

ASTHMA CONTROL

The effectiveness of a pictorial asthma action plan for improving asthma control and the quality of life in illiterate women*Leyla Pur Ozyigit, MD^{1,2}, Bahar Ozcelik, MD³, Seda Ozcan Ciloglu, MD², and Feyza Erkan, MD³¹Department of Allergy and Immunology, American Hospital, Istanbul, Turkey, ²Department of Chest Medicine, Mus State Hospital, Mus, Turkey, and ³Department of Chest Medicine, Istanbul Medical Faculty, Istanbul University, Istanbul, Turkey**Abstract**

Background: Written asthma action plans are an important part of asthma management, but cannot be used for illiterate people. **Objective:** The aim of this study was to establish the effectiveness of a pictorial asthma action plan on asthma control, health-related quality of life (HRQoL), and asthma morbidity in a population of illiterate women with asthma. **Methods:** Forty illiterate women with moderate-severe persistent asthma were assigned alternatively to receive either asthma education alone (control group) or asthma education and a pictorial asthma action plan (study group). Asthma control was assessed using the asthma control test (ACT), HRQoL was assessed using the St George's Respiratory Questionnaire (SGRQ), and the frequency of non-scheduled hospital or emergency visits was monitored. **Results:** Thirty-four patients completed the study. The ACT and SGRQ scores of both groups improved at every follow-up time point compared with baseline ($p < 0.001$). The ACT scores at 1 month (22.44 versus 20.75, $p = 0.034$) and 2 months (23.28 versus 21.81, $p = 0.010$) were higher in the study group than in the control group, but this was not maintained at 6 months (24.00 versus 23.25, $p = 0.069$). The SGRQ scores at 6 months were better in the study group (18.12) than in the control group (23.96, $p = 0.033$). No hospital admissions were recorded for either group. **Conclusion:** Education provides a significant improvement in asthma control and HRQoL while managing illiterate asthma patients, additionally the pictorial asthma action plan can be a helpful tool for self-medication.

Keywords

Asthma Control test, asthma education, literacy, pictorial action plan, St George's Respiratory Questionnaire (SGRQ)

History

Received 6 February 2013

Revised 31 October 2013

Accepted 3 November 2013

Published online 10 December 2013

Introduction

Personal asthma action plans enable individuals with asthma to adjust their own treatments according to changes in their disease [1]. To be involved in treatment decisions increases the quality of life of asthma patients [2,3]. A recent meta-analysis of studies containing written asthma action plans and standard treatments revealed a 40% decrease in asthma-related presentation to hospitals and a 20% decrease in emergency visits by patients with an action plan [4]. Action plans decrease the frequency of asthma attacks, hospital and emergency presentations, and the costs incurred by asthma [5]. As such, personal asthma action plans are recommended in all national and international asthma guidelines [1]. However, this recommendation has not been well implemented [6]. In the American National Population Survey, only 27% of patients reported that their doctors had developed a

written action plan for them. Some reasons for non-implementation include the guidelines not being within reach, absence of appropriate pre-printed templates, physicians not being confident about the implementation of the action plan, physicians' opinion that the patient is not willing to take control [7], asthma attacks developing too acutely for action plan implementation [8], and patients being unable to access action plans that are appropriate to their education levels.

Rural areas have a particularly high frequency of asthma attacks, that cause absences from school and work [9,10], presentation to emergency departments [11] and admittance to hospitals [12]. A difference between the rural and urban regions was also detected in asthma-related mortality in a pediatric population [13,14]. The reasons for this include the inability to obtain healthcare services, low levels of literacy, unsuitable conditions in home care, and poor nutrition. According to the 2009 data, about 793 million adults in the world are illiterate, of whom two-thirds are women [15]. Being illiterate prevents an individual from deriving maximum benefit from healthcare services. Regrettably, because current asthma action plans do not take literacy levels into consideration, asthma education fails to reach a large number of patients. It has been suggested that such action plans are not sensitive to language and socio-cultural conditions [16].

*This study has already been presented as a poster discussion at Annual European Academy of Allergy and Clinical Immunology Congress, Geneva, 2012.

Correspondence: Leyla Pur Ozyigit, Department of Allergy and Immunology, American Hospital, Amerikan Hastanesi Guzelbahce Sok. No: 20, Istanbul, Turkey. Tel: 009021231120007/4761. Fax: 00902123112382. E-mail: leylapo@amerikanhastanesi.org

In Turkey, it has been estimated that 84% of the 5.6 million illiterate population are women and illiteracy among women is very high particularly in eastern parts the country.

The objective of action plan implementation is to develop person-specific programs that should work regardless of literacy.

In this study we used a pictorial asthma action plan developed by a medical illustrator. A previous study confirmed that this pictorial plan is comprehensible to asthma patients with low educational levels [8]. Therefore, aim of this study was to establish the effectiveness of this pictorial asthma action plan in terms of asthma control, health-related quality of life (HRQoL), and asthma morbidity in a population of illiterate women with asthma.

Methods

Study population

The study included 40 illiterate female patients [aged 18–55 years] living in the most socio-economically under-developed province of Turkey who were diagnosed with moderate to severe persistent asthma. Illiteracy was defined as the inability to read and write due to the lack of a formal education. The asthma diagnosis was confirmed at the patient's first admission by history, physical examination and respiratory function tests [with reversibility testing] according to Global Initiative for Asthma Guidelines [1]. All patients were clinically stable. Patients were excluded if they smoked, had a pulmonary disease other than asthma, had a lower respiratory tract infection within the last 6 weeks, had previously been included in an asthma-related education program, or did not have the mental capability to provide informed consent. The study was approved by the Istanbul University Ethical Committee on Biomedical Research (2011/683-537). Informed consent was given in the form of a fingerprint signature after oral information had been provided.

Study design

Participants were enrolled from asthma patients from our primary care hospital outpatient clinic in the period from September 2010 to November 2010. On enrollment in the study, patients were alternately assigned to either the study

group or the control group according to their admittance order to the department. Both groups were given an interactive asthma education presented by the same, blindfolded respiratory physician, on the same planned day. The education material was prepared on slides including illustrations and the content involved basic mechanism, symptoms of asthma, roles of each medication (symptomatic and preventive medication), administration techniques for any device, signs for exacerbation and environmental control. In addition to this standardized education, the study group was also taught about the use of the pictorial asthma action plan. Follow-up interviews were conducted by telephone in the first and second month after initial admission. Patients were recalled and invited to our outpatient clinic for evaluation of quality of life and asthma control after six months. Patients were questioned for non-scheduled hospital or emergency visits and clinical measures were assessed. A CONSORT diagram of the study is provided in Figure 1.

Clinical measures

We determined age, socio-economic conditions, biomass exposure, duration and severity of asthma, family history for chronic diseases, asthma treatments received, and the ability to reach healthcare units in the event of asthma-related breathing difficulties. The numbers of hospitalizations and emergency department admissions due to asthma attacks during the year prior to study enrollment were obtained from hospital records (Table 1).

The level of asthma control was measured using the Asthma Control Test (ACT) [17]. The total ACT score ranges from 5 to 25, and is determined by summing the response scores to the five questions related to the actual asthma control. An ACT score of greater than 20 indicates well-controlled asthma. A difference of 3 points in mean ACT scores between two groups or in an individual patient over time are clinically significant [18].

The ACT, is a very useful self-administered questionnaire, validated for Turkish language [19]. Regrettably, there is no self-administered questionnaire appropriate for the usage of the patients unable to read and write. The pediatric version of ACT can be filled through the help of the parent but this one is not suitable for adults [20]. Consequently, the ACT

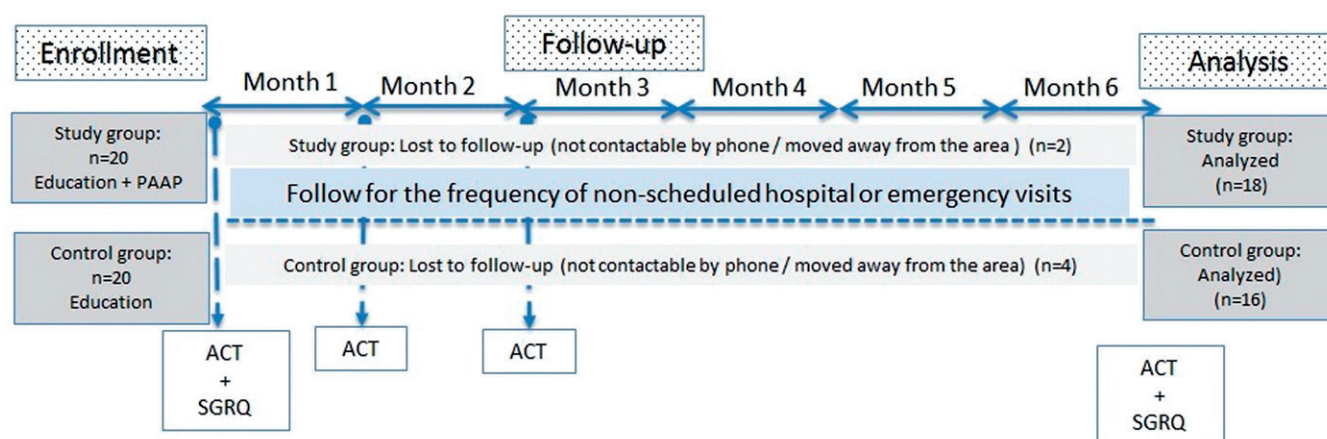


Figure 1. CONSORT diagram of the study.

Characteristics	Study group		Control group	
Age	33.67 ± 7.10		35.19 ± 6.66	
Education level of the spouse				
None	9	50.00%	4	25.00%
Primary school	4	22.20%	9	56.30%
Middle school	3	16.70%	1	6.0%
(the three years education to follow the Primary school)				
High school	2	11.10%	2	12.50%
Residence				
Urban area	8	44.4%	7	43.80%
Peri-urban area	1	5.60%	0	0.00%
Rural area	9	50.00%	9	56.20%
Marital status				
Married	16	88.90%	14	87.50%
Widower	2	11.10%	2	12.50%
Number of people living in the same apartment				
4–6	3	16.70%	2	12.50%
6–8	4	22.20%	4	25.00%
8–10	7	38.90%	8	50.00%
>10	4	22.20%	2	12.50%
Heating				
Central	2	11.10%	1	6.30%
Stove	15	83.30%	14	87.50%
Burning dung	1	5.60%	1	6.30%
Biomass	11	61.10%	9	56.30%
The time of asthma beginning				
≤1 year	1	5.60%	1	6.30%
1–5 year	10	55.60%	9	56.30%
5–10 year	5	27.80%	3	18.80%
≥10 year	2	11.10%	3	18.80%

The ACT and SGRQ were given verbally due to the low level of education of the population studied. The interviewer was a blindfolded nurse, who was not informed about the patients' belonged group and instructed not to modify the questions or otherwise influence the answers given by the interviewees.

We used a pictorial asthma action plan that was previously shown to be easily comprehensible by three different groups of asthma patients with low education levels [8]. In our study, the pictorial asthma action plan was divided into three columns with each column containing instructions, with figures for daytime and nighttime symptoms (Figure 2). The first column indicates that, when a symptom appears, the patients should use their rescue medication in addition to their standard treatment. The second column indicates that, when the frequency of use of the rescue medication increases, the patient should take methylprednisolone (16 mg tablet 1×2 a day) for 5 days and use a proton pump inhibitor prescribed for the purpose of gastric protection, after informing her physician. The third column indicates that, in the presence of symptoms after

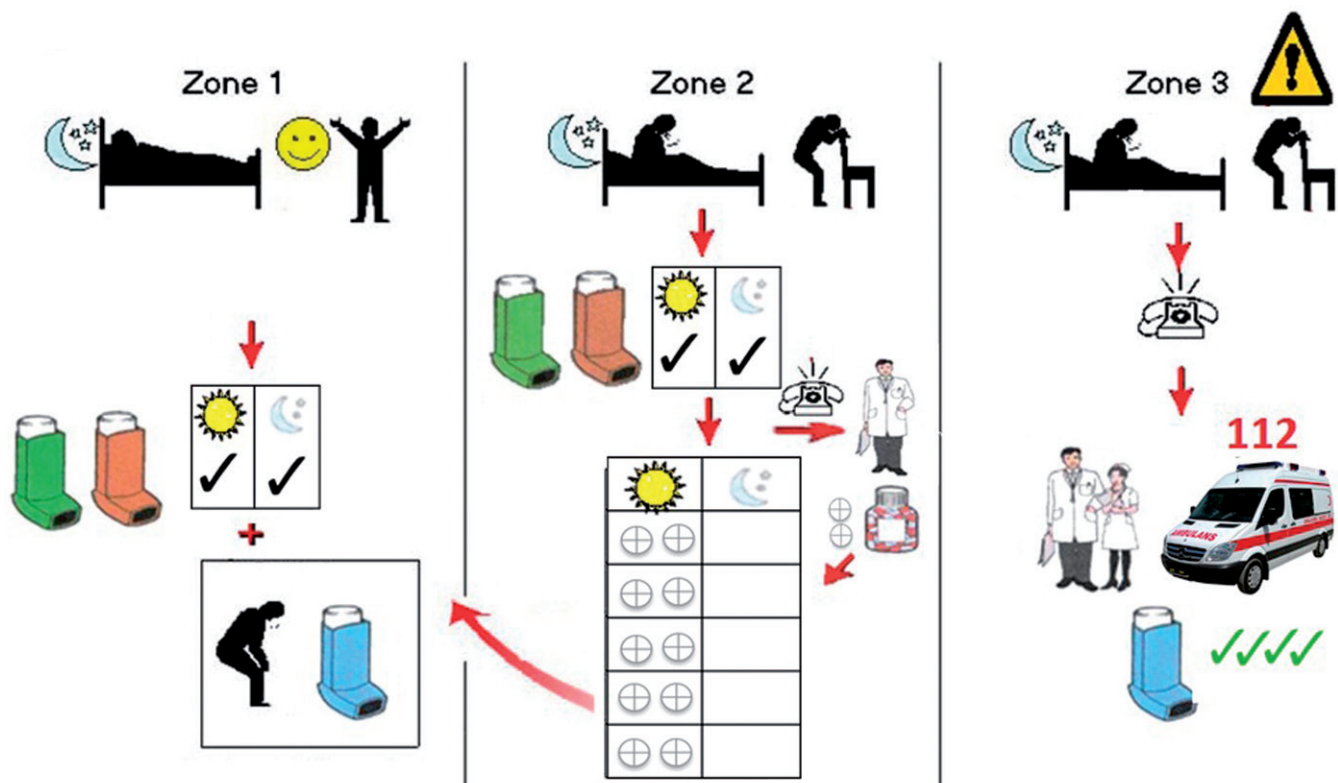


Figure 2. Pictorial asthma action plan.

methylprednisolone treatment, the patients should call their physician and present to an emergency department.

At the beginning of the study, oral steroids, 32 mg methylprednisolone as a course of five days, and a proton pump inhibitor were prescribed for each patient of the study group. These were to be used for five days when the short-acting bronchodilators are unable to relieve the worsened asthma symptoms, as shown in the second column of the pictorial asthma action plan.

Statistical method

Statistical calculations were performed with Number Cruncher Statistical System (NCSS) 2007 Statistical Software (NCSS LLC, Kaysville, UT) program for Windows. Besides standard descriptive statistical calculations (mean and standard deviation), in each group, repeated measures of ANOVA was used to determine the differences in measurement at each time point.

When $p < 0.05$, Student–Newman–Keuls multiple comparisons tests were used for pairwise comparisons. Paired t -test was employed in the assessment of pre- and post-education values; unpaired t -test was used in the comparison of groups. The Chi square test and Fisher's exact test were performed during the evaluation of qualitative data. Statistical significance level was established at $p < 0.05$.

Results

Study population

Two patients in the study group and four patients in the control group were dropped out from the study because they could not be contacted by telephone and they moved away from the area. A total of 34 patients completed the study: 18 patients in the study group, and 16 patients in the control group. The mean age of the patients was 33.67 ± 7.10 years in the study group and 35.9 ± 6.66 in the control group. The groups had similar socio-economic conditions, biomass exposure, history of asthma [including duration and severity], family history of asthma and allergy and asthma treatments. The reasons given for the inability to reach a healthcare unit in the instance of an attack included financial constraints (55% of cases), roads being blocked due to winter conditions (25% of cases), and the absence of an accompanying person (20% of cases). One or more of these reasons was given by 70% of patients in the control group and by 85% of patients in the study group. Characteristics of the study population completing the study are shown in Table 1. Analyzing separately and comparing the dropouts, six patients, with the 34 who completed the study, we could not find any statistically different demographic data.

Asthma control

The ACT score at baseline was similar in the study and control groups (13.95 versus 13.7, $p = 0.817$). The ACT scores at first, second ($p < 0.001$) and sixth months ($p < 0.001$) were higher than that at the baseline (Table 2). The ACT score at first (22.44 versus 20.75, $p = 0.034$) and second (23.28 versus 21.81, $p = 0.010$) months was higher in the study group than in the control group, but this significant

Table 2. Asthma control test scores at admission and follow-up.

ACT values	Study group	Control group	p^{**}
ACT-baseline	13.95 ± 3.55	13.7 ± 3.25	0.817
ACT – 1st month	22.44 ± 1.92	20.75 ± 2.54	0.034
ACT – 2nd month	23.28 ± 1.27	21.81 ± 1.83	0.010
ACT – 6th month	24 ± 0.97	23.25 ± 1.34	0.069
ACT baseline/1st–2nd–6th months			
p^*	<0.001	<0.001	

Data are means $\pm$ SD.

*Unpaired t -test.

**Repeated one-way ANOVA.

p Values are for comparisons between study group and control group and between the baseline and first, second and sixth month; significant values are in bold.

Table 3. St. George Respiratory Questionnaire scores at admission and at the 6-month follow-up.

	Study group ($n = 18$)	Control group ($n = 16$)	p^*
Baseline score	72.46 ± 8.74	73.26 ± 7.81	0.762
6th month score	18.12 ± 7.64	23.96 ± 7.43	0.033
p^{**}	<0.001	<0.001	
Change score (baseline–6th month)	53.67 ± 7.46	50.3 ± 7.75	0.214

Data are means $\pm$ SD.

p^* : Unpaired t -test.

p^{**} : Paired t -test.

p Values are for comparisons between study group and control group and between the baseline and sixth month; significant values are in bold.

difference was not maintained at 6 months (24.00 versus 23.25, $p = 0.069$).

Health-related quality of life

The SGRQ score at baseline was similar in both groups ($p = 0.762$) (Table 3). Both groups showed a lower SGRQ score at 6 months than at baseline ($p < 0.001$). The score was lower in the study group than the control group (18.12 versus 23.96, $p = 0.033$) (Table 3). The change of scores from baseline to the end point between the study and the control group was not statistically different (53.67 versus 50.3, $p = 0.214$).

Evaluation of control parameters

The number of visits to the emergency department (control group, 3.15 ± 2.30 ; study group, 3.70 ± 3.11 ; $p = 0.529$) and hospitalizations (control group, 0.85 ± 1.23 ; study group, 1.8 ± 2.42 ; $p = 0.126$) due to asthma, in the 12 months prior to study enrollment were similar for both groups. The number of visits to the emergency department over the 6-month study period was lower in the study group (0.85 ± 1.23) than in the control group (1.8 ± 2.42 , $p = 0.001$). There were no hospitalizations in either group over the 6-month study period.

Discussion

The education program resulted in great improvements in asthma control, HRQoL scores and asthma morbidity in illiterate asthma patients. The use of a pictorial asthma action plan in addition to patient education also had beneficial effects on disease control. These results indicate both the

significance of the education and also the usefulness of a pictorial asthma action plan for illiterate asthmatic women.

Although asthma action plans are effective [1], they need to be made more suitable for use by patients from different socio-cultural backgrounds, education levels and living conditions [22]. Of the 40 illiterate female patients included in this study, 80% were unable to reach healthcare units in the event of an attack for various geographical, social and economic reasons. In such cases, having the opportunity to manage their own treatment using an asthma action plan may be life saving.

Patients with an education below high school level are at higher risk of death due to chronic disease [23]. The illiterate patients in the present study had uncontrolled asthma as demonstrated by ACT at the time of admission, a high frequency of attacks and hospitalizations, and very low disease-related quality of life assessed by SGRQ scores. In Istanbul, largest city of Turkey, asthma patients, who have a higher education level than patients included in our study, had an average SGRQ score of 29.6 [24], which indicates a much better HRQoL than the patients in the current study having an average SGRQ score of 72.8 before the study. This suggests that education and management plans for asthma patients from various socio-cultural levels need to be tailored accordingly. Developing education techniques and asthma action plans that can be implemented in populations with low education levels is important, and can be life-saving. We observed a significant improvement in asthma control and HRQoL in both groups at six months, which was related to the appropriate education program.

The pictorial asthma action plan used in the present study has already been proven to be comprehensible by three different groups of asthma patients with low education levels [8]. However, the present study represents the first time that this plan has been used for clinical evaluation of non-literate asthma patients. The group of patients who had the opportunity to self-medicate using the pictorial asthma action plans in addition to education showed a greater improvement in asthma control at the first and second months. Furthermore, better quality of life scores of the group using action plans were obtained at the end of the study compared to the control group. In agreement with previous findings, the data is encouraging for recommending asthma action plans in addition to asthma education [25].

Another unsolved issue related to action plans is the arrangement of treatment when asthma is uncontrolled; particularly the choice and dose of inhaler or systemic steroid treatment. A recent meta-analysis showed that increasing the inhaled steroid dosage by two fold does not reduce the need for systemic steroids and that the introduction of both inhaler and systemic steroid options into action plans increases their success [26]. Another study suggests that, in fixed dose combinations, increasing the dosage causes problems in terms of cost, adherence and tolerability, and that dose adjustment difficulties might arise [27]. For these reasons, the action plan provided in the present study instructs the use of short-acting beta agonists as needed [if and when asthma was not under control] and, if sufficient control is not acquired after using these short-acting beta agonists, a 5-day course of steroids of 32 mg per day is recommended, provided the physician in

aware of taking the attack treatment. No hospitalizations occurred during the study period; we believe that this was due to the education program. Also, the group of patients given the pictorial asthma action plan in addition to education required fewer admissions to emergency departments during the study period than the group given education alone. This demonstrates the additional contribution of the asthma action plan to reducing the number of emergency department presentations.

Both the low number of patients enrolled and the absence of a formal approach to randomization are limitations. The statistical relevance of the results might be improved by implementing the pictorial action plan over a longer period of time, and by using a larger sample size. Ethical considerations prevented the inclusion of a second control group that was given neither asthma education nor an asthma action plan, as the positive effect of asthma education on asthma control is well documented.

Another limitation is the loss of the significance of difference among the ACT scores of two groups between the second to sixth months. It has already been reported that the adherence to asthma action plans decreases over time indicating the importance of the regular reinforcement of education at every follow-ups [28].

In conclusion, the implementation of a pictorial asthma action plan in one of the most underdeveloped areas in Turkey resulted in a better asthma control in illiterate patients. It also resulted in a decrease in the number of hospital admissions and emergency admissions. This study is the first to assess the effect of a pictorial action plan on asthma control, asthma morbidity and HRQoL. The benefits of asthma education in terms of asthma morbidity and the economic burden of the disease is remarkable especially for illiterate patients, this effect was even enhanced when combined with the action plan. A large number of individuals, particularly women, in the world are illiterate [15]. From this we can assume that a large proportion of the world's asthma sufferers in underdeveloped countries are illiterates and it is, therefore, of utmost importance to adapt asthma questionnaires for maximizing the physician's understanding of appropriate level of asthma control for the patients with limited literacy skills and also to modify asthma education and plans so these populations can use them. In doing so, we would expect to see an improvement in disease control and a reduction of the morbidity, mortality and cost associated with asthma. In the light of the results of this study, we hope to see the use of the pictorial asthma action plan in developing countries to provide adequate disease control.

Acknowledgements

We are extremely grateful to all the individuals who participated in the realization of the pictorial asthma action plan for allowing us to administer it to our patients: Roberts NJ, Mohamed Z, Wong PS, Johnson M, Loh LC and, especially, Prof. Martyn Partridge, who also demonstrated great generosity by helping us to realize this study. We would also like to thank Damien Jade Duff, PhD and Julian Harel for the precious help at editing the English of the manuscript.

Declaration of interest

All the authors declare that they have no relevant financial interests in this manuscript.

References

1. Bateman ED, Hurd SS, Barnes PJ, Bousquet J, Drazen JM, FitzGerald M, Gibson P, et al. Global strategy for asthma management and prevention: GINA executive summary. *Eur Respir J* 2008;31:143–178.
2. Ignacio-García JM, Pinto-Tenorio M, Chocrón-Giraldez MJ, Cabello-Rueda F, López-Cozar Gil AI, Ignacio-García JM, de Ramón-Garrido E. Benefits at 3 years of an asthma education programme coupled with regular reinforcement. *Eur Respir J* 2002;20:1095–1110.
3. Bosley CM, Fosbury JA, Cochrane GM. The psychological factors associated with poor compliance with treatment in asthma. *Eur Respir J* 1995;8:899–904.
4. Gibson PG, Powell H, Coughlan J, Wilson AJ, Abramson M, Haywood P, Bauman A, et al. Self-management education and regular practitioner review for adults with asthma. *Cochrane Database Syst Rev* 2003;CD001117.
5. Gallefoss F, Bakke PS. Cost-effectiveness of self-management in asthmatics: a 1-yr follow-up randomized, controlled trial. *Eur Respir J* 2001;17:206–213.
6. Peters SP, Jones CA, Haselkorn T, Mink DR, Valacer DJ, Weiss ST. Real-world Evaluation of Asthma Control and Treatment [REACT]: findings from a national web-based survey. *J Allergy Clin Immunol* 2007;119:1454–1461.
7. Douglass J, Aroni R, Goeman D, Stewart K, Sawyer S, Thien F, Abramson M. A qualitative study of action plans for asthma. *BMJ* 2002;324:1003–1005.
8. Roberts NJ, Mohamed Z, Wong PS, Johnson M, Loh LC, Partridge MR. The development and comprehensibility of a pictorial asthma action plan. *Patient Educ Couns* 2009;74:12–18.
9. Canino G, Koinis-Mitchell D, Ortega AN, McQuaid EL, Fritz GK, Alegría M. Asthma disparities in the prevalence, morbidity, and treatment of Latino children. *Soc Sci Med* 2006;63:2926–2937.
10. Haselkorn T, Lee JH, Mink DR, Weiss ST; TENOR Study Group. Racial disparities in asthma-related health outcomes in severe or difficult-to-treat asthma. *Ann Allergy Asthma Immunol* 2008;101:256–263.
11. Kruse LK, Deshpande S, Vezina M. Disparities in asthma hospitalizations among children seen in the emergency department. *J Asthma* 2007;44:833–837.
12. Gupta RS, Carrion-Carire V, Weiss KB. The widening black/white gap in asthma hospitalizations and mortality. *J Allergy Clin Immunol* 2006;117:351–358.
13. Akinbami LJ, Schoendorf KC. Trends in childhood asthma: prevalence, health care utilization, and mortality. *Pediatrics* 2002;110:315–322.
14. Homa DM, Mannino DM, Lara M. Asthma mortality in U.S. Hispanics of Mexican, Puerto Rican, and Cuban heritage, 1990–1995. *Am J Respir Crit Care Med* 2000;161:504–509.
15. Global Education Digest 2010. Comparing education statistics across the world. UNESCO Institute for Statistics [UIS]; 2010.
16. Adams RJ, Appleton SL, Hill CL, Ruffin RE, Wilson DH. Inadequate health literacy is associated with increased asthma morbidity in a population sample. *J Allergy Clin Immunol* 2009;124:601–603.
17. Nathan RA, Sorkness CA, Kosinski M, Schatz M, Li JT, Marcus P, Murray JJ, Pendergraft TB. Development of the asthma control test: a survey for assessing asthma control. *J Allergy Clin Immunol* 2004;113:59–65.
18. Schatz M, Kosinski M, Yarlas AS, Hanlon J, Watson ME, Jhingran P. The minimally important difference of the Asthma Control Test. *J Allergy Clin Immunol* 2009;124:719–723.
19. Uysal MA, Mungan D, Yorgancioglu A, Yildiz F, Akgun M, Gemicioglu B, Turktas H; The Turkish Asthma Control Test (TACT) Study Group. The validation of the Turkish version of asthma control test. *Qual Life Res* 2013;22:1773–1779.
20. Sekerel BE, Soyer OU, Keskin O, Uzuner N, Yazicioglu M, Kiliç M, Artaç H, et al. The reliability and validity of Turkish version of childhood asthma control test. *Qual Life Res* 2012;21:685–690.
21. Jones PW, Quirk FH, Baveystock CM, Littlejohns P. A self-complete measure of health status for chronic airflow limitation. The St. George's Respiratory Questionnaire. *Am Rev Respir Dis* 1992;145:1321–1327.
22. Gibson PG. Asthma action plans: use it or lose it. *Prim Care Respir J* 2004;13:17–18.
23. Pamuk E, Makuc D, Heck K, Reuben C, Lochner K. Socioeconomic status and health chartbook. Health, United States, 1998. Hyattsville, MD: National Center for Health Statistics; 1998.
24. Safiye O, Zehra D, Tuncalp D, Gemicioglu B. Assessment of the functional performance and quality of life in patients with COPD and asthma. *Solunum* 2007;9:158–166.
25. Côté J, Bowie DM, Robichaud P, Parent JG, Battisti L, Boulet LP. Evaluation of two different educational interventions for adult patients consulting with an acute asthma exacerbation. *Am J Respir Crit Care Med* 2001;163:1415–1419.
26. Gibson P, Powell H. Written action plans for asthma: an evidence-based review of the key components. *Thorax* 2004;59:94–99.
27. Rank MA, Volcheck GW, Li JT, Patel AM, Lim KG. Formulating an effective and efficient written asthma action plan. *Mayo Clin Proc* 2008;83:1263–1270.
28. Kaya Z, Erkan F, Ozkan M, Ozkan S, Kocaman N, Ertekin BA, Direk N. Self-management plans for asthma control and predictors of patient compliance. *J Asthma* 2009;46:270–275.