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ORIGINAL REPORT

ILLNESS BELIEFS AND TREATMENT BELIEFS AS PREDICTORS OF SHORT-TERM AND MEDIUM-TERM OUTCOME IN CHRONIC BACK PAIN

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***Objective:* Patients' illness beliefs were shown to be more relevant than other psychosocial factors of influence for predicting outcome in back pain in primary care. The aim of this study was to determine whether illness beliefs and beliefs about rehabilitation are predictors of functioning, pain intensity, and coping with pain after rehabilitation in a population with longstanding chronic back pain.**

***Design and patients:* The study included 110 patients with longstanding chronic back pain in a longitudinal study design with 3 measurement points (before rehabilitation, end of rehabilitation, and 6 months follow-up).**

***Methods:* Hierarchical multiple regression analyses were conducted to test the relative contribution of illness beliefs and beliefs about rehabilitation to the rehabilitation outcomes while adjusting for baseline values of outcome measures, mental health, sociodemographic, and illness-related variables.**

***Results:* Illness beliefs and beliefs about rehabilitation made a significant contribution to the prediction of rehabilitation outcomes. In the short and medium term, incremental variance for coping with pain was as much as 13%, for functioning up to 14%, and for pain intensity between 6% and 9%.**

***Conclusion:* Further studies should be conducted as a confirmatory test of our preliminary results and to test the relative relevance of these constructs compared with other yellow flags for chronic patient samples.**

Key words: Common Sense Model of self-regulation; illness beliefs; treatment beliefs; back pain; rehabilitation outcome.

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INTRODUCTION

Low back pain is a major health problem (1) and one of the most expensive illnesses in industrialized countries. With respect to the transition from acute to chronic low back pain (CLBP), increasing evidence demonstrates the importance of psychosocial factors ("yellow flags"), such as emotional distress, catastrophizing, or fear avoidance beliefs, although the latter factors appear to be relevant in particular with respect to adjusting to persistent pain (2).

While much research has been devoted to investigating psychological factors separately, recent studies have attempted to identify the relative weight of different variables in predicting pain-related outcomes (3). Comparing 20 potentially predictive factors, Foster et al. (4) could not confirm the independent importance of depression, catastrophizing, or fear avoidance as predictors of outcomes in back pain in primary care. Instead, self-efficacy and patients' illness beliefs were found to be "key psychological obstacles" (4, p. 8) for recovery in this population.

A theoretical framework that highlights the importance of illness beliefs is the Common Sense Model of self-regulation (CSM) (5). According to the CSM, cognitive and emotional illness representations determine the selection of coping procedures and health outcomes. Cognitive illness representations are composed of 5 interrelated components; identity (symptoms and "diagnostic label" associated with the illness), causal beliefs, timeline beliefs, beliefs about control/cure, and beliefs about consequences (6). Focusing on treatment beliefs in addition to illness beliefs, Horne (7) postulated an extended self-regulatory model.

The theoretical assumptions of the CSM particularly concerning relationships between illness beliefs, coping procedures, and different health outcomes have been empirically confirmed in many diseases (6, 8) and in many settings including multidisciplinary (vocational) rehabilitation (9). The impact of illness beliefs (10) and an extended self-regulatory model including medication beliefs (11) was also supported in different pain populations. Although treatment beliefs with respect to non-medication treatment have been studied far less frequently, preliminary results indicate the importance of perceived treatment control for compliance with physiotherapy in patients with osteoarthritis (12).

However, there is a lack of research examining illness beliefs with respect to CLBP, especially using the CSM (11, 13). Beliefs about multimodal treatment concepts, such as those offered in the rehabilitation context, have not yet been studied on the basis of the CSM, to the best of the authors' knowledge, although multidisciplinary biopsychosocial rehabilitation programmes are largely applied for these patients.

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Furthermore, most illness perception studies to date have been carried out to demonstrate relationships between illness beliefs and health outcomes. By contrast, relatively little work has been reported regarding interventions that were developed on the basis of the CSM. Existing results from intervention studies, conducted mainly on patients with coronary heart disease, are promising (14). In CLBP patients as well, it has already been shown that the CSM can be a useful treatment theory for evaluating the effectiveness of cognitive treatment of illness beliefs (15). Furthermore, the effects of cognitive therapy for illness beliefs on reducing activity limitations were proven (16) and predictors were derived for cognitive therapy of illness perceptions (17).

In an own study, informing rehabilitation patients about illness and treatment, taking their illness and treatment beliefs into consideration, improved the perception of CLBP as being personally controllable and resulted in patients assessing that their information needs were met to a greater extent compared with patients who received care-as-usual information. However, with respect to functioning, the intervention was not effective. The results of the intervention study are reported elsewhere (18).

With respect to the further development of interventions of this kind, it would be worthwhile elaborating in more detail which belief dimensions are the strongest predictors of outcome, especially for CLBP, and focus more strongly on these dimensions in the interventions. This approach is used in this study, the aim of which was to determine whether illness beliefs and beliefs about rehabilitation care are predictors of rehabilitation outcome in CLBP and if so, which ones. Prior to doing so, we conducted an exploratory study of the outcomes after rehabilitation.

METHODS

Design

In Germany, inpatient rehabilitation for CLBP usually lasts an average of 3 weeks and the patient generally has 4–5 therapy sessions a day on workdays. Rehabilitation programmes are characterized by a multimodal and interdisciplinary approach. They usually include patient education, physical therapy, health education programmes, occupational therapy, and psychological treatment, mainly in groups. However, altering illness beliefs is not an explicit or standardized component of the rehabilitation programmes. In order to tailor information about illness and treatment to patients' needs and by doing so, improve health outcomes, we developed and evaluated an intervention that applied the extended CSM during inpatient rehabilitation for patients with CLBP (18). The intervention study was conducted between December 2008 and April 2010 in 4 orthopaedic rehabilitation centres. The control group of the intervention study (18) was used for the predictor question reported here, as this group did not receive the intervention whose objective was to elaborate more adaptive illness beliefs.

This was a prospective study with 3 measurement points. Two weeks before the start of rehabilitation, patients completed questionnaires assessing illness beliefs, beliefs about rehabilitation, and baseline health status. Rehabilitation outcome was assessed at the end of rehabilitation (short term) and at a 6-month follow-up (medium term). All patients over the age of 18 years diagnosed with CLBP were included in the sample. Criteria for exclusion were disc surgery within the last 6 months, indication of an inflammatory or neoplastic origin, orientation disorders and psychiatric illnesses (such as psychotic illnesses), or application for early retirement. Only those patients were included in the study who had given their written informed consent to participate. The study was approved by the ethics committee of the University Freiburg Medical Center (approval No. 33/08).

Measures

Functioning, pain intensity, and coping with pain were selected as rehabilitation outcome indicators. Functioning was operationalized using the German versions of the Short Form-36 (SF-36) (19, 20) and the Oswestry Disability Index (ODI) (21, 22). Pain intensity was assessed using a visual analogue scale (VAS) ranging from 0–100, and coping with pain was assessed with the "German pain coping questionnaire" (FESV) (23). With this psychometrically-tested instrument, cognitive and behavioural coping strategies are measured using 24 items and 6 scales. The theme of the "Action-oriented coping" scale is the patient's knowledge about how to deal with or overcome pain. "Cognitive restructuring" refers to the patient's mental ability to relativize and accept pain as a part of life. The "Self-efficacy" scale addresses self-confidence and the capacity to "keep in good spirits" despite pain. "Mental distraction" measures the patients' ability to distract the attention from pain through visual and acoustic stimuli to alternative senses. The "Counter-activities" scale focuses on directing one's attention away from the pain and into physical or social activities. Finally, "Relaxation" addresses the extent to which patients can relax their bodies and reduce pain-related muscle tension. Empirically, higher scores of the FESV's coping dimensions predicted pain reduction (23). Thus, the increase in all the aforementioned behavioural and cognitive coping strategies is interpreted as a positive effect in the questionnaire manual and in studies measuring change after pain therapy (23–25). We concur with this viewpoint in our study. The scales of the FESV range from 4 to 24; higher values represent a higher degree of expression of the content of the scale.

To operationalize illness beliefs and beliefs about rehabilitation, instruments based on the extended CSM were used. Illness beliefs were measured using the German version (26) of the Illness Perception Questionnaire-Revised (IPQ-R) (27), which has shown good psychometric quality (28). The first section of the IPQ-R addresses the question as to whether patients have experienced different symptoms in the course of the disease and whether they believe these symptoms are caused by the illness ("Identity" scale). In the present study, following the recommendations of Moss-Morris et al. (27), the identity scale was modified in order to suit the illness studied here by adding symptoms related to back pain (such as radiation of pain) to the standard list of symptoms.

The items in the second section can be assigned to the scales "Timeline Chronic-Acute" (e.g. "My back pain will last for a long time"), "Timeline Cyclical" (e.g. "My symptoms come and go in cycles"), "Consequences" (e.g. "My back pain has major consequences on my life"), "Personal Control" (e.g. "Nothing I do will affect my back pain"), "Treatment Control" (e.g. "My treatment will be effective in curing my back pain") "Coherence" (e.g. "I have a clear picture or understanding of my condition") and "Emotional Representation" (e.g. "I get depressed when I think about my back pain"). Patients' causal beliefs are measured in the third section. In an own project (data not published) with a larger sample of patients with chronic back pain ($n=201$), Cronbach's alpha for the IPQ-R scales was between 0.71 and 0.87, however, the value of 0.65 for the scale "Timeline Cyclical" was too low, so this scale was excluded from further analyses.

Beliefs about rehabilitation were measured using the "Beliefs about Rehabilitation Questionnaire" (BRQ) (29), which was developed along the lines of the Beliefs about Medicines Questionnaire (30). Psychometric testing of the BRQ in patients with back pain was satisfactory (29). With 23 items on 4 scales, the BRQ reflects the "Psychological outcome expectation" (e.g. "I expect to see improvement in my psychological condition as a result of rehabilitation") (Cronbach's alpha 0.83), "Somatic outcome expectation" (e.g. "I expect to learn to have an active life despite my pain as a result of rehabilitation") (Cronbach's alpha 0.67), "Process expectations" (e.g. "I expect that all treatments will be explained in the initial meeting with the physician") (Cronbach's alpha 0.88), and rehabilitation-related "Concerns" (e.g. "I am afraid that the rehabilitation will have negative consequences for my private life (such as long absences from my family))" (Cronbach's alpha 0.79). Due to the relatively low Cronbach's alpha, the scale "somatic outcome expectation" was excluded from further analyses.

Statistical analyses

Differences between drop-outs and patients who remained in the study until follow-up were tested using the *t*-test, Mann-Whitney *U* test, and χ^2 tests. Changes in rehabilitation outcomes were analysed using *t*-tests for dependent samples; standardized effect sizes (SES) were calculated to quantify the effects. Following Cohen (31) small, medium, and large effect sizes were defined as $d = 0.20$, 0.50, and 0.80, respectively. Hierarchical multiple regression analyses were conducted to test the relative contribution (changes in R^2) to outcome of illness beliefs and beliefs about rehabilitation while controlling for the baseline values of outcome measures, mental health, sociodemographic, and illness-related variables. Dependent variables were SF-36, FESV, and ODI values at the end of rehabilitation and at follow-up. In the first step, the baseline values of the respective rehabilitation outcomes and mental health (using the corresponding SF-36 scale) were entered into the regression. In the second step, sociodemographic and illness-related variables (age, sex, level of education, and duration of illness) were added, and in the third step, illness beliefs and beliefs about rehabilitation were entered into the regression models. Categorical variables were dummy coded (see Tables II–V). The variance inflation factor (VIF) was calculated to assess multicollinearity. Values above 5 can be considered an indication of multicollinearity (32).

The percentage of missing values was relatively low in the scales used for predictors and outcomes (maximum 6.7%). However, since list-wise deletion in the regression analyses would have led to a reduction in the data-set and to a decrease in external validity, missing values were replaced using the NORM program (33) according to the expectation maximization algorithm.

Response rate and sample characteristics

Of the eligible patients ($n = 188$), 110 patients were included in the study (59%). Reasons for non-participation (78 patients) were unwillingness to participate (38 patients) or organizational problems such as refusal of rehabilitation (27 patients). For 13 patients, no reason for exclusion was given. At the end of rehabilitation, the response rate was 95% ($n = 105$), and at the follow-up 74% ($n = 81$). With respect to age ($p = 0.94$), gender ($p = 0.11$), duration of illness ($p = 0.62$), and intensity of pain ($p = 0.48$), there were no differences between the $n = 29$ patients who dropped out of the study at follow up and responders. However, the drop-outs displayed greater disability than study participants in the ODI ($p = 0.02$).

Table I presents patient characteristics of those patients for whom complete data were available at the end of rehabilitation.

Table I. *Patient characteristics; totals that do not add up to n = 105 are the result of missing values*

Patient characteristics	
Age years, mean (SD)	54.01 (11.0)
Sex, *n* (%)	
Female	66 (62.9)
Male	37 (35.2)
Living with a partner, *n* (%)	
Yes	78 (74.3)
No	24 (22.9)
Level of education, *n* (%)	
Elementary school	47 (44.8)
Secondary school	18 (17.1)
Polytechnic secondary school	13 (12.4)
Technical college qualification	9 (8.6)
University qualification	10 (9.5)
Other or no certificate	3 (2.9)
Employment status, *n* (%)	
Employed	62 (59.0)
Unemployed	6 (5.7)
Homemaker	3 (2.9)
Retires	18 (17.1)
Other	7 (6.7)
Duration of illness, *n* (%)	
< 1 year	4 (3.8)
1–2 years	14 (13.3)
3–5 years	15 (14.3)
6–10 years	13 (12.4)
> 10 years	52 (49.5)

SD: standard deviation.

RESULTS

At the end of rehabilitation, there were significant, but low, increases in cognitive restructuring (SES = 0.21) and relaxation (SES = 0.38). The effect was moderate for pain intensity (SES = –0.57). Significant improvements for functioning were achieved, with effects in the small to moderate range (highest SES = 0.62 for SF-36 Bodily Pain). At follow-up, coping with pain improved significantly with small to moderate effects with respect to action-oriented coping (SES = 0.43), cognitive restructuring (SES = 0.49), self-efficacy (SES = 0.24), and relaxation (SES = 0.26). There were also significant improvements with respect to the majority of the scales of the SF-36. The effects were smaller than at the end of rehabilitation and generally in the small range, but moderate effects were still measured for pain using SF-36 (SES = 0.51) and VAS (SES = –0.41).

The VIF values in the final regression models were all less than 5. At the end of rehabilitation (Table II), between 28% and 52% of variance was explained for coping with pain. The baseline value was the strongest predictor in all cases. A maximum of 4% of incremental variance was explained by the sociodemographic and illness-related variables and a maximum of 13% by illness beliefs and beliefs about rehabilitation. A psychological outcome expectation, treatment control, less pronounced subjective coherence, and the causal belief "overwork" were associated with greater gains in 4 of the 6 coping scales.

Between 24% and 68% of the variance was explained for functioning (Table III). The sociodemographic and illness-related variables were included for 3 scales and explained maximum 6% of incremental variance. Illness beliefs were relevant for 7 scales with a maximum of 14% explained incremental variance. Perceived consequences, emotional representation, and subjectively higher coherence were associated with a poorer outcome. Finally, 29% of intensity of pain was explained. In addition to the baseline value, perceived consequences and little treatment control showed an increase in variance of 9%.

At follow-up, between 23% and 37% of variance for coping with pain was explained (Table IV). The baseline value

Table II. *Prediction of short term coping with pain using hierarchical regression analyses (FESV: German pain coping questionnaire),* n = *105*

Outcome	FESV coping with pain cognitive: Action oriented coping	FESV coping with pain cognitive: Cognitive restructuring	FESV coping with pain cognitive: Self efficacy	FESV coping with pain behavioural: Mental distraction	FESV coping with pain behavioural: Counter-Activities	FESV coping with pain behavioural: Relaxation
Step 1: Baseline health status and mental health: Changes in R^2	0.22	0.37	0.37	0.33	0.53	0.29
Step 2: Baseline health status, mental health, sociodemographic and disease-related variables: Changes in R^2	–	–	0.04	0.03	–	–
Step 3: Baseline health status, mental health, sociodemographic variables, disease-related variables, illness beliefs and treatment beliefs: Changes in R^2	0.09	0.07	0.04	0.13	–	–
Predictors	β (*p*)	β (*p*)	β (*p*)	β (*p*)	β (*p*)	β (*p*)
Baseline value	0.38 (<0.001)	0.57 (<0.001)	0.58 (<0.001)	0.53 (<0.001)	0.73 (<0.001)	0.54 (<0.001)
Mental health			0.18 (0.028)			
Age						
Sex: female						
Elementary school				–0.21(0.005)		
Secondary school						
College/university						
Illness duration 0–5 years			0.18 (.021)			
Illness duration > 5 years						
Psychological outcome expectation	0.22 (0.012)	0.20 (0.010)				
Process expectations						
Rehabilitation-specific concerns						
Identity						
Timeline acute-chronic						
Consequences						
Personal control						
Treatment control	0.20 (0.022)			0.21 (0.008)		
Coherence				–0.20 (0.006)		
Emotional representation						
Cause: overwork		0.17 (0.029)	0.21 (0.011)	0.21 (0.006)		
Total variance, %						
R^2	31.4	43.4	43.9	49.1	52.5	28.9
Adjusted R^2	29.4	41.7	41.6	46.6	52.0	28.2

FESV: higher scores indicate better coping with pain (range 4–24); IPQ-R (Illness Perception Questionnaire-Revised) and BRQ (Beliefs about Rehabilitation Questionnaire): values represent the scale content; only β ($p < 0.05$) are displayed. β: standardized beta-coefficients.

was always the strongest and sometimes the only predictor. A maximum of 11% of incremental variance was explained by adding the sociodemographic and illness-related variables and a maximum of 4% by adding illness and treatment beliefs. Perceived treatment control and lower emotional representation proved to be predictors of a gain in self-efficacy and relaxation.

Between 13% and 55% of variance was explained for functioning at follow-up (Table V). The sociodemographic and illness-related variables were included for 3 scales and explained a maximum of 3% of incremental variance. Illness beliefs were relevant for 8 scales with a maximum of 14% explained incremental variance. Lower psychological outcome expectations, more pronounced process expectations, higher illness identity, perceived chronic timeline, less treatment control, and emotional representation were associated with a poorer outcome. Finally, 31% of intensity of pain was explained. In addition to the baseline value, perceived chronic timeline was associated with greater intensity of pain. The increase in variance was 6%.

DISCUSSION

The aim of this study was to analyse the impact of illness and treatment beliefs on the rehabilitation outcome for CLBP patients. Taken together, illness beliefs and beliefs about rehabilitation made a significant contribution to the prediction of different rehabilitation outcome indicators while controlling for baseline values, mental health, and sociodemographic and illness-related variables. In the short and medium term, the percentage of incremental variance for coping with pain was as much as 13%, for functioning up to 14%, and for pain intensity between 6% and 9%.

Thus, the predictive power of illness and treatment beliefs regarding functioning and pain intensity clearly exceeds that of sociodemographic and illness-related variables at both measurement points, although, deviating from findings in which sociodemographic variables frequently do not significantly contribute to the prediction of pain intensity or disability in

Table III. *Prediction of short-term outcome using hierarchical regression analyses (pain intensity, Short Form-36 (SF-36), Oswestry Disability Index (ODI)),* n = *105*

Outcome	Pain visual analogue scale	SF-36 physical functioning	SF-36 Role physical	SF-36 Bodily Pain	SF-36 General health	SF-36 Vitality	SF-36 Social functioning	SF-36 Role emotional	SF-36 Mental health	Oswestry Disability Index
Step 1: Baseline health status and mental health: Changes in R^2	0.23	0.64	0.34	0.25	0.61	0.47	0.34	0.21	0.38	0.64
Step 2: Baseline health status, mental health, sociodemographic and disease-related variables: Changes in R^2	–	–	–	–	0.03	–	0.06	–	0.06	–
Step 3: Baseline health status, mental health, sociodemographic variables, disease-related variables, illness beliefs and treatment beliefs: Changes in R^2	0.09	0.02	–	0.14	0.04	0.03	0.08	0.04	–	0.05
Predictors	β (*p*)	β (*p*)	β (*p*)	β (*p*)	β (*p*)	β (*p*)	β (*p*)	β (*p*)	β (*p*)	β (*p*)
Baseline value	0.37 (<0.001)	0.80 (<0.001)	0.59 (<0.001)	0.40 (<0.001)	0.65 (<0.001)	0.62 (<0.001)	0.50 (<0.001)		0.64 (<0.001)	0.81 (<0.001)
Mental health								0.37 (<0.001)		
Age										
Sex: female									0.24 (0.002)	
Elementary school										
Secondary school										
College/university					0.14 (0.022)					
Illness duration 0–5 years										
Illness duration > 5 years										
Psychological outcome expectation										
Process expectations										
Rehabilitation-specific concerns										
Identity										
Timeline acute–chronic										
Consequences	0.24 (0.011)			–0.33 (<0.001)	–0.23 (0.001)	–0.19 (0.012)	–0.26 (0.002)			
Personal control										
Treatment control	–0.17 (0.045)									
Coherence		–0.12 (0.041)		–0.20 (0.012)			–0.17 (0.028)			0.22 (<0.001)
Emotional representation								–0.22 (0.019)		
Cause: overwork										
Total variance, %										
R^2	31.4	65.7	34.3	38.3	67.0	50.3	48.2	25.0	43.3	68.5
Adjusted R^2	29.3	65.0	33.7	36.4	66.0	49.3	45.6	23.5	42.2	67.8

Pain visual analogue scale: higher values represent higher pain intensity (range 0–100); SF-36: higher scores indicate better health; ODI: higher scores indicate greater disability (range 0–100); IPQ-R (Illness Perception Questionnaire-Revised) and BRQ (Beliefs about Rehabilitation Questionnaire): values represent the scale content; only β ($p < 0.05$) are displayed. β: standardized beta-coefficients.

patients with CLBP (34), education, sex, and illness duration were significant predictors for some outcome indicators in our study.

With respect to content, we found that some illness belief dimensions were relevant only for some rehabilitation outcomes and had low regression coefficients overall. Other illness beliefs dimensions, however, proved to be quite stable predictors, in some cases with regression coefficients whose strength approached that of the baseline values.

Improvements in coping with pain were particularly associated with the perception of CLBP as controllable by treatment, the belief that the illness was caused by "overwork", and the expectation that the rehabilitation should result in improvements with respect to psychological aspects of health.

Regarding pain intensity and function, as in patients with low back pain in primary care (13), primarily the perception of serious consequences and the belief that the problem was long-term proved to be predictive of a poorer outcome. While high illness

Table IV. *Prediction of middle term coping with pain using hierarchical regression analyses (FESV: German pain coping questionnaire),* n = *81*

Outcome	FESV coping with pain cognitive: Action-oriented coping	FESV coping with pain cognitive: Cognitive restructuring	FESV coping with pain cognitive: Self-efficacy	FESV coping with pain behavioural: Mental distraction	FESV coping with pain behavioural: Counter-Activities	FESV coping with pain behavioural: Relaxation
Step 1: Baseline health status and mental health: Changes in R^2	0.25	0.25	0.24	0.32	0.24	0.33
Step 2: Baseline health status, mental health, sociodemographic and disease-related variables: Changes in R^2	–	0.11	0.05	0.08	–	–
Step 3: Baseline health status, mental health, sociodemographic variables, disease-related variables, illness beliefs and treatment beliefs: Changes in R^2	–	–	0.04	–	–	0.04
Predictors	β (*p*)	β (*p*)	β (*p*)	β (*p*)	β (*p*)	β (*p*)
Baseline value	0.50 (<0.001)	0.47 (<0.001)	0.35 (0.001)	0.55 (<0.001)	0.49 (<0.001)	0.53 (<0.001)
Mental health						
Age						
Sex: female				0.20 (0.030)		
Elementary school						
Secondary school		0.25 (0.009)				
College/university						
Illness duration 0–5 years		0.26 (0.007)		0.20 (0.029)		
Illness duration > 5 years						
Psychological outcome expectation						
Process expectations						
Rehabilitation-specific concerns						
Identity						
Timeline acute–chronic						
Consequences						
Personal control						
Treatment control			0.21 (0.044)			
Coherence						
Emotional representation						–0.24 (0.028)
Cause: overwork						
Total variance, %						
R^2	24.7	35.6	32.2	39.6	23.8	37.2
Adjusted R^2	23.7	33.1	28.6	37.3	22.9	34.8

FESV: higher scores indicate better coping with pain (range 4–24); IPQ-R (Illness Perception Questionnaire-Revised) and BRQ (Beliefs about Rehabilitation Questionnaire): values represent the scale content; only β ($p < 0.05$) are displayed. β: standardized beta-coefficients.

identity, i.e. attributing a range of symptoms to back pain, was also associated with disability in our study (4), it was to a clearly lesser extent than perceived consequences and timeline beliefs. Although mental health was controlled for, high emotional impact of the illness was a predictor of worse general health and emotional function. On the other hand, beliefs in the controllability of CLBP proved to be associated with better outcomes regarding pain intensity, social functioning, and mental health. However, control referred to the perception of control by treatment, while perceptions of control by own behaviour (personal control), unlike for Foster et al. (4), were not predictive of any outcome indicator in our study. It is possible that the attribution of perceived controllability shifts from personal to treatment control over the various phases of the illness and with increasing duration of chronicity. In any case, a shorter period of illness was predictive for cognitive and behavioural coping with pain, which underlines the relevance the phase of the illness has for the level of pain-related cognitions and behaviours.

The result that subjectively high coherence, in other words a better understanding of the illness, was associated with a poorer outcome in the short term may seem implausible at first glance. However, we do not know what lies behind high subjective coherence. It is conceivable, for instance, that patients who represent their illness and treatment in a way that hampers adequate pain management also subjectively express high coherence. Thus far, it could be shown that many patients represent their back pain following a biomedical model (35), that patients' beliefs are associated with professional beliefs (36), and that biomedical professional beliefs limit adherence to treatment guidelines and psychosocial pain management (36). Analysing in-depth contents of illness beliefs of CLBP patients who have an explicitly coherent perception of their illness could therefore be an interesting research topic for future studies (see 15).

In comparison with illness beliefs, beliefs about rehabilitation were weaker predictors. However, as was the case with coping, the expectation that the rehabilitation would result in improvements

Table V. *Prediction of middle term outcome using hierarchical regression analyses (pain intensity, Short Form-36 (SF-36), Oswestry Disability Index (ODI)); n = 81*

Outcome	Pain visual analogue scale	SF-36 physical functioning	SF-36 Role physical	SF-36 Bodily Pain	SF-36 General health	SF-36 Vitality	SF-36 Social functioning	SF-36 Role emotional	SF-36 Mental health	Oswestry Disability Index
Step 1: Baseline health status and mental health: Changes in R^2	0.27	0.52	0.33	0.28	0.39	0.31	0.43	0.14	0.45	0.50
Step 2: Baseline health status, mental health, sociodemographic and disease-related variables: Changes in R^2	–	0.03	–	–	–	–	0.03	–	–	0.03
Step 3: Baseline health status, mental health, sociodemographic variables, disease-related variables, illness beliefs and treatment beliefs: Changes in R^2	0.06	0.03	0.04	0.14	0.03	0.08	0.06	–	0.03	0.03
Predictors	β (*p*)	β (*p*)	β (*p*)	β (*p*)	β (*p*)	β (*p*)	β (*p*)	β (*p*)	β (*p*)	β (*p*)
Baseline value	0.38 (0.001)	0.68 (<0.001)	0.52 (<0.001)	0.37 (<0.001)	0.59 (<0.001)	0.50 (<0.001)	0.35 (0.002)		0.65 (<0.001)	0.60 (<0.001)
Mental health							0.34 (0.002)	0.37 (0.001)		
Age										
Sex: female										
Elementary school										
Secondary school										
College/university										
Illness duration 0–5 years		0.17 (.022)								
Illness duration > 5 years										
Psychological outcome expectation				0.20 (0.023)						
Process expectations		–0.17 (0.034)								
Rehabilitation-specific concerns										
Identity										0.20 (0.025)
Timeline acute-chronic	0.28 (0.011)		–0.20 (0.038)	–0.38 (<0.001)		–0.29 (0.002)				
Consequences										
Personal control										
Treatment control							0.26 (0.003)		0.18 (0.030)	
Coherence										
Emotional representation					–0.18 (0.049)					
Cause: overwork										
Total variance, %										
R^2	32.6	57.1	37.0	41.8	42.3	38.9	51.6	13.7	48.2	55.8
Adjusted R^2	30.9	55.4	35.4	39.5	40.8	37.4	49.0	12.6	46.8	54.0

Pain visual analogue scale: higher values represent higher pain intensity (range 0–100); SF-36: higher scores indicate better health; ODI: higher scores indicate greater disability (range 0–100); IPQ-R (Illness Perception Questionnaire-Revised) and BRQ (Beliefs about Rehabilitation Questionnaire): values represent the scale content; only β ($p < 0.05$) are displayed. β: standardized beta-coefficients.

with respect to psychological aspects of health was associated with better outcomes for physical pain in the medium term.

The relevance of psychological variables for predicting the outcome in patients with CLBP has been the subject of numerous studies. However, among the psychological variables there is a lack of research examining illness beliefs, especially using the CSM (11, 13), although in other diseases, illness beliefs proved to be relevant predictors of outcomes and thus, as potentially modifiable variables (37), offer many approaches for improving patient outcomes. Foster et al. (13) showed that illness beliefs are highly relevant predictors for recovery in patients with back pain in primary care. However, in that study, 63% of patients reported low back pain of an acute duration, while only 11% reported that the current episode had lasted for more than 3 years. In our study we were able to supplement these results in two ways, by investigating a sample with longstanding CLBP and by examining illness beliefs as well as rehabilitation beliefs. To date, beliefs about multimodal treatment concepts, such as those offered in the rehabilitation context, have not yet been studied on the basis of the CSM to the best of the authors' knowledge, although multidisciplinary biopsychosocial rehabilitation programmes are largely applied for these patients.

The results presented here have some practical implications. In future, it would be worthwhile addressing jointly with patients, those, possibly maladaptive, illness beliefs in particular that were shown to be predictors of a poor outcome: beliefs about (poor) control, about timeline and about the consequences of back pain. In this regard it could be explored which concrete beliefs the patient has about these dimensions (does he or she think back pain can be controlled by personal behaviour? What influence does he or she attribute to various therapy strategies? What disease course does he or she anticipate? What consequences does he or she expect in everyday life and life itself?), and is there a mismatch between the patient's and therapist's disease model? If so, what can be done to change the patient's illness beliefs in a way that supports successful adjustment to the disease? Considering the relevance of the beliefs about rehabilitation, it should also be attempted to support patients in developing a biopsychosocial model of CLBP, not only with respect to the illness, but also with respect to the rehabilitation treatment. The potential that lies in integrating behaviour-related components of the CSM is evident from recent studies, which focus on adherence to self-management strategies (38). A further development of CSM-based interventions could therefore be to address behaviour-related action plans in addition to illness and treatment beliefs.

However, since the findings presented here are to be viewed as preliminary results for the time being, confirmatory verification in a larger sample would be useful.

Our study has several limitations. Only 59% of eligible patients could be included in the study. As the non-responders did not give their consent to having their data analysed, it was not possible to conduct a non-responder analysis. At the end of rehabilitation and at follow-up, the response rate was relatively high. However, patients who dropped out of the study at follow-up had a greater disability than the participants, which further limits the generalizability to the initial sample. Another limitation involves the relatively small sample size at follow-up, although the study had enough power to detect significant results. The number of regressions carried out and the number of predictor variables also need to be taken into consideration when interpreting the results. Due to the large number of analyses, alpha error inflation cannot be ruled out. Therefore, in particular the weaker regression coefficients that have reached significance should be interpreted with caution and as preliminary results. Mental health was assessed using the corresponding SF-36 scale. A more comprehensive assessment of emotional distress could possibly have led to other results. Furthermore, other predictors relevant for predicting the outcome for CLBP were not taken into consideration, so that no statement can be made about the relative predictive power of these constructs. The simultaneous measurement of a broader set of potential, overlapping variables in CLBP could be a topic for future research.

We used coping with pain as a rehabilitation outcome because improvement in coping with pain is a rehabilitation goal (39). As some coping strategy patterns on an individual patient basis could interfere with adequate pain management, this construct is not necessarily equivalent to a (positive) "pain outcome".

Another limitation is that only low effect sizes were reached on some scales and therefore only predictors with a pronounced effect could be proven to be significant. However, overall, the effects were comparable with results from other studies of the German rehabilitation system (40).

There were also several strengths of our study. Applying a longitudinal design, outcome prediction was adjusted for baseline health status, mental health, and sociodemographic and illness-related variables. The selected outcome domains and their operationalizations were in line with recommendations from a recent overview evaluating outcomes for measuring treatment success in CLBP (41). The concepts, which were examined as potential predictors, were selected following a theory-driven rationale, and the conceptualization of treatment beliefs covers a treatment strategy relevant for CLBP.

In conclusion, illness beliefs and beliefs about rehabilitation predict the outcome of rehabilitation in patients with longstanding chronic back pain even while controlling for baseline health status, mental health, sociodemographic and illness-related variables. While our study has some methodological weaknesses and does not make any statement on the relative predictive power of illness and treatment beliefs in comparison with other psychosocial yellow flag factors, a recent study suggests that in less chronic populations, illness beliefs supersede other yellow flags (4). This result should also be verified in chronic samples to obtain further information for developing therapeutic interventions with the aim of adapting illness beliefs and self-management strategies.

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