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Psychosocial predictors of long-term success of in-patient pulmonary rehabilitation of patients with COPD

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ABSTRACT: Studies of the long-term outcome of pulmonary rehabilitation have measured quality of life (QOL) mainly as disease-specific functional impairment, but long-term effects on overall satisfaction with health or life have not yet been adequately evaluated. Furthermore, the influence of personality traits on the long-term outcome of pulmonary rehabilitation have not so far been examined. The following questions were studied: 1) What are the short- and long-term effects of a rehabilitation programme on lung function (forced expiratory volume in one second as percentage of predicted (FEV_1 % pred)), on satisfaction with life (defined as quality of life), and on health satisfaction (HS)? 2) Are there physical or psychosocial predictors for the success of pulmonary therapy?

In this prospective clinical study, baseline data (FEV_1 % pred, arterial oxygen tension (P_{a,O_2}), QOL, HS, dyspnoea, coping scales) were studied at entry (t1); follow-up on discharge (t2); and 1 yr after hospitalization (t3) in 54 consecutive patients (mean age 64 yrs) with chronic obstructive pulmonary disease (COPD). Complete data were obtained at follow-up on 32 subjects.

FEV_1 % pred improved from 42% (t1) to 52% (t2) ($p<0.001$) but dropped to 46% at t3 (t1–t3: $p<0.05$). QOL improved significantly during hospitalization but dropped to initial levels 1 yr after discharge. A significant increase in health satisfaction during hospitalization was maintained at follow-up. Improvements in lung function were greater in patients with higher QOL scores on entry; subjects with the greatest tendency to use wishful thinking as a coping strategy had less improvement.

In conclusion, the effects of pulmonary rehabilitation on lung function and health satisfaction are positive and enduring. Quality of life and coping have an effect on the long-term outcome of pulmonary rehabilitation, probably as expressions of patients' personality traits.

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Chronic obstructive pulmonary disease (COPD) is a major health problem and a leading cause of morbidity and mortality. In Switzerland, 5–8% of all patients with COPD are treated annually in multidisciplinary, in-patient pulmonary rehabilitation programmes.

In recent years, there has been increasing research evaluating rehabilitation programmes, both out-patient [1–5] and in-patient [6, 7], examining short-term [2–4, 7] and long-term [1, 5, 6] outcomes. Outcomes have been measured in terms of physiological criteria, such as forced expiratory volume in one second (FEV_1) or exercise capacity, and also in terms of measures of patient self-rated functional impairment, such as the Chronic Respiratory Disease Questionnaire (CRQ) of GUYATT *et al.* [8] and the Sickness Impact Profile (SIP) [9].

Improvement of patients' general health satisfaction is widely-accepted as a major aim of pulmonary rehabilitation [4]. Health-related satisfaction and functional status are considered key components of health-related quality of life (HRQOL) [10, 11]. Although there is no satisfactory consensus definition of quality of life (QOL), it is generally accepted that it includes both HRQOL and non-health-related QOL [10]. Instruments such as the SIP and the CRQ can provide only limited information about QOL because they cover neither health-rated satisfaction nor non-health-related QOL. The first aim of the present study was, therefore, to apply a more comprehensive measure of QOL, including health-related satisfaction, to assess the long-term outcome of a pulmonary rehabilitation programme. The instrument used was a generic [12] QOL measure, the "Questions for Life Satisfaction" (FLZ) [13]. To our knowledge, this is the first application of a comprehensive QOL measure to a long-term outcome study of pulmonary rehabilitation.

A second aim of the study was to evaluate the extent to which patient-assessed outcomes could be predicted by the patients' coping styles at the start of the rehabilitation programme. In this context, coping may be defined as cognitive, behavioural or emotional responses to circumstances that the individual perceives as stressful [14–16]. In COPD, coping strategies have been shown

to influence patient-assessed QOL in the short-term [7], and more enduring effects of coping style have been demonstrated in other chronic illnesses, such as rheumatoid arthritis [17–19].

Subjects and methods

Subjects

The subjects were drawn from a single specialist in-patient pulmonary rehabilitation unit, to which patients were referred by their general practitioner or a pulmonary specialist. Patients were included if they met the following criteria: 1) diagnosis of COPD according to the American Thoracic Society (ATS) guidelines [20]; 2) during baseline spirometry, mean FEV1 following bronchodilator administration below 80% predicted, or FEV1/ forced vital capacity (FVC) below 65%. Exclusion criteria were: 1) active or symptomatic cardiac disease; 2) myocardial infarction within the previous 6 months; 3) acute or subacute pulmonary infection; 4) poor ability to comprehend adequately or to participate in the rehabilitation programme.

Description of sample

At admission to the clinic (t1), a consecutive series of 54 patients were enrolled in the study. Complete data were gathered from all patients at discharge (t2) and from 32 subjects 1 yr after discharge (t3). Of the 22 patients from whom it was not possible to obtain complete data at t3, four had died during the period of investigation (three due to respiratory decompensation and one from a brain tumour), five withdrew because of intercurrent illness during the study period, and 13 patients failed to attend for follow-up. The study group and the group not followed up did not differ significantly in their sociodemographic profile or lung function (table 1). The only difference between the groups was that those not followed up scored higher on depressive coping. In the study group (n=32), the mean (SD) duration of illness was 12.0 (9.7) yrs. All those in the study group inhaled bronchodilators (beta$_2$-mimetics, ipratropium bromide), and 94% took additional medication (topical or systemic steroids, theophylline diuretics). Only 13% were able to work full-time, and 30% received disability benefits. Forty one per cent were still smokers. The average (SD) duration of in-patient treatment was 27.6 (5.7) days.

Tests and assessments

Spirometry, plethysmography and arterial blood gas analysis. Before and following bronchodilation with 200 μg salbutamol, FEV1 [20] and FVC were measured using a pneumotachograph (Vitalograph Compact, Buckingham, UK). Reference values of the European Coal and Steel Community (ECSC) [21] were applied. The presence of asthmatic bronchitis was defined as >15% improvement in FEV1 % pred. Body plethysmography (Jaeger, Würzburg, Germany) was performed, and the transfer factor of the lung for carbon monoxide ($T_{L,CO}$) was determined with a single-breath method, using the Jaeger transfer test module. Pulmonary emphysema was judged present when typical clinical and radiological findings were found, together with a $T_{L,CO}$ <80% of normal, or residual volume/total lung capacity (RV/TLC) >40%. Arterial oxygen tension (P_{a,O_2}) was measured with a Corning 278 blood gas analyser (Chiron diagnostics, Dietlikon, Switzerland). The lower threshold for normal P_{a,O_2} at 1,700 m above sea level was set at 8.0 kPa, irrespective of age.

Table 1. – Patients' characteristics at baseline

	Study group (n=32)	Non-follow-up group (n=22)
Sociodemographic data		
Age yrs	64±8	64±8
Male M/F	24/8	16/6
Lung function		
FEV1 % pred	43±19	41±14
P_{a,O_2} kPa	7.4±1.1	7.7±1.5
Additional diagnoses		
Asthmatic bronchitis (>15% reversibility)	7	5
Emphysema	13	9
Dyspnoea	3.16±1.32	3.32±1.09
Quality of life		
Overall quality of life (QOL)	56.3±32.4	46.4±24.8
Health satisfaction (HS)	36.9±42.8	34.1±32.8
Coping scales		
Depressive coping	1.82±0.72	2.36±1.04*
Active coping	3.40±1.02	3.16±0.96
Distraction, self-encouragement	3.09±0.83	2.77±0.90
Religion, search for meaning	2.69±0.81	2.89±0.83
Wishful thinking	2.07±1.07	2.25±0.83

Data are presented as absolute number, or mean±SD. M: male; F: female; FEV1: forced expiratory volume in one second; % pred: percentage of predicted value; P_{a,O_2}: arterial oxygen tension. *: p≤0.05, compared to the study group.

Dyspnoea. Dyspnoea was assessed on a five-point visual analogue scale (1=no dyspnoea on exertion; 5=dyspnoea at rest).

Assessment of quality of life and health satisfaction. QOL was measured using the "Questions for Life Satisfaction" (FLZ) [13]. This is based on an empirically validated, linear, additive model of life satisfaction. The model assumes that for each person, ratings of satisfaction with particular aspects of life deemed important to that individual can be summed to yield a measure of overall life satisfaction. Satisfaction with particular areas of life is weighted according to their importance to each individual. This instrument is not disease-specific and has been widely used to assess QOL in different illnesses [22–25], to compare ill and healthy samples [26], and to compare different samples of healthy people [27]. To our knowledge, this study is the first in which the FLZ has been applied in people with COPD.

The instrument, comprising 16 items, consists of a health-related section measuring health satisfaction (HS), and a non-health-specific section assessing quality of life (QOL). The HS items cover: energy/zest for life; relaxation; physical fitness; independence; pain; anxiety;

vision/hearing; and mobility. Items on QOL cover: friends/acquaintances; leisuretime/hobbies; health; income/financial security; profession/work; accommodation; family/children; and relationships/sexuality. For each item, patients are asked to rate its importance to themselves over the preceding 4 weeks, and their satisfaction with it. Ratings of importance (I) and satisfaction (S) are each made on a five-point scale. For each item, weighted satisfaction (WS) is calculated according to the formula:

$$WS=(I - 1)\times(S\times 2 - 5)$$

Thus, an item which is considered unimportant (I=1) scores zero, regardless of its satisfaction rating. Scores on items that are very important (I=5) range from -12 (not satisfied, S=1) to +20 (very satisfied, S=5). The sums of the scores on the items making up the HS or QOL subscales yield HS and QOL total scores (for each subscale, the range is -96 to +160).

Coping with illness. This was measured using the Freiburg Coping Questionnaire, the best established German language coping instrument [28]. Its 35 items include five scales: 1) depressive coping (*e.g.* "I am at odds with my fate", "I feel sorry for myself"); 2) active coping (*e.g.* "I concentrate my efforts on doing something about my illness"); 3) distraction, self-encouragement (*e.g.* "I try to distract myself", "I try to encourage myself"); 4) religion and search for meaning (*e.g.* "I try to find comfort in my religion", "I try to find a meaning in having an illness"); 5) wishful thinking (*e.g.* "I refuse to believe that I have an illness"). Each item is scored on a five-point scale (1=completely false; 5=completely true).

Study design

On the day of admission (t1), both spirometry and arterial blood gas analysis (ABGA) were carried out. All patients had medical and sociodemographic data recorded, and completed assessments of dyspnoea, HS, QOL and coping. During the first week of hospitalization, body plethysmography was performed, and the $T_{L,CO}$ was determined. On the day of discharge from the hospital (t2), spirometry, ABGA, and assessments of dyspnoea, HS and QOL were repeated. One year after discharge (t3), patients were visited at home by a technician for further spirometry, plus repeat assessments of dyspnoea, HS and QOL.

Rehabilitation programme

In-patient programme. After the diagnostic procedures, patients were entered into a 4 week multidisciplinary rehabilitation programme, including input from a chest physician, nurses, respiratory therapists, physiotherapists and dietitians. The programme included the following components:

Pharmacological therapy. An initial course of systemic steroids (starting with prednisone, 50 mg·day^{-1}) was gradually tapered and then replaced by maintenance therapy with inhaled steroids. Additionally, patients received a combined inhalation therapy of salbutamol and ipratropium bromide four times a day. If dyspnoea occurred at night, patients received an additional theophylline medication (sustained release tablets in the evening, dosed to reach a serum level of 55–110 μmol·L^{-1}).

Physiotherapy. Patients were taught pursed-lips breathing, relaxation and diaphragmatic breathing techniques, as well as methods of coughing and clearing secretions. The patients were individually instructed, and trained in group sessions (one daily). No specific ventilatory muscle training was performed.

Exercise conditioning. Depending on their functional limitations, the patients entered an individually tailored exercise programme, with the following training modalities: walking or cross-country-skiing in wintertime (daily); bicycle ergometer exercise training (1–2 sessions per day); swimming (3 sessions per week); and aerobics (3 sessions per week). The intensity of training was gradually increased to 80% of maximal workpower and controlled by heart rate monitoring (Sporttester PE 400®; Polar Electro, Kempele, Finland), as well as measuring lactate levels after training sessions. The training sessions were always supervised by physiotherapists.

Education. The goal of the education programme was to inform the patients about the pathophysiology of their disease, the rationale of the therapy, and the detrimental effects of smoking. In addition, they were instructed in the correct use of peak flow meters, daily recording of their symptoms, correct administration of drugs, avoidance of aggravating stimuli, and in techniques to stop smoking. They also received individual counselling for nutritional and psychological problems.

Out-patient programme. Each patient was discharged with an individual treatment programme to carry on at home. This was supervised by the same physician who referred the patient to the hospital. The physician was informed about the individual home programme of the patient and was encouraged to actively support and control the activities of his patient at home. Pharmacological therapy started during the in-patient rehabilitation programme was continued for a further 12 months. Patients were regularly monitored at home by nurses and technicians of the regional Lung Association (part of the Swiss Lung Association), and received counselling for inhalation techniques and exercise conditioning.

Statistical analysis

Differences between the study group and the non-follow-up group, as well as long-term changes in the most important parameters, were assessed using t-tests. To evaluate the association between measures, the Spearman's rank correlation coefficient was used because most variables were not normally distributed or had ordinal characteristics. The significance threshold was defined as $\alpha=0.05$ ($p\leq 0.05$).

Results

Intercorrelation of QOL and HS and correlations of QOL and HS with coping scales

On entry (t1), there was a significant intercorrelation between QOL and HS for the study group (table 2). No significant correlations of QOL and HS with the coping scales were detected (table 2).

Changes in FEV1 % pred, dyspnoea, QOL and HS

During the treatment programme, there were significant improvements in FEV1 % pred, P_{a,O_2}, dyspnoea, QOL and HS (table 3). Despite a decline in FEV1 % pred following discharge from hospital (t2–t3), FEV1 % pred at follow-up remained significantly higher than before the rehabilitation programme. However, despite this improvement in lung function, dyspnoea at follow-up had returned to pre-rehabilitation levels.

QOL scores at follow-up had dropped to their initial levels, despite significant improvement during the in-patient programme (table 3). During in-patient treatment (t1–t2), the item "health" improved significantly and remained improved on follow-up. There was also an unexpected short-term rise for "accommodation"; study subjects appeared to regard the clinic's accommodation more favourably than their own homes. Along with an overall significant improvement in HS during hospitalization, improved ratings were found on six of the HS items. However, a year later, only "energy/zest for life" showed an enduring significant improvement. Nevertheless, slight improvements in all the remaining HS items resulted in an enduring improvement in HS overall at follow-up, compared with the level at entry.

Correlations between change in FEV1 % pred and psychosocial, sociodemographic and medical data

The change in FEV1 % pred between baseline and follow-up (ΔFEV1%) was used as the spirometric indicator for the effectiveness of therapy in individual patients. It was defined as the difference between FEV1 % pred at t3 and at t1, as a percentage of FEV1 % pred at t1. The mean ΔFEV1 % was 11.4% (SD 21.2, range -17 to +64).

Table 2. – Intercorrelations of quality of life (QOL) and health satisfaction (HS) and correlations of QOL and HS with coping scales (n=32)

	QOL	HS
QOL	-	0.60**
HS	0.60**	-
Coping scales		
Depressive coping	-0.24	-0.29
Active coping	0.07	-0.22
Distraction, self-encouragement	0.07	0.15
Religion, search for meaning	-0.04	0.20
Wishful thinking	-0.27	-0.08

Values are Spearman's rank correlation coefficients. **: p≤0.01, intercorrelation between QOL and HS.

Table 3. – Developments of FEV1 % pred, arterial oxygen tension, dyspnoea, quality of life (QOL) and health satisfaction (HS) (n=32)

	Admission (t1)	Discharge (t2)	1 yr after discharge (t3)
FEV1 % pred	42±19	52±22***	46±21+
P_{a,O_2} kPa	7.43±1.1	8.11±1.1***	
Dyspnoea	3.16±1.32	2.34±1.19*	3.13±1.10
QOL total score	56.3±32.4	66.9±25.8*	56.7±38.3
Friends/ acquaintances	5.9±5.9	6.7±5.3	5.5±5.9
Leisuretime/hobbies	6.5±6.0	7.4±.57	7.2±6.4
Health	0.8±9.1	7.0±7.0**	4.3±7.4+
Income/ financial security	5.7±7.4	7.5±5.7	5.4±8.9
Profession/work	6.3±8.2	5.4±7.2	5.4±7.4
Accommodation	10.8±6.3	13.3±4.4**	11.0±7.0
Family/children	12.5±6.1	12.3±6.9	11.2±8.5
Relationship/ sexuality	7.8±8.2	7.3±7.4	6.7±7.7
HS total score	36.0±42.7	68.9±39.6***	53.4±39.7+
Energy/zest for life	3.7±8.2	8.9±7.4**	6.8±7.3+
Relaxation	3.8±7.5	6.6±6.4*	4.1±5.3
Physical fitness	0.0±7.2	5.8±6.2***	1.9±6.7
Independence	8.5±7.6	13.8±5.4**	12.3±8.7
Pain	2.0±9.9	7.9±5.6**	4.7±6.8
Anxiety	5.4±7.8	7.8±6.8	6.5±6.5
Vision/hearing	9.5±7.3	9.3±7.5	9.7±6.9
Mobility	3.1±8.8	8.8±6.1**	7.4±7.0

Data are presented as mean±SD. For further definitions see legend to table 1. *: p≤0.05; **: p≤0.01; ***: p≤0.001, compared to value at t1; +: p≤0.05, compared to value at t1.

There was no relationship between the ΔFEV1% and the degree of respiratory impairment at t1, measured by P_{a,O_2} or FEV1 % pred (table 4). Higher initial QOL ratings predicted greater improvement in FEV1. Reliance on wishful thinking as a coping strategy led to less improvement in FEV1. No significant difference in lung function was found between patients with or without bronchial reversibility. Also, no significant differences were found between smokers and nonsmokers in physical or psychological data at t1 or on follow-up.

Table 4. – Correlations of ΔFEV1% with sociodemographic, medical and psychological data (n=32)

	ΔFEV1%
Sociodemographic and medical data	
Age	-0.09
Sex	0.05
FEV1 % pred	-0.21
P_{a,O_2}	-0.11
Quality of life (QOL)	0.33*
Health satisfaction (HS)	-0.08
Coping scales	
Depressive coping	-0.07
Active coping	0.14
Distraction, self-encouragement	-0.11
Religion, search for meaning	-0.20
Wishful thinking	-0.39*

Values are Spearman's rank correlation coefficients. ΔFEV1%: difference between forced expiratory volume in one second percentage predicted at t3 and t1, as a percentage of FEV1 % pred at t1. For further definitions see legend to table 1.

Discussion

Our results demonstrate that pulmonary rehabilitation for COPD patients can have long-term physical and psychological benefits. In the rehabilitation programme investigated, FEV_1 % pred showed enduring improvement, although the significant reduction in dyspnoea during the programme was not sustained at 1 yr follow-up. The programme also led to significant improvements in QOL and HS, although only the latter was sustained on follow-up.

In keeping with other long-term outcome studies [1], only 59% of our sample of patients consecutively admitted to the rehabilitation programme could be followed up after 1 yr. The only significant difference between the study sample and those not followed up was the greater endorsement among the latter of depressive coping strategies. Patients who volunteer to participate in clinical trials may be better adjusted and have better coping skills than those who decline to participate [29]. However, self-selection of the patients followed up cannot account for their favourable long-term outcomes, for two main reasons. Firstly, the sample as a whole (including those patients lost to follow-up) showed positive coping strategies. Compared with patients with rheumatoid arthritis [30] or multiple sclerosis [31], they coped with their illness more actively, with greater awareness of problems and with less feelings of depression. Secondly, patients' coping strategies had relatively little impact on improvements in lung function, or on QOL or HS.

Previous long-term outcome studies [1, 5, 6] have used measures of functional impairment to assess patients' views on the success of treatment. The main innovation in the present study was the assessment of patient-rated outcomes using a more comprehensive instrument, incorporating both HS and QOL. The importance of including such subjective, patient-rated measures is highlighted by studies in other chronic physical illnesses, which demonstrate that disability and other similar outcome measures are more closely related to patient perceptions and associated psychological variables than to objective "disease" variables [17–19]. QOL and HS were correlated at t1. However, they did not change in parallel during the treatment and follow-up. While HS showed sustained improvement, QOL showed only short-term gains during the rehabilitation programme itself. However, change in lung function (ΔFEV_1%) correlated with initial QOL, but not with HS. These results suggest that HS and QOL both contribute to patient-assessed outcomes, and that each makes a contribution independently of the other.

The significant improvement in health satisfaction was probably related to some extent to improved treatment of lung disease. Pulmonary rehabilitation can lead to improvements in neuropsychological function, such as enhanced psychomotor speed and greater mental flexibility [2], which are likely to influence patients' perceived satisfaction. However, the sustained improvement in HS despite an increase in dyspnoea at follow-up suggests that lung function alone is unlikely to account for HS ratings. Increased medical and social support during rehabilitation may also have had beneficial effects.

Improvements in FEV_1 % pred were not related to initial clinical or sociodemographic variables. Of the baseline variables investigated, only two showed a significant correlation with ΔFEV_1%. Greater improvement in FEV_1 % pred correlated with higher initial QOL scores, and with lower ratings of wishful thinking as a coping strategy. Although it may appear paradoxical that a measure of physical outcome is predicted better by psychological factors than by clinical variables, this has been reported in other chronic physical illnesses [17–19]. It may be that higher perceived QOL leads to better adherence to the treatment regimen. Conversely, wishful thinking as a coping strategy has been found to have an adverse effect on adjustment to chronic illness [32]. It has been suggested that wishful thinking is associated with poor acceptance of physical disability [32]. It may also be that reliance on wishful thinking reduces the patient's motivation to collaborate with the treatment programme. That these effects of psychological factors are mediated through motivation and adherence remains speculative, since neither adherence to the medical regimen nor motivation were measured directly in this study. However, this is consistent with evidence from other studies [33].

The results of this study demonstrate the potentially important influence of psychological factors on rehabilitation outcome in chronic obstructive pulmonary disease, as in other physical illnesses [34]. Where psychological factors contribute to an unfavourable outcome, they are amenable to change, for example using cognitive-behavioural therapy [35, 36]. Such therapy has been shown to improve exercise tolerance and subjective well-being among people with chronic obstructive pulmonary disease, and is also likely to improve patients' adherence to their rehabilitation programme [33]. Further work should aim to identify in more detail those psychological factors likely to influence rehabilitation outcomes, and to extend rehabilitation programmes to incorporate interventions focused on these factors.

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References

1. Vale F, Reardon JZ, ZuWallack RL. The long-term benefits of out-patient pulmonary rehabilitation on exercise endurance and quality of life. *Chest* 1993; 103: 42–45.
2. Emery CF, Leatherman NE, Burker EJ, MacIntyre NR. Psychological outcomes of a pulmonary rehabilitation program. *Chest* 1991; 100: 613–617.
3. Niederman MS, Clemente PH, Fein AM, *et al*. Benefits of a multidisciplinary pulmonary rehabilitation program. *Chest* 1991; 99: 798–804.
4. Wijkstra P, Van Altena R, Kraan J, Otten V, Postma DS, Koeter GH. Quality of life in patients with chronic obstructive pulmonary disease improves after rehabilitation at home. *Eur Respir J* 1994; 7: 269–273.
5. Ries AL, Kaplan RM, Limberg BS, Prewitt LM. Effects of pulmonary rehabilitation on physiologic and psychosocial outcomes in patients with chronic obstructive pulmonary disease. *Ann Intern Med* 1995; 122: 823–832.

6. Goldstein RS, Gort EH, Stubbing D, Avendano MA, Guyatt GH. Randomised controlled trial for respiratory rehabilitation. *Lancet* 1994; 344: 1394–1397.
7. Buchi S, Buddeberg C, Wolf C, Schwarz F, Villiger B. Einfluss einer stationären Behandlung auf die pulmonalen Befunde und die subjektive Befindlichkeit bei Patienten mit chronischer Bronchitis. *Schweiz Med Wochenschr* 1993; 123: 1742–1752.
8. Guyatt HG, Berman LB, Townsed M, Pugsley SO, Chambers LW. A measure of quality of life for clinical trials in chronic lung disease. *Thorax* 1987; 42: 773–778.
9. Bergner M, Bobbit RA, Carter WB, Gilson BS. The sickness impact profile: development and final revision of a health status measure. *Med Care* 1981; 19: 787–805.
10. Shumaker SA, Naughton MJ. The international assessment of health-related quality of life: a theoretical approach. *In*: Shumaker SA, Berzon R, eds. The International Assessment of Health-Related Quality of Life: Theory, Translation and Analysis. Oxford, Rapid Communications, 1995; pp. 3–10.
11. Guyatt GH, Feeny DH, Patrick DL. Issues in quality of life measurements in clinical trials. *Control Clin Trials* 1991; 12: 81–90.
12. Anderson RT, Aaronson NK, Wilkin D. Critical review of the international assessment of health-related quality of life: generic instruments. *In*: Shumaker SA, Berzon R, eds. The International Assessment of Health-Related Quality of Life: Theory, Translation, Measurement and Analysis. Oxford, Rapid Communications, 1995; pp. 11–39.
13. Herschbach P, Henrich G. Der Fragebogen als methodischer Zugang zur Erfassung von "Lebensqualität" in der Onkologie. *In*: Schwarz R, ed. Lebensqualität in der Onkologie. München, W. Zuckerschwerdt Verlag, 1991; pp. 34–46.
14. Heim E. Krankheitsauslösung - Krankheitsverarbeitung. *In*: Heim E, Willi J, eds. Psychosoziale Medizin. Bd. 2. Berlin, Springer, 1986; pp. 364–382.
15. Heim E. Coping und Adaptivität: Gibt es geeignetes und ungeeignetes Coping? *Psychother Med Psychol* 1988; 38: 8–18.
16. Folkman S, Lazarus RS. The relationship between coping and emotion: Implications for theory and research. *Soc Sci Med* 1988; 26(3): 309–317.
17. Keefe FJ, Brown GK, Wallston KA, Caldwell DS. Coping with rheumatoid arthritis pain: catastrophizing as a maladaptive strategy. *Pain* 1989; 37: 51–56.
18. Newman S, Fitzpatrick R, Lamb R, Shipley M. Patterns of coping in rheumatoid arthritis. *Psychol Health* 1990; 4: 187–200.
19. Anderson KO, Keefe FJ, Bradley LA, *et al*. Prediction of pain behavior and functional status of rheumatoid arthritis patients using medical status and psychological variables. *Pain* 1988; 33: 25–32.
20. American Thoracic Society. Standards for diagnosis and care of patients with chronic pulmonary disease (COPD) and asthma. *Am Rev Respir Dis* 1985; 137: 225–244.
21. Quanjer PhH. Standardized lung function testing. Report of Working Party "Standardization of Lung Function Tests" of the European Coal and Steel Community. *Bull Eur Respir J* 1993; 6, Suppl. 16: 5–40.
22. Fahrenberg J, Myrtek M, Wilk D, Kreutel K. Multimodale Erfassung der Lebenszufriedenheit: Eine Untersuchung an Herz-Kreislauf-Patienten. *Psychother Med Psychol* 1986; 36: 347–354.
23. Roder JD, Herschbach P, Sellschopp A, Siewert JR. Quality of life assessment following oesophagectomy. *Theor Surg* 1991; 6: 206–210.
24. Harrer ME, Mosheim R, Richter R, Walter MH, Kemmler G. Coping and quality of life of Hodgkin's disease survivors: a contribution to the problem of adaptivity of coping. *Psychother Psychosom Med Psychol* 1993; 43: 121–132.
25. Albus C, Ollenschlager G, Thomas W, Fischer H, Peters R. Evaluation of a diabetes education program: does additional psychosomatic intervention improve its efficacy? *Klin Wochenschr* 1990; 68: 77–82.
26. Huber D, Heinrich G, Herschbach P. Measuring the quality of life: a comparison between physically ill patients and healthy persons. *Pharmacopsychiatry* 1988; 21: 453–455.
27. Henrich G, Herschbach P, von Rad M. "Lebensqualität" in alten und neuen Bundesländern. *Psychother Med Psychol* 1992; 42: 31–32.
28. Muthny F. Freiburger Fragebogen zur Krankheitsverarbeitung. Weinheim, Beltz, 1989.
29. Breetvelt IS, van Dam FSAM. Underreporting by cancer patients: the case of response-shift. *Soc Sci Med* 1991; 32: 981–987.
30. Buddeberg C, Frei R, Limacher B, Merz J. Krankheitsverarbeitung von chronisch körperlich Kranken-erste Erfahrungen mit dem Zürcher Fragebogen zur Krankheitsverarbeitung (ZKVB). *Schweiz Arch Neurol Psychiatr* 1988; 139: 23–40.
31. Buchi S, Buddeberg C, Sieber M. Die Bedeutung somatischer und psychosozialer Faktoren für die Krankheitsverarbeitung von Multiple-Sklerose Kranken. *Nervenarzt* 1989; 60: 641–646.
32. Felton BJ, Revenson TA. Coping with chronic illness: a study of illness controllability and the influence of coping strategies on psychological adjustment. *J Consult Clin Psychol* 1984; 52: 343–353.
33. Atkins CJ, Kaplan RM, Timms RM, Reinsch S, Lofback K. Behavioural exercise programmes in the management of chronic obstructive pulmonary disease. *J Consult Clin Psychol* 1984; 52: 591–603.
34. Sensky T. Patients' reactions to illness: cognitive factors determine responses and are amenable to treatment. *BMJ* 1990; 300: 622–623.
35. Sensky T. Cognitive therapy in physical illness. *In*: Hodes M, Moorey S, eds. Psychological Treatment in Human Disease and Illness. London, Gaskell Press, 1993; pp. 30–45.
36. Williams SJ. Chronic respiratory illness and disability: a critical review of the psychosocial literature. *Soc Sci Med* 1989; 28: 791–803.