

# Influence of asthma education on asthma severity, quality of life and environmental control

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**J Côté, A Cartier, P Robichaud, et al. Influence of asthma education on asthma severity, quality of life and environmental control. Can Respir J 2000;7(5):395-400.**

**BACKGROUND:** Several studies have examined the influence of asthma education, focusing mainly on the use of health services.

**OBJECTIVES:** To assess the influence of an asthma education program (AEP) on airway responsiveness, asthma symptoms, patient quality of life (QOL) and environmental control.

**DESIGN:** A prospective, randomized, controlled study with parallel groups.

**SETTING:** Three tertiary care hospitals in Quebec.

**POPULATION:** One hundred and eighty-eight patients with moderate to severe asthma.

**INTERVENTION:** After optimization of asthma treatment with inhaled corticosteroids, patients were randomly assigned to receive either an education program based on self-management (group E) or usual care (control group C).

**RESULTS:** One year after an AEP, there was a significant decrease in the number of days per month without daytime asthma symptoms in group E only ( $P=0.03$ ). Asthma daily symptom scores decreased significantly in group E in comparison with group C ( $P=0.006$ ). QOL scores improved markedly in both groups after treatment optimization during

the run-in period ( $P<0.01$ ). After an AEP, the QOL score increased further in group E patients in comparison with group C patients ( $P=0.04$ ). The concentration of methacholine that induces a 20% fall in forced expiratory volume in 1 s (PC<sub>20</sub>) improved significantly in both groups (group E  $1.2\pm 1.1$  to  $2.4\pm 0.2$ , group C  $1.5\pm 1.2$  to  $2.4\pm 1.3$ ,  $P<0.01$ ). After one year, 26 of 37 patients from group E sensitized to house dust mites (HDM) adopted the specific measures recommended to reduce their exposure to HDM, while none of the 21 subjects from group C did ( $P<0.001$ ). Among the patients sensitized to cats or dogs, 15% of patients from group E and 23% of patients in group C no longer had a pet at home at the final visit ( $P>0.5$ ).

**CONCLUSIONS:** One year after the educational intervention, it was observed that the program had added value over and above that of optimization of medication and regular clinical follow-ups. The education program was highly effective in promoting HDM avoidance measures but minimally effective for removing domestic animals, suggesting that more efficient strategies need to be developed for the latter.

**Key Words:** Asthma education; Asthma outcome; Asthma treatment

*Pour le résumé, voir page suivante*

## Influence de l'éducation en matière d'asthme sur la gravité de l'asthme, la qualité de vie et le contrôle de l'environnement

**HISTORIQUE** : Plusieurs études antérieures à propos de l'éducation des sujets asthmatiques ont principalement évalué son impact sur la consommation des soins de santé.

**OBJECTIFS** : Cette étude fut élaborée afin de déterminer l'influence d'un programme d'éducation (AEP) sur la sévérité des symptômes d'asthme, l'environnement et la qualité de vie (QOL).

**DESIGN** : Une étude prospective, randomisée et contrôlée avec groupes parallèles.

**SUJETS** : 188 patients ayant un asthme modéré à sévère suivis dans un centre tertiaire.

**INTERVENTION** : Après optimisation du traitement de l'asthme avec des corticostéroïdes en inhalation, les patients furent randomisés soit dans le groupe E (éducation avec plan d'action) ou dans le groupe C (groupe contrôle) où ils recevaient le traitement usuel.

**RÉSULTATS** : Un an après la participation au AEP, nous avons observé une diminution significative du nombre de jours sans symptôme diurne chez les sujets du groupe E ( $p=0.03$ ). Le score moyen des symptômes d'asthme a aussi diminué significativement dans le groupe E en comparaison avec le groupe C ( $p=0.006$ ). Le score de la qualité de vie s'est amélioré significativement dans les 2 groupes lors de la période d'enrôlement ( $p<0.01$ ). Après un AEP, le score de la qualité de vie s'est amélioré davantage chez les sujets du groupe E en comparaison avec ceux du groupe C ( $p=0.04$ ). La PC<sub>20</sub> méthacholine s'est améliorée également dans les 3 groupes ( $p<0.01$ ). Après un an, 26 des 37 patients du groupe E sensibilisés aux acariens avaient adopté des mesures pour minimiser leur exposition à cet allergène alors qu'aucun des sujets ne l'avait fait dans le groupe C ( $p<0.001$ ). Parmi ceux sensibilisés aux chats ou aux chiens, 15 % des sujets du groupe E et 23 % des sujets du groupe C s'étaient départis de leur animal préféré ( $p>0.05$ ).

**CONCLUSIONS** : Un an après l'intervention éducative, nous avons pu observer des bénéfices reliés à l'éducation et ce malgré l'optimisation du traitement et un suivi régulier.

Asthma education can decrease the use of health services in patients with asthma, particularly in those with a high asthma-related morbidity (1-3). Previous studies on the potential benefits of asthma education programs (AEPs) have focused mainly on the influence of AEPs on asthma morbidity. In addition, efforts to evaluate asthma education have been hampered by suboptimal study designs and by concomitant initiation of other therapeutic interventions (4-9).

We designed an individualized AEP based on either monitoring of asthma symptom severity – education with action plan based on monitoring of asthma symptoms (ESM) – or peak expiratory flows (EPM). This program was set up to cover what appears to be the most important issues in asthma, including brief information on the pathophysiology of asthma, the role of medication and side effects, allergenic and nonallergenic triggers, symptoms heralding the beginning of a flare-up and, finally, the role of self action plans. We have previously shown that such a program can improve knowledge about asthma and that this effect is still measurable one year after participation in an AEP (10). In this last study on a group of patients with moderate to severe asthma with low morbidity and well controlled asthma, as reported in some other studies, the education program induced no significant change in morbidity, whether combined with education and action plan based on peak flow monitoring or asthma symptoms (10-14). However, whether such monitoring might help in improving asthma symptom severity and quality of life (QOL) of patients with asthma remains to be documented.

The present study was, therefore, designed to evaluate the influence of an AEP based on self-management plans guided by either peak expiratory flow (PEF) or asthma symptom monitoring on the following parameters: airway responsiveness, asthma symptom score, QOL and environmental control in a group of patients with moderate asthma not selected on the basis of a high morbidity index.

## PATIENTS AND METHODS

The present analysis was performed in the context of a larger study on the influence of asthma education on asthma outcomes. The primary goal of the main study was to examine the influence of optimal treatment with or without structured education based on action plans (10). The investigators had also planned to perform a second wave of analyses looking at secondary parameters such as respiratory symptoms, airway function, environmental control and QOL.

One hundred and eighty-eight adult patients with asthma were recruited from three tertiary care hospitals (l'hôpital Laval, Sainte-Foy; l'hôpital du Sacré-Coeur, Montréal; and l'hôpital du Saint-Sacrement, Québec city, Québec) following hospitalization or a visit to the clinic for asthma. After rigorous optimization of asthma therapy under the care of respirologists, patients were assigned to one of three groups – group C (control group, no formal education), group EPM or group ESM.

Eligibility criteria included the presence of moderate asthma requiring daily treatment with inhaled corticosteroids. The diagnosis of asthma had to be confirmed by either a reversibility of greater than 15% in forced expiratory volume in 1 s (FEV<sub>1</sub>) after salbutamol, or the concentration of methacholine that induces a 20% fall in FEV<sub>1</sub> (PC<sub>20</sub> metacholine), of 8 mg/mL or more using American Thoracic Society criteria (15). The study protocol was approved by the ethics committee of each hospital, and all patients gave informed consent. Patients requiring more than 7.5 mg/day prednisone to control asthma and those with prior participation in an AEP were excluded.

**Study design:** This study was a randomized, controlled trial with parallel groups. During the run-in period (visit 1 to visit 4, duration two to six weeks), medication was adjusted according to the *International Consensus Report on Diagnosis and Management of Asthma* (16). Patients were then

asked (visit 1) to measure PEF in the morning and evening for two weeks and score their asthma symptoms daily (breathlessness, wheezing, cough) using a scale of 0 (no symptoms) to 3 (night-time asthma symptoms, severe daily symptoms preventing usual activities).

On the second visit, two weeks after visit 1, spirometry was performed and PEF values checked by the physician. Patients were randomly assigned if they met one of the following three criteria of stability: PEF diurnal variation 15%; postbronchodilator FEV<sub>1</sub> of 85% or greater of predicted; and mean PEF greater than or equal to 85% of predicted. For unstable patients, the dose of inhaled beclomethasone dipropionate could be doubled. Patients monitored their symptoms and PEF for two weeks up to visit 3, where the same measures as visit 2 were obtained. On visit 4, all patients not requiring daily oral prednisone were randomly assigned to one of the three study groups. The value of PEF obtained during this last period was considered their personal best value (PBV).

The statistician who randomly placed patients into one of the three groups (group C, group ESM, group EPM) was blinded to the patients. Patients were seen for follow-up visits by the educator at one, three, six, nine and 12 months after random assignment.

Subjects of the control group (group C) received instructions from their respirologist regarding dosage of medication to use, and influence of allergenic and nonallergenic triggers. They had to record asthma symptom score daily in the two weeks before each follow-up visit.

For patients of the educated group, group E, which included both group ESM and EPM patients, the same intervention as group C was given plus individual counselling with a specialized educator for a 1 h session. Education was complemented at each follow-up visit. All patients were given the book *Understand and Control Your Asthma* (17). Educated patients were also randomly assigned to group ESM (self-management plan based on symptom only) or group EPM (self-management plan based on PEF monitoring). The patients of the ESM group had to record their asthma symptom score daily. They were also asked to adjust their medication following an action plan based on asthma symptom severity and bronchodilator use that consisted of four different steps. This action plan has been previously published (10). Patients from group EPM were asked to measure PEF twice daily and to adjust treatment according to a self action plan where step 1 corresponded to PEF between 80% and 100% of PBV, step 2 60% and 80%, step 3 50% to 60% and, finally, step 4 to less than 50% of PBV.

**Airway responsiveness:** A methacholine challenge test was done using the method described by Juniper et al (18). PC<sub>20</sub> was measured at random assignment and at the final visit.

**QOL:** QOL was assessed with regard to four different domains (emotions, physical activities, symptoms and environment) using the questionnaire recently developed by Juniper et al (19). QOL score was evaluated using a scale of 0 to 7. Clinical significance was established at a difference of 0.5 (20).

**Environmental control:** Patients sensitized to house dust mites (HDM) (skin prick test wheal response of 3 mm or more)

**TABLE 1**  
**Patient characteristics (controls [C] and educated [E] groups) at the time of random assignment**

	Group C (n=54)	Group E (n=95)
Age (years)	36±3	38±2
Sex (male/female)	16/38	37/58
Atopy (%)	42 (78%)	75 (79%)
Asthma medication		
Inhaled bronchodilator (salbutamol) (inhalations/day [SEM])	3.1 (0.4)	3.2 (0.4)
Inhaled corticosteroid (µg/day)*	1370 (105)	1450 (87)
Theophylline (%)	2 (3.7)	7 (7.5)
Prednisone (%)	1 (1.8)	0 (0)
Duration of asthma (years, mean ± SEM)	12±2	14±2
Peak expiratory flow (percentage of predicted value)		
Morning	95 (2)	92 (3)
Evening	100 (3)	97 (3)

\*In equivalent of inhaled beclomethasone dipropionate

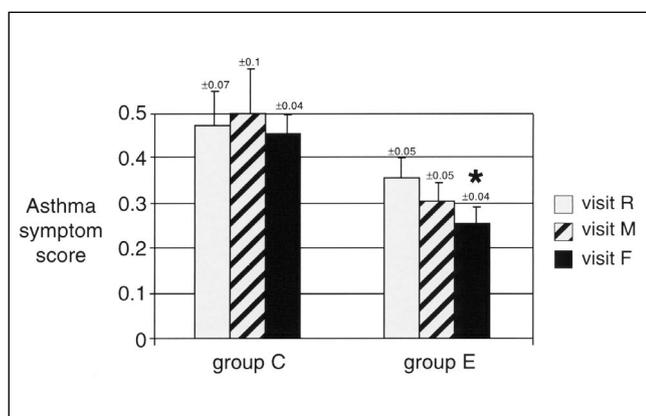
were asked to wash bedding with hot water (50°C), buy a special cover for mattresses and pillows, and remove carpets from the bedroom (21,22). In patients sensitized to cats or dogs, using individual counselling and reinforcement, it was explained that this exposure could worsen asthma symptoms. At each follow-up visit, patients were encouraged to get rid of their pet.

**Statistical analysis:** Data were grouped according to groups C or E for severity and frequency of symptoms, PC<sub>20</sub> methacholine and environmental control because there was no difference between the two subgroups of group E. QOL score data were, however, reported for groups C, ESM and EPM.

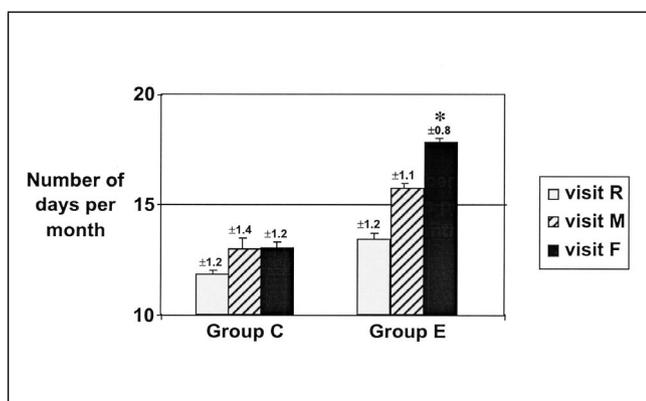
Continuous data were analyzed using univariate ANOVA (23). Frequency data were analyzed using the  $\chi^2$  test or Fisher's exact test when required. Nonparametric statistics were applied to data with a non-normal distribution. Statistical significance was established at P<0.05.

## RESULTS

**Patients:** One hundred and eighty-eight patients with moderate to severe asthma were recruited. Overall, 39 (21%) patients dropped out. Twenty-two were lost to follow-up. Another 17 were excluded because they did not meet the study requirements (asthma too mild or concurrent medical illnesses). A total of 95 patients completed the study in group E (45 using symptoms-based action plan and 50 using PEF) and 54 in group C. No significant differences were observed between groups C and E regarding age, duration of asthma, atopy, sex, dose or medication prescribed (Table 1). From the initial visit to random placement, the dose of beclomethasone dipropionate (µg/day) was increased from 940±110 to 1370±105, and from 923±90 to 1450±77 in groups C and E, respectively.



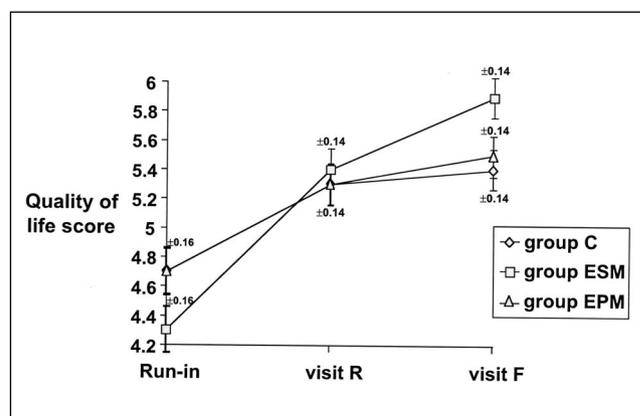
**Figure 1)** Initially, there was no significant difference between groups. Asthma symptom scores decreased significantly in educated patients (group E) in comparison with controls (group C) from random assignment (R) to the final visit (F) at 12 months ( $P < 0.01$ ). No significant change was observed between random assignment (R) and the six-month follow-up visit (M). Asthma symptom score was assessed using a scale from 0 (asymptomatic) to 3 (severe asthma symptoms)



**Figure 2)** There was a significant increase in the number of days without daily asthma symptoms in educated patients (group E) compared with control subjects (group C) from random assignment (R) to the 12-month visit (F) ( $P = 0.03$ ). However, no significant change was shown between random assignment and the six-month follow-up visit (M)

**Asthma symptom severity:** Initially there was no significant difference among groups (Figure 1). However, from random assignment to the 12-month visit, the asthma symptom score decreased significantly in group E only ( $C = 0.48 \pm 0.07$  to  $0.45 \pm 0.05$ ,  $E = 0.35 \pm 0.04$  to  $0.26 \pm 0.04$ ,  $P = 0.006$ ). No significant change was observed at the six-month follow-up.

**Asthma symptom frequency:** Figure 2 shows that the number of days per month without daily asthma symptoms increased significantly from random placement to the 12-month visit in group E only ( $C = 11.8 \pm 1.2$  to  $13.4 \pm 1.2$ ,  $E = 13.4 \pm 1.0$  to  $17.8 \pm 0.8$ ,  $P = 0.03$ ). Again, no significant change could be observed between the two groups at six months. The number of days without nocturnal awakenings increased in group E compared with group C, from random assignment to the



**Figure 3)** The quality of life scores improved significantly from the run-in period to the random assignment visit (R) in all groups ( $P < 0.05$ ). After random assignment, quality of life scores increased only in educated patients (group E) ( $P = 0.04$ ). This change was clinically significant (difference of greater than 0.5) in group education with action plan based on monitoring of asthma symptoms (ESM) only at visit F. EPM Education and action plan based on peak flow monitoring

12-month visit ( $C = 17.8 \pm 1.0$  to  $20.2 \pm 1.2$ ,  $E = 18.8 \pm 0.8$  to  $23.2 \pm 0.8$ ,  $P = 0.09$ ).

**QOL:** The mean QOL scores for the four domains (emotions, physical activities, symptoms and environment) improved significantly after optimization of asthma therapy during the run-in period in all three groups ( $C = 4.7 \pm 0.16$  to  $5.5 \pm 0.13$ ,  $ESM = 4.5 \pm 0.12$  to  $5.4 \pm 0.16$ ,  $EPM = 4.7 \pm 0.17$  to  $5.3 \pm 0.15$ ) (Figure 3). However, from random assignment to final visit, QOL scores further improved significantly only in educated patients of groups ESM and EPM ( $C = 5.3 \pm 0.16$ ,  $ESM = 5.9 \pm 0.17$ ,  $EPM = 5.5 \pm 0.15$ ,  $P = 0.04$ ). The increment in QOL scores was clinically significant only in patients who were given a self action plan based on symptoms (group ESM). Furthermore, the improvement in QOL scores was observed for all four domains.

**Airway responsiveness:** A significant improvement in airway responsiveness was observed in both groups. From random assignment to the 12-month visit,  $PC_{20}$  methacholine (mg/mL) increased significantly in both groups ( $C = 1.5 \pm 1.2$  to  $2.4 \pm 1.3$ ,  $E = 1.2 \pm 1.1$  to  $2.4 \pm 0.2$ ,  $P < 0.01$ ).

**Environmental control:** After participation in the AEP, 70% of the patients of group E sensitized to HDM adopted preventive measures to decrease their indoor exposure to this allergen, while none of the patients in group C did ( $P < 0.001$ ) (Table 2). The impact of asthma education in patients with asthma sensitized to their own pet was examined also. After one year, the educational intervention did not have any significant influence compared with simple medical advice by the physician with regard to exposure to domestic animals.

## DISCUSSION

After participation in an individualized AEP based on self-management, educated patients with asthma had a decrease in their asthma symptom scores, an increase in the

number of days without daily asthma symptoms and a trend toward a decrease in the number of symptom-free nights. These significant changes were only observed after six months from initiation of the intervention. Airway responsiveness improved similarly in controls and educated patients. Educated patients sensitized to HDM were much more likely to adopt the measures necessary to lower their indoor exposure to this specific allergen after participation in this program. On the other hand, in patients with cat or dog allergies, asthma education was no better than medical advice alone in motivating them to get rid of their favourite domestic animal. QOL improved significantly in educated patients only.

It has been reported that an improvement in asthma knowledge does not always mean an improvement in patient behaviour or a change in the use of health services (24-26). In the present study, improvement was accompanied by a decrease in both asthma symptom frequency and severity, and an improvement in QOL of patients with asthma. These favourable outcomes may be explained by the fact that when patients with asthma have a better knowledge of how and when to use asthma medication, they can prevent severe asthma symptoms from occurring and have more symptom-free days.

Furthermore, the present study was designed to try to differentiate between the influence of inhaled corticosteroid treatment and that of asthma education – a problem that was frequently encountered in previous studies. However, even with the optimization of asthma therapy, leaving little room to observe the benefits, we were still able to identify significant benefits of asthma education in this group. We agree that the changes in asthma symptom score and QOL were not that large; however, had the initial stability and control criteria been less stringent, we may have observed a larger improvement in these two outcomes after participation in the AEP. Nevertheless, the change in the number of days without daily asthma symptoms was much more important in the educated group.

The changes in asthma symptom frequency and severity became significant only in the last six-month period of this trial. These findings can be explained by the fact that it takes time for an asthma patient to develop good self-management skills and to change his or her behaviour. This delay in onset of benefits has been observed previously by Wilson et al (11) as a significant decrease in asthma morbidity that could only be observed in the second year. Studies dealing with asthma education should consequently last more than six months.

This study was conducted in tertiary care hospitals. It may thus be difficult to extrapolate our results to other subgroups of patients with asthma. Because asthma is often less rigorously controlled in the usual care setting, had this trial been conducted in a group of patients receiving the usual care, the differences observed may have been more important.

Airway responsiveness decreased significantly but equally in both groups. These findings are probably related to the asthma therapy being optimized with inhaled corticosteroids before random assignment in both groups of patients.

The present study is one of the few that has evaluated the

**TABLE 2**  
Influence of education on adherence to house dust mite (HDM) preventive measures and avoidance of pet exposure

	Group C (n=54)	Group E (n=95)	P
HDM positive skin prick test*	21/54	37/95	NS
HDM preventive measures			
At random placement	0/21	0/37	
At 12-month visit	0/21	26/37 <sup>†</sup>	<0.001
Dog at home			
At random placement	9/54*	17/95*	NS
At 12-month visit	6/54	15/95	
Cat at home			
At random placement	7/54*	15/95*	NS
At 12-month visit	4/54	12/95	

\*Number of sensitized subjects (skin prick test was considered positive when the induration was greater or equal to 3 mm). <sup>†</sup>Difference statistically significant at  $P < 0.001$  (Fisher's exact test). NS Not significant

benefits of a structured AEP on the QOL of patients with asthma using a validated scale such as the one designed by Juniper et al (19). We had previously shown an improvement in QOL after asthma education in an uncontrolled study (27). This trial confirms this observation in a larger group of patients using a controlled prospective design. It is interesting to note that the QOL questionnaire identifies differences that were not shown by lung function tests. QOL is an asthma outcome that certainly needs to be evaluated more extensively in studies dealing with asthma education. The improvement was small and reached clinical significance only in the group of patients who had a self action plan based on symptom monitoring. In our study, inhaled corticosteroids were supplied freely. Because these are expensive drugs, the compliance of control subjects was probably improved by this measure, preventing us from observing marked differences between controls and educated patients.

HDM are important allergens as asthma inducers (21,22). Because our AEP emphasizes the importance of avoiding allergen exposure in sensitized patients to reduce airway inflammation and responsiveness, we would consequently expect educated people with asthma to adopt these recommendations in a higher proportion. Asthma education was quite successful in motivating patients sensitized to these allergens to lower their exposure by buying pillow and mattress covers and washing bedding regularly in hot water. The efficacy of these measures in decreasing the level of HDM and asthma symptom severity was shown by Huss et al (28). With time, this decrease in exposure may lead to significant improvement in bronchial reactivity as it is observed in occupational asthma when subjects are removed from exposure. However, with regard to patients with asthma sensitized to their favourite domestic animal, education was no better than medical advice alone. Similar results were obtained in the study by Wilson et al (11). These findings may be explained by the fact that a longer period is necessary to reach this goal. Further research is needed to find better strategies to overcome this problem.

## CONCLUSIONS

One year after the educational intervention, we observed that our program had added value over and above that of optimization of medication and regular clinical follow-ups. Our study shows that in asthma patients with low morbidity, asthma education may help to improve their QOL, and asthma symptom frequency and severity. These goals are worthwhile when considering the number of children and adults affected by this chronic disease and the resulting consequences of poorly controlled asthma.

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