



Coping styles in patients with COPD before and after pulmonary rehabilitation



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Summary

Introduction: Pulmonary rehabilitation (PR) improves physical and psychological symptoms in COPD patients. Patients' coping with daily symptoms and limitations may have more influence on important patient-centred outcomes than the impaired lung function. To date, it remains unknown whether and to what extent coping styles change following PR, and whether coping styles are associated with the outcomes of a comprehensive PR.

Methods: Coping styles were assessed in 303 COPD patients before and after a PR programme using the Utrecht Coping List (UCL). Additionally, lung function, St. George's Respiratory Questionnaire (SGRQ), Hospital Anxiety and Depression Scale, anxiety (HADS-A) and depression (HADS-D) subscales and six-minute walking distance (6MWD) were recorded.

Results: The level of active confronting coping style increased ($p < 0.05$), whereas the levels of avoidance ($p < 0.05$), passive reaction pattern and reassuring thoughts coping styles decreased following PR (both $p < 0.001$). More than 50% of the patients changed their level of active confronting, passive reaction pattern or expressing emotions coping style. Coping styles and/or changes in coping styles after PR were related to changes in exercise tolerance, anxiety and depression, but were not related to changes in health status. Following PR, SGRQ total score, HADS-A and HADS-D scores decreased (all $p < 0.001$), while 6MWD increased ($p < 0.05$).

Conclusion: Comprehensive PR results in change in coping styles of COPD patients. Coping styles are related to improvements in exercise tolerance, anxiety and depression, but they are not related with changes in health status after PR. Further studies are needed to evaluate the outcome of interventions actively targeting coping styles.

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Introduction

Patients with COPD may experience fatigue, impaired health status, loss of independence, work absenteeism, and social isolation.¹ In addition, patients with COPD may endure psychological problems, including depression, anxiety and poor coping with their symptoms.^{2,3}

Coping, as an adaptive response to a chronic illness, is defined as selecting and acting on the information derived from the individual's symptom recognition and interpretation.³ Some patients deal with their duties and difficulties, which are the result of their confrontation and evaluation of their chronic illness more successfully than others.⁴ Previous studies suggest that adequate coping styles are important for self-management of COPD.^{5,6} Two cross-sectional studies in COPD patients demonstrated that coping styles were associated with symptoms of anxiety and depression, exercise intolerance, and health status.^{7,8} Further, a passive coping style was related to an impaired level of daily functioning.⁹ Finally, in patients with advanced COPD, inability to cope with the effects of their disease was linked to an increased mortality.¹⁰

PR with its interdisciplinary, comprehensive, patient-centred approach is an effective intervention for improving symptoms and reducing disability in patients with COPD.¹¹ Coping styles seem to be important for the maintenance of post-rehabilitation effects.¹² Moreover, many patients entering PR predominantly use a passive reaction pattern coping style.⁸ To date, it remains unknown whether and to what extent: 1) coping styles may change following comprehensive PR; and 2) baseline coping styles are associated with the changes in exercise tolerance, mood status and health status following a PR programme.

Methods

Design

The present study was a retrospective analysis of coping styles in COPD patients before and after completion of a comprehensive PR programme.

Participants

Patients with mild to very severe COPD admitted to CIRO+, a centre of expertise for chronic organ failure (Horn, the Netherlands) for a comprehensive PR programme¹³ between January 2010 and December 2011 were included. In total, 303 patients: 128 (42.2%) inpatients and 175 (57.8%) outpatients had complete data on the primary and secondary outcome variables and were included for analyses. The diagnosis of COPD was based on the definition provided by the Global initiative for chronic Obstructive Lung Disease (GOLD).¹

Pulmonary rehabilitation programme

Following the baseline assessment, patients participated in an 8-week inpatient or 14 week outpatient comprehensive PR programme.¹⁴ The interdisciplinary team supervised by

a chest physician, consisted of respiratory nurses, dietician, occupational therapist, physiotherapist, psychologist and social worker. Components of the programme included daily exercise training; nutritional support and psychological counselling (if indicated); and 20 group educational sessions of one hour. All of the patients included in this study underwent group educational sessions which were conducted as part of PR. (See [Online Supplement](#) for components of the educational programme.) In contrast, individual psychological counselling was offered to patients with psychological problems, such as symptoms of depression, anxiety, adaptation problems and personality disorders. The PR program did not include an intervention aimed at changing patients' individual coping styles. All outcomes were recorded in the clinical routine. Approval from the institutional board of directors was obtained to use patients' records for the study and patients' confidentiality was maintained.

Outcome measures

General characteristics of patients, such as sex, age and marital status were recorded during the baseline assessment. Pulmonary function (forced expiratory volume in the first second (FEV₁) and forced vital capacity (FVC)), body-mass index (BMI), exercise tolerance (two 6-min walking distance tests (6MWT), and severity of dyspnoea (Medical Research Council dyspnoea scale (MRC)) were assessed at baseline and after completion of PR, as described before.^{15,16}

Coping styles

The primary outcomes of interest were coping styles, assessed with the Utrecht Coping List (UCL).¹⁷ The UCL consists of 47 items, which represent seven different coping styles. The seven coping subscales are: *active confronting coping* (confronting problems and employing purposeful strategies, e.g., tackle problems immediately) (6 items); *palliative reaction* (distracting one's attention from the problems and includes smoking and drinking, e.g., forget problems by going out) (4 items); *avoidance* (waiting and keeping clear of the problem e.g., avoid difficult situations) (3 items); *seeking social support* (seeking comfort and help from others, e.g., sharing one's worries) (5 items); *passive reaction pattern* (rumination and drawing back, e.g., not feeling able to do something) (5 items); *expression of emotions* (e.g., showing annoyance or anger; releasing tension) (2 items); and *fostering reassuring thoughts* (e.g., self-encouragement through such thoughts as 'worse things can happen') (2 items). Patients were asked to rate how often they used certain coping behaviours. Four response options for each item were offered: 'seldom or never' (1 point), 'sometimes' (2 points), 'often' (3 points) and 'very often' (4 points). Mean total scores are calculated for every subscale. A higher score indicates an increased tendency towards using that specific coping style. Furthermore, scores are categorised in: very low; low; medium; high; or very high, based on Dutch norm scores, which are calculated for men and women in different age categories.¹⁷ The UCL has been widely used for the assessment of coping styles in other conditions such as osteoarthritis, eating disorders and Parkinson's disease.^{18–20}

Symptoms of anxiety and depression

The validated Dutch version of the Hospital Anxiety and Depression Scale (HADS) was used to assess symptoms of anxiety and depression.²¹ The HADS is a self-administered questionnaire, consisting of 14 items divided into an anxiety subscale (HADS-A) and depression subscale (HADS-D). Scores for both subscales range from 0 (optimal) to 21 (worst) points. A score equal to or greater than 10 represents the presence of clinically relevant symptoms of anxiety or depression (sensitivity 0.69 (95% CI, 0.48–0.84); specificity 0.85 (95% CI, 0.74–0.91)).^{22,23}

Disease-specific health status

Disease-specific health status was assessed using the self-administered St. George's Respiratory Questionnaire (SGRQ).²⁴ A total score and three domain scores (symptoms, activity and impact) are provided. Scores range from 0 (best) to 100 points (worst). The SGRQ was reported to be valid and reliable in patients with COPD.²⁴

Statistical analysis

Statistical analysis was performed using SPSS 20.0 (SPSS Inc. Chicago, IL). Categorical variables were described as frequencies, while continuous variables were tested for normality and are presented as mean \pm SD. Paired *T*-tests were used to compare the following outcome parameters before and after PR: UCL subscale scores, SGRQ total and subscale scores, HADS scores, BMI and 6MWD. Frequencies were used to show the change in distribution per level of coping style. Ordinal data were analysed using nonparametric tests. Four multiple linear stepwise regression models were developed to assess the association between baseline coping styles, changes in coping styles and outcomes of PR. SGRQ total score, 6MWD, HADS-A score, or HADS-D score were entered as dependent variable in the four models, respectively. UCL subscale scores and changes in UCL subscale scores were entered as independent variables, as well as possible confounders. A *p*-value of ≤ 0.05 was considered as statistically significant.

Results

Patient characteristics

Patients had an impaired disease-specific health status, and a reduced exercise tolerance (Table 1). Baseline coping styles of COPD patients were: active confronting 16.1 \pm 3.7 points; palliative reaction 15.9 \pm 3.5 points; avoidance 15.6 \pm 3.4 points; seeking social support 11.9 \pm 3.2 points; passive reaction pattern 11.8 \pm 3.3 points; expressing emotions 5.3 \pm 1.5 points; and reassuring thoughts 11.3 \pm 2.4 points. Following PR, SGRQ total score improved (-6.3 ± 12.9 points, $p < 0.001$). Also HADS-A and HADS-D scores improved after PR (-1.7 ± 3.6 points; and -1.6 ± 3.7 points, respectively, both $p < 0.001$). The proportion of patients reporting clinically relevant symptoms of anxiety (HADS-A score ≥ 10 points) changed from 28.7% to 13.2% after PR ($p < 0.001$), while the proportion of patients reporting clinically relevant symptoms of

Table 1 Baseline patient characteristics.

	Patients (n = 303)
Age (years)	62.3 (8.3)
Sex (male), n (%)	161 (53.1%)
Marital status (married/living with partner), n (%)	213 (70.3%)
FEV ₁ (litres)	1.3 (0.6)
FEV ₁ (% predicted)	47.7 (19.5)
FEV ₁ /FVC (%)	38.0 (12.1)
MRC dyspnoea scale (grade)*	3.4 (1.1)
BMI (kg. m ⁻²)	25.8 (5.2)
SGRQ symptoms (points)	58.6 (20.24)
SGRQ activity (points)	75.0 (18.1)
SGRQ impact (points)	44.7 (18.9)
SGRQ total (points)	56.2 (15.5)
6MWD (meters)	441.6 (112.2)
HADS-A (points)	7.4 (4.2)
HADS-D (points)	7.1 (4.1)

Data are presented as mean (standard deviation, SD) or number of patients (%). **n* = 284.

Abbreviations: FEV₁: forced expiratory volume in the first second; FVC: forced vital capacity; MRC: Medical Research Council; BMI: body mass index; SGRQ: St. George Respiratory Questionnaire; 6MWD: six-minute walking distance; HADS-A: Hospital Anxiety and Depression Scale, anxiety subscale; HADS-D: Hospital Anxiety and Depression Scale, depression subscale.

depression (HADS-D score ≥ 10 points) changed from 29.4% to 15.8% after PR ($p < 0.001$). Finally, 6MWD increased 28.9 \pm 51.2 m ($p < 0.05$).

Coping styles before and after PR programme

The level of *active confronting* coping style increased following PR ($+0.4 \pm 3.5$ points, $p < 0.05$). The level of *avoidance* coping style decreased after PR (-0.6 ± 3.7 points, $p < 0.05$), as well as the levels of *passive reaction pattern* coping style (-0.6 ± 3.1 points, $p < 0.001$) and *reassuring thoughts* coping style (-0.5 ± 2.5 points, $p < 0.001$). The levels of *palliative reaction*, *seeking social support* and *expressing emotions* coping styles did not change following PR ($p > 0.05$) (Fig. 1). For the UCL subscales *active confronting*, *passive reaction pattern* and *expressing emotions* coping style, more than 50% of the patients changed their level of coping style to another (lower or higher) level (Fig. 2). For example, 22 (34.4%) of 64 patients using at baseline a *very low* active confronting coping style, did not change their level of coping style. Fifteen patients (23.4%) changed into a *low* level, 25 patients (39.0%) changed into a *medium* level, one patient (1.6%) changed into a *high* and one patient (1.6%) changed into a *very high* level of active confronting coping style after PR. The percentage of all patients that increased their *very low* level into a higher level of active confronting coping style was 65.6% (Fig. 2). For the UCL subscales *palliative reaction*, *avoidance*, *seeking social support* and *reassuring thoughts*, the majority of the patients did not change their level of use after PR. See Online Supplement

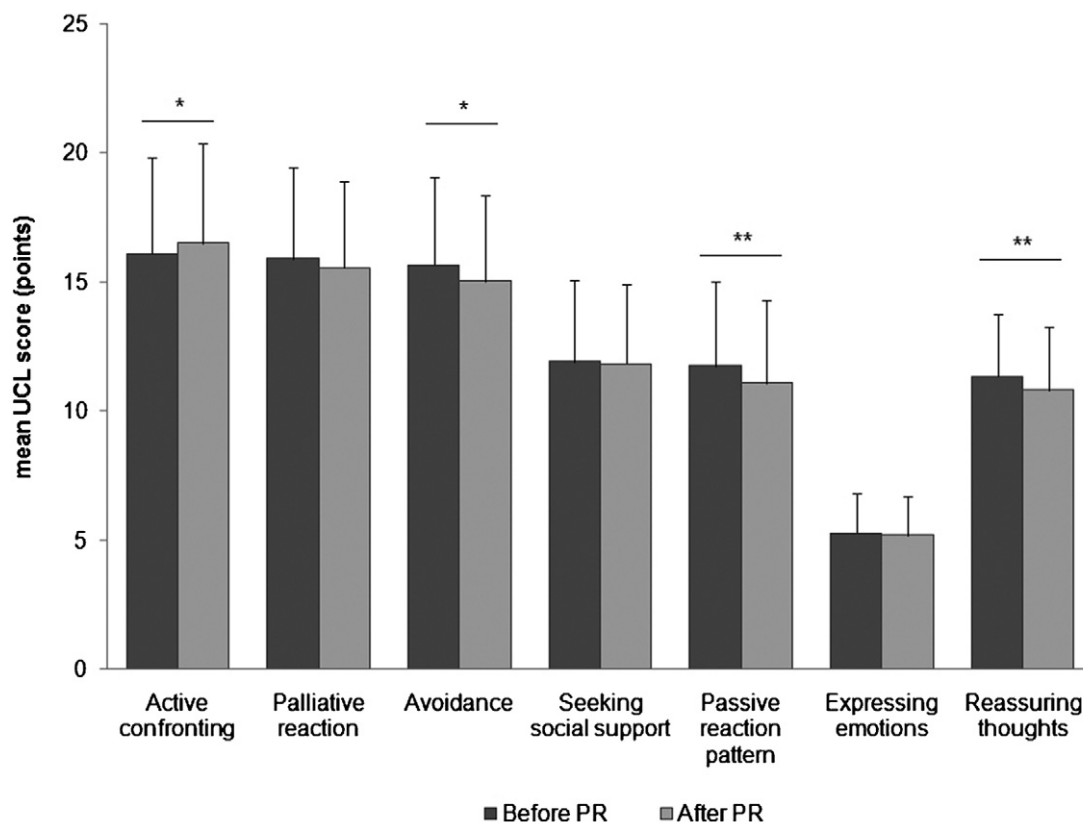


Figure 1 Data are presented as mean (standard deviation, SD). * p -value based on paired-samples T -test, $p < 0.05$. ** p -value based on paired-samples T -test, $p < 0.001$.

for differences in baseline and changes in coping styles among genders following PR.

Relationship between coping styles, changes in coping styles and outcomes of PR

None of the coping styles or changes in coping styles was related to change in disease-specific health status following PR. However, baseline SGRQ total score, HADS-D score, 6MWD; and change in HADS-D score and change in 6MWD were related to change in SGRQ total score (Table 2).

Furthermore, baseline 6MWD, SGRQ total score, *seeking social support* coping style; and change in SGRQ total score were related to change in exercise tolerance (Table 3).

Determinants of change in HADS-A score were baseline HADS-A score, HADS-D score, *active confronting*, *passive reaction pattern*, *expressing emotions*, *reassuring thoughts* coping styles; and change in HADS-D score and change in *passive reaction pattern* coping style (Table 4). These variables were able to explain 64% of the change in HADS-A score after PR.

Finally, change in HADS-D score in response to PR was associated with baseline HADS-A score, HADS-D score, *palliative reaction* and *expressing emotions* coping styles; and change in HADS-A score, change in SGRQ total score, and change in *expressing emotions* coping style (Table 5). These variables were able to explain 65% of the change in HADS-D score following PR.

Discussion

Key findings

The present study has two important findings. First, the results indicate that comprehensive interdisciplinary PR programme is able to change coping styles in patients with COPD. Second, coping styles are predictors of changes in exercise tolerance, symptoms of anxiety and depression, but are not related to changes in disease-specific health status following PR.

Change in coping styles as response to a comprehensive PR programme

Improvements in exercise tolerance, symptoms of anxiety and depression and disease-specific health status after PR in patients with COPD are well documented.²⁵ However, the influence of a PR programme on coping styles has rarely been studied in COPD.²⁶ In the present study, the level of *active confronting* coping style increased, whereas the levels of *avoidance*, *passive reaction pattern* and *reassuring thoughts* coping styles decreased after PR. Additionally, the mean differences in all coping subscales can be small, but within each coping subscale – changes can be significant, as shown in Fig. 2. These findings support the hypothesis of Lazarus and Folkman, stating that coping styles are process-oriented, which means that they depend on the

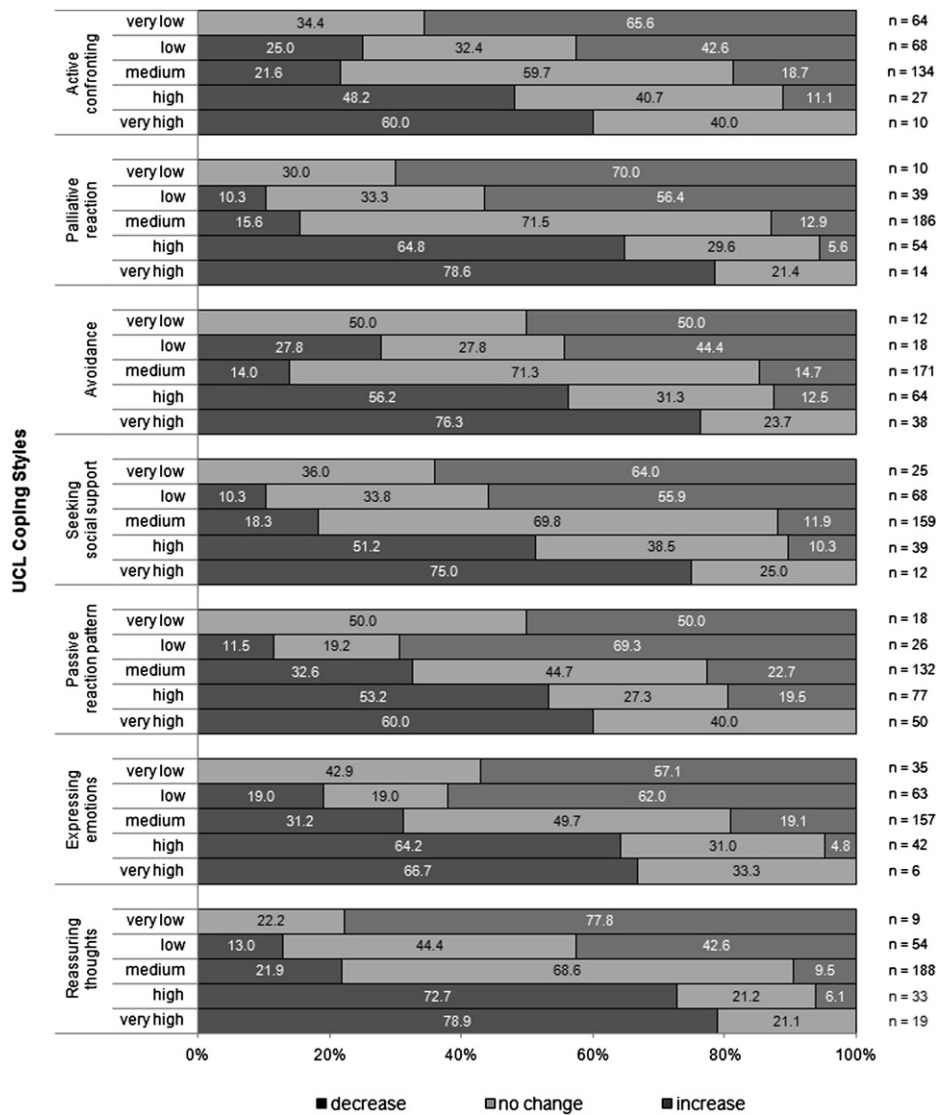


Figure 2 Data are presented as percentage (%). n = 303. Decrease = change to a lower level. No change = same level of coping style. Increase = change to a higher level.

nature of the stressor and they are prone to change, rather than people are being “pre-programmed” to use the same coping style regardless of the stressful situation.⁴

COPD patients rely less on active confronting coping style when compared to the general population.²⁷ A recent study in COPD patients entering PR showed that patients with symptoms of anxiety and/or depression reported a lower use of *active confronting* and an increased use of *avoidance* and *passive reaction pattern* coping styles than patients without symptoms of anxiety and/or depression.⁸ *Active confronting* coping style describes problem-focused concentrated efforts on acting upon the illness or modifying the situation, which may result in better adjustment with regard to patient’s COPD.²⁸ Furthermore, a decrease in *avoidance*, *passive reaction pattern* and *reassuring thoughts* coping styles, suggests that patients with COPD after PR will be more willing to confront their situation and address the problems.¹⁷ Therefore, the increase in the level of *active confronting* and decrease in the levels of

avoidance and *passive reaction pattern* coping styles can be considered as positive outcomes of PR. In contrast, studies by Janelli et al.²⁹ and Scherer et al.,³⁰ which assessed general coping behaviours before and after a group teaching programme for patients with COPD, found no changes in coping styles. Possible explanations for these differences are dissimilarities in the contents of the programmes and the use of a different coping instrument (Jalowiec Coping Scale).

Coping styles as predictors of change in clinical outcomes after PR

None of the baseline coping styles and changes in levels of coping styles after PR was associated with a change in disease-specific health status. This confirms the findings of Buchi et al., who found no significant relationship between generic health status and coping styles in COPD patients

Table 2 Results of stepwise regression analysis for baseline coping styles, changes in coping styles and change in disease-specific health status.

Δ SGRQ total score	Correlates	Standardized beta	p-Value
$R^2 = 0.37$, $F = 13.332$, $p = 0.000$	Baseline SGRQ total score	-0.486	0.000
	Baseline HADS-D score	0.283	0.000
	Baseline 6MWD	-0.204	0.000
	Δ HADS-D score	0.428	0.000
	Δ 6MWD	-0.269	0.000

$n = 282$.

Abbreviations: see legend Table 1.

The following variables were no significant predictors and were excluded from the model: Sex, Age, MRC dyspnoea scale, FEV₁ % pred., BMI, Δ BMI, HADS-A, Δ HADS-A, UCL (Utrecht Coping List) Active confronting, UCL Palliative reaction, UCL Avoidance, UCL Seeking social support, UCL Passive reaction pattern, UCL Expressing emotions, UCL Reassuring thoughts, Δ UCL Active confronting, Δ UCL Palliative reaction, Δ UCL Avoidance, Δ UCL Seeking social support, Δ UCL Passive reaction pattern, Δ UCL Expressing emotions, Δ UCL Reassuring thoughts.

attending PR.³¹ However, a study by Ketelaars et al., showed that *avoidance* and *expressing emotions* coping styles were the best predictors of disease-specific health status, next to the lung function and exercise tolerance.³² They assessed coping styles in patients with COPD entering PR using another instrument, the COPD Coping Questionnaire,³² which may explain these inconsistent findings. Moreover, coping styles only modestly explained the variance of disease-specific health status.³²

Table 3 Results of stepwise regression analysis for baseline coping styles, changes in coping styles and change in exercise tolerance.

Δ 6MWD	Correlates	Standardized beta	p-Value
$R^2 = 0.18$, $F = 5.926$, $p = 0.016$	Baseline 6MWD	-0.259	0.000
	Baseline SGRQ total score	-0.163	0.016
	Δ SGRQ total score	-0.370	0.000
	Baseline UCL Seeking social support	-0.166	0.003

$n = 282$.

Abbreviations: see legend Table 1.

The following variables were no significant predictors and were excluded from the model: Sex, Age, MRC dyspnoea scale, FEV₁ % pred., BMI, Δ BMI, HADS-A, Δ HADS-A, HADS-D, Δ HADS-D, UCL (Utrecht Coping List) Active confronting, UCL Palliative reaction, UCL Avoidance, UCL Passive reaction pattern, UCL Expressing emotions, UCL Reassuring thoughts, Δ UCL Active confronting, Δ UCL Palliative reaction, Δ UCL Avoidance, Δ UCL Seeking social support, Δ UCL Passive reaction pattern, Δ UCL Expressing emotions, Δ UCL Reassuring thoughts.

Table 4 Results of stepwise regression analysis for baseline coping styles, changes in coping styles and change in anxiety score.

Δ HADS-A score	Correlates	Standardized beta	p-Value
$R^2 = 0.64$, $F = 5.382$, $p = 0.021$	Baseline HADS-A score	-0.766	0.000
	Baseline HADS-D score	0.425	0.000
	Δ HADS-D score	0.577	0.000
	Baseline UCL Active confronting	-0.110	0.015
	Baseline UCL Passive reaction pattern	0.226	0.000
	Baseline UCL Expressing emotions	-0.091	0.021
	Baseline UCL Reassuring thoughts	0.140	0.001
	Δ Passive reaction pattern	0.165	0.000

$n = 282$.

Abbreviations: see legend Table 1.

The following variables were no significant predictors and were excluded from the model: Sex, Age, MRC dyspnoea scale, FEV₁ % pred., BMI, Δ BMI, Baseline SGRQ total score, Δ SGRQ total score, Baseline 6MWD, Δ 6MWD, UCL (Utrecht Coping List) Palliative reaction, UCL Avoidance, UCL Seeking social support, Δ UCL Active confronting, Δ UCL Palliative reaction, Δ UCL Avoidance, Δ UCL Seeking social support, Δ UCL Expressing emotions, Δ UCL Reassuring thoughts.

Coping styles are determinants of exercise tolerance.⁸ A lower use of baseline *seeking social support* coping style was associated with an increase in exercise capacity after PR. This confirms previous findings suggesting that use of seeking social support coping style is not associated with better outcomes in COPD patients. On the contrary, this coping style is associated with worse total functioning and higher anxiety levels.²⁷

In the present study, coping styles were related to changes in symptoms of anxiety following PR. Increased levels of baseline *active confronting* and baseline *expressing emotions* coping styles, were associated with lower levels of anxiety after PR. Increased levels of baseline *passive reaction pattern*, *reassuring thoughts* coping styles and change in *passive reaction pattern* coping style, were associated with increased anxiety levels after PR. A consistent body of research in COPD patients, shows that the use of *active confronting* coping style is associated with positive outcomes and lower levels of psychological distress,^{8,26} whereas the use of passive reaction pattern coping style is associated with increased psychological distress.^{8,27} Our findings support these results. Additionally, patients who reported at baseline more use of *reassuring*

Table 5 Results of stepwise regression analysis for baseline coping styles, changes in coping styles and change in depression score.

Δ HADS-D score	Correlates	Standardized beta	p-Value
$R^2 = 0.65$, $F = 5.076$, $p = 0.025$	Baseline HADS-A score	0.553	0.000
	Baseline HADS-D score	-0.723	0.000
	Δ HADS-A score	0.586	0.000
	Δ SGRQ total score	0.144	0.000
	Baseline UCL	-0.130	0.001
	Palliative reaction		
	Baseline UCL	0.155	0.001
	Expressing emotions		
	Δ Expressing emotions	0.102	0.025

$n = 282$.

Abbreviations: see legend Table 1.

The following variables were no significant predictors and were excluded from the model: Sex, Age, MRC dyspnoea scale, FEV₁ % pred., BMI, Δ BMI, Baseline SGRQ total score, Baseline 6MWD, Δ 6MWD, UCL (Utrecht Coping List) Active confronting, UCL Avoidance, UCL Seeking social support, UCL Passive reaction pattern, UCL Reassuring thoughts, Δ UCL Active confronting, Δ UCL Palliative reaction, Δ UCL Avoidance, Δ UCL Seeking social support, Δ UCL Passive reaction pattern, Δ UCL Reassuring thoughts.

thoughts may be less able to reduce levels of anxiety following PR. On the other hand, we found that *expressing emotions* coping style, generally described as a passive and maladaptive coping style,^{26,29} can contribute to lowering the level of anxiety following PR. The disparity between studies with regard to the adaptive significance of expressing emotions coping style can be explained by the fact that this may depend on the controllability of the confronted stressor, as described by Andenaes et al.³³

Coping styles were also related to the changes in the levels of depression following PR. Patients, who at baseline reported more use of *expressing emotions* coping style, may benefit less from PR in terms of higher level of depression following PR. Also, decrease in this coping style after PR showed an association with decrease in symptoms of depression following PR. In contrast, patients who at baseline reported more use of *palliative reaction* coping style may benefit more from PR in terms of improvements in symptoms of depression. Previously, a study in COPD outpatients showed that higher use of palliative reaction coping style is associated with less prescribed pulmonary medication.²⁷ The use of palliative reaction coping style refers to efforts to control negative emotions by means of distraction, or the use of psychoactive substances.¹⁷ This suggests that patients try to distract their thoughts instead of constantly directing their attention to the chronic stimuli of COPD and they less tend to recognise, interpret and report its symptoms.

The data presented in this study illustrate that coping styles of patients with COPD are important in relation to symptoms of anxiety and depression, as it was shown before.⁸ Furthermore, the association between coping styles and exercise intolerance, symptoms of anxiety and depression, may not translate simply into improvements in disease-specific health status, which can possibly be related to the time needed for these patients to experience the effects in the daily living. The exact interrelation between coping styles and these clinical outcomes warrants further investigation.

Nowadays, self-management interventions implemented in PR programmes for COPD patients should stimulate behavioural change and active participation of patients through education and the promotion of self-management behaviour.³⁴ These interventions will empower patients with specific disease-related skills that emphasise disease control through behaviour change,³⁵ which may actually lead to a consistent modification of patients' coping styles. Indeed, self-management of COPD includes sufficient coping behaviour.³⁶ Moreover, an inclusion of interventions which will incorporate structured psychosocial elements aiming at behaviour modification in PR is essential.¹² Nevertheless, it remains unknown whether interventions can modify coping styles of patients with COPD, as well as if these interventions can improve other outcomes such as patients' physical and psychological symptoms and exercise tolerance. De Ridder and Schreurs suggested in a review that interventions may be able to change coping styles in patients with chronic diseases.³⁷ However, the results only showed improvement of a few coping styles and problem-focused styles in particular.³⁷ Interestingly, in all of the included studies a cognitive behavioural approach was used. Techniques used to influence emotion-focused coping style were cognitive restructuring and relaxation, while training of problem-solving skills, social skills, communication skills, decision making and negotiating were used as techniques to influence problem-focused coping.³⁷ The authors suggest that besides strategies for enhancement of a particular coping style, the appraisal of stressful situations, the use of coping resources and the strategic application of particular coping styles, should also be considered in future development of interventions.³⁷

Methodological considerations

Several limitations should be taken into consideration when interpreting the results. Co-morbidities were not assessed, which may have an impact on coping styles and may limit the generalizability of our findings. Further, several instruments to assess coping styles are available and other instruments define different coping styles categories.^{3,7,26,31} Thus, the use of another instrument might have changed our results. Nonetheless, the UCL was previously applied in COPD patients, and has shown satisfactory psychometric properties in a Dutch population.^{17,27} Also, multiple instruments exist for assessment of symptoms of anxiety and/or depression. We used the HADS, a well validated instrument frequently used in patients with COPD.² However, the choice of the instrument might have influenced our results. Finally, it cannot be determined

which component (or sum of components) of PR has resulted in the changes in coping styles. Nevertheless, evidence for the possible direct effect of PR on patients' coping styles might provide future opportunities for development of a patient-tailored PR programme.

Conclusions and implications for clinical practice

The present study has shown that coping styles may change following PR. Moreover, coping styles and changes in coping styles may influence outcomes of PR. Indeed, coping with COPD involves an adjustment to daily limitations.³² Therefore, enhancement of understanding of healthcare professionals of the patient's coping styles and the adaptation process is needed. The findings from the present study suggest that components included in a comprehensive PR can stimulate a change in the patients' coping styles, even without the inclusion of intervention aiming at changing coping styles. Hence, these results also suggest that PR may be a venue in which it is possible to offer interventions aimed at modification of coping styles. However, further studies are warranted to evaluate the outcomes of interventions actively targeting coping styles.

Conflict of interest statement

The authors declare that they have no conflict of interest.

Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.rmed.2013.03.001>.

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