

Effect of educational programs on asthma control and quality of life in adult asthma patients

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Abstract

This study investigated the effectiveness of different educational programs in obtaining better asthma control and asthma-related quality of life (QoL). In 60 adult patients with moderate persistent asthma we tested the benefit of individual verbal instructions (IVI), written information (“asthma booklet”, B), and integrated asthma classes (“asthma school”, AS). At the enrollment and at the end of the study, all participants completed the questionnaires regarding their asthma-related knowledge (ArK) and QoL. During the 12-week period all patients recorded their asthma symptoms, morning and evening peak expiratory flow rates (PEFR), and the use of rescue medication. AS and IVI groups showed a significantly greater improvement in QoL than the B group. AS group obtained the highest ArK but no difference in the level of improvement among the groups has been documented. The improved average asthma symptom score and decreased utilization of the rescue medication were documented in all groups without significant differences among them. We also found significant improvements in both morning and evening PEFR in IVI group as well as in the morning PEFR in AS group. We conclude that among tested educational interventions the AS caused the best improvement in QoL while IVI produced the best overall response in both parameters of the asthma control and QoL.

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1. Introduction

Continuous education of patients with asthma enhances the probability of long-term asthma control and often has essential importance for successful management of all types of asthma [1]. Different educational programs for patients with asthma have been widely used for a long time [2–5]. However, they largely differ in respect of content, design, intensity, and duration, depending largely on the quality of the educator. This variability resulted in lack of consensus in the respective field [6].

In spite of recommendations for teamwork and multi-disciplinary approach in education of asthma patients, medical doctors and nurses still carry out the greatest part of patients’ education [7]. However, the combined form of individual and group education recently gained in its importance [5]. There is increasing evidence that permanent education of patients helped in better control and more successful treatment of asthma mostly due to encouragement of efficient self-care in accomplishing the set management targets [8–10]. In addition, there is a potential of educational assistance of pharmacists who could particularly help in adequate selection and proper usage of asthma medications [1,11,12].

According to published studies, educational programs for asthma patients resulted in improved control of asthma

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regarding the number and severity of asthma exacerbations, school and work absenteeism, medical resources utilization, asthma morbidity and mortality, and the rate of complications [13,14].

The aim of the present study was to investigate the effectiveness of different forms of medical education in improving the control of asthma and quality of life (QoL) in patients with moderate persistent asthma. Different modalities of the patients' education included integrated asthma classes ("asthma school", AS), individual verbal instructions (IVI), and the education based on the usage of the written information—"asthma booklets" (B). The decision for recruitment of patients with moderate persistent asthma was based on their significant necessity for permanent medical care and regular controls. The possible effectiveness of a particular educational program in obtaining better asthma control in these patients could have a significant impact on overall health-care expenses for asthma because of their significant proportion, high rate of exacerbations and hospital admissions [15].

2. Methods

The study was designed as randomized, parallel groups, prospective, intervention study in adult patients with moderate persistent asthma. The institutional Ethics Committee has approved the plan of the study and all participating patients signed written consents before the recruitment. Sixty consecutive patients with moderate persistent asthma were recruited into the study in the inpatient and outpatient wards of the Department for Clinical Immunology and Pulmology, General Hospital "Sveti Duh", Zagreb, Croatia. Randomization was carried out using randomization routine to allocate patients in three different educational programs in order to get equally numbered groups. At the enrollment and at the end of the study all patients completed questionnaires aimed to estimate their QoL and degree of general asthma-related knowledge (ArK).

Afterwards, in each of the three assigned groups a certain educational program (AS, IVI or B) has been applied. During the study all patients were regularly treated with inhaled corticosteroids (daily dose of beclomethasone of 800–2000 µg or equivalent dose of fluticasone or budesonide), and were allowed to use salbutamol as rescue medication (100 µg, as needed). No change in the medication was allowed during the study.

The duration of the study was 12 weeks. According to guidelines of the Global Initiative for Asthma (GINA) [1], this was the optimal period to evaluate the effectiveness of the treatment measures. During the study, patients recorded the morning and evening peak expiratory flow rates (PEFR), asthma symptoms as well as the usage of the rescue medication (daily record cards, DRC). All patients attended regular 4-week control examinations where, in addition to physical

examination, the physicians checked their DRCs, the technique of PEFR measurement and notified adverse events.

2.1. Patients

Sixty adult patients (39 women and 21 men) with moderate persistent asthma were assigned into three groups with equal number of participants. We used the GINA guidelines criteria for moderate persistent asthma [1], which mean FEV₁ or PEFR of 60–80% of predicted values, PEFR variability >30%, everyday day-time and frequent night-time symptoms, everyday use of rescue medication and regular use of inhaled corticosteroids. We also estimated the patients' willingness to participate in the study as well as the ability to properly complete QoL and ArK questionnaires and DRCs.

The exclusion criteria included significant liver, kidney or cardiovascular disorders; serious muscle, endocrine or other disorder affecting lung function; pregnancy and breastfeeding; mental or psychiatric disorder that would affect patients' ability to comply with the study protocol.

2.2. Questionnaires

We used a modified short version of Living With Asthma Questionnaire (ms-LWAQ) for assessment of the QoL in asthmatic patients [16]. This questionnaire covered the main spheres of human living, which included work place and home assignments (three questions), sleeping and relaxation (four questions), sport and recreation (two questions), family affairs (three questions), social contacts (four questions), health care (one question), and material status (one question). The patients were offered to tick the "correct" and "not correct" boxes. The answers were quantified in the way that positive answers on negative statements were given 1, while the negative were given 0 points, and vice versa for positive statements. The final score has been calculated by dividing the total number of points by the number of answers. The score of 1 meant the worst possible, while the score of 0 meant the best possible asthma-related QoL. The change of the score between enrollment and end of the study of 0.1 point represented the clinically significant change in QoL.

ArK Questionnaire (20 questions) covered the general knowledge on asthma including prevention measures, PEFR monitoring, diagnostic procedures, and treatment modalities. Each correct answer gained one point, which meant the maximum score was 20 points and represented the best possible general ArK.

2.3. Baseline lung function measurements

The spirometry was performed according to the American Thoracic Society guidelines [17] using the body plethmograph (Jaeger, Germany). For the evaluation of

bronchial obstruction we analyzed FVC, FEV₁, FEF₂₅, FEF₅₀, FEF_{25–75}, and PEF.

2.4. Peak expiratory flow rate

The PEFR was measured using standard PEFR meter (Mini-WrightTM, Clement Clarke International Ltd., Essex, England) at the approximately same time in the morning and evening, and prior to asthma medication. Patients were instructed to record the best of three measurements.

2.5. Daily record cards

In addition to the best PEFR values, patients were instructed to record their day- and night-time asthma symptoms and number of puffs of the rescue medication. Asthma symptoms were ranged from 0 to 3. We calculated the average weekly symptom scores for the day and night as well as the average number of puffs of the rescue medication.

2.6. Interventions

All randomized patients attended different educational programs for adult asthma patients. These programs were uniform in content but differed in form, the way of application and extensiveness.

2.6.1. Asthma school

AS group received three 4 h sessions of group education which consisted of lectures and workshops. Lectures, given by physicians and asthma nurses, discussed significant aspects of asthma, like prevention, asthma trigger recognition and methods of its avoidance, diagnostic procedures, methods of self-control, and main principles of asthma management stressing the importance of regular use of inhaled corticosteroids for long-term asthma control. In workshops, moderated by asthma nurses, patients formed smaller groups and practiced the use of PEFR meters, correct techniques of use of different inhalation devices and spacers, and prepared the plan of action for the case of asthma exacerbations. Finally, under the guidance of physiotherapists, patients were instructed in basic physical methods, namely breathing and relaxation techniques with special emphasis on the breathing during asthma attacks.

2.6.2. Individual verbal instructions

The patients in IVI group received three 1 h sessions. During the first session, each patient was individually introduced by a well-trained spirometry technician to the proper use of PEFR meter, and types and use of inhalation devices. In the second session, led by asthma nurses, the patients learned about asthma triggers, technique of their avoidance and were instructed in basic physical methods. In the third session, the patients were individually interviewed by a physician who analyzed the asthma-related problems and answered their potential queries and doubts.

2.6.3. Written information

In this group patients received only written information in form of a brochure (“asthma booklets”). In 16 pages, this booklet covered the main topics on asthma: anatomy and physiology of the respiratory system, asthma prevention, diagnostic procedures, plan for treatment and self-control, and basic information on asthma relieving and controlling medications. The booklets also explained the basic breathing exercises and the use of PEFR meter.

2.7. Statistical analysis

Baseline characteristics (age, parameters of lung function, ms-LWAQ and ArK scores) for between group comparisons were analyzed using analysis of variance. Results were expressed as mean values (SE). Gender difference between groups was analyzed using Persons chi-square test. Repeated measures analysis of variance was used to test the change over time in different groups for parameters of QoL, ArK, and parameters of asthma control (PEFR, asthma symptoms, puffs of rescue medication) with introduction of proper variables as covariates (gender, age, baseline values for tested variable) for between group comparisons. Statistical analysis was performed using computer program Statistica, Kernel release 5.5A (StatSoft Inc., Tulsa, OK, USA). *P*-values <0.05 were considered statistically significant.

3. Results

Baseline subject characteristics are shown in Table 1. No significant differences between groups with exemption of gender distribution (*P* = 0.023, Chi-square test) were found. The groups were well balanced for baseline lung function parameters as well as for QoL and ArK (analysis of variance).

Table 1
Subjects' baseline characteristics

Characteristic	AS	IVI	B	<i>P</i> -value
Sex (women/men)	10/10	13/7	16/4	0.023 ^a
Age (years)	43.5 (3.8)	40.2 (3.2)	46.6 (3.8)	0.45 ^b
FVC (% predicted)	92.3 (2.2)	93.4 (2.8)	96.1 (2.3)	0.55 ^b
FEV ₁ (% predicted)	70.3 (1.9)	67.9 (1.6)	68.4 (1.9)	0.64 ^b
FEF ₅₀ (% predicted)	58.7 (3.5)	54.5 (4.2)	54.1 (3.2)	0.42 ^b
PEF (% predicted)	75.6 (4.9)	71.0 (4.8)	69.8 (4.0)	0.62 ^b
QoL (score)	0.62 (0.05)	0.66 (0.05)	0.69 (0.04)	0.59 ^b
ArK (score)	9.8 (0.6)	8.2 (0.7)	7.8 (0.7)	0.07 ^b

AS: asthma school; IVI: individual verbal instructions; B: booklets; FVC: forced expiratory capacity; FEV₁: forced expiratory volume in Second 1; FEF₅₀: forced expiratory flow at 50% of FVC; PEF: peak expiratory flow; QoL: quality of life (according to ms-LWAQ: modified short version of Living With Asthma Questionnaire); ArK: asthma-related knowledge (according to ArK Questionnaire). Results are presented as mean (S.E.) if not specified otherwise.

^a *P*-value for Chi-square test.

^b *P*-values for analysis of variance.

3.1. Degree of education and QoL prior and after education

In all groups the ArK expressed as number of points obtained in ArK Questionnaire has improved. This improvement was significant in AS and IVI groups ($P < 0.001$ for both) with no significant difference between them ($P = 0.63$, repeated measurements ANOVA; Table 2). Asthma-related QoL showed a similar pattern of improvement from baseline, being statistically and clinically significant for AS and IVI groups ($P < 0.001$ for both). The between group comparison showed a significant difference in the level of the QoL improvement, being the greatest in the AS group ($P = 0.0045$, repeated measurements ANOVA; Table 2).

3.2. Impact of education on asthma control

3.2.1. PEFr as a parameter of disease control

Average weekly values of morning and evening PEFr in studied groups are shown in Figs. 1 and 2. AS and IVI groups showed a significant improvement in morning PEFr values during the observed period being more prominent during the initial 6 weeks of study ($P < 0.05$ and < 0.001 , respectively, repeated measures ANOVA). Between group comparison adjusted for gender, age and baseline value differences showed a significantly better improvement in morning PEFr values in IVI than in the B group ($P < 0.05$, repeated measures ANOVA). IVI group was the only one that showed a significant improvement in evening PEFr values during the observed period, mostly during the first 6 weeks ($P < 0.001$, repeated measures ANOVA). Between group comparison adjusted for gender, age and baseline value differences showed a significantly better improvement in evening PEFr values in IVI group compared to B one ($P < 0.05$, repeated measures ANOVA). B group did not show any improvement in either morning or evening PEFr.

3.2.2. Symptom score as a parameter of disease control

In all groups we observed significant improvement in the daily average number of day- and night-time

symptoms ($P < 0.001$ for all groups and both parameters), with no significant difference between groups ($P = 0.74$ for day-time symptoms, $P = 0.56$ for night-time symptoms, adjusted for gender, age and baseline values difference; repeated measures ANOVA; Table 3). The largest improvement has been observed during the initial 6 weeks.

3.2.3. Use of rescue medication as a parameter of disease control

During the observed period, we documented a significant decrease in the daily average use of rescue medication in all groups, expressed as the number of day- and night-time puffs ($P < 0.05$ for all groups and both parameters). We found no significant difference between groups ($P = 0.61$ for day usage, 0.87 for night usage, adjusted for gender, age and baseline values difference; repeated measures ANOVA; Table 3). The greatest effect was evident during the initial 8 weeks.

4. Discussion and conclusions

It is widely accepted that patients' education is an essential part of the overall management of asthma. Therefore, the present study was aimed to investigate the effectiveness of different educational programs in obtaining better asthma control and asthma-related QoL.

Correspondingly to other reports [18–20], we found that the completion of programs of medical education in AS and IVI significantly increased the general asthma-related knowledge and awareness. In contrast, in group of patients who, besides the standard medical care, received only written information, the ArK remained unchanged. Furthermore, our results documented that improved ArK corresponded nicely with the improvement in QoL and asthma control. Asthma symptom scores and the use of rescue medication as parameters of asthma control manifested good sensitivity but were not discriminative. In the present study, the most discriminative and sensitive parameter of asthma

Table 2

Degree of asthma-related knowledge and quality of life at baseline and at the end of the study

	Baseline ^a	End of study ^a	Difference ^b	P-value	P-value for between groups comparisons ^c
ArK					
AS	9.8 (4–15)	11.9 (7–15)	2.1 (1.5–2.7)	0.000	0.63
IVI	8.2 (0–14)	10.3 (7–15)	2.2 (1.3–3.0)	0.000	
B	7.8 (3–14)	9.2 (4–14)	1.4 (0.1–2.6)	0.072	
QoL					
AS	0.62 (0.89–0.17)	0.44 (0.67–0.06)	−0.18 (−0.22 to −0.13)	0.000	0.0045
IVI	0.66 (0.94–0.11)	0.53 (0.83–0.06)	−0.13 (−0.16 to −0.09)	0.000	
B	0.69 (1.00–0.33)	0.64 (0.94–0.28)	−0.05 (−0.12 to −0.02)	0.056	

ArK: asthma-related knowledge (according to ArK Questionnaire); QoL: quality of life (according to ms-LWAQ: modified short version of Living With Asthma Questionnaire); AS: asthma school; IVI: individual verbal instructions; B: booklets.

^a Results are presented as mean (range).

^b Results are presented as mean difference (95% confidence interval).

^c Repeated measures ANOVA adjusted for sex and age.

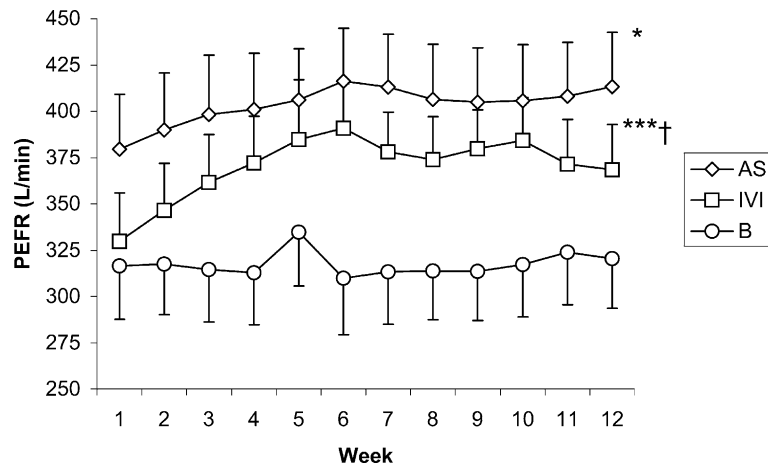


Fig. 1. The average weekly values of morning peak expiratory flow rate (PEFR) significantly increased during the studied period in patients educated in “asthma schools” (diamonds, AS; $P < 0.05$) and by integrated verbal instructions (squares, IVI; $P < 0.001$), while remained unchanged in patients educated by asthma booklets (circles, B). Between group comparison adjusted for gender, age and baseline value differences showed a significantly better improvement in morning PEFR values in IVI then in the B group ($P < 0.05$).

control was the morning PEFR. Surprisingly, the group that showed the best overall improvement in both asthma control and QoL was IVI, thus documenting that even low budgeted programs based on personal interactive contact between physician and patient could significantly improve QoL and level of disease control in adult asthmatic patients.

4.1. Discussion

In a more comprehensive and longer study, Bauman et al. [19] investigated a difference in quality of asthma-related care between asthmatic patients subjected to an intensive 6-month educational program and control group on standard treatment. The results indicated that only the educated group improved theoretical and practical ArK, which corresponded with less emergency hospitalizations, improved symptom

score and overall QoL. Our findings supported these results in spite of differences in applied educational programs. Similarly, de Oliveira et al. documented beneficial effects of medical education in socially deprived asthma patients [20]. Longer studies investigated the effect of medical education on the quality of medical interventions in asthma patients. Cartier and coworkers [21] reported that, compared to controls, asthma patients who were intensively instructed in guided self-management during 1 year period had a significantly better disease control and more appropriate treatment program.

The evaluation of asthma education programs in Australia indicated that programs were mainly focused on the improvement of theoretical asthma-related knowledge with only a few programs intended to stimulate patients' involvement into guided self-management based on stepwise

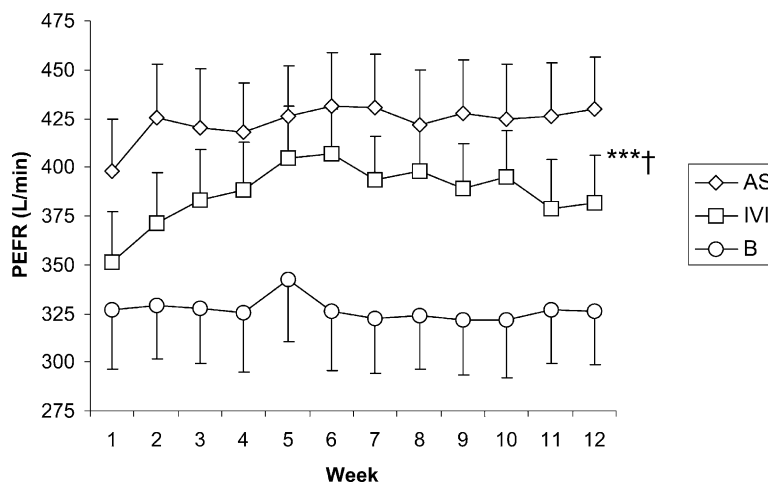


Fig. 2. The average weekly values of evening peak expiratory flow rate (PEFR) significantly increased during the studied period only in patients educated by integrated verbal instructions (squares, IVI; $P < 0.001$), while remained unchanged in patients educated in “asthma schools” (diamonds, AS) and asthma booklets (circles, B). Between group comparison adjusted for gender, age and baseline value differences showed a significantly better improvement in morning PEFR values in IVI then in the B group ($P < 0.05$).

Table 3

Average daily day- and night-time symptoms and requirement for a short acting bronchodilator as parameters of disease control in three study groups during 12 weeks of study

Week	Day-time symptoms			Night-time symptoms			Day-time requirement for rescue medication			Night-time requirement for rescue medication		
	AS	IVI	B	AS	IVI	B	AS	IVI	B	AS	IVI	B
1	0.67 (0.33–1.01)	0.82 (0.46–1.18)	0.95 (0.56–1.34)	0.89 (0.39–1.38)	1.28 (0.59–1.97)	1.09 (0.63–1.54)	0.66 (0.20–1.11)	1.01 (0.53–1.50)	1.10 (0.39–1.81)	1.16 (0.30–2.01)	1.41 (0.68–2.15)	1.34 (0.74–1.93)
2	0.32 (0.09–0.55)	0.60 (0.12–1.08)	0.68 (0.28–1.08)	0.30 (0.10–0.50)	0.61 (0.08–1.15)	0.70 (0.27–1.13)	0.44 (0.02–0.87)	0.89 (0.36–1.41)	1.00 (0.21–1.79)	0.89 (0.20–1.59)	0.86 (0.32–1.39)	0.95 (0.33–1.57)
3	0.51 (0.18–0.83)	0.39 (0.09–0.70)	0.79 (0.33–1.24)	0.40 (0.13–0.67)	0.49 (0.15–0.82)	0.87 (0.39–1.35)	0.73 (0.21–1.24)	0.49 (0.15–0.82)	1.16 (0.27–2.05)	0.79 (0.19–1.39)	0.87 (0.24–1.50)	1.18 (0.53–1.83)
4	0.34 (0.09–0.60)	0.36 (0.11–0.60)	0.82 (0.26–1.39)	0.33 (0.08–0.58)	0.41 (0.09–0.72)	0.99 (0.24–1.73)	0.51 (0.04–0.97)	0.41 (0.09–0.72)	1.09 (0.37–1.82)	0.81 (0.28–1.34)	0.76 (0.20–1.33)	1.13 (0.50–1.76)
5	0.24 (0.02–0.45)	0.32 (0.07–0.58)	0.71 (0.28–1.14)	0.19 (0.00–0.38)	0.34 (0.00–0.67)	0.69 (0.33–1.06)	0.44 (0.02–0.85)	0.34 (0.00–0.67)	0.96 (0.24–1.69)	0.70 (0.09–1.31)	0.61 (0.10–1.13)	1.01 (0.48–1.55)
6	0.22 (0.05–0.40)	0.29 (0.06–0.52)	0.63 (0.23–1.03)	0.24 (0.03–0.46)	0.36 (0.03–0.68)	0.54 (0.26–0.81)	0.32 (0.00–0.64)	0.36 (0.03–0.68)	0.92 (0.20–1.64)	0.74 (0.15–1.32)	0.60 (0.00–1.20)	0.86 (0.34–1.38)
7	0.29 (0.02–0.55)	0.31 (0.11–0.52)	0.53 (0.21–0.85)	0.24 (0.00–0.48)	0.33 (0.02–0.64)	0.51 (0.27–0.76)	0.44 (0.03–0.86)	0.33 (0.02–0.64)	0.76 (0.12–1.39)	0.80 (0.18–1.42)	0.57 (0.01–1.14)	0.77 (0.28–1.27)
8	0.22 (0.06–0.38)	0.39 (0.11–0.67)	0.57 (0.18–0.96)	0.21 (0.01–0.41)	0.34 (0.05–0.64)	0.53 (0.26–0.80)	0.35 (0.09–0.61)	0.34 (0.05–0.64)	0.77 (0.10–1.44)	0.44 (0.07–0.82)	0.58 (0.00–1.16)	0.81 (0.32–1.30)
9	0.26 (0.06–0.47)	0.44 (0.15–0.72)	0.66 (0.27–1.04)	0.21 (0.01–0.40)	0.42 (0.09–0.75)	0.60 (0.31–0.89)	0.37 (0.07–0.68)	0.42 (0.09–0.75)	0.91 (0.26–1.57)	0.56 (0.09–1.02)	0.73 (0.09–1.37)	0.93 (0.43–1.42)
10	0.21 (0.06–0.37)	0.35 (0.11–0.59)	0.56 (0.23–0.88)	0.24 (0.03–0.44)	0.38 (0.06–0.69)	0.57 (0.27–0.88)	0.33 (0.03–0.63)	0.38 (0.06–0.69)	0.81 (0.18–1.43)	0.61 (0.12–1.10)	0.71 (0.04–1.39)	1.01 (0.45–1.57)
11	0.16 (0.00–0.33)	0.32 (0.10–0.54)	0.41 (0.14–0.68)	0.17 (0.00–0.35)	0.39 (0.09–0.69)	0.36 (0.17–0.56)	0.29 (0.00–0.59)	0.39 (0.09–0.69)	0.55 (0.14–0.96)	0.36 (0.00–0.73)	0.62 (0.04–1.20)	0.70 (0.27–1.13)
12	0.12 (0.00–0.24)	0.35 (0.16–0.54)	0.40 (0.09–0.71)	0.15 (0.02–0.28)	0.33 (0.05–0.60)	0.33 (0.08–0.57)	0.22 (0.01–0.43)	0.33 (0.05–0.60)	0.65 (0.12–1.18)	0.33 (0.04–0.62)	0.73 (0.18–1.28)	0.72 (0.20–1.25)
P-value ^a	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.047	<0.019	<0.028	<0.021	<0.001	<0.002
P-value ^b	0.74			0.56			0.61			0.87		

AS: asthma school; IVI: individual verbal instructions; B: booklets: Results are presented as mean (95% confidence interval).

^a Repeated measures ANOVA.

^b Repeated measures ANOVA adjusted for gender, age and baseline values.

asthma treatment approach [22]. The results of our study documented that those educational programs, which covered practical aspects of asthma management and encouraged the active role of patients in asthma-related self-care, were particularly effective.

Besides overall QoL and asthma control, most often selected endpoints in estimating the effectiveness of asthma education, some other specific beneficial effects were also studied. During the 3-years monitoring of asthma patients, Emtner and coworkers [23] reported significant improvement in psychophysical condition and increase of self-esteem with significantly less rate of hampered everyday activities, helplessness, anxiousness and concerns in patients who completed a group education program.

Although almost all published reports on asthma-related education agreed regarding improvements in at least some aspects of patient's health status and QoL, some recent studies suggested that observed improvements could be a consequence of a more effective asthma pharmacotherapy as well [24,25]. We believe that improved QoL and asthma control observed in our study depended on educational programs only, since pharmacological treatment remained unchanged throughout the study. We also believe that the efficacy of education was documented in a fairly objective way, by estimating the QoL improvement as well as objective parameters like PEFR, asthma symptom scores and use of rescue medication. The same outcome measures were recommended also by other authors [26–28]. In fact, many authors agreed that PEFR was an especially good indicator of asthma activity and that regular PEFR monitoring had extreme importance for reduction of morbidity and optimal utilization of anti-asthma medication. Therefore, they also agree that all educational programs should cover PEFR monitoring and consequent planning of asthma treatment [29–32].

Finally, we are aware that the present study was limited by the small number of participants and relatively short period of duration, having not enough statistical power to demonstrate differences between AS and IVI groups in parameters of disease control and QoL. A longer study would estimate effects of education on long-term asthma control better. This, as well as possible additive effect of various educational interventions or repeated programs should be the goal of further studies.

4.2. Practical implications

This study bears a merit in involving various forms of education in everyday clinical practice. Adult patients with moderate persistent asthma, who attended AS, as the most comprehensive form of education, achieved the best results regarding QoL while patients who received IVI accomplished the best overall improvement consisted of both significantly improved parameters of asthma control and QoL. Based on the same criteria, the written information was

ineffective. We conclude that based on these results and having in mind costs of educational interventions, personally oriented low budgeted comprehensive programs could be the optimal choice. Written materials, lay prints or asthma brochures could be useful in these programs but are an inadequate substitute.

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