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The effects of patient education in COPD in a 1-year follow-up randomised, controlled trial

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Abstract

The aims were to explore the effects and health economic consequences of patient education in patients with COPD in a 12-month follow-up. Sixty-two patients with mild to moderate Chronic Obstructive Pulmonary Disease (COPD) were at our out-patient clinic randomly allocated to an intervention group or a control group. The intervention group participated in a 4 h group patient education, followed by one to two individual nurse- and physiotherapist-sessions. Self-management was emphasised following a stepwise treatment plan. Effectiveness was expressed in terms of number of general practitioner (GP) consultations, proportions in need of GP consultations, utilisation of rescue medication and patient satisfaction. Costs related to doctor visits, days off work, dispensed pharmaceuticals, hospital admissions, travel costs, educational and time costs were recorded. Patient education reduced the need for GP visits with 85% (from 3.4 to 0.5, $P < 0.001$) and kept a greater proportion independent of their GP during the 12-month follow-up, compared with no education (73% versus 15%, respectively). Patient education reduced the need for reliever medication from 290 to 125 Defined Daily Dosages (DDD), and improved patient satisfaction with overall handling of their disease at GP. The control and intervention groups induced mean total costs of NOK 19 900 and 10 600 per patient, respectively. For every NOK put into patient education, there was a saving of 4.8. The Number Needed to Educate (NNE) to make one person satisfied with their GP was 4.5 and associated with a concomitant saving of NOK 41 900. Patient education of patients with COPD improved patient outcomes and reduced costs in a 12-month follow-up.

Keywords: COPD; Patient education; Cost analysis; Economics; Randomised controlled trial

1. Introduction

There has been an increase in morbidity and mortality due to Chronic Obstructive Pulmonary Disease (COPD) in the western world through the last decades [1]. The world-wide prevalence of COPD in 1990 was estimated at 9.34/1000 in men and 7.33/1000 in women [1]. The calculated total costs of COPD in the US in 1993 was US$ 23.9 billion [1].

COPD is both chronic and incurable. In the absence of cure, treatment is directed towards reducing frequency and severity of acute exacerbations and minimising the effect of the disease on the patients' health. The effects of patient education in asthma is well established [2,3] and has recently been reported by our group to improve quality of life, lung function [4] and steroid inhaler compliance [5], to reduce the need for general practitioner (GP) visits and absenteeism from work [6] and to be cost-effective [7]. Prior to our study, there were no randomised controlled trials available reporting neither the effect nor the costs of patient education and self-management in patients with COPD. This situation is still unchanged. Reports are lacking on the effects of patient education alone, without standard rehabilitation in patients with COPD [8].

The objectives of the present study were to examine the effect and cost-effectiveness of patient education and self-management on patients with COPD.

This paper summarises the effectiveness outcomes of patient education and self-management in COPD in referral to previous papers from the same trial [4–6,9,10] were the effects of patient education in COPD usually were presented in conjunction with asthma.

2. Methods

This section of the study is previously described in detail [4–6,9]. We here summarise only some of the core methodological aspects and assumptions.

Between May 1, 1994 and December 1, 1995, a total of 62 consecutive patients with COPD were included in the study.

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Before randomisation they had received ordinary consultation care at our out-patient chest clinic at Central Hospital of Vest-Agder, Kristiansand, Norway. Eligible subjects were patients with COPD, <70 years of age, not suffering from any other serious disease. Subjects with COPD were to have a forced expiratory volume in 1 s (FEV1) equal to or higher than 40% and lower than 80% of predicted [11]. Among patients with COPD, 32% showed ≥20% reversibility to 80 μg ipratropium bromide and/or 400 μg salbutamol [12,13]. Of the eligible patients, the inclusion rate was 91% (62/68).

The patients signed a written consent and were then randomly assigned. The control group was followed by their GPs, while the intervention group first received an education program and a self-management plan, before being transferred to a 1-year follow-up by their GPs. The availability and organisation of GP care was similar in the two treatment groups.

Permission to establish a register of patients was given by the National Data Supervision Centre. The methods were in accordance with the ethical standards of the Helsinki Declaration as approved by the regional ethical committee.

2.1. Educational intervention

The intervention group received a specially-made 19-page booklet with essential information on asthma/COPD, medication, self-assessment and self-management. Instruction in the recording of peak expiratory flow (PEF) and symptoms in a diary was given. Patient education consisted of 2 h × 2 h group sessions (five to eight persons) on two separate days, 1 week apart. The main issues were the components of bronchial obstruction, prevention of attacks, the effects of anti-obstructive medication, self-assessment and self-management, treatment plans and physiotherapy.

During one to two individual sessions with a specially trained nurse, effort was made to establish a partnership with the patient by using open-ended questions. Concerns and fears regarding their disease and medication were acknowledged and individual symptoms and factors causing attacks were noted. Tobacco weaning was emphasised, inhalation technique was checked and symptoms and PEF were discussed.

At the final teaching, the patients received an individual treatment plan on the basis of the acquired personal information and 2 weeks of peak flow monitoring. The personal understanding of the treatment plan with regard to changes in PEF and symptoms was discussed and tested. All patients received step-wise treatment plans aimed at making early changes in medication in the event of exacerbations. Forty-six percent of those educated (12 of 26) received a standard treatment plan [9]. Non-standard treatment plans, incorporating the use of oral steroids as the first line of action in the yellow zone, were followed in some cases, for example, if the patient already used high dosages of inhaled steroids as maintenance therapy, or could report that a double or triple increase in inhaled steroids previously had shown marginal effect on the course of attacks/exacerbations. Among those 14 patients receiving non-standard treatment plans, eight patients did not want to or were not able to use peak flow monitoring as a basis for change in medication. For those patients, symptom-only based treatment plans were issued.

The individual physiotherapist lessons (one to two sessions of 40 min) concentrated on breathing patterns, coughing, management of attacks and how to exercise.

2.2. Effectiveness measures

Medication was coded to Defined Daily Dosages (DDD) according to the Anatomical Therapeutic Chemical (ATC) classification index [14]. Short-acting β2-agonist inhalations were recorded as rescue/reliever medication since they were not recommended for regular use. Dispensed medications were reported from all local pharmacies through monthly printouts from the pharmacy computer records [5]. Compliance of regular medication was calculated as a percentage: (dispensed DDD/PDDD (prescribed Defined Daily Dosage)) × 100 during the 1-year follow-up. We defined the patient as compliant when dispensed regular medication was above 75% of prescribed regular medication during the study period [15].

The number of GP-visits and absenteeism from work was self-reported at monthly intervals, while days in hospital were both self-reported and checked against hospital records [9].

We used four simple health-related quality of life (HRQoL) questions translated from the Omnibus interviews [16]. Wording of the questions and the pre-printed alternatives for answering were: (1) the last year my chest trouble has become: worse, unchanged or better; (2) the last 2 weeks I have had asthma/COPD symptoms during the day: all the time, 2–4 times a day, every day, 2–3 times a week or more seldom; (3) the last 2 weeks I have had asthma/COPD symptoms during the night: waken three times or more, waken 1–2 times or do not wake up; (4) my asthma/COPD have the last 2 weeks restricted me from doing what I want: to a great extent, medium extent or little or no extent. We asked the same four questions after a 1-year follow-up. The St. George's Respiratory Questionnaire [17] (SGRQ, a disease-specific instrument with 76 weighted items) measures HRQoL. The SGRQ total score was assessed at follow-up, thus providing a global estimation of the patients' respiratory health [18,19].

Patient satisfaction with health professionals at baseline and at 12-month follow-up, was assessed by a questionnaire based on selected parts from the Omnibus Survey [16]. The answers were blinded for patient identity in order to receive the highest degree of honesty. The questions addressed satisfaction with overall handling of COPD by GP, and agreement or disagreement with various satisfaction measures [6]. The same questions were asked regarding the pulmonary out-patient clinic. At the 1-year follow-up, the same questions were answered.

2.3. Costs

The costs were based on utilisation of care and unit costs (1 US$ = 7 NOK, 1 English £ = 10 NOK, 1994). Patient out-of-pocket costs were included in the costs. *Direct costs* were defined as costs borne by the health care system and community due to COPD (diagnosis, treatment, doctor visits, hospitalisations, patient education). *Indirect costs* were defined as productivity loss and time costs due to COPD borne by the individual, family, society or by the employer. The study was conducted in the societal perspective, implying that all costs are accounted for, irrespective of who pays.

The cost of *patient education* included individual costs (NOK 472) and reimbursement costs (NOK 160) according to the National Health Insurance (NHI), reimbursements for individual physiotherapist sessions (NOK 101 per session), the market price for the peak flow meter (NOK 207), average cost of premises (NOK 45 per patient) and print costs of the patient brochure (NOK 10 per item) [10]. The cost of *hospital care* for COPD was recorded according to the Norwegian Diagnosis Related Groups (DRG) reimbursement rates [20] (NOK 21 120 per stay). The costs due to GP visits were set according to the NHI fee schedule [21], including the public block grant for GPs. *Pulmonary consultant visits* were priced according to the NHI fee schedule [21]. *The cost of respiratory medication* was based on current market prices for dispensed medication, including inhaled steroids and prednisolon, as reported monthly from local pharmacies [7]. *The cost of time* for those employed was set equal to the mean national hourly wage rate (NOK 106.2) [22]. Time costs were applied for both seeking health care and asthma education. The cost of lost leisure for those not employed, was assumed to be zero. The number of *days absent from work* due to COPD was valued according to the national average daily wage rate (NOK 567) [22]. Patients' *travel costs* in relation to medical care and education were calculated on the basis of bus fares from the patients' residence.Cost-benefit analyses express both inputs and consequences of different interventions in monetary units. A cost-benefit ratio was calculated as follows: (educational costs + patient time cost for educational programme)/(total costs − (educational costs + patient time cost for educational programme)).

Cost-effectiveness analyses compare competing interventions in terms of cost per unit of clinical effectiveness. A *cost-effectiveness ratio* is the difference in costs between two alternatives divided by the difference in effectiveness between the same two alternatives.

2.4. Statistical analysis

The assumptions and rationale for all statistical tests were clarified and discussed in previous papers [4–7,9,10]. Statistical tests were performed two-sided with a significance level of 5%. The concept of Number Needed to Educate (NNE) [7] was applied. NNE is the estimated number of patients who need to be educated compared with no education, for one additional patient to benefit [23]. NNE has the advantage of conveying both statistical and clinical significance and identifies the clinical effort required to attain a beneficial outcome.

3. Results

In the control group four patients were withdrawn (lack of co-operation ($n = 2$), diagnosis of rectal cancer ($n = 1$) and emigration ($n = 1$)). Two of the withdrawn control group patients were hospitalised for exacerbations of their COPD. This left us with 27 patients (84%) for the 1-year follow-up.

In the intervention group, four patients failed to complete the educational program (social problems ($n = 1$), unannounced emigration ($n = 1$), failure to meet at educational group sessions for unknown reasons ($n = 1$) and serious myocardial infarction ($n = 1$)). Another patient was withdrawn from the study during the follow-up due to lymphoma ($n = 1$). This left us with 26 patients (81%) for a 1-year follow-up. The patients who were withdrawn from the intervention group did not, to our knowledge, have any serious deterioration in their obstructive lung disease, and none were hospitalised.

The study participants had a mean FEV1 at baseline of 57% of predicted (Table 1). At randomisation, 48% were employed and 39% were current smokers, while 94% had a history of smoking. The mean age (S.D.) was 57 [9] years.

Ninety-two percent used inhaled steroids at randomisation (Table 1), amounting to a mean (S.D.) steroid inhaler dose of 439 DDD (216). No significant difference was observed between the treatment groups regarding steroid inhaler compliance during the 1-year follow-up [5]. Among those who collected rescue medication (89%), the educated patients collected less than half the amount compared with the non-educated (Fig. 1) [5].

The mean reduction in GP consultations for the educated was 85% (from 3.4 to 0.5, $P < 0.0001$, Mann–Whitney *U*-test), compared with uneducated (Table 2) [9]. The quarter that visited their GP most frequently, had ≥1 GP visits in the educated group, compared with ≥4 visits in the control group during the 12-month follow-up. The maximum numbers of consultations were 4 versus 27 in the education and control groups, respectively. Of all GP visits during the 12-month follow-up, the percentages of "acute GP visits" due to obstructive problems were comparable (i.e. 64 and 67% in the control and intervention group, respectively).

During the 12-month follow-up, approximately five times as many educated patients did not visit their GP compared with non-educated (73% versus 15%, $P < 0.001$, χ^2-test). Or to put it another way, approximately three times as many control patients as intervention patients visited their GPs (85% versus 27%). The statistically significant differences in GP visits between the intervention and control groups

Table 1
Baseline characteristics of patients with COPD included in the study

	Control group, $n = 31$	Intervention group, $n = 31$
Sex, men, *n* (%)	16 (52)	15 (48)
Age, mean (S.D.) (years)	58 (10)	57 (9)
Smoking habits		
Current smokers, *n* (%)	12 (39)	12 (39)
Pack years, median[a]	17	17
Ex-smokers, *n* (%)	19 (61)	15 (48)
Never-smokers, *n* (%)		4 (13)
Employed, *n* (%)	16 (52)	14 (45)
Forced expiratory volume in 1 s (FEV1), mean (S.D.) (l)	1.7 (0.5)	1.8 (0.5)
% predicted, mean (S.D.)	56 (11)	59 (9)
Forced vital capacity (FVC), mean (S.D.) (l)	3.3 (0.9)	3.3 (1.0)
% predicted, mean (S.D.)	89 (12)	88 (14)
PEF, % predicted, mean (S.D.)	70 (19)	69 (20)
%FEV1[b], mean (S.D.)	52 (10)	55 (9)
Inhaled steroids, *n* (%)	27 (87)	30 (97)
Long-acting β2-agonist inhalations, *n* (%)	8 (26)	11 (36)
Ipratropium bromide inhalations, *n* (%)	12 (39)	12 (39)
Xantine derivate tablets, *n* (%)	3 (10)	3 (10)
Steroid tablets, *n* (%)	2 (7)	3 (10)

Short-acting β2-agonist inhalations not included since we only recommended their use as rescue medication.
[a] Median values are employed for non-normally distributed data.
[b] (FEV1/FVC) × 100.

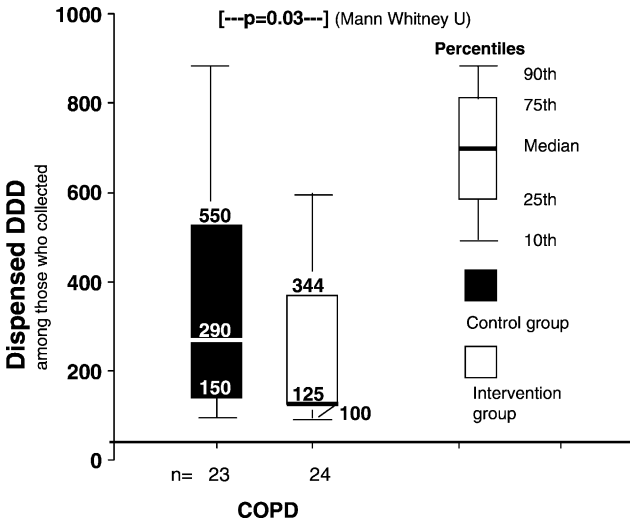

Fig. 1. Dispensed short acting β2-agonist inhalations (DDD) during a 12-month follow-up.

were maintained also when the first and last 6-month periods were investigated separately (all $P < 0.02$, Mann–Whitney *U*-test).

Regarding occupational status, at the 1-year follow-up, 52% had a regular job in the control group, compared with 50% in the intervention group. For the educated group, a mean 95% reduction in absenteeism from work was observed, compared with control, but the difference was not statistically significant. When excluding the unemployed, we observed a moderate correlation between number of GP visits and absenteeism from work (Spearman's correlation coefficient = 0.42, $P < 0.028$). None of the patients with zero GP visits had sick leaves, while those patients who had one to three GP visits during the 1-year follow-up had 9 days (mean) off work. Those with more than three GP visits had 54 days (mean) off work.

At baseline, high and comparable proportions were satisfied with overall handling of their disease at both their out-patient clinic (87%) and GP (85%) [6]. At the 1-year follow-up, all educated patients with COPD were satisfied with the overall handling of their disease by their GP, compared with 78% in the control group ($P = 0.023$, Fisher's exact test) [6]. Patient satisfaction with out-patient clinic seemed high, unchanged and comparable to baseline values (all $P > 0.118$) [6].

Patient satisfaction with overall handling of COPD (Q1) [6] at GP was best correlated with the perception that the GP was helpful, sympathetic, caring and understanding (Q3), and that patients were satisfied with and trusted their doctor (Q4). Correspondingly, the correlations revealed the same tendencies regarding the out-patient clinic (Tables 3 and 4).

At the 1-year follow-up, 81 and 19% of the educated rated the education to have been "very useful" and "useful", respectively. Likewise, 58 and 42% of the educated considered themselves now to be "much safer" and "safer", respectively.

The mean direct cost (if >100 NOK, rounded off to nearest 100 NOK when presented, but not when calculated) in the educated COPD group was NOK 9600, the indirect NOK

Table 2
GP consultations, absenteeism from work and days in hospital due to COPD during a 12-month follow-up

	Control, $n = 27$		Intervention, $n = 26$		P[c]
	Median[a]	Mean (S.D.)	Median[a]	Mean (S.D.)	
GP consultations	1 (1/4)	3.4 (5.5)	0 (0/1)	0.5 (0.9)	<0.0001
Absenteeism from work[b]	0 (0/0.3)	18.5 (86)	0 (0/0)	1 (7)	0.64
Days in hospital	0 (0/0)	2.5 (11)	0 (0/0)	0.7 (2)	0.74

[a] Median values (25th and 75th percentiles).
[b] The number of patients with COPD in regular work were 14 and 13 in the control and intervention groups, respectively.
[c] Mann–Whitney *U*-test.

Table 3
Patient satisfaction with GP and out-patient clinic at baseline. Percentage agreeing with the statement ($n = 62$)

		GP (%)	Out-patient clinic (%)	P^a
Q2	Medication/treatment suits me	83	92	0.227
Q3	Helpful/sympathetic/caring/understanding	93	97	0.688
Q4	Satisfied/trust my doctor	89	97	0.180
Q5	Gives repeat prescriptions/never examines me	13	7	0.344
Q6	Never explains anything	7	7	1.000
Q7	Fully understands how I feel about asthma	80	87	0.424

Be aware that negative satisfaction measures are registered regarding Q5 and Q6. Hence, low proportions are favourable. The proportions being satisfied with the out-patient clinic was high and comparable between asthmatics and patients with COPD (all $P > 0.285$).

[a] McNemar's test.

Table 4
Non-parametric bivariate correlation between patient satisfaction with overall handling of COPD (Q1) and the other statements (Q2–Q7) at baseline ($n = 62$)

		General practitioner		Out-patient clinic	
		ρ^a	P	ρ^a	P
Q2	Medication/treatment suits me	0.063	0.635	0.235	0.073
Q3	Helpful/sympathetic/caring/understanding	0.636	<0.001	0.511	<0.001
Q4	Satisfied/trust my doctor	0.575	<0.001	0.474	<0.001
Q5	Gives repeat prescriptions/never examines me	−0.154	0.241	−0.288	0.026
Q6	Never explains anything	−0.449	<0.001	−0.318	0.014
Q7	Fully understands how I feel about asthma	0.143	0.272	0.279	0.031

Negative correlation coefficients for Q5 and Q6 are due to negative statements being registered. Be aware that negative satisfaction measures are registered regarding Q5 and Q6. Hence, low proportions are favourable.

[a] Spearman's correlation coefficient (ρ).

Table 5
Direct, indirect and total costs (NOK) per patient during a 12-month follow-up for the intervention and control groups

Cost items	Control, $n = 27$, mean (S.D.)	Intervention, $n = 26$, mean (S.D.)	P^a
Educational program	0	900 (200)	<0.001
Peak flow meter	0	200	<0.001
Respiratory medication	6700 (4400)	5700 (3400)	0.618
GP visits	900 (1400)	100 (200)	<0.001
Pulmonary physician visits	100 (400)	29 (100)	0.636
Hospital admissions	6300 (21000)	2400 (6900)	0.694
Travel costs doctor visits	89 (200)	13 (29)	<0.001
Travel costs educational program	0	100 (36)	<0.001
Total direct costs	14000 (23300)	9600 (8500)	1.000
Patient time cost for educational program	0	700 (700)	<0.001
Patient time cost for doctor visits	500 (1400)	33 (99)	0.007
Production loss	5500 (20200)	300 (1300)	0.648
Total indirect costs	5900 (21400)	1100 (1700)	0.168
Total costs	19900 (38800)	10600 (8400)	0.581

(1 US$ = 7 NOK, 1 English £ = 10 NOK, 1994). Both cost items and sums are, if NOK > 100, rounded off to nearest NOK 100 when presented, but not when calculated. Time costs include travel time and were only calculated for those being employed, but alternative assumptions were explored through sensitivity analysis.

[a] Mann–Whitney U-test.

1100, in total NOK 10 600 (Table 5) [10]. The corresponding costs for the control group were NOK 14 000, 5900 and 19 900, but the differences between groups were not statistically significant. If however, the costs for GP visits, hospitalisations and absenteeism from work were summed, the mean (S.D.) cost difference (NOK 9700) between the groups was statistically significant, namely NOK 12 600 (35 500) and NOK 2900 (6900) ($P = 0.003$, Mann–Whitney U-test) for the control and intervention groups, respectively. Reduced absenteeism from work in the educated group explained most of the difference in total costs. Thus, patient education incurred lower total costs and better outcomes. If indirect costs were disregarded, the costs were still lower in the educated group.

The cost benefit ratio for patient education was calculated to 1600:7700, i.e. for every NOK put into patient education, there was a saving of 4.8 [10].

A cost-effectiveness analysis revealed that the NNE to make one patient satisfied with their GP amounted to 4.5 (95% CI 2.9–10) and associated with a concomitant total cost saving of NOK 41 900 [10].

4. Discussion and conclusion

Our study showed that patient education emphasising self-management and control of exacerbations in patients with COPD, reduced the need for short-acting β2-agonist inhalations as rescue medication by more than 50%. Further, patient education reduced the need for GP visits and kept a greater proportion of patients independent of their GPs. Before given structured patient education, equal and high proportions of patients with COPD were satisfied with both their GPs and the out-patient clinic. Patient satisfaction with overall handling of COPD was best correlated with a helpful, sympathetic, caring and understanding doctor and being satisfied with and trusting the doctor. Patient education received at the out-patient clinic, improved patient satisfaction with overall handling of their disease at GP. Both direct, indirect and total costs were reduced in the educated group, compared to the non-educated. For every NOK put into patient education, there was a saving of 4.8. The NNE to make one patient satisfied with their GP was 4.5 and associated with a concomitant saving of NOK 41 900.

4.1. Discussion

The first impression might be that patient education in COPD not seemed that effective, especially if compared with the asthma group, where education improved quality of life, lung function [4] and steroid inhaler compliance [5]. However, these lacks of statistical significant differences should be interpreted with some caution due to the small sample sizes of the COPD treatment groups, although the overall impression from the data is that patient education alone was not as effective for patients with COPD as for asthmatics.

But why should patient education not be as effective for patients with COPD as for asthmatics? There could be several explanations: First, the concept of patient education has been developed and scientifically evaluated primarily for asthmatics. Our total education program might have suited asthmatics better than patients with COPD, for instance, the self-management plan may have been more easily applied to asthmatics, due to higher variability in lung function in asthmatics than in COPD patients. Thus, the asthmatics may have been more motivated to stick to the self-management plan by experiencing that it worked. It may also have been inappropriate to emphasise education instead of full rehabilitation in a group with mild to moderate COPD. Second, the rationale for regular use of medication may all have been more easily adjusted, incorporated and justified for asthmatics than for patients with COPD. The reason why steroid inhaler compliance was comparable in the COPD treatment groups, and at the same level as attained in the educated asthma group, might be explained by more daily symptoms for patients with COPD than for asthmatics. There could be several reasons for the fact that the uneducated COPD patient dispensed twice the amount of rescue medication as the educated: educated patients with COPD might have had less daily symptoms than uneducated patients or might have treated their exacerbations more effectively. A greater tolerance to symptoms without the use of rescue medication or better interpretation of dyspnea could also partly explain the results for the educated COPD group.

Patient education improved patient satisfaction with GP in patients with COPD, but not in asthmatics. This might be explained by different perceptions of various satisfaction items in asthmatics and COPD patients or better care given by GPs to patients with COPD than asthmatics. The average COPD patient may have experienced little additional effect of patient education, thereby maybe affirming a perception of satisfaction with their GP care. On the other hand, patient education may have been of greater importance regarding symptom control for asthmatics than for patients with COPD, thereby possibly reducing satisfaction with GP care for asthmatics.

The differences between HRQoL and patient satisfaction are illustrated here; asthmatics improved their quality of life, while patient satisfaction seemed unchanged. On the other hand, patients with COPD did not change their quality of life, while patient satisfaction improved. This demonstrates that the concept of patient satisfaction reports other aspects important to the individual than quality of life. You may well have a patient with a bad quality of life that nevertheless is very satisfied with the medical service provided or vice versa.

The reported effectiveness measures may be argued. One could question whether a “GP independent patient”, “increased satisfaction with GP after patient education in an out-patient clinic” and “reduced dispensed rescue medication” were desirable outcomes of patient education in COPD. However, although none of these measures are core estimates in the handling of patients with COPD, it is likely that they together indicate a desirable outcome, especially in relation to the fact that all educated patients with COPD said that they felt “much safer” or “safer” after patient education [6]. In that perspective, reduced need for GP consultations and rescue medication most probably indicate a desirable outcome. Patient satisfaction says something about quality of care and is considered an important issue in the patient–doctor relationship. Patient satisfaction may well explain more of the positive effects of patient education than previously thought. Good discussions are likely to encourage positive attitudes, which again are likely to be influenced by patient experience of successful control.

Regarding the cost analysis of patient education for patients with COPD, the mean differences in costs seemed even larger than for the asthmatics [7]. Production loss seemed of greatest importance, but hospitalisation costs also contributed significantly to the difference. However, the distribution of costs was skewed, so that a few costly patients in each group had a large impact on the average costs. The differences may therefor easily have been both larger and smaller.

Interestingly, the mean costs in the COPD control group aligned fairly well with the mean total costs in COPD patients in Sweden as recently communicated by Jansson et al. [24]. They made telephone interviews of 213 patients with COPD from a representative cohort with mild, moderate and severe disease and reported a mean total cost of approximately 19 000 Swedish Crowns per year. They reported that for mild COPD, the main cost item was medication, while for moderate and increasingly so for severe disease, hospitalisation costs became the main cost item.

The outcomes of both the cost-benefit and cost-effectiveness analyses of patient education in COPD were powerful. The cost-benefit ratio in this study express that money was used in a sensible way. In medicine better outcomes are normally achieved at greater costs. This trial reveals the power of patient education also on patients with COPD, with better outcomes at lower costs.

4.2. Practice implication

The trial shows that important clinical effects can be achieved at lower costs with only patient education and training of self-management skills in patients with COPD. It might be that the full rehabilitation programs often offered to COPD patients, could be too comprehensive, especially when we know that the effects very often deteriorate quickly after rehabilitation programs are ended. The educational package given to patients in this trial, was in many ways comparable to what was offered asthmatics in a similar study in our clinic. It might be that such an educational setting with emphasis on smoking cessation, is adequate for many patients with mild and moderate COPD. This trial may contribute to the discussion on what to offer to which patients with COPD. Future research should concentrate on how pre-intervention testing in relation to age, disease severity, intellectual capacity, educational status and personality, can improve the chance to develop personally designed education programs. The cognitive impairment on standard neuropsychological tests seen in COPD patients and its implications for patient education and rehabilitation, should also be further investigated. Further, what characterises those patients with COPD who only need patient education and when is rehabilitation necessary? We also lack information as to what level of lung function and/or to what personality traits the rehabilitation aspect is more important than education for patients with COPD.

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