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Activity Avoidance and Function in Persons with Chronic Back Pain

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This study examined the relative contribution of two aspects of pain-related fear to functional disability among 133 persons with chronic pain, predominantly chronic back pain: 1) beliefs that pain represents damage or significant harm to the body and 2) beliefs that activities that cause pain should be avoided. Pain-related fear was assessed using the Tampa Scale for Kinesiophobia, Version 2 (TSK-2). Factor analysis in the present study replicated the two-factor solution found in a previous investigation, representing the two dimensions of pain-related fear noted above. Activity avoidance was significantly associated with the percent of maximum expected weight lifted from floor to waist and waist to shoulder during Progressive Isoinertial Lifting Evaluation (PILE). Fear of damage or harm to the body was only significantly related to the floor to waist lift. When controlling for demographic, physiologic, and other psychological variables, only activity avoidance continued to significantly predict performance on both lifts of the PILE. Although it has been proposed that deconditioning may mediate the relationship between activity avoidance and disability, this was not supported in the present investigation. The results highlight the importance of pain-related fear, particularly activity avoidance, in the assessment of functional activity among persons with chronic pain.

KEY WORDS: chronic pain; back pain; disability; pain-related fear; activity avoidance.

INTRODUCTION

Pain-related fear (fear of physical activity, pain, and bodily damage or reinjury) is being increasingly recognized as an important contributor to disability and adjustment among persons with chronic pain. It is believed that pain-related fear over time leads to avoidance of activities or situations that are expected to produce pain (1–4). Often, these perceptions are inaccurate, and research has shown that persons with a high degree of pain-related fear tend to overestimate the amount of pain experienced during functional activity (5–7). In this manner, pain-related fear and associated avoidance of activity theoretically contribute

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to disability among persons with chronic pain independent of pain itself. Ongoing study of factors that contribute to disability among chronic pain patients is important given the lack of an observed relationship between clinical pain and disability (7–10).

A number of recent studies support the contention that pain-related fear is significantly related to greater perceived disability and poorer performance during functional activity. For example, Waddell *et al*. (11) found that pain-related fear was significantly related to decreased activities of daily living as well as work lost in the past year, and more highly related to these variables compared to self-reported pain. Vlaeyen *et al*. (10) found that pain-related fear demonstrated a stronger association with self-reported disability compared to ratings of biomedical findings and self-reported pain. Jensen *et al*. (12) found that pain-related fear was significantly related to greater self-reported disability, even when controlling for demographic factors and pain duration and intensity. Two studies (13,14) have demonstrated that pain-related fear is associated with a profile of high psychological distress, high interference due to pain, low perceived control over pain, and low activity levels on the Multidimensional Pain Inventory (MPI; 15). Studies have also demonstrated that decreases in pain-related fear as a function of treatment are associated with improved physical functioning, decreased depression and pain severity, and lower interference due to pain (16,17).

The results of these endeavors have also been replicated with more objective measures of function. Vlaeyen *et al*. (18) examined the relationship between pain-related fear and amount of time persons with chronic low back pain were able to hold a heavy bag until pain or physical discomfort made it impossible to continue. Patients who scored high on a measure of pain-related fear demonstrated decreased ability to tolerate the task. Crombez *et al*. (19) examined the relationship between pain-related fear and isokinetic trunk extension and flexion among persons with chronic back pain. Consistent with previous findings, higher peak torque on this test was associated with lower pain-related fear. Similar findings were obtained on measures of knee extension and flexion, as well as trunk rotation.

Further research is needed to determine the critical component(s) of pain-related fear. This need is highlighted in a recent study by Crombez *et al*. (19), who found a different pattern of relationships between disability and three measures of pain-related fear. Although the authors found that the Fear Avoidance Beliefs Questionnaire (FABQ; 11) and a Dutch version of the Tampa Scale for Kinesiophobia (TSK; 2) were consistently related to several measures of disability, they observed that the Pain Anxiety Symptoms Scale (PASS; 20) was not significantly related to performance on one of the behavioral tasks. The authors proposed that content differences on these scales explain the findings, as they indicated the PASS contains more items, which assess general fear of pain, whereas the FABQ and TSK measure fear of physical movement to a greater degree. Lackner *et al*. (21) found that functional self-efficacy, or judgements regarding one's ability to execute or achieve tasks of physical performance, significantly predicted better functional performance even when controlling for ratings of likelihood of reinjury and expected pain among persons with chronic low back pain. Given these findings and the multidimensional composition of pain-related fear assessment tools, an empirical examination of the relative contribution of the different components of pain-related fear to disability appears warranted.

In addition, factors that may mediate or moderate the relationship between pain-related anxiety and disability remain relatively unexplored. Several hypotheses have been proposed to explain the relationship between pain-related anxiety and disability, as outlined

by Crombez *et al*. (19). First, fear leads to avoidance of daily activities that are expected to produce pain, further promoting disability. Second, it has been proposed that pain-related fear increases the allocation of attentional resources to pain-related information, which in turn disrupts processing of information related to task performance and implementation of coping strategies (22–26). Third, avoidance of activities may provide fewer opportunities to correct aberrant expectations of pain associated with functional tasks, perpetuating avoidance and overestimation of pain that might occur with activity. Finally, activity avoidance may lead to deconditioning, which in turn contributes to disability.

The purpose of the present study was to examine the relative contribution of two components of pain-related anxiety to functional performance: 1) fear that pain represents an underlying serious injury or damage to the body (fear) and 2) a belief that one should avoid activities such as exercise that may cause increased pain (avoidance). These constructs were examined by computing subscale scores from the Tampa Scale for Kinesiophobia, Version 2 (TSK-2; 27). A factor analysis conducted by the authors suggests that this scale comprises these two constructs, which they labeled Pathological Somatic Focus and Activity Avoidance, respectively. In the present study, we attempted to replicate this factor structure. Second, we wished to examine whether pain-related fear was associated with measures of poor physical fitness in this population, specifically, body mass index (BMI) and projected maximum MET level based on a bicycle ergometer submaximal cardiovascular stress test. We predicted, as hypothesized by Crombez *et al*. (19), that greater pain-related fear would be significantly related to greater deconditioning, suggesting that this factor may mediate or moderate the relationship between pain-related fear and disability. Finally, the relative contribution of demographic variables, pain, physical variables, and pain-related fear to functional task performance was examined in a simultaneous regression analysis. We predicted that activity avoidance would be significantly related to functional activity even when controlling for other physiological and psychological variables, whereas fear of injury or damage to the body reinjury would not be significantly related. A measure of depression was included in this analysis to control for the possibility that pain-related fear is related to functional activity through its association with affective distress.

METHOD

Subjects

Subjects were 133 persons with chronic (3 or more months) disabling back pain who completed a multidisciplinary assessment of their pain at the University of Michigan Spine Program. The evaluation consisted of functional testing, physical therapy evaluation, psychological evaluation, evaluation by a rehabilitation counselor, and cardiovascular fitness testing. Persons in the sample had a mean age of 41.7 years ($SD = 8.5$), and a mean duration of pain of 65.3 months ($SD = 86.6$). Seventy-five persons were male, and 58 were female. The majority of patients had low back pain ($n = 101$), as defined by the International Association for the Study of Pain Primary Site of Pain Coding System (28). Pain in three or more bodily sites ($n = 12$), cervical pain ($n = 9$), and thoracic pain ($n = 8$) were the next three most common sites of pain. Forty-one percent of patients were receiving some type of compensation related to their pain at the time of evaluation, and 31% were involved in litigation. One patient had completed less than 6 years of formal education, 16 reported that

they had completed eighth grade but did not complete high school, 33 had completed high school, 57 reported taking some courses in college or technical school, 10 reported that they had completed college, and 16 had completed a graduate or professional program. The sample was predominantly Caucasian ($n = 124$), but eight persons were African American, and one was Hispanic. Fifty (37.6%) patients reported that their back pain was work-related, whereas the remainder reported that their pain was due to another type of injury, or that the onset was insidious.

Measures

Pain Questionnaire

Individuals completed a questionnaire that solicits information regarding duration of pain, education, race, and other sociodemographic information such as litigation and compensation status. For the correlational or regression analyses, categorical variables were dummy coded. Compensation and litigation status were coded as 0 for "no," 1 for "yes." For sex, males were coded as 0, and females as 1.

Pain

As part of their clinical evaluation, subjects completed the McGill Pain Questionnaire (MPQ; 29). The MPQ measures subjective pain experience in a quantitative form, and consists of 20 groups of single word pain descriptors with the words in each group increasing in rank order intensity. The sum of the rank values for each descriptor based on its position in the word set results in a score termed the Pain Rating Index (PRI). There are also three major subscales of the MPQ, which assess the sensory, affective, and evaluative dimensions of pain experience. The Total PRI was used in the present study as the measure of self-reported pain intensity. Repeat administration of the MPQ has revealed a 70.3% consistency rate in the PRI score (29).

Depressive Symptoms

Self-report of depressive symptoms was obtained using the Center for Epidemiological Studies Depression Scale (CES-D; 30). The CES-D is a 20-item scale of depressive symptoms, including four reversed items. Persons are asked to rate the frequency of depressive symptoms on a 0–3 scale in relation to how they felt during the past week. A total score is obtained by summing the responses to all of the items. Higher scores reflect greater depressive symptoms. Berkman *et al*. (31) suggest that the validity of the scale is not compromised among persons with physical disabilities, and recent studies indicate that the CES-D has good concurrent validity with depression diagnoses established through clinical interview (32,33).

Pain-Related Fear

Beliefs that pain signals serious damage to the body, and that activities that cause pain should be avoided were assessed using the TSK-2 (27). The measure is a 13-item version of

the original scale (2), and excludes four of the original items that were found to have small item-to-total score correlations (27). Persons are asked to rate their level of disagreement or agreement with each item on a 1 (*strongly disagree*) to 4 (*strongly agree*) scale. Sample items include "pain always means I have injured my body" and "It's really not safe for a person with a condition like mine to be physically active." A total score for the scale is obtained by summing the items. Internal consistency (Chronbach's alpha) for the scale has been reported to be high (.86; 27). Factor analysis of the scale suggests that items measure two constructs, labeled Activity Avoidance and Pathological Somatic Focus (27). These subscales will be referred to as the avoidance and fear scales, respectively.

Functional Activity

The Progressive Isoinertial Lifting Evaluation (PILE; 34–36) was used to assess strength, endurance, and psychophysiologic effort. Performance on the PILE is measured in terms of a percentage of maximum weight lifted. This is calculated by dividing the expected weight to be lifted, based on Mayer's (35) data to account for gender and body size, by the actual weight lifted and multiplied by 100. Each person is tested on a floor to waist (30 in.) lift, and a waist to shoulder (30–54 in.) lift. Men start at 10 lb, and women at 5 lb, and are asked to perform four repetitions of the lift at each weight. Following the completion of each lift, they are asked if they believe they can lift more weight, or if they wish to stop the task. If they indicate they can lift more weight, the total weight is increased by 5 lb. Those who progressively lift more weight are stopped when they reach their expected maximum weight.

Perceived Exertion

The rate of perceived exertion was assessed following the completion of both the floor to waist and waist to shoulder lift on the PILE task, using the Borg scale (37). Borg scores range from 6 (*very, very light*) to 20 (*very, very heavy*).

Heart Rate

Heart rate (HR) was recorded using a transmitter strapped across the chest, and a wireless monitor (Pulse model, Polar Electro, Inc., Woodbury, NJ). Percent of maximum heart rate during the PILE was calculated by dividing the patients' maximum heart rate by their maximum heart rate based on age (220 beats/min − age; 38).

Bike Test

A projected maximum metabolic equivalent (MET) level was calculated for each person based on a bicycle ergometer submaximal cardiac stress test (39). Subjects are asked to pedal a stationary bike at a constant rate (50 rpm). The initial workload and changes in resistance are based on the person's heart rate, gender, and physical condition. Once the subject's heart rate begins to plateau, the resistance is increased. A heart rate between 110 and 155 beats/min at two or more workloads is needed to calculate a projected maximum MET level. A test is considered valid if a stable heart rate between 110 and 155 at two or

more workloads is obtained, and the person is able to pedal at a rate of 48–52 rpm. The test is terminated at the request of the subject, if the person is unable to pedal at the specified speed, or the person exceeds 85% of his/her maximum heart rate.

Body Mass Index

Body mass index was calculated based on individual's height and weight, which were routinely recorded for all persons to determine the maximum expected weight lifted on the PILE. Body mass index was calculated using the formula weight (kilograms)/height (meters^2).

RESULTS

As outlined in the Introduction, we sought to examine three issues in the data. First, a factor-analysis was performed on the TSK-2 items to cross-validate the factor structure proposed by Clark *et al*. (27). Second, we wished to examine the relationship between the TSK-2 avoidance and fear subscales, and performance on the PILE and the various physiological and psychological parameters examined in the study. Third, we wished to examine the independent contribution of TSK-2 scores, physical factors, and psychological factors to the prediction of PILE performance, using simultaneous regression analysis.

To validate the factor structure of the TSK-2 proposed by Clark *et al*. (27), the TSK-2 items for each subject were subjected to a principal factor analysis with Varimax rotation, using SPSS software. The rotated factor loadings for each item are presented in Table I. The loading of the item in the factor structure presented by Clark *et al*. (27) is presented in the column labeled "original factor." A scree plot and inspection of the eigenvalues suggested that a two-factor solution best fit the data, accounting for 69.2% of the total variance. Inspection of the factor loadings indicates that 12 of the 13 items loaded on the same factor reported by Clark *et al*. (27), with the exception of Item 8. In our sample, this item loaded slightly higher on the avoidance factor compared to the fear factor. However, given that the

Table I. TSK-2 Original Factor Item Loadings and Rotated Factor Loadings from Present Sample

Item	Original factor (Clark *et al*., 1996)	Factor 1 (Avoidance)	Factor 2 (Fear)
1	2	.38	**.68**
2	2	.43	**.79**
3	2	.46	**.72**
4	1	**.58**	.47
5	1	**.61**	.49
6	1	**.61**	.54
7	2	.49	**.74**
8	2	**.59**	.49
9	1	**.75**	.44
10	1	**.67**	.54
11	1	**.76**	.39
12	1	**.79**	.40
13	1	**.66**	.46

Note: Loadings in bold denote factor loading in present analysis.

Table II. Correlations Between Demographic and Pain Variables and Performance on the PILE (Percent Maximum Expected Weight)

	Pile F–W	Pile W–S
Age	−.02	.03
Sex	−.07	.23**
Compensation status	−.21**	−.20**
Litigation status	−.27**	−.23**
Pain duration	.18*	.20**
McGill Total PRI	−.13	−.19*

Note. F–W: floor to waist lift; W–S: waist to shoulder lift.
* $p < .05$; ** $p < .01$.

item tended to load highly on both factors, we retained the original factor structure found by Clark *et al*. (27). Avoidance and fear subscale scores for the TSK-2 were computed by summing the items that loaded on the respective factor as reported by Clark *et al*. (27).

Only 85 of the 133 subjects in the sample were able to put forth sufficient effort on the bike test to obtain a valid MET level. Thus, for persons who were unable to adequately complete this task, their value for the MET level in the subsequent analyses was substituted with the mean for the entire sample (7.71). Inspection of the correlation matrices between this variable and other variables in the study excluding persons with invalid tests, and including them with the mean substituted value were similar.

A preliminary analysis was performed to examine the influence of demographic and pain variables on PILE performance. These data are presented in Table II. Age was not significantly related to functional performance. Sex was significantly related to percent maximum weight lifted from waist to shoulder ($r = .23$, $p < .01$), as women tended to perform better on this task compared with men. Both receiving compensation and being involved in litigation were significantly related to lower percent maximum weight lifted from floor to waist ($r = -.21$, $p < .01$ and $r = -.27$, $p < .01$) as well as from waist to shoulder ($r = -.20$, $p < .01$ and $r = -.23$, $p < .01$). Duration of pain was significantly and positively related to percent maximum weight lifted on both portions of the PILE ($r = .18$, $p < .05$ and $r = -.20$, $p < .01$). Higher McGill Total PRI scores were significantly related to lower percent maximum weight lifted, but only for the waist to shoulder lift. As age was not significantly related to either functional task, this variable was excluded from the subsequent analyses.

The correlations between PILE performance, TSK-2 subscales, measures of physical conditioning, self-report of depressive symptoms, and physiologic and perceived effort during the PILE are presented in Table III. As one would expect, measures of perceived and physiologic effort were significantly and highly related to better performance on the PILE floor to waist lift ($r = .52$, $p < .001$ and $r = .53$, $p < .001$) as well as the waist to shoulder lift ($r = .55$, $p < .001$ and $r = -.56$, $p < .001$). The TSK-2 avoidance subscale was significantly and inversely related to both lifts on the PILE ($r = -.30$, $p < .001$ and $r = -.31$, $p < .001$), whereas the fear subscale was only related to the floor to waist lift ($r = -.29$, $p < .001$). Neither BMI levels nor MET levels were related to functional performance on the PILE. TSK-2 fear subscale scores were significantly related to higher BMI ($r = .16$, $p < .05$). In contrast, fear scores were significantly related to higher MET levels ($r = .15$, $p < .05$). TSK-2 avoidance scores were not significantly related to either measure of physical conditioning. The TSK-2 avoidance scores were significantly related to lower

Table III. Correlations Between Performance on the PILE and TSK-2 Subscales, Effort During the Task, Deconditioning and Depressive Symptoms

Variable	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. TSK-2 avoidance	.50***	.44***	.01	−.09	−.21**	−.12	−.10	−.14	−.30***	−.31***
2. TSK-2 fear		.35***	.16*	.15*	−.16*	−.15*	−.11	−.11	−.14	−.29***
3. CES-D			.08	−.15*	−.32***	−.24**	−.18*	−.19*	−.25**	−.25**
4. BMI				−.07	−.02	.03	.09	−.01	−.08	−.11
5. MET					−.10	−.21**	−.05	−.08	.06	−.11
6. Max HR F–W						.73***	.64***	.44***	.53***	.53***
7. Max HR W–S							.40***	.57***	.40***	.56***
8. Borg F–W								.60***	.52***	.41***
9. Borg W–S									.38***	.55***
10. Percent weight F–W										.73***
11. Percent weight W–S										

Note. F–W: floor to waist lift; W–S: waist to shoulder lift.
* $p < .05$; ** $p < .01$; *** $p < .001$.

maximum HR on the floor to waist lift of the PILE ($r = -.21$, $p < .01$), but not to HR during the waist to shoulder lift. TSK-2 fear scores were significantly and inversely correlated with maximum HR during both the floor to waist lift ($r = -.16$, $p < .05$) and the waist to shoulder lift ($r = -.15$, $p < .05$). Neither of the TSK-2 subscales was related to perceived effort during the tasks.

To examine the relative contribution of the demographic, pain, psychological, and physical variables to functional task performance, a simultaneous regression analysis was performed on data from both the floor to waist and waist to shoulder lift of the PILE. The data for the regression on floor to waist performance is presented in Table IV. The multiple regression coefficient with all variables entered was .67 ($F = 7.92$, $p < .0001$), and all the variables combined accounted for 44% of the variance in percent maximum weight lifted from floor to waist. Greater physiologic and perceived effort significantly predicted better task performance ($t = 2.78$, $p < .01$ and $t = 3.53$, $p < .001$) independent of the other variables in the equation. Being involved in litigation was also significantly associated with poorer performance on this task ($t = -2.65$, $p < .01$), as well as higher scores on the TSK-2 avoidance subscale ($t = -2.68$, $p < .01$). No other variables contributed independently to the prediction of percent maximum weight lifted during this task.

Table IV. Simultaneous Regression Analysis of Psychological and Physical Factors and Performance on the Floor to Waist Portion of the PILE

Variable	Beta	*t*-Ratio	*p*-Value
Pain duration	.06	0.76	n.s.
Sex	.02	0.20	n.s.
Litigation	−.20	−2.65	<.01
Compensation	−.06	−0.80	n.s.
McGill Total PRI	.16	0.57	n.s.
BMI	−.10	−1.40	n.s.
MET	.09	1.20	n.s.
Maximum HR	.27	2.78	<.01
BORG	.32	3.53	<.001
CES-D	.00	0.04	n.s.
TSK-2 avoidance	−.23	−2.68	<.01
TSK-2 fear	.10	1.25	n.s.

Table V. Simultaneous Regression Analysis of Psychological and Physical Factors and Performance on the Waist to Shoulder Portion of the PILE

Variable	Beta	*t*-Ratio	*p*-Value
Pain duration	.07	1.02	n.s.
Sex	.20	3.77	<.01
Litigation	−.06	−0.83	n.s.
Compensation	−.01	−0.14	n.s.
McGill Total PRI	.03	0.47	n.s.
BMI	−.06	−0.88	n.s.
MET	.04	0.49	n.s.
Maximum HR	.33	4.03	<.001
BORG	.32	4.10	<.001
CES-D	.00	0.04	n.s.
TSK-2 avoidance	−.18	−2.27	<.05
TSK-2 fear	−.05	−0.66	n.s.

The simultaneous regression data for the waist to shoulder lift is presented in Table V. Similar findings emerged. The multiple regression coefficient was .71 ($F = 10.41$, $p < .0001$), and all the variables combined accounted for 51% of the variance in percent maximum weight lifted. Again, greater physiologic and perceived effort significantly predicted better task performance ($t = 4.03$, $p < .001$ and $t = 4.10$, $p < .001$). Higher scores on the TSK-2 avoidance subscale ($t = -2.27$, $p < .05$) were also significantly related to poorer task performance, independent of the other variables in the equation. Sex was significantly related to the waist to shoulder lift, with women tending to perform better than men ($t = 3.77$, $p < .01$). No other variable independently predicted task performance.

DISCUSSION

The current study examined the relative contribution of beliefs that pain is a sign of serious harm or damage to the body versus beliefs that activities that cause pain should be avoided to functional limitations among persons with chronic pain, predominantly chronic low back pain. We also wished to examine how these beliefs are related to physical factors that may contribute to enhanced disability, such as physical deconditioning. Factor analysis replicated the factor structure of the TSK-2 reported by Clark *et al*. (27), with the exception of one item. The TSK-2 appears to consist of items that measure fear of pain or a pathological somatic focus, as well as avoidance of activities that may cause pain. Consistent with the observations of Crombez *et al*. (19), the results of the present study suggest that avoidance of specific activities is a stronger predictor of disability or functional limitations among chronically disabled persons with pain, compared to general fear of pain. Zero-order correlations in the present sample indicated that TSK-2 avoidance scores were significantly related to both floor to waist and waist to shoulder performance on the PILE, whereas the TSK-2 fear subscale was only significantly related to the floor to waist lift. Controlling for demographic, pain, physical factors, and depression, TSK-2 avoidance scores continued to significantly predict functional task performance, whereas fear subscale scores did not. Both subscales demonstrated significant relationships to measures of deconditioning, but these relationships tended to be small, and for estimated MET level, in the opposite direction than was hypothesized. Simultaneous regression analyses suggest that the activity

avoidance component of pain-related fear significantly contributes to functional task performance independent of depressive symptoms, pain, physical fitness, and physiological and perceived effort. The important contribution of activity avoidance to functional limitations among persons with chronic back pain is highlighted by simultaneously controlling for influence of these factors.

The design of the present study has limitations. First, the data were obtained from a cross-sectional analysis, and no inference of causality can be made. Second, the attrition in available data for the measure of MET level used in the study decreases the validity of the findings in the present study. It is likely that the observed relationship between this variable and TSK-2 scores is an underestimate of the actual relationship, as the variance in MET level was likely restricted due to the mean substitution. In addition, a post hoc analysis indicated that ability to complete the bicycle submaximal stress test was related to TSK-2 scores, thus, the inability to obtain a valid MET level was not random. We suggest that the bicycle ergometer submaximal stress test is essentially a functional task. The relationship between the TSK-2 fear subscale and another measure of physical deconditioning, BMI, was statistically significant, but low. This relationship should be explored in greater detail, although the simultaneous regression suggest that the influence of activity avoidance on disability is independent of the two measures of physical fitness examined in the study.

Several demographic factors also contributed to functional task performance, even when controlling for the influence of other physiologic and psychological factors. Zero-order correlations indicated that compensation and litigation were significantly associated with performance on the PILE, and litigation continued to significantly predict PILE performance on the waist to shoulder lift when examined in the simultaneous regression analysis. Previous studies have found that individuals receiving Workers' Compensation tend to respond poorly to treatment (40–42), and that failure in treatment is often attributed to secondary gain (43). Zero-order correlations indicated that longer duration of pain was associated with better performance on the PILE. This may be attributable to accommodation to pain over time (44). Women tended to perform better than men did on the waist to shoulder lift on the PILE. This may be due to the fact that women, tending to be shorter in height, were forced not to bend forward as far as men during this task as it was performed at a consistent height (30–54 in.) for all subjects. Given that the majority of patients suffered from low back pain, this may have made the task more difficult or anxiety-provoking for men.

The results of the present study suggest that future studies examining the relationship between pain-related fear and disability should examine activity avoidance as a key component of pain-related fear. Although general fear of pain may contribute to avoidance of pain soon after the development of pain (19), the results of the present study suggest that activity avoidance contributes to and perpetuates disability among persons with chronically disabling back pain. These results are also consistent with the findings of Lackner *et al*. (21) referred to in the Introduction, if one assumes that beliefs that activities should be avoided are inversely related to functional self-efficacy beliefs. This also has significant implications for interventions designed to alleviate pain-related fear among persons with chronic back pain. The results of the present study suggest that interventions specifically designed to assist patients with confronting activities they avoid might be particularly beneficial adjunctive treatments for disability due to pain. As mentioned in the Introduction, persons with chronic pain and a high degree of pain-related fear tend to overestimate the amount of pain they will experience during functional activity (5,6). This is particularly

important as anticipated pain during functional activity, and not actual pain experienced during a task, better predicts task performance among persons with chronic back pain (19). Thus, interventions designed to improve the accuracy of anticipated pain during functional activity, as well as treatments designed to expose back pain patients to activities they avoid, might be particularly beneficial.

Despite the current findings, it can be debated whether fear of pain and pain avoidance are adaptive or dysfunctional among persons with pain. Although the present study and others reviewed earlier in this paper suggest that pain-related fear exacerbates disability independent of clinical pain, fear of pain and pain avoidance are often viewed as adaptive in the context of acute pain or dangerous environments. For example, loss of pain sensation in persons with leprosy and other neuropathies may be catastrophic because of the inability to mount fear and subsequent avoidance of painful stimuli (45). Also, The International Paris Task Force on Back Pain recently proposed that exercise is contraindicated for acute back pain (46). This raises several issues related to when and under what circumstances pain avoidance and fear of pain become maladaptive.

The results of the current investigation are also consistent with a growing literature that functional disability among persons with chronic pain is not significantly related to clinical pain intensity (7–10), and studies suggest that functional performance in these populations is significantly related to psychological factors such as somatization, catastrophic thoughts about pain, perceived control over pain, functional self-efficacy beliefs, and psychological distress (21,47–49). Although the zero-order correlation between self-reported pain intensity and performance on the floor to waist lift was significant, the zero-order relationship between pain and the waist to shoulder lift was not. This may reflect the fact that most persons in the sample had low back pain, and that the influence of chronic low back pain on functional activity may be more apparent on tasks involving bending as opposed to reaching. However, this relationship was no longer significant when controlling for the other physical and psychological factors examined in the simultaneous regressions. This finding is important as functional assessments of persons with pain generally consider pain to be the primary factor that limits activity. Evaluation of psychological factors such as activity avoidance and those just noted might be beneficial in terms of identifying factors other than pain that contribute to disability among persons with chronic pain.

Further research examining the factors that contribute to high pain-related fear would also be beneficial. For example, Geisser and Roth (8) found that patients who were unsure about or disagreed with their underlying etiology of pain displayed greater levels of pain-related fear, which in turn contributed to higher disability. Research has also suggested that high pain-related fear may be associated with greater negative thoughts about pain, or catastrophizing (10), and greater muscular reactivity to stressors, which may contribute to ongoing pain (18). Further examination of the factors that contribute to high pain-related fear may lead to early detection and prevention of high pain-related fear, in addition to enhancing treatments for individuals with chronic pain and high pain-related fear.

In summary, activity avoidance appears to be the most important contributor to functional limitations among persons with chronically disabling back pain. This finding suggests that alteration of activity avoidance may be an important adjunct in treating disability due to back pain, and instruments designed to assess pain-related fear should include measurement of this construct. The results of this investigation suggest that future studies should continue

to examine the relative importance of activity avoidance in contributing to disability due to chronic pain.

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