

# Psychosocial Variables Associated with Back Pain in the Elderly: A Retrospective Analysis

Chad Cook, PhD, PT, MBA, OCS, COMT,<sup>1</sup> Jean-Michel Brismée ScD, PT, OCS, FAAOMPT,<sup>2</sup>  
Phillip S. Sizer, Jr, PhD, PT, OCS, FAAOMPT<sup>3</sup>

<sup>1</sup>Assistant Professor & Program Director, Department of Rehabilitation Sciences, Texas Tech University Health Sciences Center, Odessa, TX

<sup>2</sup>Assistant Professor, Department of Rehabilitation Sciences, Texas Tech University Health Sciences Center, Lubbock, Texas

<sup>3</sup>Associate Professor & Program Director, ScD Program in Physical Therapy, Department of Rehabilitation Sciences, Texas Tech University Health Sciences Center, Lubbock, Texas

## ABSTRACT

**Background and Purpose:** Numerous studies have reported the association of psychosocial factors with experience of back pain in younger populations. Similar investigations of the elderly are limited, especially with respect to the elderly that continue employment. The purposes of this study were to determine if established psychosocial risk factors were associated with report of back pain in: (1) a sample of elderly survey participants and (2) a subset of these participants who were working. **Methods:** This was a retrospective study using cross-sectional data from the 1998 Health and Retirement Study (HRS). Two logistic regression analyses investigated the association of back pain with established psychosocial variables. **Results:** We found that few psychosocial variables were associated with experience and report of back pain in the elderly. Significant variables were "perception of poor health" (odds ratio = 1.99), "pain or pain perception" (odds ratio = 2.39), "psychological problems" (odds ratio = 1.74), and "female gender" (odds ratio = 1.25). Only 1 psychosocial variable, "perception of poor health" (odds ratio = 2.02), was associated with experience or report of low back pain in the employed elderly. **Conclusion:** These findings suggest that for a sample of elderly individuals, back pain was influenced by selected psychosocial factors and that employment may alter the influence of these factors.

**Keywords:** psychosocial factors, low back pain, occupation, sociodemographic factors

## INTRODUCTION

Numerous studies have suggested that psychosocial factors<sup>1-9</sup> are more important predictors of back pain than physical factors.<sup>2,10-15</sup> These psychosocial risk factors include depression;<sup>6,7,16,17</sup> perception of poor health;<sup>6,18</sup> family social support that includes marital status;<sup>6,19,20</sup> pain or pain perception;<sup>2,6,21,22</sup> fear avoidance behaviors;<sup>6,18</sup> and psychological problems that include anxiety,<sup>6,7</sup> stress, coping behaviors,<sup>6,8</sup>

and emotional problems.<sup>23</sup> Additionally, numerous psychosocial job satisfaction indexes identified as "yellow, blue, and black flags" are associated with chronicity of low back symptoms.<sup>2,6,18,20,24,25</sup>

Sociodemographic factors offer little predictive value,<sup>26</sup> though selected variables such as smoking,<sup>27-29</sup> being an older adult female retired from employment,<sup>30</sup> and having low education,<sup>20,31,32</sup> have been retrospectively associated with back impairment. Little evidence suggests that chronological age is a predictive factor for acute or chronic low back pain.<sup>26,33-35</sup> Studies indicating age as a predictor have only done so in the context of postsurgical recovery.<sup>36,37</sup>

The preponderance of research to date has focused on younger working subjects, typically involved in work-loss scenarios. The authors of this study have found insufficient evidence for a relationship between psychosocial factors and back pain in the elderly population, especially those that continue employment. The purposes of this study were to determine if established psychosocial risk factors were associated with report of back pain in: (1) a sample of elderly survey participants and (2) a subset of these participants who were working. There is a potential for the elderly to be influenced by the same psychosocial factors that influence younger individuals. This retrospective study may serve as a preliminary foundation for future predictive investigations examining back impairment in the elderly.

## METHODS

### Study Design

This study is a retrospective cross-sectional, survey design using data from the 1998 Health and Retirement Study (HRS). The HRS is a pre-existing database that consists of over 600 questions associated with health, retirement, and finances. The HRS group was able to target their sample with the help of multiple private and governmental agencies.<sup>38</sup> Upon registration, the HRS data are available free to research analysts at <http://www.umich.edu/~hrswwww/>.

### Sample

The population in the HRS data set includes a randomized cross sectional, longitudinal sample of 21,284 Americans near retirement or retired. Because the HRS sample consists of retired or near-retired Americans age 25 to 106, we restricted the database to a smaller sample consisting of respondents 65 and older (Medicare beneficiary population). This reduction created a new subsample of 11,126 respondents. This subsample of 11,126, age 65 and older was further reduced to our targeted sample (N = 2,357) by selecting participants first interviewed in 1998. Those not included in this sample were participants who were interviewed several times over multiple years, providing longitudinal responses.

Address correspondence to: Chad Cook, Assistant Professor & Program Director, Department of Rehabilitation Sciences, Texas Tech University Health Sciences Center, Odessa, TX, Ph: 432/349-4603, Fax: 432/335-5365 (cookttu@yahoo.com).

By restricting participants to those who entered the HRS database in 1998, the sample was no longer longitudinal and association among variables is more compelling. One weakness of longitudinal data sets is the inability to associate data values selected from one specific timeframe of multiple interviews. By choosing those participants whom responded only in 1998, the dataset is cross sectional and associations are applicable. Lastly, to isolate the working elderly from the sample for the second logistic regression, it was necessary to refine the data further. By using the reduction function of SAS, a subset of presently employed elderly (N = 344) was further distilled from the sample of 2,357.

### **Instrument**

The HRS was one of the largest, most expensive (\$31 million) and most complex academic social science projects ever undertaken.<sup>38</sup> The HRS, which includes multidisciplinary perspectives integrating information from economics, sociology, epidemiology, and demography, is a recurrent survey of the same participants conducted in 6-month increments every 2 years.<sup>38</sup> New participants are included each 2 years to replace those that have expired. The cross sectional pool of respondents represents data collection within a 6-month time span via telephone, with each survey administrator specifically trained for consistent performance. Since tabulation and computation of data take years to report, the 1998 data are the most current responses to date.

### **Validity and Reliability**

The HRS database consists of survey subjects from 4 separate survey waves: 'Phase I' (individuals born in 1931-1941), 'Phase II' (individuals born in 1914-1923), 'Phase III' (individuals born in 1924-1930), and 'Phase IV' (individuals born in 1942-1947). Each group was included to prevent a lapse in age cohorts. Reliability of each wave was good (raw 0.83, overall 0.84) using a test-retest method. Those who were institutionalized were excluded from the survey because the potential exists that these individuals may present with cognitive problems.<sup>39</sup>

The psychometric properties of the HRS were carefully evaluated through multiple iterations. Face validity for each group of questions was developed through the collective efforts of researchers from the U.S. Census Bureau, the University of Michigan, National Institute on Aging, the Social Security Administration, the Pension and Welfare Benefits Agency, the U.S. Department of Labor, and the NIA Office of Minority Affairs.<sup>38</sup> Construct validity was derived from well-known scales that included activities of daily living, cognitive measures, and somatic measures. Content validity was analyzed through benchmark surveys and cognitive scales. Univariate analyses were executed to determine normality of the data. Reliability and validity assessment demonstrated that the findings were "good" and the survey was valid.<sup>39</sup>

## **VARIABLES**

### **Dependent variable**

The dependent variable of the study "experience or report of back pain" was operationally defined by the HRS database as "...persistent and troublesome problems including symp-

toms of back pain." The HRS administrators do not provide further explanation to each participant, primarily to ensure a singular and specific representation from the multiple administrators. Participants were allowed to adopt their own interpretation of back pain using the specific definition provided.<sup>39</sup>

### **Independent variables**

Psychosocial independent variables were selected based on availability of characteristics within literature and the HRS database. Report of depression, perception of poor health, smoking, gender, age, and lower education (less than a high school or equivalent degree) were well defined with the HRS questionnaire. The variable 'psychiatric problems' included a diagnosis of emotional, nervous, or psychiatric problems.<sup>39</sup> The independent variables pain or pain perception and family social support that included marital status required data manipulation and creation of new codes. Pain or pain perception was recoded using 3 survey questions: (1) report of frequent troubling pain; (2) report of severe pain most of the time; and (3) report of pain that alters usual activities including activities of daily living (ADLs). This recoded pain variable is similar to the constructs used by other investigations including fear of injury or reoccurrence of pain.<sup>6,40</sup> Family support, including marital status, was recoded to include the statuses of divorce and/or separation.

### **Data Analysis**

Data analysis consisted of descriptive and inferential statistics that included a frequency distribution and 2 multivariate logistic regression analyses. The SAS version 8.2 was used to perform a logistic regression analysis with simultaneous entry designed to identify psychosocial factors associated with report of back pain in: (1) a sample of elderly survey participants; and (2) a subset of these participants who were working. A limitation in the SAS software program required the use of the 'descending' function of SAS for each logistic regression analysis. Otherwise, SAS would have defaulted to the selection with the most numerous choices and provided contradictory conclusions.

## **RESULTS**

### **Sample Characteristics**

The sample population ranged from age 65 to 84 years. A summary of the descriptive statistics is found in Table 1.

### **Regression Analyses**

The first logistic regression analysis measured the association of psychosocial variables with back pain in the sample of elderly survey participants. The model fit characteristic of the analysis was significant (Likelihood Ratio = 135.44;  $p < 0.0001$ ) and the R-Square value was 0.056. The percentage accuracy in classification was 84%. Four variables achieved significance ( $\alpha \leq 0.05$ ): perception of poor health (odds ratio = 1.99), pain or pain perception (odds ratio = 2.39), psychological problems (odds ratio = 1.74), and female gender (odds ratio = 1.25). All variables were associated with an increased likelihood of experiencing and reporting back pain. The findings of the logistic regression analysis are presented in Table 2.

The second logistic regression analysis examined the

association of psychosocial variables and back pain among a subset of presently employed elderly survey participants. The model fit characteristic of the analysis achieved significance (Likelihood Ratio = 15.93;  $p=0.04$ ); the R-Square value was 0.045. The percentage accuracy in classification was 64%. Only 1 variable, perception of poor health (odds ratio = 2.02), was significantly associated with report of back pain ( $\alpha \leq 0.05$ ). No other variable approached significance. Table 3 outlines the characteristics of the second logistic regression analysis.

## DISCUSSION

**Table 1. Demographics of Elderly Individuals Included in the Study**

Descriptors	n	(%)
Sex		
Male	986	(42%)
Female	1371	(58%)
Marital Status		
Divorced or Separated	260	(11%)
Other	2097	(89%)
Report of Depression		
Yes	268	(11%)
No	2089	(89%)
Report of Psychological Problems		
Yes	243	(10%)
No	2114	(90%)
Report of Poor Health		
Yes	734	(31%)
No	1623	(69%)
Pre-Occupation; Pain Perception		
Yes	104	(4%)
No	2253	(96%)
Education		
Low Education (< 12 years)	759	32%
Other	1598	(68%)
Smoker		
Yes	338	(14%)
No	2019	(86%)
Report of Back Pain		
Yes	837	(36%)
No	1520	(64%)
Age		
65-69	645	(14%)
70-74	1682	(85%)
75-80	23	(1%)
81 and older	7	(<1%)

Four variables (pain or pain perception, psychological problems, perception of poor health, and female gender) were found to be significant predictors of back pain in the first logistic regression analysis. Perception of poor health was also significantly associated with report of back pain in the subset of working-elderly. Remarkably, though other variables (eg, depression, low education, etc.) are associational in numerous prospective and retrospective studies that examined younger employed subjects,<sup>6,31,42-44</sup> this study found no other variables that achieved significance.

## Pain or Pain Perception

Few measurement technologies measure pain-related behaviors with confidence and reliability, and few include the same constructs.<sup>17,40,45</sup> Though pain is a perceptual phenomenon, the body's physiological reaction includes physiological and psychological reactions.<sup>8</sup> To accurately define pain perception, it is necessary to include criteria of physiological responses,<sup>6,40</sup> and fears of catastrophic reinjury with activities.<sup>2,6,21,22</sup> Only 4.4% of the study participants met the criteria for the preoccupation pain perception variable, a percentage similar to previous studies that reported that the lay population consists of a small but notable group that is preoccupied with severe chronic pain.<sup>2,8,36</sup>

The logistic regression involving the working elderly failed to confirm a relationship between pain or pain perception and report of back pain. This may be because of the role employment takes in the elderly individual's life. An internal locus of control and active 'self-reliance' coping strategies can improve one's perception of chronic pain, where an external locus of control and 'passive reliance' in others could increase pain perceptions.<sup>46-48</sup> Elderly individuals who are not employed could suffer from increased perception of pain in part due to increased reliance on others during daily activities and a sensed loss of control with respect to pain. Conversely, a lack of relationship between preoccupation with pain or pain perception and report of back pain may be related to the positive influence that employment could have on self-reliance and internal loci of control. Moreover, employment in the elderly may divert a preoccupation with pain due to its influence on diverting attention, which can reduce the perception of chronic pain and related symptoms.<sup>49,50</sup>

Multiple studies have found numerous psychosocial fac-

**Table 2. Logistic Regression Analysis Showing the Association of Psychosocial Variables with Report of Back Pain in a Sample of Individuals at Least 65 Years of Age**

Parameter	df	Odds Ratio	95% Confidence Limits	Significance
Report of Poor Health	1	1.99	1.64 to 2.41	< 0.0001*
Pre-occupation, Pain Perception	1	2.39	1.55 to 3.68	< 0.0001*
Psychological Problems	1	1.74	1.32 to 2.31	< 0.0001*
Female Gender	1	1.25	1.05 to 1.50	0.014**
Report of Depression	1	1.23	0.93 to 1.61	0.14
Divorced or Separated	1	1.19	0.91 to 1.57	0.21
Identification as Smoker	1	1.15	0.89 to 1.47	0.27
Chronological Age	1	0.98	0.94 to 1.02	0.35
Less than High School Education	1	1.01	0.83 to 1.21	0.99

\*  $p < 0.0001$   
\*\*  $p \leq 0.05$

**Table 3. Logistic Regression Analysis Showing the Association of Psychosocial Variables with Report of Back Pain in a Sample of Working (Employed) Individuals at Least 65 Years of Age**

Parameter	df	Odds Ratio	95% Confidence Limits	Significance
Report of Poor Health	1	2.03	1.13 to 3.64	0.017**
Pre-occupation, Pain Perception	1	5.93	0.57 to 61.4	0.13
Psychological Problems	1	1.79	0.73 to 4.38	0.20
Divorced or Separated	1	1.43	0.74 to 2.78	0.29
Identification as Smoker	1	1.47	0.71 to 3.02	0.30
Report of Depression	1	1.45	0.65 to 3.23	0.36
Less than High School Education	1	0.79	0.46 to 1.39	0.42
Chronological Age	1	1.04	0.92 to 1.18	0.51
Female Gender	1	1.04	0.64 to 1.69	0.88

\*\*  $p \leq 0.05$

tors that are related to experience of back pain in younger populations. Our study found selected psychosocial factors were associated with report of back pain. The differences between these findings may involve the role that employment plays between both groups. Frymoyer suggested that increases in work-related reports of back pain may result from an entitlement component of occupation on the younger population.<sup>11</sup> Selected authors have noted that within industrialized nations, back pain has become a phenomenon of litigation, sick days, and disdain of one's current job.<sup>11</sup> The younger working population is significantly affected by employment based issues extending beyond physical occupational demands.<sup>8</sup> Whether the elderly also are affected by these issues is unknown. Unless the elderly individual relies solely on the income made from the job situation, they are most likely less influenced by these occupational factors. The employed-elderly may continue to work out of desire and not by need. To date, there is little evidence other than theory that supports this supposition. Future prospective studies associated with job attitudes that measure a sample of working elderly could investigate this issue further.

### Psychological Problems

Numerous studies have suggested that psychological and cognitive factors are associated with report of low back pain and progression to chronicity.<sup>3,41,51,52</sup> Factors such as stress, frustration, anger, anxiety, personal alienation, manipulation tendencies, and fear have all been reported.<sup>52-54,56-59</sup> The complexities that are associated with elderly life may contribute to the escalation of these psychological factors. The results from this study may suggest that elders' continued employment may reduce the influence of these factors on chronic pain incidence and increasing individuals' ability to cope with pre-existing chronic pain conditions. Conversely, the findings may indicate that older adults are more likely to work if they experience decreased psychological problems, evident from the failure of psychological factors to meet significance in our study. A prospective analysis may serve to answer this question.

Intuitively, a program designed to treat psychological factors in addition to pain should exhibit more success; however, the success of such intervention programs is mixed. Ostelo et al<sup>53</sup> reported no differences in fear of movements and catastrophizing for groups who received controlled versus psychological interventions. Others have reported that

treatment of pain-related complaints through traditional rehabilitation interventions may positively alter the influence of psychological factors, including emotions and coping behaviors.<sup>3,54</sup> This finding suggests that a traditional, biomedical approach to care of back pain still has merit. Horneij and colleagues<sup>55</sup> supported this finding when they reported that a work-place stress management course was equivocal to a physical intervention program which solely targeted reduction of pain. However, the question remains whether an independent psychological or behavioral intervention is effective for reducing report of back pain and progression to chronicity. In selected instances of physical improvements, separate psychological interventions may be necessary for reducing back pain incidence.<sup>60</sup>

### Poor Perceived Health

Poor perceived health lowers the expectations of recovery from a back injury.<sup>18,52</sup> This finding is supported by many prior studies, including those on multiple health-related maladies.<sup>61</sup> The association between a perception of poor health and experience of back pain suggests that a program geared toward prevention of back pain should additionally focus on general health and fitness of the entire population.<sup>62</sup> This hypothesis is supported by Vuori<sup>63</sup> who reported evidence from randomized controlled trials that physical activity could produce a preventative effect on low back pain. Positive associations have been found between the development of back pain and pre-existing health conditions such as respiratory disorders, cardiovascular disease, and poor general health.<sup>64</sup> Because the prevalence of these health conditions increases with age, general fitness programs promoting health through appropriate nutrition information and exercises might be useful in decreasing the morbidity associated with back pain.<sup>62,65</sup> Since the negative impact of spinal pain on the health status of patients has been established,<sup>66</sup> and that poor health has been positively associated with reports of back pain,<sup>64</sup> multidisciplinary rehabilitation programs<sup>67</sup> and general fitness programs<sup>62</sup> could be beneficial in preventing back pain, especially for the more sedentary elderly population.<sup>68</sup>

### Female Gender

Why elderly females have an elevated likelihood of reporting back pain is less understood. Although men are more likely to report injury at work, women appear to be substan-

tially affected by an injury. Past studies have reported that younger, working females were less likely to return to work quickly after an injury,<sup>69-72</sup> less likely to return to work,<sup>2,73</sup> and more likely to complain of pain or disability after an injury.<sup>52</sup> Sheffer et al<sup>30</sup> reported that retired females are more likely to report chronic pain behavior associated with back pain but suggested this finding may be associated with reduced activity.

One explanation may include physiological differences between males and females. Elderly females are more inclined to spine compression fractures associated with osteoporosis; by the age of 80, they experience 3.3 times the loss of bone strength realized by men.<sup>74</sup> Regardless of age, women report higher levels of morbidity and physiological illness than men in illness-related phenomenon.<sup>75</sup> Further study is suggested in this area.

### Limitations

This study is not without limitations. Back pain is seldom classified into homogenous diagnostic groups for clarification. The chance exists that a number of variables may affect a certain 'type' of classification more than others, thus altering the strength of the relationship. Using back classifications may specify variable association with more common elderly diagnoses such as degenerative disc or joint disease.

Additionally, this study is retrospective in nature, thus appropriate for associations but inappropriate for predictions. Cross sectional studies provide only a snapshot of information at a specific time. A prospective predictive longitudinal analysis would provide more valuable data leading to information attributed over time. A predictive model designed for accurate identification of subjects susceptible for disability associated with back pain, could generate substantial savings in disability-related costs.<sup>1</sup>

### CONCLUSION

This study found that selected psychosocial factors influence experience and report of back pain in a sample of American subjects aged 65 and older. Additionally, a subset of employed elderly appears to be less influenced by psychosocial factors when compared to the sample that included both working and not working elderly. Future studies should prospectively analyze psychosocial variables in the elderly and working-elderly populations to ascertain whether a predictable association exists.

### REFERENCES

1. Cats-Baril W, Frymoyer J. Identifying patients at risk of becoming disabled because of low back pain. The Vermont Rehabilitation Engineering Center predictive model. *Spine*. 1991;16:605-607.
2. Gatchel R, Polatin P, Mayer T. The dominant role of psychosocial risk factors in the development of chronic low back pain disability. *Spine*. 1995;20:2702-2709.
3. Hasenbring M, Marienfeld G, Kuhlendahl D, Soyka D. Risk factors of chronicity in lumbar disc patients. A prospective investigation of biologic, psychologic, and social predictors of therapy outcome. *Spine*. 1994;19:2759-2765.
4. Hunter S, Shaha S, Flint D, Tracy D. Predicting return to

- work. A long-term follow-up study of railroad workers after low back injuries. *Spine*. 1998;23:2319-2328.
5. Kendall N. Psychosocial approaches to the prevention of chronic pain: The low back paradigm. *Best Pract Res Clin Rheumatol*. 1999;13:545-554.
6. Pincus T, Vlaeyen S, Kendall S, Von Korff M, Kalauokalani D, Reis S. Cognitive-Behavioral therapy and psychosocial factors in low back pain. *Spine*. 2002;27:E133-E138.
7. Polatin P, Cox B, Gatchel R, Mayer T. A prospective study of Waddell signs in patients with chronic low back pain. When they may not be predictive. *Spine*. 1993;22:1618-1621.
8. Truchon M. Determinants of chronic disability related to low back pain: Towards an integrative biopsychosocial model. *Disabil Rehabil*. 2001;23:758-767.
9. Truchon M, Fillion L. Biophysical determinants of chronic disability and low back pain: a review. *J Occup Rehabil*. 2000;10:117-142.
10. Carrington-Reid M, Williams C, Concato J, Tinetti ME, Gill T. Depressive symptoms as a risk factor for disabling back pain in community-dwelling older persons. *J Am Geriatr Soc*. 2003;51:1710-1717.
11. Frymoyer J. Predicting disability from low back pain. *Clin Orthop*. 1993;279:101-109.
12. Hadijistavropoulos H, Craig K. Acute and chronic low back pain: Cognitive, affective, and behavioral dimensions. *J Consult Clin Psychol*. 1994;62:341-349.
13. McIntosh G, Frank J, Hogg-Johnson S. Prognostic factors for time receiving workers' compensation benefits in a cohort of patient with low back pain. *Spine*. 2000;26:758-765.
14. Reid M, Williams C, Gill T. The relationship between psychological factors and disabling musculoskeletal pain in community-dwelling older persons. *J Am Geriatr Soc*. 2003;51:1092-1098.
15. Werneke M, Hart D. Centralization phenomenon as a prognostic factor for chronic low back pain. *Spine*. 2001; 25:758-764.
16. Schade V, Semmer N, Main C, Hora J, Boos N. The impact of clinical, morphological, psychosocial and work-related factors on the outcome of lumbar discectomy. *Pain*. 1999;80:239-249.
17. Strong J, Ashton R, Stewart A. Chronic low back pain: Toward an integrated psychosocial assessment model. *J Consult Clin Psychol*. 1994;62:1058-1063.
18. Meloche W. Biopsychosocial multivariate predictive model of occupational low back disability. *Spine*. 2002; 27:2720-2725.
19. Elkayam O, Ben Itzhak S, Avrahami E, et al. Multidisciplinary approach to chronic back pain: prognostic elements of the outcome. *Clin Exp Rheumatol*. 1996;14:281-288.
20. Valat J, Goupille P, Vedere V. Low back pain: Risk factors for chronicity. *Revue due Rhumatisme*. 1997;64:189-194.
21. Lehmann T, Spratt K, Lehmann K. Predicting long-term disability in low back injured workers presenting to a spine consultant. *Spine*. 1993;18:1103-1112.
22. McCracken L. "Attention" to pain in persons with chronic pain: a behavioral approach. *Behavioral Ther*. 1997;28: 271-284.
23. Foppa I, Noack R. The relation of self-reported back pain

- to psychosocial, behavioral, and health-related factors in a working population in Switzerland. *Soc Sci Med*. 1996; 43:1119-1126.
24. Schultz I, Crook J, Berkowitz S, et al. Biopsychosocial multivariate predictive model of occupational low back disability. *Spine*. 2002;27:2720-2725.
  25. Williams R, Pruitt S, Doctor J, et al. The contribution of job satisfaction to the transition from acute to chronic low back pain. *Arch Phys Med Rehabil*. 1998;79:365-374.
  26. Fritz J, George S. Identifying psychosocial variables in patients with acute work-related low back pain: The importance of fear-avoidance beliefs. *Phys Ther*. 2002;82: 973-983.
  27. Goldberg M, Scott S, Mayo N. A review of the association between cigarette smoking and the development of nonspecific back pain and related outcomes. *Spine*. 2000;25:995-1014.
  28. Oleske D, Andersson G, Lavender S, Hahn J. Association between recovery outcomes for work-related low back disorders and personal, family, and work factors. *Spine*. 2000;25:1259-1265.
  29. Tubach F, Leclerc A, Landre M, Pietri-Taleb F. Risk factors for sick leave due to low back pain: A prospective study. *J Occup Environ Med*. 2002;44:451-458.
  30. Sheffer C, Cassisi J, Ferraresi L. Sex differences in the presentation of chronic low back pain. *Psychol Women Quart*. 2002;26:329-340.
  31. Dionne C, Von Korff M, Koepsell T, Deyo R, Barlow W, Checkoway H. Formal education and back pain: a review. *J Epidemiol Community Health*. 2001;55:455-468.
  32. Viikari-Juntura E, Vuori J, Silverstein B, Kalimo R, Kuosma E, Videman T. A life-long prospective study on the role of psychosocial factors in neck-shoulder and low-back pain. *Spine*. 1991;16:1056-1061.
  33. Burton A, Tillotson K, Main C, Hollis S. Psychosocial predictors of outcome in acute and subchronic low back trouble. *Spine*. 1995;20:722-728.
  34. Katz J, Stucki G, Lipson S, Fossel A, Grobler L, Weinstein J. Predictors of surgical outcome in degenerative lumbar spinal stenosis. *Spine*. 1999;24:2229-2233.
  35. Werneke M, Hart D. Discriminate validity and relative precision for classifying patient with nonspecific neck and back pain by anatomic pain patterns. *Spine*. 2003;28:161-166.
  36. DeBerard M, Masters K, Colledge A, Schieusener R, Schlegel J. Outcomes of posterolateral lumbar fusion in Utah patients receiving worker's compensation: A retrospective cohort study. *Spine*. 2001;26:738-746.
  37. Stewart G, Sachs B. Patient outcomes after reoperation on the lumbar spine. *J Bone Joint Surg AM*. 1996;78:706-711.
  38. Juster F. An overview of the health and retirement study. *J Human Resources*. 1995;30:7-56.
  39. HRS database. Sample Sizes and Response Rates. Available at: [http://www.hrsonline.isr.umich.edu/intro/sho\\_uinfo.php?hfyle=sample&xtyp=2](http://www.hrsonline.isr.umich.edu/intro/sho_uinfo.php?hfyle=sample&xtyp=2). Accessed February 4, 2004.
  40. Frymoyer J, Cats-Baril W. Predictors of low back pain disability. *Clin Orthop*. 1987;221:89-98.
  41. Hartvigsen J, Lings S, Leboeuf-Yde C, Bakketeig L. Psychosocial factors at work in relation to low back pain and consequences of low back pain; a systematic, critical review of prospective cohort studies. *Occup Environ Med*. 2004;61:e2.
  42. Hurwitz E, Morgenstern H, Yu F. Cross-sectional and longitudinal associations of low-back pain and related disability with psychological distress among patients enrolled in the UCLA Low-Back Pain Study. *J Clin Epidemiol*. 2003;56:463-471.
  43. Kerr M, Frank J, Shannon H, et al. Ontario Universities Back Pain Study Group. Biomechanical and psychosocial risk factors for low back pain at work. *J Public Health AM*. 2001;91:1069-1075.
  44. Reichborn-Kjennerud T, Stoltenberg C, Tambs K, et al. Back-neck pain and symptoms of anxiety and depression: a population-based twin study. *Psychol Med*. 2002; 32:1009-1020.
  45. Bradley L, Lindblom U. Do different types of chronic pain require different measurement technologies? In: Chapman C, Loeser J, eds. *Issues in Pain Measurement*. New York, NY: Raven Press; 1989:445-450.
  46. Crisson J, Keefe F. The relationship of locus of control to pain coping strategies and psychological distress in chronic pain patients. *Pain*. 1988;35:147-154.
  47. Harkapaa K, Jarvikoski A, Mellin G, Hurri H, Luoma J. Health locus of control beliefs and psychological distress as predictors for treatment outcome in low-back pain patients: Results of a 3-month follow-up of a controlled intervention study. *Pain*. 1991;46:35-41.
  48. Chibnall J, Tait R. The short form of the Beck Depression Inventory: validity issues with chronic pain patients. *Clin J Pain*. 1994;10:261-266.
  49. Arntz A, Dreessen L, De Jong P. The influence of anxiety on pain: attentional and attributional mediators. *Pain*. 1994;56:307-314.
  50. Arntz A, Dreessen L, Merckelbach H. Attention, not anxiety, influences pain. *Behav Res Ther*. 1991;29:41-50.
  51. Klenerman L, Slade P, Stanley I. The prediction of chronicity in patients with an acute attack of low back pain in a general practice setting. *Spine*. 1995;20:478-484.
  52. Thomas E, Silman A, Croft P, Papageorgiou A, Jayson M, Macfarlane G. Predicting who develops chronic low back pain in primary care: a prospective study. *Br Med J*. 1999;318:1662-1667.
  53. Ostelo R, De Vet H, Vlaeyen J, et al. Behavioral graded activity following first-time lumbar disc surgery: 1-year results of a randomized clinical trial. *Spine*. 2003;28:1757-1765.
  54. Weiner D, Rudy T, Glick R, Boston, et al. Efficacy of percutaneous electrical nerve stimulation for the treatment of chronic low back pain in older adults. *J Am Geriatr Soc*. 2003;51:599-608.
  55. Horneij E, Hemborg B, Jensen I, Ekdahl C. No significant differences between intervention programmes on neck, shoulder, and low back pain: a prospective randomized study among home care personnel. *J Rehabil Med*. 2001;33:170-176.

56. Keefe F, Brown G, Wallston K, Caldwell D. Coping with rheumatoid arthritis pain: catastrophizing as a maladaptive strategy. *Pain*. 1989;37:51-56.
57. Reesor K, Craig K. Medically incongruent chronic back pain: physical limitations, suffering, and ineffective coping. *Pain*. 1988;32:35-45.
58. Rosenstiel A, Keefe F. The use of coping strategies in chronic low back pain patients: relationship to patient characteristics and current adjustment. *Pain*. 1983;17:33-44.
59. Sullivan M, D'Eon J. Relation between catastrophizing and depression in chronic pain patients. *J Abnorm Psychol*. 1990;99:260-263.
60. Alaranta H, Rytokoski U, Rissanen A, et al. Intensive physical and psychosocial training program for patients with chronic low back pain. A controlled clinical trial. *Spine*. 1994;19:1339-1349.
61. Stoedefalke K. Motivating and sustaining the older adult in an exercise program. *Topics in Geriatric Rehabilitation*. 1985;1:78.
62. Hunt A. Musculoskeletal fitness: the keystone in overall well-being and injury prevention. *Clin Orthop*. 2003;409:96-105.
63. Vuori I. Dose-response of physical activity and low back pain, osteoarthritis, and osteoporosis. *Med Sci Sports Exerc*. 2001;33(Suppl):S551-586.
64. Hestbaek L, Leboeuf-Yde C, Manniche C. Is low back pain part of a general health pattern or is it a separate and distinctive entity? A critical literature review of comorbidity with low back pain. *J Manipulative Physiol Ther*. 2003;26:243-252.
65. Feuerstein M, Berkowitz S, Huang G. Predictors of occupational low back disability: implications for secondary prevention. *J Occup Environ Med*. 1999;41:1024-1031.
66. Fanuele J, Birkmeyer N, Abdu W, Tosteson T, Weinstein J. The impact of spinal problems on the health status of patients: have we underestimated the effect? *Spine*. 2000;25:1509-1514.
67. Lang E, Liebig K, Kastner S, Neundorfer B, Heuschmann P. Multidisciplinary rehabilitation versus usual care for chronic low back pain in the community: effects on quality of life. *Spine*. 2003;3:270-276.
68. Bijnen F, Feskens E, Caspersen C, Mosterd W, Kromhout D. Age, period, and cohort effects on physical activity among elderly men during 10 years of follow-up: the Zutphen Elderly Study. *J Gerontol A Biol Sci Med Sci*. 1998;53:M235-241.
69. Cheadle A, Franklin G, Wolfhagen C, et al. Factors influencing the duration of work-related disability: A population based study of Washington state worker's compensation. *Am J Public Health*. 1994;84:190-196.
70. Coste J, Delecoeuillerie G, Cohen de Lara A, Le Parc J, Paolaggi J. Clinical course and prognostic factors in acute low back pain: An inception cohort study in primary care practice. *Br Med J*. 1994;308:577-580.
71. Crook J, Moldofsky H, Shannon H. Determinants of disability after a work related musculoskeletal injury. *J Rheumatol*. 1998;25:570-577.
72. Infante-Rivard C, Lortie M. Prognostic factors for return to work after a first compensated episode of back pain. *Occup Environ Med*. 1996;53:488-494.
73. Cairns D, Mooney V, Crane P. Spinal pain rehabilitation: Inpatient and outpatient treatment results and development of predictors of outcome. *Spine*. 1984;9:91.
74. Cummings S, Rubin SM, Black D. The future of hip fractures in the United States: Numbers, costs, and potential effects of postmenopausal estrogens. *Clin Orthop*. 1990;252:163-166.
75. Sayer G, Britt H. Sex differences in morbidity: A case of discrimination in general practice. *Soc Sci Med*. 1996;42:257-264.