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# The role of fear-avoidance beliefs in acute low back pain: relationships with current and future disability and work status

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**Abstract**

Fear-avoidance beliefs have been identified as an important psychosocial variable in patients with chronic disability doe to low back pain. The importance of fear-avoidance beliefs for individuals with acute low back pain has not been explored. Seventy-eight subjects with work-related low back pain of less than 3 weeks'duration were studied. Measurements of pain intensity, physical impairment, disability, nonorganic signs and symptoms, and depression were taken at the initial evaluation. Fear-avoidance beliefs were measured with the work and physical activity subscales of the Fear-avoidance Beliefs Questionnaire. Disability and work status were re-assessed after 4 weeks of physical therapy. Patterns of correlation between fear-avoidance beliefs and other concurrently-measured variables were similar to those reported in patients with chronic low back pain. Fear-avoidance beliefs did not explain a significant amount of the variability in initial disability levels after controlling for pain intensity and physical impairment. Fear-avoidance beliefs about work were significant predictors of 4-week disability and work status even after controlling for initial levels of pain intensity, physical impairment, and disability, and the type of therapy received. Fear-avoidance beliefs are present in patients with acute low back pain, and may be an important factor in explaining the transition from acute to chronic conditions. Screening for fear-avoidance beliefs may be useful for identifying patients at risk of prolonged disability and work absence. 

*Keywords*: Low back pain; Fear avoidance beliefs; Screening; Secondary prevention

## 1. Introduction

Although episodes of acute low back pain (LBP) are a nearly universal human experience, the subsequent development of chronic disability and diminished work capacity occurs in only a limited percentage of individuals (Spitzer, 1987; Thomas et al., 1999). Despite the relatively low occurrence of chronic disability in patients with acute LBP, the economic impact of this subset of patients is substantial. In 1987 the Quebec Task Force on Spinal Disorders reported that 7% of individuals with work-related LBP accounted for 76% of compensation costs and work absence due to low back pain (LBP) (Spitzer, 1987). A more recent population-based study conducted in Sweden reported that 6% of individuals with LBP accounted for 41% of the total health care visits (Linton et al., 1998). Work absenteeism showed a similarly skewed distribution, with only a minority of LBP sufferers (19%) reporting 1 or more days of sick leave.

Increasing amounts of research have been directed towards identifying risk factors for chronic disability and prolonged work loss. Several studies have found that initial pain intensity and physical impairments such as limited range of motion or diminished straight leg raising are of little prognostic value in predicting the transition to chronicity (Klenerman et al., 1995; Burton et al., 1995; van den Hoogen et al., 1997). Conversely, studies have been consistent in identifying various psychosocial variables as more important predictors of chronic disability in patients with acute LBP (Klenerman et al., 1995; Burton et al., 1995; Dionne et al., 1997; Macfarlane et al., 1999). However, the specific psychosocial factors most associated with the transition from acute to chronic LBP, the optimal manner of measuring these factors, and the ideal timing for assessment all remain uncertain.

The response of an individual experiencing acute pain has been hypothesized to fall along a continuum between two extremes; confrontation or avoidance (Slade et al., 1983).

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Where on this continuum an individual patient will fall is determined by his or her fear of pain (Lethem et al., 1983; Rose et al., 1992). Confrontation is generally considered to be an adaptive response, in which the individual views pain as a nuisance and has strong motivation to return to normal levels of activity. This response is seen as gradually leading to a reduction in fear and a return to normal activity (Lethem et al., 1983). Avoidance is a maladaptive response causing the patient to avoid certain activities that are anticipated to cause an increase in pain and suffering (Crombez et al., 1998). An avoidance response may lead to a reduction in physical and social activities, an exacerbation of the fear and avoidance behaviors, prolonged disability, and adverse physical and psychological consequences (Lethem et al., 1983; Vlaeyen et al., 1995, 1999). The role of fear of pain and subsequent avoidance behaviors have been succinctly summarized by Waddell and colleagues with the statement 'Fear of pain and what we do about it may be more disabling than the pain itself' (Waddell et al., 1993). Several other authors have supported the theory that fear-avoidance beliefs may be the most important cognitive factors impacting the development of chronic disability in patients with LBP (Crombez et al., 1999; Troup et al., 1987).

An individual's fear of pain and the degree to which he or she will seek to avoid painful experiences or behaviors is conditioned by the psychological context within which the painful event occurs. Four factors have been identified as influencing the psychological context; previous stressful life events, personal pain coping strategies, prior pain experiences, and personality characteristics (Lethem et al., 1983; Klenerman et al., 1995; Rose et al., 1992). Each of these factors is mostly in place in an individual prior to the onset of the painful episode, leading some researchers to conclude that the tendency to fear pain, and avoid activities perceived to cause pain may be more related to the expectation of pain with certain activities, or a disposition to respond fearfully to a troubling situation, rather than an actual experience of pain exacerbation with the activity during the current painful episode (Philips, 1987). If fear of pain and subsequent avoidance behavior are largely determined by personality traits and experiences pre-dating the onset of pain, the assessment of the fear of pain in patients soon after the onset of pain may be useful for detecting these factors and predicting the subsequent course of recovery (Waddell et al., 1993; Rose et al., 1992).

Waddell et al. (1993) developed the Fear-Avoidance Beliefs Questionnaire (FABQ) based on the Fear-Avoidance Model. The questionnaire is designed to quantify a patient's beliefs about how physical activity and work may affect his or her pain and risk of re-injury. In validating this instrument, Waddell et al. reported that fear-avoidance beliefs about work explained a substantial amount of the variance in disability and work loss, even after controlling for pain intensity and location (Waddell et al., 1993). The patients studied had chronic LBP, and work loss was evaluated retrospectively over a 1-year period. The authors of this paper, as well as others, have speculated that fear-avoidance beliefs may develop much earlier in the course of LBP, and may be of prognostic value in the early identification of patients at risk for chronic disability (Crombez et al., 1999; Vlaeyen et al., 1999; Hadijistavropoulos and Craig, 1994). To date this hypothesis remains untested.

The purposes of this study were: (1) to examine the relationship between fear-avoidance beliefs, as measured with the FABQ, with concurrent baseline measures of pain intensity, physical impairment, depressive symptoms, abnormal illness behavior, and low back-related disability in patients with acute, work-related low back pain; (2) to investigate the relationship between fear-avoidance beliefs about work measured at baseline and disability and work status after 4 weeks of rehabilitation. We hypothesized that the relationships between fear-avoidance beliefs and other variables would be similar to those reported in populations of patients with chronic LBP. We further hypothesized that fear-avoidance beliefs about work would contribute significantly to the explained variance in 4-week disability and work loss even after controlling for the initial levels of disability, pain intensity, and physical impairment.

## 2. Methods

### 2.1. Subjects

Subjects were participants in a clinical trial comparing different physical therapy approaches for patients with acute, work-related LBP. All subjects had developed LBP due to work-related activities of less than 3 weeks'duration, and of sufficient magnitude to necessitate modification of employment duties. All subjects were referred to physical therapy that began within one week of randomization. Subjects were randomized to receive guideline-based therapy using the recommendations of the Agency for Health Care Policy and Research (Bigos et al., 1994), or individualized therapy based on the classification system recommended by Delitto et al. (1995). All subjects in the guideline-based group received treatments based on the AHCPR guidelines including low stress aerobic exercise (walking on a treadmill or stationary cycling), general muscle re-conditioning exercises (e.g. abdominal curls, quadruped arm and leg extensions, etc.), and reinforcement of the advice to remain as active as possible within the limits of pain and reassurance of recovery and return to full work capacity. Subjects in the classification-based group were re-examined by the treating physical therapist and placed into one of four treatment classifications based on the subject's signs and symptoms. The groups were manipulation followed by active range of motion exercises, repeated end-range exercises (i.e. flexion or extension exercises), spinal stabilization exercises, or traction. Further description of the classification categories and associated treatments has been published elsewhere (Delitto et al., 1995;

Fritz and George, 2000). Subjects in the classification-based group were re-evaluated at each visit; if the subject's presentation changed the treatment was altered accordingly. Subjects in both groups were scheduled for 2–3 therapy sessions per week, and re-assessed by the occupational medicine physician on a weekly or bi-weekly basis. Discharge from physical therapy occurred at the discretion of the occupational medicine physician who was blind to the subject's treatment group. Outcome measures were assessed initially and after 4 weeks, at which time the subject's current work status was also obtained and classified as either returned to work without restrictions, or continued work restrictions (e.g. reduced hours, lifting restrictions, off work entirely, etc.)

Seventy-eight subjects were enrolled in the study. Thirty subjects (38%) were female; mean age was 37.4 years (range 18–58, SD = 10.4), and the mean time from onset to evaluation was 5.5 days (range 0–19, SD = 4.6). Twenty-three subjects (30%) were health care workers involved in direct patient care (e.g. RN, LPN, nurse's aide, patient transport, etc.). Fifty subjects (64%) had occupations involving regular manual labor but not directly related to patient care, and five subjects (6%) had occupations that did not involve regular manual labor. Thirty-seven subjects were randomized to the AHCPR treatment group, 41 to the classification treatment group. There was a prior history of LBP in 39 (50%) subjects. Details of the subject characteristics are given in Table 1.

### 2.2. Measures

All subjects underwent a baseline examination by a research assistant. Patients were asked about any prior episodes of activity-limiting LBP, with responses were graded 'yes' or 'no'. Physical impairment was assessed using the seven-item impairment index described by Waddell et al. (1992). The seven items consist of four range of motion variables (total flexion, total extension, average side-bending, average straight leg raise), two strength variables (active sit-up and bilateral straight leg raise) and one pain variable (spinal tenderness). Each variable is scored as positive (1) or negative (0) based on published values, resulting in a total score ranging from 0 to 7. The developers of the scale found high levels of interrater reliability for each item, and reported that the scale successfully discriminated between individuals with and without LBP (Waddell et al., 1992). The five nonorganic signs were assessed as described by Waddell et al. (1980), and each patient was scored from 0 to 5.

Table 1
Subject characteristics at the initial examination ($n = 78$)

| Variable | Mean (SD) |
|---|---|
| Time from injury (days) | 5.5 (4.6) |
| CES-D depression score | 13.1 (7.6) |
| Fear-avoidance beliefs score | |
| Work subscale | 27.9 (8.6) |
| Physical activity subscale | 18.9 (5.8) |
| Impairment index | 4.6 (1.7) |
| Pain rating | 6.6 (1.8) |
| Nonorganic index | 2.9 (2.1) |
| Oswestry score (initial) | 42.9 (15.8) |
| Oswestry score (after 4 weeks) | 26.4 (20.3) |

Following the examination subjects were given a set of questionnaires to complete prior to the first physical therapy appointment. Appointments were scheduled 1–3 days following the completion of the examination and all questionnaires were returned at the time of the first appointment.

Questionnaires completed included a 0–10 ordinal scale of current pain intensity, with higher numbers indicating increased pain intensity. Depressive symptoms were assessed with the Center for Epidemiological Studies Depression Scale (CES-D), a 20-item scale designed for use in community-dwelling adults (Radloff, 1977). Each item asks the subject to rate the frequency of a depressive symptom on a 0–3 scale, for a total possible score from 0 to 60. Higher numbers indicate greater severity of depressive symptoms. The CES-D has been tested in general samples and in populations with psychiatric diagnoses, and has shown adequate internal consistency, reliability, and discriminative validity (Weissman et al., 1977; Turk and Okifuji, 1994). The seven nonorganic symptom descriptor questions were completed as described by Waddell et al. (1984). Both the nonorganic signs and symptoms are considered to be findings more attributable to aspects of distress and abnormal illness behavior then physical pathology (Waddell et al., 1980; Main and Waddell, 1998). The number of positive responses on the nonorganic symptoms was added to the number of nonorganic signs to calculate a nonorganic index ranging from 0 to 12 for each subject.

Low back-related disability was assessed with the Modified Oswestry Disability Questionnaire (OSW). The OSW is a 10-item scale originally described by Fairbank et al. (1980). Each item is scored from 0 to 5, and the final score is expressed as a percentage with higher numbers indicating greater disability. The OSW used in this study was modified in a manner similar to Hudson-Cook et al. (1989), in which a section regarding employment/homemaking ability was substituted for the section related to sex life because the sex life item was frequently found to be left blank. The modified version of the OSW was reported to have similar levels of reliability and validity (Hudson-Cook et al., 1989).

Fear-avoidance beliefs were assessed through the (FABQ) described by Waddell et al. (1993). The FABQ has 16 items, each scored 0–6, with higher numbers indicating increased levels of fear-avoidance beliefs. Two subscales within the FABQ have been identified; a seven-item work subscale scale (score range 0–42), and a four-item physical activity subscale (score range 0–24). Previous studies in patients with chronic LBP have found the FABQ work subscale to be more predictive of disability and work loss (Waddell et al., 1993; Hadijistavropoulos and Craig, 1994; Crombez et al., 1999).

### 2.3. Data analysis

The relationship between fear-avoidance beliefs and other measures was assessed with Pearson correlation coefficients. The relationship between initial disability and fear-avoidance beliefs about work was further investigated with a hierarchical linear regression using the OSW as the dependent variable. Physical impairment and pain intensity were entered in the first step, and the FABQ work subscale in the second step. This hierarchical approach was used to determine if fear-avoidance beliefs would further improve the fit of the regression model after controlling for impairment and pain intensity. For each step adjusted $R^2$ values were calculated, reflecting the goodness of fit of the linear model adjusted for the number of independent variables in the equation. The significance of the change in $R^2$ at each step was tested. Standardized beta coefficients for each variable in the final model were calculated and the significance of each was tested under the null hypothesis that the coefficient was not different from zero (Neter et al., 1996). The analysis was repeated using the FABQ physical activity subscale instead of the work subscale.

The relationship between fear-avoidance beliefs about work and future disability was assessed using a hierarchical linear regression with the OSW score after 4 weeks as the dependent variable. Initial physical impairment, pain intensity, and OSW score were entered in the first step. The interaction between the dichotomous variable treatment group and the FABQ work subscale was entered in the second step to determine if the interaction between the terms was significant. If the interaction was not significant, the interaction term was not included in the final model, and the variable treatment group was entered in the next step and the FABQ work subscale in the final step. If the interaction was significant, separate regression equations were obtained for each treatment group. This approach was used to explore the relationship between initial fear-avoidance beliefs and disability after 4 weeks while controlling for the effects of initial disability, pain intensity, physical impairment, and the type of physical therapy received. The regression analysis was also conducted using the FABQ physical activity scale. The analyses were also repeated entering the FABQ score prior to the treatment variable to examine the importance of type of treatment after controlling for fear-avoidance beliefs.

The relationship between fear-avoidance beliefs and future work status was assessed using hierarchical logistic regression models with return to work as the dependent variable. Separate analyses were performed for the work and physical activity subscales. The method of variable entry was similar to the previous analysis. Initial pain, impairment and disability scores were entered in the first step. The significance of the interaction between treatment group and FABQ subscale was next assessed. If the interaction was not significant, treatment group and finally the FABQ subscale were entered. If the interaction was significant, separate logistic regression were performed for each treatment group. At each step, the improvement in model fit given the addition of the independent variables was assessed through a chi-square of the difference in likelihood ratio statistics at a significance level of 0.05. Nagelkerke's $R^2$ statistic was obtained at each step to assess the strength of association (Nagelkerke, 1991). For the final model, odds ratios and 95% confidence interval (CI) were calculated for each variable to estimate the increase in odds of not returning to work within 4 weeks associated with an increase in the initial value of the variable being tested (Sharma, 1996). The regressions were also repeated switching the order of entry for the fear-avoidance and treatment group variables.

## 3. Results

The correlation coefficients among variables are reported in Table 2. The work and physical activity subscales of the FABQ were significantly correlated ($r = 0.55$). The FABQ work subscale showed the highest correlation with the 4-

Table 2
Pearson correlation coefficients among the initial evaluation variables and the 4-week Oswestry score[a]

| | FABQ work | FABQ physical activity | Age | Depressive symptoms | Impairment | Initial Oswestry | 4-week Oswestry | Nonorganic index | Pain rating |
|---|---|---|---|---|---|---|---|---|---|
| FABQ work | – | 0.55** | −0.072 | 0.26* | 0.19 | 0.40** | 0.46** | 0.26* | 0.53** |
| FABQ physical activity | | – | −0.002 | 0.14 | 0.24* | 0.34* | 0.37* | 0.35* | 0.40** |
| Age | | | – | 0.029 | 0.037 | 0.023 | 0.19 | −0.062 | −0.037 |
| Depressive symptoms | | | | – | −0.052 | 0.34* | 0.22 | −0.036 | 0.12 |
| Impairment | | | | | – | 0.42** | 0.30* | 0.47** | 0.47** |
| Initial Oswestry | | | | | | – | 0.44** | 0.31* | 0.58** |
| 4-week Oswestry | | | | | | | – | 0.30* | 0.34* |
| Nonorganic index | | | | | | | | – | 0.53** |
| Pain rating | | | | | | | | | – |

[a] $*P < 0.05$, $**P < 0.01$.

Table 3
Hierarchical linear regression analysis of the relationship between initial Oswestry disability score and fear-avoidance beliefs about work (Analysis 1) and physical activity (Analysis 2) controlling for pain and impairment ($n = 76$)

| Variables entered | | Adjusted $R^2$ | Significance of $R^2$ change | Standardized beta coefficient (final model) | Significance of beta coefficient |
|---|---|---|---|---|---|
| *Analysis 1* | | | | | |
| Step 1 | Pain rating | | | 0.32 | 0.003 |
| | Physical impairment | 0.35 | < 0.0001 | 0.23 | 0.023 |
| Step 2 | FABQ work subscale | 0.36 | 0.17 | 0.24 | 0.17 |
| *Analysis 2* | | | | | |
| | Pain rating | | | 0.41 | 0.001 |
| Step 1 | Pain rating | 0.35 | < 0.0001 | 0.21 | 0.046 |
| Step 2 | FABQ physical activity subscale | 0.35 | 0.19 | 0.14 | 0.19 |

week OSW score ($r = 0.46$). The results of the linear regression on the initial OSW score indicated that addition of the FABQ work or physical activity subscale scores did not improve the model fit after controlling for pain intensity and physical impairment (Table 3). 4-week re-evaluation OSW scores were available on 69 (88%) subjects. The interaction between treatment and fear-avoidance beliefs was not significant for the work ($P = 0.97$) or the physical activity subscale ($P = 0.53$). The addition of treatment group to the model resulted in a significant increase in $R^2$ (Table 4). A comparison of the mean 4-week Oswestry scores reveals less disability in the classification treatment group (mean = 21.4, SD = 19.0) than the guideline-based group (mean = 32.4, SD = 20.6) ($P = 0.024$). There was no difference in disability between the groups at baseline ($P = 0.97$). The addition of the FABQ work subscale score in the final step was significant, indicating that fear-avoidance beliefs significantly improved model fit even after controlling for initial pain intensity, physical impairment, disability and treatment group. The addition of the physical activity subscale did not improve model fit. Reversing the order of entry of the FABQ score and treatment group variable showed a significant effect for the treatment group even after controlling for pain, impairment, disability, and fear-avoidance beliefs about work ($P = 0.035$) or physical activity ($P = 0.039$).

After 4 weeks, 55 (72%) subjects were able to return to work without restrictions, while 22 remained restricted. The return to work status of one subject could not be ascertained. Seven subjects with restrictions were in the classification-based treatment group, 15 in the guideline-based group ($\chi^2 = 5.68, P = 0.017$). The interactions between treatment and fear-avoidance beliefs about work and physical activity were not significant ($P = 0.92$ and 0.32, respectively). Addition of treatment group significantly improved model fit, as did fear-avoidance beliefs about work (Table 5). The addition of fear-avoidance beliefs about physical activity was not significant. When the order of entry was reversed, treatment group continued to improve model fit when fear-avoidance beliefs about physical activity were controlled ($P = 0.030$), and approached significance when fear-avoidance beliefs about work were controlled ($P = 0.052$).

Table 4
Hierarchical linear regression analysis of the relationship between fear-avoidance beliefs about work (Analysis 1) and physical activity (Analysis 2) and the 4-week Oswestry score ($n = 69$)[a]

| Variables entered | | Adjusted $R^2$ | Significance of $R^2$ change | Standardized beta coefficient (final model) | Significance of beta coefficient |
|---|---|---|---|---|---|
| *Analysis 1* | | | | | |
| Step 1 | Pain rating | | | −0.19 | 0.47 |
| | Physical impairment | | | 0.10 | 0.34 |
| | Initial Oswestry | 0.18 | 0.001 | 0.30 | 0.019 |
| Step 2 | Treatment Group | 0.23 | 0.021 | −0.21 | 0.032 |
| Step 3 | FABQ work subscale | 0.30 | 0.009 | 0.36 | 0.009 |
| *Analysis 2* | | | | | |
| Step 1 | Pain rating | | | −0.029 | 0.89 |
| | Physical impairment | | | 0.061 | 0.63 |
| Initial Oswestry | 0.18 | 0.001 | 0.36 | 0.008 | |
| Step 2 | Treatment group | 0.23 | 0.021 | −0.23 | 0.039 |
| Step 3 | FABQ physical activity subscale | 0.26 | 0.083 | 0.21 | 0.083 |

[a] The interaction between treatment and fear-aviodance beliefs was not significant for either analysis.

Table 5
Hierarchical logistic regression analysis of the relationship between fear-avoidance beliefs about work (Analysis 1) and physical activity (Analysis 2) and return to work status after 4 weeks ($n = 76$)[a]

| Variables entered | | Step chi-square | Nagelkerke's $R^2$ | Odds ratio (95% CI) |
|---|---|---|---|---|
| *Analysis 1* | | | | |
| Step 1 | Pain rating | | | 1.09 (0.62, 1.90) |
| | Physical impairment | | | 1.16 (0.76, 1.77) |
| | Initial Oswestry | $\chi^2 = 10.42$, df = 3, $P = 0.015$ | 0.19 | 1.02 (0.98, 1.08) |
| Step 2 | Treatment group | $\chi^2 = 4.52$, df = 1, $P = 0.034$ | 0.26 | 3.19 (0.95, 10.76) |
| Step 3 | FABQ work subscale | $\chi^2 = 8.84$, df = 1, $P = 0.003$ | 0.39 | 1.17 (1.04, 1.31) |
| *Analysis 2* | | | | |
| Step 1 | Pain rating | | | 1.23 (0.76, 2.00) |
| | Physical impairment | | | 1.01 (0.67, 1.52) |
| | Initial Oswestry | $\chi^2 = 10.42$, df = 3, $P = 0.015$ | 0.19 | 1.03 (0.98, 1.08) |
| Step 2 | Treatment group | $\chi^2 = 4.52$, df = 1, $P = 0.034$ | 0.26 | 3.57 (1.09, 11.71) |
| Step 3 | FABQ physical activity subscale | $\chi^2 = 10.48$, df = 1, $P = 0.23$ | 0.30 | 1.14 (0.96, 1.34) |

[a] The interaction between treatment and fear-aviodance beliefs was not significant for either analysis.

## 4. Discussion

The purpose of this study was to investigate the role of fear-avoidance beliefs in patients with acute, work-related LBP. The hypotheses that fear-avoidance beliefs in these patients would show a similar pattern of correlation with concurrently measured variables of pain intensity, physical impairment, disability, and depressive symptoms as has been reported in patients with chronic LBP, and that fear-avoidance beliefs about work would be significantly related to future (4-week) measures of disability and work status were generally supported by the results.

The current study involved subjects with work-related LBP of less than 3 weeks' duration. Previous studies using the FABQ have involved patients with more chronic conditions and have not looked exclusively at work-related LBP. The high compensation costs related to work-related LBP make a focus on this group warranted. In addition, studies have found that majority of patients with work-related LBP will return to work within the first 1–2 months after injury (Spitzer, 1987; Williams et al., 1998). Those who do not return within this time frame become increasingly unlikely to do so, and account for the majority of the health care and indemnity costs associated with occupational LBP. It has been proposed that fear-avoidance beliefs may be the most specific and powerful cognitive factor in patients with LBP, and may have particular relevance in explaining work absence (Waddell et al., 1993; Troup, 1988). The initial weeks after injury may be the optimal time to identify patients at risk for prolonged disability and work absence due to fear-avoidance beliefs.

The fear-avoidance scores were higher in this sample than in previously published studies using the FABQ (Waddell et al., 1993; Crombez et al., 1999; Moffett et al., 1999). The higher values in this study may be due to the acuity of the subjects' LBP, the work-related nature of the injuries, or a combination of both factors. In a different patient sample we have found higher FABQ scores in those receiving compensation, and in those with acute conditions (George et al., 2001). Vlaeyen et al. (1995) did not use the FABQ, but reported higher levels of fear of movement in individuals with chronic LBP.

The FABQ subscales were each highly correlated with initial pain and disability scores, and to a lesser extent with depressive symptoms, physical impairment, and nonorganic findings (Table 2). The FABQ work and physical activity subscales correlated with a concurrent measure of disability with $r$ values of 0.40 and 0.34, respectively. Correlation coefficients between disability scores and measures of fear-avoidance beliefs in studies involving patients with chronic LBP have been of similar magnitude, ranging from 0.37 to 0.55 (Waddell et al., 1993; Crombez et al., 1999; Vlaeyen et al., 1995; McCracken et al., 1996). As in this study, others have found greater correlations between the work subscale and disability as opposed to the physical activity subscale (Waddell et al., 1993; McCracken et al., 1996). The present study was the first to compare the relationship of the subscales with concurrent and future measures of disability and work loss. The results support the greater utility of the work subscale of the FABQ for explaining outcomes.

This sample of patients with acute LBP showed smaller correlations between depressive symptoms, as assessed by the CES-D, and fear-avoidance beliefs than previous studies of individuals with chronic LBP (Waddell et al., 1993; Vlaeyen et al., 1995). These results appear to support to the hypothesis that depressive symptoms are exacerbated by prolonged fear of pain/re-injury and avoidance of activity (Council et al., 1988; Philips, 1987).

Correlations between the nonorganic index and fear-avoidance beliefs were statistically significant, but generally low. Nonorganic signs and symptoms are considered to be indicators of abnormal illness behavior, which has been defined as 'observable and potentially measurable actions and conduct that express and communicate the individual's own perception of disturbed health' (Waddell et al., 1989). The precise nature of the relationship between illness behavior and fear-avoidance beliefs has not been examined. These results indicate that these two concepts are not highly correlated in patients with acute, work-related LBP, at least not as measured by nonorganic signs and symptoms and the FABQ. The FABQ subscales were more highly correlated than the nonorganic index with initial and 4-week disability scores, indicating fear-avoidance beliefs may be more specific and important than nonorganic signs and symptoms in determining present and future levels of disability.

Waddell et al. (1993) used a hierarchical regression model to explore the relationship between concurrent measures of disability and fear-avoidance beliefs in a sample of 184 patients with chronic LBP. The FABQ work subscale contributed significantly to the model after controlling for the anatomical location, intensity and timing of pain (adjusted $R^2 = 0.37$) (Waddell et al., 1993). In our analysis of the relationship between FABQ subscales and concurrent disability, the FABQ scores did not contribute significantly to the models. This difference may be due to controlling for physical impairment, or may represent a meaningful distinction in the relationship between fear-avoidance beliefs and concurrent disability between patients with acute versus chronic LBP. The correlation between pain intensity and disability in the present study ($r = 0.58$) is higher than has been reported in patients with chronic LBP; however, the correlation between physical impairment and disability (0.42) is of a similar magnitude (Hazard et al., 1994; Waddell et al., 1992). The more direct relationship between pain intensity and disability in patients with acute LBP may reduce the influence of cognitive factors such as fear-avoidance beliefs.

Although the pain intensity and physical impairment correlated more highly with the initial disability score, the variable explaining the greatest amount of variability in disability scores after 4 weeks was the FABQ work subscale ($r^2 = 21\%$) exceeding even the initial disability score. In addition, the FABQ subscale scores were the only variables other than age that were more highly correlated with the 4-week versus initial disability scores. This finding supports previous hypotheses that fear-avoidance beliefs may be the most important factor in determining the transition from acute to chronic LBP.

The regression models also support the importance of fear-avoidance beliefs about work in predicting future disability and work status. The hierarchical regression performed using the 4-week OSW scores as the dependent variable indicated that the FABQ work score significantly improved the model even after controlling for initial levels of pain, physical impairment, disability, and the treatment received (Table 4). Therefore while the FABQ work subscale was not found to contribute significantly to explaining the variability in a concurrent measure of disability, it did contribute to the explanation of future disability. The importance of fear-avoidance variables in predicting future disability in patients with acute LBP was also documented by Klenerman et al. (1995). Although not measured with the FABQ instrument used in this study, these authors reported that fear-avoidance beliefs explained 25% of the variability in disability scores after 2 months in 162 patients with acute LBP.

The FABQ work subscale score also contributed significantly to the explanation of variation in 4-week work status, even after controlling for initial levels of pain intensity, disability, physical impairment, and type of treatment received. Return to work has been identified as an important outcome for patients with work-related LBP, and studies have found that patients not returning to work within 4–8 weeks after onset are at substantially increased risk of protracted work absence (Williams et al., 1998). Therefore the potential for the FABQ work subscale score measured at the initial examination to assist in the identification of patients at risk for work restrictions extending beyond 4 weeks could be important for clinicians attempting to make the most effective use of resources to prevent long-term disability. The relationship between work status and fear-avoidance beliefs about work was also reported by Waddell et al. (1993) in their study of patients with chronic LBP. However, this study used a retrospective assessment of work loss in the previous year, and not a prospective prediction of future work status.

It has been proposed that avoidance behaviors in response to pain may be adaptive in the acute phase of an injury, helping an individual to avoid situations that might increase the tissue damage and nociceptive input, and only become maladaptive in more chronic stages (Vlaeyen et al., 1995). The results of the present study are in contradiction to this hypothesis. Higher levels of fear-avoidance beliefs did not appear to offer any protective benefits, but instead were related to more persistent disability and difficulty returning to full work status. This result is consistent with current evidence demonstrating the detrimental effects of inactivity in the form of bed rest for patients with acute LBP (Waddell et al., 1997) and advocating advice to maintain normal levels of activity as an effective method of management (van Tulder et al., 1997).

If fear-avoidance beliefs are present from the initial experience of LBP, and represent a detriment to recovery, interventions in the acute stage may be most useful in reducing fear-avoidance beliefs and promoting return to normal activity. The optimal treatment program to address the specific psychological impairment of fear-avoidance beliefs has not been determined, however cognitive-behavioral approaches involving graded exposure to physical activity have been advocated (Crombez et al., 1999). This recommendation is supported by experimental findings that individuals who initially over-predict the amount of pain an activity will produce are able to correct the faulty predictions with exposure to the activity (Crombez et al., 1996). If excessive levels of fear of movement could be corrected through graded exposure early in the course of rehabilitation, some cases of prolonged disability may be averted. Because many patients with an episode of acute LBP will resume normal activities with minimal intervention, a screening tool for identifying patients at increased risk is crucial to most effectively utilize resources. Only one randomized trial has examined the effectiveness of a behavioral program for patients with acute LBP. No differences were found between the groups after 6 weeks, but the long-term follow-up (9–12 months) showed decreased health care utilization and patient-reported impairment in the behavioral group (Fordyce et al., 1986). No attempt was made in this study to a priori identify individuals with increased risk for prolonged difficulties. If patients at risk can be identified for a targeted behavioral intervention, treatment effects will likely improve, and costs will decrease when compared with the indiscriminate application of a behavioral program for all patients with acute LBP. The FABQ work subscale may provide such a screening tool.

The interaction between treatment group and FABQ scores were non-significant, and the importance of the treatment group in explaining outcomes persisted even after controlling for fear-avoidance beliefs. These findings indicate the type of physical therapy treatment had a significant relationship with 4-week disability and return to work status, which was independent of fear-avoidance beliefs. Consistent with the overall results of the clinical trial (Fritz et al., submitted) the group receiving individualized, classification-based treatment had superior outcomes than the group receiving guideline-based treatment using the AHCPR recommendations for all subjects. These findings attest to the need for application of the most appropriate interventions to manage the individual patient's signs and symptoms, in addition to consideration of the potential influence of cognitive factors such as fear-avoidance beliefs. The most appropriate interventions for individuals with acute, work-related LBP have yet to be fully elucidated; however, these results suggest that approaches based on a patient's signs and symptoms may hold more promise than guideline-based approaches that do not emphasize individual differences in presentation.

This study examined the role of fear-avoidance beliefs in a group of patients with acute, work-related LBP. The results support the hypothesis that fear-avoidance beliefs are established early in the course of a pain experience, and are likely determined to a great extent by the psychological context within which the injury occurs. Furthermore, fear-avoidance beliefs in the acute stage of a painful episode do not appear to offer a protective benefit to patients, but instead are related to the development of prolonged work absence and increased disability. Further research is required to elucidate the role of fear-avoidance beliefs in patients with acute LBP, both work-related and non-work-related. If fear-avoidance beliefs prove to be a pivotal factor in determining which patients will make the transition from acute to chronic LBP, screening tools and targeted treatment interventions may be developed to reduce the proportion of patients making such a transition.

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