

Evaluation of the efficacy of a hospital-based asthma education programme in patients of low socioeconomic status in Hong Kong

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D. K. L. CHOY, M. TONG, F. KO, S.T. LI, A. HO, J. CHAN, R. LEUNG and C. K. W. LAI

Department of Medicine, Prince of Wales Hospital, The Chinese University of Hong Kong, Republic of China

Abstract

Background Good asthma control requires optimal medical treatment in conjunction with appropriate self-management. In the West, the effectiveness of patient education on improving self-management has been well documented. However, data amongst Asian populations are lacking. We performed a pilot study to evaluate the efficacy of a hospital based education programme aimed at improving self-management skills and reducing morbidity in a Chinese population with low socioeconomic status and education level.

Methods Our asthma education programme was a low-cost programme conducted in essence by specialist respiratory nurses. Patients attending our asthma clinic were instructed during a two-hour educational session on the pathophysiology of asthma, its potential triggers, the appropriate use of medications including proper inhaler techniques, and the self-management of their disease. These instructions were reinforced by video sessions at subsequent outpatient clinic attendance when patients' inhaler and peak flow techniques were checked by the same nurses and their self-management plan re-examined by the attending physicians. Asthma knowledge, inhaler technique, FEV₁ and peak expiratory flow (PEF), and patients' self-rating of their asthma were determined at baseline, 6 months and 1 year after the intervention. Morbidity was assessed by the numbers of hospitalizations, unscheduled visits to family physicians and accident and emergency department attendance, courses of oral steroid used and days off work or school at baseline and 1 year.

Results Two hundred and thirty patients were recruited for the study, 83% completing the entire assessment period. The group demonstrated significant improvements in lung function: the mean FEV₁ $\pm$ SD increased from $63.6 \pm 20.6\%$ of predicted values at baseline to $68.5 \pm 22.3\%$ at 6 months and $68.6 \pm 22.8\%$ at 1 year ($P < 0.05$), and the mean PEF $\pm$ SD increased from $64.6 \pm 23.0\%$ of predicted values at baseline to $75.4 \pm 27.0\%$ at 6 months and $76.8 \pm 24.5\%$ at 1 year ($P < 0.001$). There were also significant improvements in inhaler technique ($P < 0.01$), asthma knowledge ($P < 0.001$), patients' self-rating of their asthma ($P < 0.05$), and reductions in the numbers of hospitalizations ($P < 0.01$), visits to family physicians ($P < 0.001$) and accident and emergency department attendance ($P < 0.001$) during the study period. Patients with moderate to severe asthma as defined by an FEV₁ of $< 80\%$ of predicted values were most likely to benefit from the programme.

Conclusions We conclude that patient education is likely to be an essential component in the holistic approach to the management of asthma even amongst Asian populations of low socioeconomic status and education level. Further studies using randomised controlled trials are necessary to consolidate our findings.

Keywords: asthma education, socioeconomic status, Hong Kong, Chinese

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Introduction

Asthma is a common and chronic health problem, affecting patients of all ages. The prevalence of asthma is increasing [1,2], as are admission rates for adults with asthma [3]. In contrast with other chronic diseases, mortality for asthma has also been rising [4,5]. The combination of frequency and chronicity makes asthma a costly condition. In the USA, it has been estimated that asthma costs \$6.2 billion per annum whilst the loss of value and reduced productivity due to absenteeism from work represents the largest single indirect cost approaching \$1 billion per annum [6].

Several studies investigating the causes of death from asthma in the community have suggested that major problems exist in the management of this common disorder [7,8]. Factors identified that may contribute to morbidity and mortality include poor compliance with treatment, and failure by the patient and relatives to assess and appreciate the severity and speed of onset of an acute attack, thereby resulting in delay in initiating appropriate treatment [9]. Hence, patient education has become an important focus in the management of asthma. In recent years, a number of group education programmes for adult asthma have been developed that focus on improving patient self-management [10–18]. Randomized controlled trials of the effectiveness of such interventions [14–19] have shown a significant but modest impact on morbidity. However, the ideal content and the best modalities of asthma education programmes remain to be defined [22–24]. Programmes promoting early intervention during asthma exacerbations, the use of an action plans, and measurement of peak expiratory flow rates have been more successful in improving the control of asthma and in reducing its associated morbidity than those aimed at improving knowledge [25]. The characteristics of attenders and nonattenders at asthma education programmes have also been studied. Yoon and coworkers found that the level of education was significantly associated with attendance [16]. On the other hand, D'Souza and coworkers performed a trial of a 'credit card' asthma self-management plan in the generally poorly educated New Zealand rural Maori community and found that it was still highly effective [23].

In Hong Kong, asthma prevalence and hospital admissions have risen in recent years [27]. Asthma mortality in the 5–34 years age group has been steadily increasing from 1976 to 1985 [28] and has remained elevated since. Despite Western influence, the use of Chinese herbal medicine with its dubious efficacy is still widespread in Hong Kong [29]. Its use amongst asthmatics remains unknown. There is currently no available data on the benefit of asthma education in Asian populations which generally have different cultural beliefs in disease management. In view of the success of asthma education in the West, we have performed

a pilot study to determine if a similar asthma education programme would also benefit a group of asthmatics of low socioeconomic status and education level in Hong Kong.

Subjects and methods

All subjects were patients who attended the asthma clinic at a teaching hospital in Hong Kong. Two hundred and thirty consecutive patients who had not received asthma education previously from either a nurse or a medical practitioner were invited to attend the programme; 192 (83%) completed the study. They all fulfilled the American Thoracic Society diagnostic criteria for asthma. There were 75 males and 117 females with a mean age of 48.6 (range: 14–86) years. All were of Hong Kong Chinese descent. As a group, they generally represented the less affluent and less educated people of the territory (Table 1): 114 (59.4%) of the patients lived in 'public housing' estates, while 108 (56.2%) had an education level of primary school or less, with only 9 (4.7%) having attended tertiary education. Asthma severity varied but was at least moderate as a group with a mean $FEV_1 \pm SD$ of $64.5 \pm 20.3\%$ of predicted values. All required inhaled steroids in the form of beclomethasone dipropionate or budesonide in addition to an inhaled β_2 -adrenergic agonist.

All patients in groups of tens attended a two-hour educational session run by nursing staff who have been trained by health educationalists in asthma education endorsed by the Asthma and Respiratory Foundation of New Zealand. The education programme was adopted from the *Asthma Management Handbook 1993* which in turn was based on

Table 1. Subjects' characteristics

<i>Sex ratio</i>	
Males: 75 (39.1%)	
Females: 117 (60.9%)	
<i>Baseline lung function</i>	
> 80%	<i>n</i> = 41 (21.3%)
60–80%	<i>n</i> = 58 (30.2%)
< 60%	<i>n</i> = 93 (48.4%)
<i>Socioeconomic status</i>	
Public housing estates	<i>n</i> = 114 (59.2%)
Housing scheme estates	<i>n</i> = 38 (19.7%)
Private housing	<i>n</i> = 33 (17%)
Miscellaneous*	<i>n</i> = 7 (4.1%)
<i>Education level</i>	
None	<i>n</i> = 40 (20.8%)
Primary	<i>n</i> = 68 (35.4%)
Secondary	<i>n</i> = 75 (39.1%)
Tertiary	<i>n</i> = 9 (4.7%)

*Including temporary housing, huts, government staff quarters.

the *Australian Asthma Management Plan 1990*. Patients were educated regarding the nature of asthma, its potential triggers, the types of medications available and their appropriate use, as well as proper inhaler techniques. Diagrams and models of the bronchial tree were used as teaching aids to illustrate the difference between an asthmatic vs a normal airway. Layman language was used to cater for the poorly educated. All subjects were asked to demonstrate their inhaler technique in turns which was then corrected as necessary. Special emphasis was placed on the development of a self-management plan based on the 'credit card' asthma self-management system developed by Crane and coworkers in New Zealand [30]. All patients were provided with a credit card-sized instruction pamphlet (Fig. 1) that detailed what self-management steps to take and when to seek help based on a combination of peak expiratory flow rate recordings and diary recording of asthma symptoms on a daily basis. Worsening of asthma symptoms and peak flow readings were also colour-coded to serve as warnings of deteriorating asthma control and highlight the need of increasing prophylactic medications. The essence of the programme was reinforced by means of video sessions at each subsequent clinic attendance at intervals of 4–12 weeks. In addition, inhaler and peak flow techniques were checked by the same nursing officers and each patient's self-management plan was reviewed and individualized by the attending physicians.

To assess the efficacy of the programme, we measured a number of characteristics at baseline, 6 months and 1 year. During each of the three visits, PEF and FEV₁ were measured by the Mini-Wright peak flow meter (Clement Clarke International Ltd, Essex, UK) and compact spirometer (Vitalograph, Buckingham, UK), respectively. Each subject had the inhaler technique assessed by the same nursing specialist and was given a score of 1–3 (1, poor; 2, acceptable; 3, good). A 28-item 'true' or 'false' questionnaire based on 'Asthma IQ Quiz', adopted from the national asthma education programme developed by the US department of Health and Human Services, was completed to assess knowledge of asthma pathophysiology, nature of

medication, and appropriate self-management approaches (1, <60%; 2, 60–80%; 3, >80%). Patients' self-rating of their asthma control over the past 6 months were recorded (1, poor; 2, acceptable; 3, good). In addition, at baseline and 1 year, the numbers of hospitalizations, visits to family physicians, accident and emergency (A & E) department attendance, days off work or school, and courses of oral steroid used in the past year because of asthma were recorded as a measure of morbidity.

Statistical analyses

Values were mean $\pm$ SD unless otherwise stated. A *P* value of <0.05 was regarded as statistically significant. Parametric data were analysed by ANOVA and nonparametric data by the Friedman test. Where significant improvements occurred, 'least significant difference' studies for parametric variables and 'Friedman multiple comparisons studies' for nonparametric variables were performed to determine if improvements were more significant during the first 6 months or the last 6 months. Subgroup analyses were performed for results at baseline vs 1 year according to the patients' lung function (FEV₁ > 80%, 60–80%, <60% of predicted values); sex; age ($\geq$ 50, <50 years); education level (primary or none, secondary or above); and improvements in asthma knowledge and inhaler technique.

Results

Thirty-eight patients defaulted follow-up at our clinic. Therefore, there were 192 patients for whom results were completed and only these results were analysed. Of these, 75 were either working or attending school. The rest were mostly housewives or they had retired. The results were summarized in Table 2.

Pulmonary function

Significant improvements in FEV₁ and PEF were seen at 6 months and these were maintained at 1 year (*P* < 0.05 and

Symptoms based

Asthma under control	Continue current medication
Nocturnal symptoms/bronchial infections	Increase inhaled steroids
Decreased duration of effect of bronchodilators/ increasing breathlessness	Start oral steroids and contact doctor
Severe asthmatic attack	Seek medical advice urgently

PEFR based

Normal PEFR	Continue current medications
Less than 80% of previous best	Increase inhaled steroids
Less than 60% of previous best	Start oral steroids and contact doctor
Less than 40% of previous best	Seek medical advice urgently

Fig. 1. 'Credit card' self-management plan.

Table 2. Changes in outcome variables at 6 months and 1 year follow-up

	Baseline	6 months	1 year
PEF	64.6 ± 23.0%	75.4 ± 27.0% **	76.8 ± 24.5%***
FEV ₁	63.6 ± 20.6%	68.5 ± 22.3%*	68.6 ± 22.8%*
Knowledge	1.70 ± 0.73	2.20 ± 0.70***	2.35 ± 0.64***
Inhaler technique	2.33 ± 0.56	2.51 ± 0.51**	2.50 ± 0.60**
Self-rating	2.68 ± 0.71	2.77 ± 0.66	2.88 ± 0.65*
A & E attendance	1.34 ± 2.07	NA	0.62 ± 1.35***
Hospitalizations	0.71 ± 1.11	NA	0.45 ± 1.28**
GP visits	7.26 ± 12.7	NA	2.98 ± 6.73***
Days off (<i>n</i> = 75)	5.07 ± 13.7	NA	3.05 ± 6.88
Courses of steroids	2.02 ± 3.82	NA	1.37 ± 2.30

Values are mean ± SD. **P* < 0.05 vs baseline, ***P* < 0.01 vs baseline, ****P* < 0.001 vs baseline. NA = not available.

< 0.001, respectively). These were most significant during the first 6 months.

Asthma knowledge, inhaler technique and self-rating

Similar results were obtained for asthma knowledge and inhaler technique (*P* < 0.001 and < 0.01, respectively). Improvements were again most marked during the first 6 months. Patients' self-rating improved significantly at 1 year (*P* < 0.05 vs baseline).

Morbidity

Compared with the year prior to entry into the education programme, the numbers of hospitalizations, visits to family physicians, and A & E attendance all showed significant reductions during the study period. The corresponding *P* values were < 0.01, < 0.001 and < 0.001, respectively. During the study period, there were no significant reductions in the numbers of days off work and courses of oral steroid used.

Subgroup analysis

There were no significant intergroup differences when results were analysed according to age and education

level. Although reduction in steroid use did not reach statistical significance at 1 year as a group, the reduction amongst females was significantly more than that amongst males (*P* < 0.05). When results were analysed according to the baseline lung function, we found that the reduction in A & E attendance was significantly more in the group with moderately severe asthma, i.e. FEV₁ was 60–80% of predicted values (*P* < 0.05) than patients with mild disease (FEV₁ > 80% predicted) or severe disease (FEV₁ < 60% predicted), though all three groups achieved significant reductions. Patients with moderate to severe asthma were found to demonstrate significant improvements in their lung function as measured by the FEV₁ while there was no significant change in the FEV₁ of mild asthmatics (*P* < 0.01). Improvements in knowledge and inhaler technique showed no significant correlation with improvements in the other parameters (data not shown).

Use of inhaled and oral medications

There was a significant increase in the use of inhaled steroids and long-acting β-agonists (*P* < 0.05 for both) and a significant reduction in the use of oral medications (*P* < 0.01) at the end of the study period (Table 3).

Table 3. Medication use during study

	Baseline	6 months	1 year
Inhaled steroids (mean µg ± SD)	1454 ± 679	1565 ± 875	1616 ± 887*
Long-acting β-agonists (mean no. of puffs ± SD)	0.388 ± 1.058	0.989 ± 1.580*	1.180 ± 1.721*
Oral medications (no. of patients)	43	33	25**

P* < 0.05 vs baseline, *P* < 0.01 vs baseline.

Discussion

Asthma education and self-management have been repeatedly shown to be effective in reducing asthma morbidity in Western countries [20,21,31]. To the best of our knowledge, this is the first attempt to assess the efficacy of a similar asthma education programme in Asian populations. This study suggests that our asthma education programme is effective in improving asthma knowledge and pulmonary function, with a resultant reduction in health services utilization and asthma morbidity, even amongst patients of low socioeconomic status and education level in Hong Kong. Furthermore, this is a low-cost programme conducted mainly by respiratory nursing officers who were responsible not only in the primary education of the patients but also in reviewing their progress in subsequent visits. The physicians' main role was to individualize patients' self-management plans. Hence, it is a highly cost-effective programme.

In our study, we failed to demonstrate a reduction in the number of courses of steroid used or absenteeism from work as has been demonstrated in other studies [21]. Some asthma management guidelines [31] use 50% of best PEF as the cut-off point for commencing oral steroids while others [33] recommend that cut-off points should best be individualized. We used 80% of previous best PEF as the cut-off for increasing inhaled steroid and 60% for commencing oral steroid which may have resulted in early step-up of anti-inflammatory medication leading to more rapid control of symptoms and in turn, a reduction in asthma exacerbation and hence less health care attendance.

The comparison of results at 6 months and 1 year showed improvements were maintained with time. In our study, the essence of the education programme including inhaler technique and the understanding of asthma medication and the action plan were constantly reassessed during subsequent outpatient visits. Patients were subjected to a repeat attendance at the educational programme at the discretion of the attending physicians. This practice was derived from previous observations that repeated teaching and reassessment were needed to maintain the efficacy of the programme [21].

Subgroup analyses showed that patients with moderate to severe asthma were more likely to benefit from our programme than those with mild asthma. This is not surprising as a treatment effect would be difficult to detect when disease is mild. However, asthma education should be implemented even amongst mild asthmatics as we believe that an integrated approach is essential for the management of all asthmatics. We found no significant intergroup differences when analyses were performed according to education level, suggesting our programme was effective for patients of all educational backgrounds. The lack of

correlation between improvement in asthma knowledge and improvement in other parameters confirms the results of previous studies that programmes that merely improve asthma knowledge *per se* are unlikely to improve health outcomes [25]. While we believe that ensuring proper inhaler techniques are important in the integral management of asthma, we found no significant correlation between improvement in inhaler technique and improvement in other parameters. However, most of our asthmatics already had good inhaler techniques at baseline and the subsequent small improvement (Table 2) would have made it difficult to detect a treatment effect.

Our asthma self-management plan based asthma control upon both peak flow readings and symptoms, the two traditional means of self-assessment of asthma flare-ups. Instructions were given in the form of a credit card-sized instruction pamphlet. This 'credit card' plan had previously been shown to be an effective system for the management of asthma amongst the New Zealand Maori community [26] and adult asthmatics with frequent attendance to emergency departments for the treatment of acute asthma [31]. The use of PEF are preferred by some as a substantial number of asthmatics, particularly those who have experienced near fatal attacks and have poor symptom perception [32–36]. PEF measurements are also considered by both patients and educators as a valuable tool to help, at least initially, to better assess the level of symptoms in relation to medication changes required [21]. These recommendations are supported by a pivotal study by Beasley, Cushley and Holgate [32] who showed that the use of an asthma action plan based on peak expiratory flow rates improved asthma control. Symptoms used to monitor asthmatic control included the presence of nocturnal symptoms and reduction in the duration of the effect of bronchodilator therapy. Both have been shown to reflect an unstable asthmatic state [37–39]. More recent evidence suggests that such key symptoms are also important in detecting asthma exacerbations early [33,40], whilst Charlton and coworkers reported that teaching of asthma flare-ups management based on symptom assessment should be the main component of asthma education, even more than peak flow meter use [41]. The study by Beasley is hospital based while that by Charlton is community based, reflecting perhaps the different needs for patients with different asthma severity.

We may be criticized for the lack of a control group in our study, which may make it difficult to assess whether the improvement in health outcomes was merely secondary to improved medical treatment. During the study period, the mean dose of inhaled steroids used increased from a baseline of 1454 μg to 1616 μg at 1 year. However, this was unlikely to produce significant effects clinically as previous studies had demonstrated that the dose–response curve for inhaled steroids was relatively flat at high doses [42,43].

Although there was also a similar increased use of long-acting β -agonist, previous studies, whilst showing the addition of this drug would reduce asthma symptoms and improve lung function, had not shown any significant reduction in the number of asthma exacerbations [44–47]. This was implicit in the results of our study which showed that the number of courses of oral steroids used had not changed significantly. On the other hand, the self-commencement of oral steroids through the implementation of an effective asthma management plan had resulted in a significant reduction in health care attendance. Finally, even the best treatment regime would fail if patients were non-compliant. Given long periods of up to 3 months between visits in our outpatient clinic and results of studies that show asthmatic compliance rates may be as low as 30% [44], it would be difficult to imagine that improvements of such magnitude could be attained if patients did not take their medication or remained unmotivated about their self-management during the in-between visit period. In other words, if improved outcomes were secondary to increased use of medications alone, these would not be forthcoming unless compliance also improved. Hence, it was unlikely that the treatment effect could be achieved by better medications alone.

Our pilot study of Hong Kong Chinese of low socio-economic status and education level demonstrate that asthma morbidity, even amongst this group may be improved by an asthma education programme. Further studies using randomized controlled trials are now necessary to delineate which part of the intervention (education, self-management or better treatment) was the successful component.

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