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Do worker's compensation patients with neck pain have lower SF-36 scores?

Received: 12 October 2001
Revised: 6 March 2002
Accepted: 12 April 2002
Published online: 15 June 2002
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Abstract Poorer outcomes of treatment are reported in patients with spinal disorders who receive worker's compensation. The reason for their suboptimal outcomes is unclear. No study has examined the relationship between worker's compensation and SF-36 health status of patients with neck pain. The aim of our study was to compare the self-perceived health status of patients with neck pain receiving worker's compensation, with that of patients not receiving worker's compensation. A cross-sectional study was conducted on 2356 patients with neck pain who were evaluated at the 27 centers comprising the National Spine Network, between January 1998 and April 2000. The outcome measures used were the eight individual and two component scores of the SF-36 health survey. Of the 2356 patients, 171 (7%) were receiving worker's compensation. Bivariate

analyses revealed seven individual scores (except General Health) and two summary scores of the SF-36 were significantly lower in patients receiving worker's compensation. After controlling for confounding covariates, worker's compensation status was a significant predictor of lower SF-36 scores for Physical Functioning ($P<0.05$). The results of this study indicate that worker's compensation status is associated with poorer Physical Functioning in patients presenting with neck pain. Another significant finding of the study is that confounding factors can exert major effects on the SF-36 scores obtained on normal validated instruments.

Keywords National Spine Network · Neck pain · Physical Functioning (PF) · SF-36 health status · Worker's compensation

Introduction

Spinal disorders have a profound effect on the workforce and the health care resources available [2, 6]. The socioeconomic burden of spinal disorders is steadily increasing. Studies have indicated that 80% of the population experiences back pain during their active lives [10]. Recovery from various spinal conditions depends not only on physical factors, but also on psychological factors [20]. Patients receiving compensation are more likely to be influenced by psychological factors [16], thus delaying re-

covery from back pain [8]. Worker's compensation status maybe associated with later return to work [9, 12, 16, 17], though this statement is disputed by some [3].

Worker's compensation and litigation negatively affect the post-rehabilitation prognosis for chronic back pain [5]. It has been reported that active worker's compensation and litigation issues are associated with poor operative management results for chronic back pain in adults with low-grade spondylolisthesis [19].

The physical and mental health status of worker's compensation patients evaluated for spinal problems have historically received little attention [1]. The patient's per-

ception of their health status is becoming increasingly important in outcomes research [11]. Assessment of the health status of patients receiving worker's compensation may allow identification of patients at higher risk of chronicity and absenteeism from work.

The Short Form Health Survey (SF-36) measures health-related qualities of life [21]. It has been recommended for spine research because of its brevity, psychometric properties, and wide clinical use with patients who have other chronic medical conditions [4, 18]. The ease of use and interpretability of the SF-36 questionnaire shows that it can be a useful adjunct in the assessment of patients with low-back pain [18].

No study has examined the effects of worker's compensation on the SF-36 health status of patients evaluated for neck pain. The purpose of our study is to detect significant differences in the health status of patients with neck pain who received worker's compensation versus other sources of payment.

Materials and methods

This is a cross-sectional study on 2356 patients with neck pain enrolled at first visit in the National Spine Network (NSN) database from January 1998 to April 2000 inclusively. The NSN, established in February 1995, is a non-profit organization of 27 spine care centers located throughout the United States. These centers are professionally recognized as international leaders in high-quality patient care and for their commitment to appropriate treatment of spine-related conditions. The NSN was formed as a mechanism to foster longitudinal research into the care of spine patients by spine specialists.

The data from our study were derived from the NSN's Initial Visit Health Survey questionnaire, which was completed by patients when first evaluated for back or neck pain. There were no criteria applied to the initial patient selection. The patients answered questions regarding age, gender, ethnicity or race, marital

status, highest education attained, smoking status, comorbidity, current working status, worker's compensation status, disability insurance status, litigation status, previous spinal surgery, and presence and duration of symptoms related to the spine. They also completed the standardized, self-administered Medical Outcomes Trust's SF-36 health status questionnaire. The physicians then provided information about various clinical signs (neurological signs, non-organic signs, and dermatomal distribution of pain), diagnosis, and treatment plans.

The functional status of the patients at initial evaluation was measured by the SF-36 health status questionnaire, administered at the NSN centers. The SF-36 describes both the physical and mental components of health (Table 1, Table 2). The eight scales of the SF-36 are: Physical Functioning (PF); role function as limited by physical problems or Role Physical (RP); Bodily Pain (BP); General Health (GH); Vitality (VT); Social Functioning (SF); role function as limited by emotional problems or Role Emotional (RE); and Mental Health (MH). The eight primary SF-36 scales form distinct physical and mental health domains [22]. For each of the eight scales, scores range from 0 to 100, with greater scores reflecting a better self-reported health profile. Two standardized summary scales – the Physical Component Summary Scale (PCS) and the Mental Component Summary Scale (MCS) – were derived, based on the scores for the eight scales of the SF-36 scored by a sample of the general population in the United States [23]. In contrast to the 0–100 scoring used for the eight individual SF-36 scales, a linear T-score transformation was used, such that both the PCS and MCS had a mean of 50 and a standard deviation of 10. Higher PCS or MCS scores also imply better self-reported health.

The 2356 patients were divided into two groups for statistical analyses. One group comprised patients not receiving worker's compensation. The other group included patients receiving worker's compensation. Baseline variables were obtained for all patients in the two groups (Table 3). The variables included: age, gender, ethnicity or race, marital status, body mass index, highest education level attained, smoking status, current working status, disability insurance status, legal action (none or considering/taken), medical comorbidities, type of medical institution or hospital (public/private), radiculopathy (no/yes), duration of spine-related symptoms, duration of pain, neurological signs (no/yes), non-organic or non-physiological signs (no/yes), dermatomal distribution of pain (no/yes), previous spinal surgery (no/yes). Duration of spine-related symptoms refers to the length of time the patient has

Table 1 Brief description of the SF-36 scales

SF-36 scale	No. of items	Description
Physical Functioning (PF)	10	Assesses limitations in performing physical activities
Role Physical (RP)	4	Assesses work problems or problems related to other activities of daily living, due to physical health
Bodily Pain (BP)	2	Assesses frequency of pain, and extent of role interference due to pain
General Health (GH)	5	Assesses global evaluations of general health
Vitality (VT)	4	Assesses perceived energy level
Social Functioning (SF)	2	Assesses the extent to which mental or physical health interferes with normal social activities
Role Emotional (RE)	3	Assesses problems with work or other daily activities due to mental health
Mental Health (MH)	5	Assesses general mood or affect, including depression, anxiety, and positive well-being
Physical Component Summary (PCS)	35	Assesses the physical aspects of health-related quality of life ^a
Mental Component Summary (MCS)	35	Assesses the mental aspects of health-related quality of life ^a

^a Each SF-36 item contributes differentially to these scales, based on factor analyses of the eight individual scales

Table 2 Questions and responses from the eight individual primary scales of the SF-36

Scale	Questions	Response
PF	Vigorous activities, e.g., running, lifting heavy objects, doing strenuous sports? Moderate activities, e.g., moving table, pushing vacuum cleaner, bowling, or golfing? Lifting or carrying groceries? Climbing several flights of stairs? Climbing one flight of stairs? Bending, kneeling, or stooping? Walking more than 1 mile? Walking several blocks? Walking one block? Bathing or dressing yourself?	Yes, limited a lot/Yes, limited a little/No, not limited at all
RP	Cut down the amount of time you spent on work or other activities? Accomplished less than you would like? Were limited in the kind of work or other activities? Had difficulty performing the work or other activities?	Yes/No
BP	How much bodily pain have you had during the past 4 weeks? During the past 4 weeks, how much did the pain interfere with your normal work (including both work outside the home and housework)?	None/Very mild/Mild/Moderate/Severe/Very severe Not at all/A little bit/Moderately/Quite a bit/Extremely
GH	In general, would you say your health is: I seem to get sick a little easier than other people I am as healthy as anybody I know I expect my health to get worse My health is excellent	Excellent/Very good/Good/Fair/Poor Definitely true/Mostly true/Don't know/Mostly false/Definitely false
VT	Did you feel full of pep? Did you have a lot of energy? Did you feel worn out? Did you feel tired?	All the time/Most of the time/A good bit of the time/ Some of the time/A little of the time/None of the time
SF	During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, etc? During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (visiting with friends, relatives, etc.)?	Not at all/Slightly/Moderately/Quite a bit/Extremely All the time/Most of the time/Some of the time/ A little of the time/None of the time
RE	Cut down the amount of time you spent on work or other activities? Accomplished less than you would like? Didn't do work or other activities as carefully as usual?	Yes/No
MH	Have you been a very nervous person? Have you felt so down in the dumps that nothing could cheer you up? Have you felt calm and peaceful? Have you felt downhearted and blue? Have you been a happy person?	All the time/Most of the time/A good bit of the time/ Some of the time/A little of the time/None of the time

one or more of the following symptoms: pain in the spine or radiating pain in the extremities, numbness in the extremities, weakness in the extremities, and/or paresthesia in the extremities. Duration of pain refers to the length of time the patient has spinal pain or radicular symptoms. Dermatomal distribution of pain refers to

pain in the extremities that follows particular dermatomal distributions. Radiculopathy refers to pain in the spine that radiates distal to the elbows.

Group distributions of categorical variables were assessed using Pearson's χ^2 statistic. Differences in means of continuous vari-

Table 3 Demographic variables and worker's compensation status^a

	Not worker's compensation	Worker's compensation	P-value (diff) ^b
Gender			0.001
Females	1173 (54%)	68 (40%)	
Males	1012 (46%)	103 (60%)	
Ethnicity			ns
White	1712 (87%)	142 (88%)	
Non white	247 (13%)	20 (12%)	
Marital status			ns
Married	1295 (66%)	97 (60%)	
Widowed	80 (4%)	3 (2%)	
Living with signif. other	96 (5%)	9 (6%)	
Never married	210 (11%)	26 (16%)	
Divorced/Separated	279 (14%)	27 (17%)	
Education			0.0001
Less than high school	150 (8%)	23 (14%)	
High school graduate	505 (26%)	69 (43%)	
Some college	566 (29%)	48 (30%)	
College graduate	415 (21%)	14 (9%)	
Post graduate	335 (17%)	8 (5%)	
Smoking status			0.01
Never smoked	822 (41%)	47 (29%)	
Smoke or quit	1178 (59%)	116 (71%)	
Current smoker	532	74	
Quit >1 year	576	35	
Quit <1 year	70	7	
Age			0.0001 ^c
Sample size	2178	171	
Mean±SD	49.2±13.4	44.1±9.2	
Median	48	44	
Body Mass Index			0.01 ^c
Sample size	2018	164	
Mean±SD	27.0±5.3	28.3±5.7	
Median	26.2	27.5	
Currently working			0.0001
No	996 (46%)	133 (78%)	
Yes	1189 (54%)	38 (22%)	
Disability insurance case			0.05
No	2095 (96%)	157 (92%)	
Yes	90 (4%)	14 (8%)	
Legal action			0.0001
None	1353 (81%)	62 (44%)	
Considering/taken	323 (19%)	78 (56%)	
Hospital			0.01
Public	1704 (78%)	118 (69%)	
Private	479 (22%)	53 (31%)	
Duration of symptoms			0.001
<1 year	726 (38%)	84 (52%)	
>1 year	1189 (62%)	77 (48%)	
Neurological signs			ns
No	1288 (60%)	98 (58%)	
Yes	856 (40%)	72 (42%)	

Table 3 (continued)

	Not worker's compensation	Worker's compensation	P-value (diff) ^b
Non-organic signs			0.01
No	2056 (96%)	156 (92%)	
Yes	79 (4%)	14 (8%)	
Comorbidities			ns
No	601 (28%)	39 (23%)	
Yes	1584 (72%)	132 (77%)	
Duration of pain			0.05
<7 weeks	320 (16%)	11 (7%)	
7–12 weeks	200 (10%)	21 (13%)	
3–6 months	358 (17%)	36 (22%)	
>6 months	1173 (57%)	96 (59%)	
Dermatomal pain			ns
No	939 (45%)	66 (39%)	
Yes	1126 (55%)	104 (61%)	
Radiculopathy			0.01
No	855 (39%)	46 (27%)	
Yes	1330 (61%)	125 (73%)	
Previous surgery			ns
No	1868 (85%)	139 (81%)	
Yes	317 (15%)	32 (19%)	

^a The sum of some subgroups does not equal the total number of worker's or non-worker's compensation in some cases because not all patients in the NSN database filled up the survey forms completely, i.e. there are missing data in some patients

^b Pearson's χ^2 test used to compare group distributions

^c ANOVA used to assess mean differences

ables (SF-36 scores, age and body mass index) were assessed using ANOVA methods (Table 3).

The eight individual item SF-36 scores as well as the component summary scores (PCS, MCS) were obtained for all study patients, placed in the two previously mentioned groups, and statistically analyzed (Table 4). The difference in means of the ten scores between the two groups was assessed using the F-test (ANOVA). If there was evidence of non-normality among any of the ten scores, further statistical analyses would be performed using the nonparametric Kruskal-Wallis test.

Of the baseline variables (Table 3), race, marital status, presence of neurological signs, comorbidities, dermatomal pain, and previous surgery to the spine did not significantly differ between worker's compensation and non-worker's compensation patients, using the $P < 0.05$ criterion. The remaining variables and relevant interactions were used as potential predictors in stepwise linear regression models where the SF-36 scores were the outcomes and worker's compensation status was forced into the model as a predictor. Table 5 illustrates the SF-36 scores for the two groups after adjustment for the significant demographic covariates. The scores were a reflection of the regression analyses (also called least square means).

Results

Records were available for 2356 patients who had initial spine evaluations at NSN centers between January 1998

Table 4 SF-36 scores and worker's compensation status (*n* sample size)

	Not worker's compensation	Worker's compensation	<i>P</i> -value (F) ^a
GH			ns
<i>n</i>	2135	170	
Mean±SD	61.9±22.7	59.1±23.1	
Median	67	60	
PF			0.0001
<i>n</i>	2156	169	
Mean±SD	58.9±27.9	41.9±25.6	
Median	65	40	
BP			0.0001
<i>n</i>	2150	166	
Mean±SD	35.5±22.2	23.9±17.2	
Median	33	23	
MH			0.0001
<i>n</i>	2150	170	
Mean±SD	65.0±21.1	56.6±22.6	
Median	68	60	
SF			0.0001
<i>n</i>	2155	170	
Mean±SD	57.1±29.3	41.0±26.2	
Median	50	38	
VT			0.001
<i>n</i>	2153	170	
Mean±SD	42.2±22.9	35.9±22.1	
Median	40	35	
RP			0.0001 ^b
<i>n</i>	2138	164	
Mean ±SD	24.8±36.4	5.6±21.1	
Median	0	0	
RE			0.0001 ^b
<i>n</i>	2121	163	
Mean±SD	62.1±43.8	41.5±43.2	
Median	100	33	
PCS			0.0001
<i>n</i>	2040	158	
Mean±SD	35.0±10	30.0±8.0	
Median	34	29	
MCS			0.0001
<i>n</i>	2040	158	
Mean±SD	45.9±12.3	41.1±13.0	
Median	48	40	

^a Difference in means assessed using the F test (ANOVA)^b Differences in distribution assessed by F test and non-parametric Wilcoxon test**Table 5** Adjusted SF-36 scores and worker's compensation status

	Not worker's compensation Mean±SE	Worker's compensation Mean±SE	<i>P</i> (F) ^a
GH	59.9±0.6	63.0±1.9	ns
PF	57.5±0.7	52.1±2.2	0.05
BP	34.6±0.6	33.8±1.9	ns
MH	63.2±0.6	63.8±1.8	ns
SF	56.1±0.7	55.5±2.4	ns
VT	40.6±0.7	42.9±2.0	ns
RP	23.9±1.0	19.5±3.1	ns
RE	58.5±1.2	56.5±3.7	ns
PCS	34.6±0.3	33.3±0.8	ns
MCS	44.8±0.4	44.9±1.1	ns

^a Difference in adjusted means assessed using multiple regression

ulation by worker's compensation status. Compared to non-worker's compensation patients, patients receiving worker's compensation were more likely to have the following characteristics: male; educated up to high school or lower; current/previous smoker; younger age; higher body mass index; currently not working and disabled; currently considering or had taken legal action; initial evaluation at private hospital; presence of radicular symptoms and non-organic signs; and 1 year or less of symptoms.

Table 4 shows the mean scores, based on worker's compensation status, derived for the eight individual SF-36 scales as well as the two summary scales (PCS, MCS). Analyses of differences in mean scores between the two groups using the F-test (ANOVA) revealed that worker's compensation patients scored significantly lower for all individual items, except General Health, and two component summary scales of the SF-36. The difference was highly significant ($P<0.001$). Given the non-normality of the Role Emotional (RE) and Role Physical (RP) scales of the SF-36, differences in these scores between worker's and non-worker's compensation patients were also assessed using the nonparametric test, as mentioned in the methodology section. The nonparametric test results were consistent with the ANOVA results (Table 4).

Multivariate analyses using stepwise linear regression methods (Table 5) revealed that, after controlling for confounding covariates, worker's compensation status was still a significant predictor of SF-36 score for Physical Functioning ($P<0.05$).

Discussion

The results of this study demonstrate that worker's compensation is associated with significantly lower SF-36 health status. This is the first report, to our knowledge, on the comparison of SF-36 health status scores at initial evaluation between worker's compensation and non-work-

and April 2000. Seven percent (171 patients) were receiving worker's compensation. The mean age of the 2356 patients was 48.8 (SD 13.2, range 18–91) years. The mean body mass index was 27.1 (SD 5.3, range 13.2–57.9). Table 3 summarizes the demographics of the sample pop-

er's compensation patients suffering from neck pain. The findings were derived from a large database, prospectively gathered from multiple centers specializing in the management of spine patients. As the NSN is a non-profit organization, no funding arrangements or other considerations applied to the pre-selection of patients into this study. Thus, the worker's compensation population in this study is broadly equivalent to the total worker's compensation population.

Patients receiving worker's compensation had significantly lower Physical Functioning (PF), even after controlling for possible confounding covariates (Table 5). All available potential baseline variables that might confound the results were analyzed in our study. Patients receiving worker's compensation were significantly younger than their counterparts who were not receiving worker's compensation. Age is a significant risk factor for recovery from spinal problems. One study found patients over the age of 50 returned to work with much less frequency after rehabilitation for chronic back pain [5]. Older age was also associated with increased time receiving benefits in patients with low-back pain [13]. One may suggest that this is an indication of the size effect of the worker's compensation status. However, there were other significant baseline variables that were different, such as education and smoking status. Level of education may be considered as a surrogate for socio-economic status. There were significantly fewer subjects in the worker's compensation group educated to a higher level, and this is noted to be associated with poorer responses to outcome measurement. Similarly, more worker's compensation patients smoked. By the same argument, these variables were not significant in the multivariate analysis, as one SF-36 scale (PF) was still significantly different between the two groups of patients in our study.

Health-related quality of life assessment is gaining importance in the field of spinal research, especially in patient outcomes [7]. It is important to remember that SF-36 scores represent self-reported, and not objective, data of the patients. The significant associations between lower SF-36 health status and worker's compensation may imply the need to assess the functional status of these patients when they are first evaluated for their cervical spinal disorders. The cause of poor treatment outcomes for worker's compensation patients with spinal disorders is debatable. One study focused on the outmoded rehabilitation methods as a possible role [12]. In a worker's compensation venue, outmoded postoperative rehabilitation methods may be responsible for suboptimal outcomes after spinal surgery for degenerative conditions [12]. Another study found that, in chronic low-back pain, compensation involvement may adversely affect self-reported pain, depression, and disability before and after rehabilitation [15]. Psychological factors may have a profound influence on self-perceived general well-being and disability from back pain [14]. Poorer treatment outcomes in

worker's compensation patients after surgery or rehabilitation, or both, may result from initial lower perceived health-related quality of life in these patients.

The strengths of our study are several. First of all, this is the first report comparing the SF-36 health status scores between worker's compensation and non-worker's compensation patients with neck pain at initial evaluation. The study consists of a large prospectively gathered database of spinal patients evaluated at reputable centers that made up the National Spine Network. The establishment of the NSN has been a major step forward in spine research. The unique resource of the National Spine Network allowed us to gather data from various locations throughout the United States. The data are based on a large diverse pool of 2356 patients. The size and spectrum of the data allowed us to analyze, with detail and by controlling for all available potential confounding covariates, the effect of worker's compensation status on the health status of these patients. Many possible covariates that might confound the study results were taken into account, e.g., smoking status, body mass index, educational level, litigation status, and presence of non-organic signs. In our assessment study, it appears that the primary focus is that the SF-36 scores can be used to objectively identify the "patient at risk". Of course, further prospective studies need to be performed to confirm this finding of ours.

One of the major findings of this study was that, although there were many differences in SF-36 scores between the worker's compensation and non-worker's compensation groups, only one scale (Physical Functioning) was significantly predicted following multivariate analysis. Our study demonstrated the significant impact of various confounding factors or variables on the measurement of disability and health status in patients with neck pain or other spine-related conditions. In the group analysis, worker's compensation patients were found to be significantly different in many of the baseline variables. These differences were subsequently found to be associated with many of the commonly recognized confounding factors. One of the principal difficulties in the assessment of effective treatment in these patients has been making a clear and accurate description of the patient group undergoing treatment. The value of this study, we believe, lies in the clear demonstration that confounding factors can have a major effect on the values (SF-36 scores) obtained on normal validated instruments. Our study also defines the requirements when describing a patient population for a prospective study.

The study also has several limitations. As a cross-sectional study, temporal relationships cannot be addressed, nor can causality. Although we controlled for all available potential confounders, there may be others for which data were not available. Finally, given the large sample size, very small differences may be statistically significant. As with any study, statistical significance should not be confused with clinical significance.

Acknowledgement The National Spine Network (NSN) is a non-profit organization of spine physicians who collaborate to collect data on their patients for research purposes. The analysis and any

conclusions drawn from the data provided by NSN are the sole responsibility of the authors.

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