

# Learning impact of education during Pulmonary Rehabilitation program. An observational short-term cohort study

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**ABSTRACT:** *Learning impact of education during Pulmonary Rehabilitation program. An observational short-term cohort study. E. Crisafulli, S. Loschi, C. Beneventi, A. De Biase, B. Tazzioli, A. Papetti, C. Lorenzi, E.M. Clini.*

**Background.** Among the several components constituting a pulmonary rehabilitation (PR) course, education may contribute to an individual's recognition of symptoms and worsening of the disease. However, the specific benefits of education is far greater than can be clearly documented to the health care providers. The aim of our preliminary study was to assess the learning impact of educational sessions (ES) in Chronic Obstructive Pulmonary Disease (COPD) patients referred to standard PR.

**Methods.** Six ES on 3 areas (Symptoms-Therapies, Aids, Mood) were applied during PR at our clinic. The learning effect was prospectively evaluated by a specific questionnaire (ESQ) in 285 COPD patients (age 69±8 years, FEV<sub>1</sub> 53±14 % pred), then grouped into those who

have completed ES (*Completers* group, n=226) or who did not (mean 2±1 ES) (*Control* group, n=59). Total and partial ESQ scores, and PR outcomes (6-minute walking test-6MWD, effort-dyspnoea at Medical Research Council scale-MRC, and health-related quality of life scale-SGRQ) were assessed in a pre (T0) to post (Tend) design.

**Results.** Similar improvement in PR outcomes was recorded in both groups at Tend, whereas ESQ total and partial scores significantly increased in '*Completers*' only ( $p<0.001$ ). ESQ-*Aids* score improved to a greater extent in *Completers* than in *Control* (+0.60±1.03 vs +0.27±1.27 point respectively,  $p=0.036$ ). A higher proportion of *Completers* improved above the median change of both ESQ *total* and *aids* scores ( $p<0.05$ ).

**Conclusion.** Attending educational sessions produces a specific short-term learning effect during rehabilitation of COPD patients.

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**Keywords:** Education, COPD, Rehabilitation, Self-management.

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## Introduction

Pulmonary Rehabilitation (PR), a non-pharmacological comprehensive intervention for disabled chronic respiratory patients, proves effective in terms of exercise tolerance and perceived symptoms (e.g. dyspnoea and/or fatigue) in Chronic Obstructive Pulmonary Disease (COPD) individuals [1].

Among the several components integrating a formal rehabilitation setting, education and self-management may substantially contribute to the individual's early recognition of symptoms and worsening of the disease [2, 3], through recalling information on the pathophysiological alterations and reinforcing skills.

Actual recommendations always suggest including education during PR course, nonetheless, the relative and specific effectiveness of this component throughout is still not sufficiently documented to health care providers [4].

The present preliminary study, therefore, has been undertaken to assess the learning impact of structured educational sessions (ES) applied dur-

ing a standard PR program delivered to disabled COPD patients.

## Methods

### Patients

Patients suffering from COPD referred to our clinic for rehabilitation purposes in between January and December 2008 were studied. Diagnosis and classification were according to the Global Initiative for Chronic Obstructive Pulmonary Disease (GOLD) guidelines [5].

Only clinically stable patients entered the study. Those suffering from recent acute exacerbation of their disease (in the preceding 4 weeks) were excluded. Moreover, patients with respiratory conditions other than COPD (either obstructive or restrictive), associated malignancies, or any unstable clinical condition (e.g. severe heart failure, neuro-motorial conditions) which might have interfered with adherence, or patients with cognitive impairment that might have interfered with under-

standing and learning, were not included. All the selected patients gave their informed consent to participate in the study.

Figure 1 shows the flow diagram of the study cohort.

**Study design**

The institutional review board at our hospital approved this observational study; all procedures were conducted according to the Declaration of Helsinki.

The study design was a prospective short-term *pre-to-post* comparison of measurements in all individuals. Comparison was made in the whole sample and between the following two groups: patients who have completed all the educational sessions (ES) (*Completers* group, n=226), or those who did not (number of ES=2±1) (*Control* group, n=59) due to clinical or personal reasons.

**PR program**

The patient’s selection to PR was made according to the ATS/ERS joint statement [1]. All the

selected COPD patients performed a standard PR program with outcome measures taken at the beginning and immediately prior to discharge; details on this program have been reported previously from our group [6]; each daily session lasted three hour and included endurance and resistance training of the peripheral muscles, as recommended [1]. Educational course (see below), psychological and/or nutritional support (if appropriate) completed the program.

The duration of PR was over a minimum of 15 consecutive sessions.

**Educational course**

This was provided by 6 different ES lasting 1 hour each, which integrated the rehabilitation program. Patients were grouped to attend each lesson in the morning at the same time and following the training activities, but they were left free to choosing if they wanted to participate in each lesson.

Lessons were held for pertinence by different “health educators” (physician, respiratory therapist, nurse and psychologist) on the following topics: anatomy and physiology of pulmonary system,

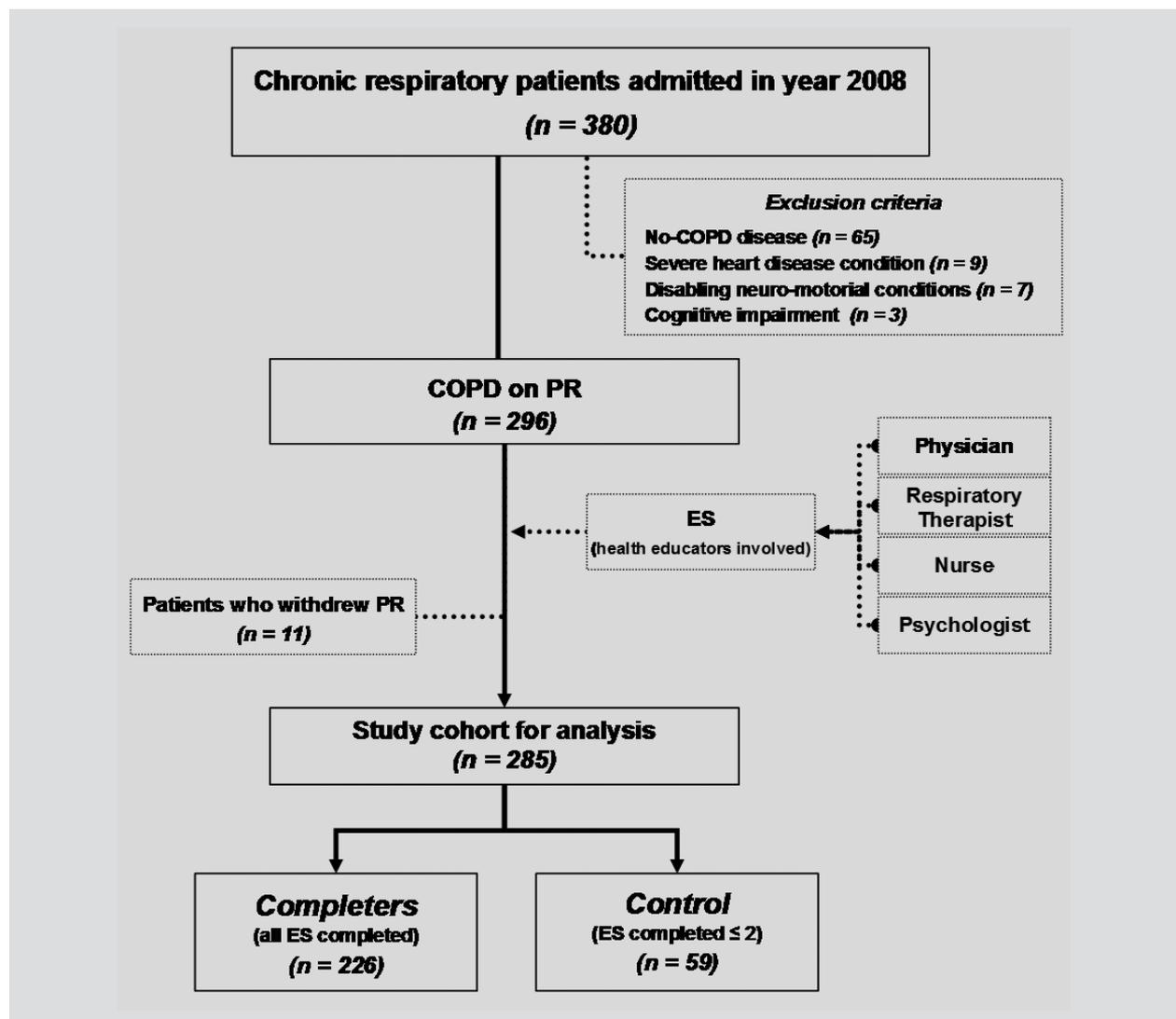


Fig. 1. - Study flow diagram. PR: Pulmonary Rehabilitation; ES: Educational Sessions.

early recognition of symptoms and signs of exacerbation (physician), role of muscle training and chest physiotherapy in pulmonary diseases (respiratory therapist), domiciliary use and management of respiratory aids, oxygen or drug inhalers (nurse and respiratory therapist), management of mood disturbances (psychologist).

Access to each ES was registered and attendants signed their presence.

Any other specific information and/or educational material (i.e. brochure) on specific non included topics were also encouraged and proposed to each patient according to his/her individual needs; however, these topics were covered over and above the standard delivery of ES.

### Measures

#### GENERAL DATA

Anthropometric and demographic characteristics of all the selected patients were collected at study entry. Lung function in terms of dynamic volumes (forced expiratory capacity in the 1st second-FEV<sub>1</sub>, and FEV<sub>1</sub> to forced vital capacity-FVC ratio) was recorded by means of a spirometer (Masterscope; Jaeger; Hoechberg, Germany); parameters were expressed both as absolute or percentage of predicted values according to the equation of Quanjer [7].

#### OUTCOME MEASURES

These measurements were taken within 24-48 hours from the beginning of PR (T<sub>0</sub>) and immediately prior to discharge (T<sub>end</sub>) after the program has been completed.

#### LEARNING QUESTIONNAIRE

A specific questionnaire (ESQ) completed by all patients in the study (without the assistance of any operator) represented the clinical tool we used to assess the level of patient's knowledge and the learning impact of the ES course. This multiple-choice questionnaire (see Appendix) was composed of ten questions (one correct answer for each question) grouped in three different areas: *Symptoms-therapy, Aids, Mood*. Questions were previously elaborated and selected by our multidisciplinary group and judged on "what is relevant for the patient to know" in each topic. A formal group brainstorming and evaluation of website accessible materials for COPD patients [8] preceded the questionnaire composition.

For each correct answer 1 point was assigned, the total score therefore ranged from 0 (minimum) to 10 (maximum).

#### SPECIFIC PR MEASURES

Exercise tolerance, as measured by 6-minute walked distance (6MWD) [9], perceived effort-dyspnoea, as recalled by means of a five-point (0 as best, 4 as worst) modified Medical Research Council (MRC) scale [10], and specific health-related quality of life questionnaire (St. George's Respiratory Questionnaire-SGRQ) validated in Italian language [11], were recorded as general PR outcomes.

### Statistical analysis

Statistical analysis was carried out using SPSS software (SPSS 8.0 for Windows; SPSS, Chicago, IL).

All values are expressed as mean (with SD) or frequency (nr or %) and presented in the whole cohort or in the two groups. Statistical comparison between groups and times for different size parameters was made using test *t* of Student and by a General Linear Model. The Wilcoxon and Kruskal-Wallis tests were applied for comparison of non-parametric variables. A *chi-square* test was added for comparison between number (and %) of patients in each group who improved above the median change of the questionnaire scores (total and partial).

In any case a result with a statistical probability (*p*) <.05 was considered to be of significant difference.

### Results

296 COPD patients were selected for this study and of them 285 (66% male) completed the rehabilitation course and had their results analysed (see figure 1). Withdrawal rate from PR was therefore about 4%.

Most of these patients (79%, n=226) completed ES course and were thus grouped into *Completers*, whereas 59 remained as *Control*.

68% of controls did not complete ES due to voluntary withdrawal (they did not attend the scheduled lessons), while the remaining 32% had clinical problems (intercurrent symptoms such as worsening dyspnea, malaise, back or joint pain) which temporarily precluded their chance to reach the educational room.

The baseline descriptive characteristics of patients are shown in table 1. 67% of them were in stage III and IV according to GOLD classification, whereas 30% were on long-term oxygen (LTOT) at home. No differences were recorded between groups.

Table 2 shows total and partial ESQ scores, as recorded at study entry, which were similar in the two groups. Analysis of *pre-to-post* group comparison of both specific PR outcomes and ESQ scores is shown in table 3. Exercise tolerance and perceived effort-dyspnoea significantly (*p*=0.001) and similarly improved in both groups, whereas ESQ total and partial scores significantly changed (*p*=0.001) in *Completers*. The analysis of difference of both ESQ absolute value (table 4) and the proportion of patients who improved above the median change of the questionnaire scores (table 5) as obtained after PR further confirmed a significant change in favour of *Completers*.

### Discussion

It is likely that educational component of a structured comprehensive rehabilitation program may attract individuals to a more active participation and collaboration (compliance) in the rehabilitative track. Indeed, compliance is almost known

Table 1. - Anthropometric and clinical characteristics in the study cohort. Data presented as mean (SD) of percentage value

		Study Cohort	Completers Group	Control Group	<i>p</i>
		( <i>n</i> =285)	( <i>n</i> =226)	( <i>n</i> =59)	
M:F	<i>nr</i>	188 / 97	151 / 75	37 / 22	0.502
Age	<i>years</i>	69.9 ± 8.0	70.2 ± 8.2	68.2 ± 6.7	0.128
BMI	<i>kg·m<sup>-1</sup></i>	26.0 ± 4.8	25.7 ± 4	26.1 ± 4.0	0.451
FEV <sub>1</sub>	<i>l.</i>	1.05 ± 0.58	1.01 ± 0.49	1.08 ± 0.63	0.309
	<i>% pred.</i>	53.4 ± 14.4	50.1 ± 12.9	54.5 ± 10.0	0.186
FEV <sub>1</sub> /FVC	<i>%</i>	53.7 ± 12.8	54.1 ± 10.1	52.3 ± 11.5	0.865
GOLD staging					0.128
<i>Mild</i>	<i>nr (%)</i>	4 (1.4)	3 (1.3)	1 (1.6)	
<i>Moderate</i>	<i>nr (%)</i>	91 (31.8)	63 (27.8)	28 (47.4)	
<i>Severe</i>	<i>nr (%)</i>	85 (29.9)	71 (31.4)	14 (23.7)	
<i>Very severe</i>	<i>nr (%)</i>	105 (36.8)	89 (39.3)	16 (27.1)	

M: male; F: female; BMI: Body Mass Index; FEV<sub>1</sub>: Forced expiratory volume in 1st sec; FEV<sub>1</sub>/FVC: Tiffenau index or ratio FEV<sub>1</sub>/FVC, Forced vital capacity; GOLD: Global Initiative for Chronic Obstructive Pulmonary Disease.

to represent a “key point” of success in PR [12]. In the present study, about 80% of patients attended and completed the ES. This is new and interesting data which has emerged from real life. A recent study in PR found approximately a 90% attendance rate among outpatients COPD [13], but gave no information on attendance rate at any single PR component including education course.

Over recent years, the role of education is considered to be of increasing interest for COPD patients' management. A current method of teaching by means of frontal lessons is a useful means of instructing patients regarding their disease and its consequences, and to challenge them through change in lifestyle to accomplish the best possible control of their clinical condition once at home [14, 5].

Although literature still shows no firm and consistent benefits from formal education [16-18] two recent studies centred on patient's “*self-management*” with the aim of recognising exacerbation as early as possible, resulted in substantial reduction of hospitalisation rate over 1-year [3] and up to 2-year [4] of follow-up.

Our study documented that educational sessions produce a specific short-term learning effect during a standard rehabilitation program in COPD patients, in particular regarding the management of respiratory aids (e.g. oxygen or devices for inhaled therapy) in daily use. In a narrow analogy with previous studies [19] and international guidelines [1, 2], effectiveness of PR program in terms of general function is here provided by results of both exercise tolerance, breathlessness and health-

Table 2. - ESQ scores in the study cohort as assessed at admission. Data presented as mean (SD)

		Study Cohort	Completers Group	Control Group	<i>p</i>
		( <i>n</i> =285)	( <i>n</i> =226)	( <i>n</i> =59)	
<i>Questionnaire scores</i>					
SYMPTOMS-THERAPY	<i>score</i>	2.75 ± 1.06	2.74 ± 1.02	2.79 ± 1.22	0.734
AIDS	<i>score</i>	2.60 ± 0.95	2.60 ± 0.92	2.62 ± 1.06	0.856
MOOD	<i>score</i>	1.24 ± 0.70	1.24 ± 0.69	1.25 ± 0.73	0.950
<b>TOTAL</b>	<i>score</i>	6.63 ± 1.85	6.59 ± 1.79	6.67 ± 2.08	0.417

Table 3. - Time course of specific PR outcomes (*Part A*) and ESQ scores (*Part B*) as assessed throughout PR. Data presented as mean (SD)

PART A		Completers Group (n=226)			Control Group (n=59)			p*
		T0	T end	p	T0	T end	p	
6MWD	meters	354.6 ± 101.7	422.7 ± 107.1	<b>0.001</b>	354.2 ± 88.0	429.3 ± 85.5	<b>0.001</b>	0.844
MRC	score	3.25 ± 0.93	2.22 ± 0.90	<b>0.001</b>	3.46 ± 0.89	2.42 ± 0.86	<b>0.001</b>	0.178
SGRQ	score	36.33 ± 14.65	25.52 ± 12.91	<b>0.001</b>	34.45 ± 15.18	24.38 ± 10.69	<b>0.001</b>	0.423
PART B		Completers Group (n=226)			Control Group (n=59)			p*
		T0	T end	p	T0	T end	p	
<i>Questionnaire scores</i>								
SYMPTOMS-THERAPY	score	2.74 ± 1.02	3.21 ± 0.91	<b>0.001</b>	2.79 ± 1.22	3.00 ± 1.14	0.171	0.825
AIDS	score	2.60 ± 0.92	3.20 ± 0.84	<b>0.001</b>	2.62 ± 1.06	2.89 ± 1.09	0.107	0.956
MOOD	score	1.24 ± 0.69	1.49 ± 0.63	<b>0.001</b>	1.25 ± 0.73	1.42 ± 0.67	0.086	0.709
<b>TOTAL</b>	score	6.59 ± 1.79	7.91 ± 1.80	<b>0.001</b>	6.67 ± 2.08	7.20 ± 2.21	0.077	0.747

6MWD: 6-min walked distance test; MRC: Medical Research Council breathlessness score; SGRQ: St. George's Respiratory Questionnaire total score. \* Comparison between groups (Completers vs Control groups).

related quality of life (table 3, part A), which did not parallel the observed gain associated with learning (table 3, part B).

Both total and partial ESQ mean scores significantly improved at the end of the rehabilitation period only in patients who fully attended the educational course, while they remained unchanged in those patients who did not. In addition, both analysis of difference of ESQ absolute value (table 4) and the proportion of patients who improved above the median change of the questionnaire scores (table 5) confirmed the adjunctive gain on learning in *Completers* only.

It is likely that direct message of our educational lessons supported this result, thus enabling

patients who complied with all the lessons to achieve this extra gain irrespective of their severity and/or functional complexity (i.e. presence or absence of respiratory failure).

Despite the lack of unequivocal scientific evidence on the real learning benefit from a single therapeutic modality in patients with COPD [20, 21], education component has the aim not only of encouraging the active participation and collaboration of the rehabilitation program but also (and especially) to “teach” some technical and behavioural aspects of daily living.

The aim of this type of learning would be to focus the patient's attention on the chronic aspects of his/her disease, such as the early signs of exacer-

Table 4. - Analysis of difference in ESQ scores between groups as obtained at discharge (Tend). Data presented as mean (SD)

		Study Cohort	Completers Group	Control Group	p
		(n=285)	(n=226)	(n=59)	
<i>Questionnaire scores (Δ)</i>					
SYMPTOMS-THERAPY	score	+ 0.41 ± 1.02	+ 0.46 ± 0.99	+ 0.20 ± 1.12	0.077
AIDS	score	+ 0.53 ± 1.09	+ 0.60 ± 1.03	+ 0.27 ± 1.27	<b>0.036</b>
MOOD	score	+ 0.22 ± 0.75	+ 0.24 ± 0.75	+ 0.16 ± 0.74	0.502
<b>TOTAL</b>	score	+ 1.22 ± 1.85	+ 1.31 ± 1.79	+ 0.86 ± 2.03	0.094

Δ: Difference of variables obtained between the end and begin of PR program.

Table 5. - Comparison between proportion of patients in each group who improved above the median change of the questionnaire scores (total and partial). Data presented as n (%)

		Completers Group (n=226)	Control Group (n=59)	$\chi^2$
SYMPTOMS-THERAPY	n (%)	197 (87.1)	49 (83.0)	0.413
AIDS	n (%)	202 (89.3)	46 (77.9)	<b>0.020</b>
MOOD	n (%)	198 (87.6)	53 (89.8)	0.639
<b>TOTAL</b>	n (%)	148 (65.4)	30 (50.8)	<b>0.039</b>

bation, to prevent unfavourable consequences [22] and to increase general adherence to therapies [8, 23], in other words to improve the “self-efficacy” [3]. Indeed, it’s commonly recognised that COPD exacerbation may cause several clinical adverse events both at lung [24] or systemic level [25], thus increasing health-care costs [26] and mortality [27]. The correct delivery of drugs and the use of respiratory aids represent aspects of main importance in the long term. When compared to those patients who failed to fully attend the ES in our study, the proportion of COPD patients who completed the educational course reported a significantly higher change of ESQ-Aids score above the median observed absolute change (table 5), which is likely to enable them to improve these skills even after returning home.

Given that compliance is a key element in the management of chronic diseases and patient’s adherence to therapies [28] a formal program of education has not only the aim of “teaching” concepts and “training” techniques, but also to “educate” the patients; so that, he/she becomes more aware of any consequence derived from a irresponsible use or a no-use of requested devices and aids. This might further translate in a true economic advantage in the long-term; indeed, cost saving from change in lifestyle has been already demonstrated in COPD [29].

Notwithstanding, our study presents several limitations. First, the absence of a control group, we have only assessed the learning effect of a specific intervention in a short period after rehabilitation nor we did assess the patients’ change in lifestyle after program discharge over a formal longer follow-up. Therefore, we can only speculate any further advantage in the patient’s daily living once he/she returned home.

Second, one should note the very different amount of patients in the two study groups. The number of control patients was determined *ex post* since we did not expect precisely the rate of adherence to our ES course (which can vary consistently in different population and/or setting).

Future studies with a randomised trial design should address the short and (hopefully) long-lasting effect derived from a structured educational program in COPD patients, and even assess the possible cost-benefit advantage of such intervention.

In conclusion, our preliminary research has fairly shown that attending formal education is likely to produce a specific learning effect during standard rehabilitation delivered to COPD patients. As a consequence, we might speculate that formal education enhances patients’ *self-management* and practical skills in their daily lives.

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Appendix



**“VILLA PINETA” HOSPITAL - PULMONARY REHABILITATION UNIT**



**LEARNING QUESTIONNAIRE**

SURNAME.....NAME..... AGE.....SEX..... COMPILATION DATE.../.../.....

**Area 1: SYMPTOMS-THERAPY**

**Health educators involved: PHYSICIAN, RESPIRATORY THERAPIST**

- Q: What is dyspnoea?  
 A: a sensation of difficult breath (**correct**)  0  1  
 a sensation of physical weakness  
 a symptoms regarding digestive system
- Q: In COPD disease purulent mucus is indicative of  
 A: suspects bacterial infection of the airways (**correct**)  0  1  
 a normality condition  
 it's must be treated with bronchodilators drugs
- Q: When muscle training should be performed?  
 A: only during hospital stay  0  1  
 at least for 1 month post discharge  
 daily, it's must become a part of life-style (**correct**)
- Q: When mucus drainage should be made?  
 A: always  0  1  
 only in presence of mucus hypersecretion (**correct**)  
 only together respiratory therapist

**Area 2: AIDS**

**Health educators involved: NURSE, RESPIRATORY THERAPIST**

- Q: How much aerosol-therapy should last?  
 A: more than 30 minute  0  1  
 more than 15 minute  
 until a maximum of 10 minute (**correct**)
- Q: What is the correct position to perform aerosol-therapy?  
 A: seated (**correct**)  0  1  
 tended up  
 lying down
- Q: When the prescribed oxygen-therapy is useful?  
 A: only when there is dyspnoea  0  1  
 only at rest  
 always (**correct**)
- Q: Can the use of oxygen improve attention and memory?  
 A: yes (**correct**)  0  1  
 no  
 maybe

**Area 3: MOOD**

**Health educators involved: PSYCHOLOGIST**

- Q: Anxiety is  
 A: an emotive reaction (**correct**)  0  1  
 a depression sensation linked to physical fatigue  
 a pulmonary problem
- Q: Depression is  
 A: lack of energy, loss of interest for the activities (**correct**)  0  1  
 daily inability to try happiness  
 euphoria, increase in energy, good consideration of himself

**0 = Uncorrect answer      1 = Correct answer**

**TOTAL SCORE**