School of Medicine, Manisa)
19. Guven AO (Nihat Kitapci Chest Diseases Hospital, Erzurum)
20. Camsari G (Yedikule Chest Diseases Hospital, Istanbul)

21. Ozseker F (Sureyyapasa Chest Diseases Hospital, Istanbul)
22. Cimen F (Atatürk Chest Diseases Hospital, Ankara)
23. Kurutepe M (Sureyyapasa Chest Diseases Hospital, Istanbul)
24. Senyigit A (Department of Chest Diseases, Dicle University, School of Medicine, Diyarbakir)
25. Bektas Y (Trabzon Chest Diseases Hospital, Trabzon)
26. Ozbudak O (Department of Chest Diseases, Akdeniz University, School of Medicine, Antalya)
27. Saylan B, Baslilar S (Chest Diseases Clinic, Umraniye Research and Training Hospital, Istanbul)
28. Polatli M (Department of Chest Diseases, Adnan Menderes University, School of Medicine, Aydin)
29. Cagatay T (Department of Chest Diseases, Istanbul University, Istanbul School of Medicine, Istanbul)
30. Kalkan S (Chest Diseases Clinic, Private Batman Hospital, Batman)
31. Ozer A (Chest Disease Clinic, Cukurova State Hospital, Adana).

Disclosure

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