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Outcomes in Work-Related Upper Extremity and Low Back Injuries: Results of a Retrospective Study

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Background *The outcomes of treatment for work-related injuries and illnesses are multidimensional and complex, but have rarely been explored in detail. This study was intended to provide information on a sample of workers representing a range of jobs and employers typical of the workers compensation system.*

Method *A mailed, self-report survey measuring multiple dimensions was conducted. Identified through the New Hampshire Division of Workers' Compensation First Report of Injury database, a sample of workers with injuries to their lower back (60%) or upper extremities (40%) a year prior to the study were surveyed. Response rate was 80% (N = 169; upper extremity cases = 70; low back cases = 99).*

Results *Most (82.8%) were working one year post-injury. Over half reported residual effects of the injury on work or activities of daily living. Many working subjects reported persistent injury-related anxiety and pain at the end of the work day, worse in those with low back pain compared to those with upper extremity injuries. Almost 40% of those who returned to work suffered a reinjury. Forty-four percent of respondents suffered significant injury-related financial problems, which were worse in those who had been out of work for longer periods.*

Conclusion *Occupational musculoskeletal injuries do result in significant, long-term adverse physical, economic, and psychological consequences, as demonstrated in self-reported surveys.* Am. J. Ind. Med. 37:400–409, 2000. *© 2000 Wiley-Liss, Inc.*

KEY WORDS: occupational disorders; musculoskeletal disorders; outcomes; functional status; occupational injuries; work disability

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INTRODUCTION

Work-related musculoskeletal disorders (WRMSDs) affect over 19 million US workers annually [Fryomeyer and Cats-Baril, 1991]. They account for over 85% of all workers' compensation claims, (including lacerations) each year, affect one out of every five workers, and lead to absence from work in one out of every 20 workers. WRMSDs are estimated to result in over $35 billion per year in medical and indemnity payments. Indirect costs to employers for administrative costs, replacement workers, and lost productivity have been estimated at two to eight times the direct costs for medical care and lost wages of the injured employee [Burton, 1993; Thompson, 1992].

To date, the majority of studies on the sequel of work-related injuries have focused on a narrow range of outcomes, such as return to work, employment status, or claim closure [Pransky and Himmelstein, 1996]. Often, data are obtained from secondary, administrative databases, thus limiting the types and accuracy of outcomes that can be examined [Cheadle et al., 1994]. Several studies with detailed outcomes information have shown that symptoms and functional deficits can persist long after a work-related injury. However, these investigations were undertaken in groups of workers who were sampled from selected clinical, industrial, or research intervention populations and may not be generalizeable to the experience of the majority of those who suffer work-related injuries. (See, for example, Bigos et al. [1991], Volinn et al. [1991], Feuerstein et al. [1994].

STUDY AIMS AND HYPOTHESES

This study was intended to examine long-term work-related, as well as non-work-related, consequences of occupational injuries in a community-based sample of employed individuals. The central hypothesis underlying this research is that the outcomes of treatment for WRMSDs are multidimensional and comprise a number of worker-centered aspects beyond simple return to work or clinical resolution of symptoms. These outcomes include long-term job retention, productivity and quality of work life, job satisfaction, relationships with supervisors and coworkers, economic consequences of time lost from work and of medical expenses, and a sense of physical and emotional well-being. It was hypothesized that those workers who had a shorter duration of time lost from work would suffer fewer negative economic, social, and emotional consequences of the job injury. Specifically, workers with less time lost from work due to the injury were hypothesized to have better functional status one year after the injury than those with longer periods of disability.

MATERIALS AND METHODS

Individuals were selected with low back or upper extremity injuries, as these two categories account for almost 50% of all reported work-related injuries, and over 80% of all associated insurance costs which include medical expenses and lost wage payments [Bureau of Labor Statistics, 1993]. Selection of specific injury categories also enabled the use of several previously-validated, condition-specific measures of functional status, including the Back Pain/Disability subscale from the North American Society Spine survey, or NASS, [Daltroy et al., 1996] and the Upper Extremity Function Scale, or UEFS [Pransky et al., 1997]. Examination of more than one type of injury provided an opportunity to contrast the experiences of subjects with different, yet common impairments.

Workers were sampled who reported work-related low back or upper extremity injuries to the New Hampshire Department of Labor (NHDOL) in August or September 1995, a year prior to the survey. New Hampshire requires all employers to report work-related injuries within five days of occurrence. The NHDOL First Report of Injury database formed the primary source of potential subject identification and uses National Center for Compensation Insurance (NCCI) codes [National Council on Compensation Insurance, 1995] to describe the body part affected.

Eligible cases included only those individuals whose body part codes were consistent with low back or upper extremity injuries (i.e., NCCI code numbers 12 [lumbar/lumbosacral injury] and 30–38 [injuries to hand, arm, shoulder, wrist, and elbow, including carpal tunnel syndrome and tendinitis]). Low back body part codes included diagnoses of lumbosacral strain, sacroiliac pain and dysfunction, herniated lumbar intervertebral disc, and other similar diagnoses [National Council on Compensation Insurance, 1995]. Upper extremity body part codes included diagnoses of laceration, sprain, strain, and fracture.

During these two months in 1995, there were 3,428 first reports of injury to the upper extremities and 816 reports of low back injuries. Only 15% of the total number of cases were recorded as having lost a week or more of work time due to their injury. A directed sampling strategy was employed to obtain adequate numbers of respondents with both back and upper extremity injuries and lost time, defined as four or more consecutive days of work absence related to the injury. Cases with low back and upper extremity injuries were sampled on a 60/40 ratio. Cases who were recorded as having a work absence of at least four days and those who had lost less than four days were also sampled on a 60/40 ratio. Individuals with reported injuries to the same body part during the previous year were excluded, in order to avoid confounding of the effects of the current injury with other recent prior events.

Domains for questionnaire items were selected based on a thorough review of studies of outcomes in work-related injuries, prior investigations, focus groups, and cognitive interviews with individuals who had experienced occupationally-related low back or upper extremity injuries. The complete list of questionnaire domains and number of items for each domain is presented in Table I.

A number of new scales were constructed from questionnaire items to represent domains felt to be intermediate outcomes or factors affecting outcomes. These included a measure of negative employer response to the injury event, satisfaction with the response of the Workers' Compensation insurer, change in quality of work life due to the injury, economic consequences of the injury, pre-injury job satisfaction, and anxiety due to the injury. Item inclusion and formatting were refined through a series of focus groups, directed interviews, and input from experts in the measurement and management of occupational injuries and their consequences. The final questionnaire was tested through cognitive interviewing to assure that written responses were consistent with intent.

All new items and scales, or those adopted from other sources, were subjected to appropriate reliability and validity checks and evaluated according to published criteria [Nunnally, 1978; Stewart, 1990]. Scales were constructed utilizing Principal Axes Common Factor Analysis. Internal consistency reliability was good to excellent, according to established criteria [Robinson et al., 1991; Bartko and Carpenter, 1976], with Cronbach or KR-20 *alphas* ranging from 0.77 to 0.92. Average scale inter-item correlations ranged from 0.41 to 0.71. Test-retest reliability studies of multi-item scales resulted in intraclass correlations ranging from 0.41 to 0.99, with an average ICC of 0.80. Dichotomous item *kappas* were all significant at $P < 0.01$ and ranged between 0.52 and 1.0. Items with lower test-retest reliability were those that might be expected to change over time, such as, subject's overall satisfaction with life condition. Total factor variance explained by the new scales ranged from 40% to 71%. Commonalities for these scales were expected to be somewhat low given the small number of items included in each scale, necessitated by the relatively small sample size. The questionnaire was designed for an 8th grade reading level, and was written only in English, as the non-English speaking population in New Hampshire is quite small.

The focus on long-term outcomes necessitated a retrospective follow-up design. All study respondents had suffered the injury of interest one year before the completion of the survey, enabling us to obtain a long-range picture of their current function, and economic, social and psychological status. This time frame also allowed capture of information about the majority of treatment episodes and the employers' and workers' compensation insurer responses related to the injury.

TABLE I. Domains Included in Questionnaire: New Hampshire Workers with Lower Back and Upper Extremity Injuries

Domains	Number of items
Outcomes domains	
Work outcomes	
Time lost from work	2
Change in job/employment	11
Changes in quality of work life	14
Functional outcomes	
North American Spine Society Subscale (Pain/disability subscale)[9]	9
Upper Extremity Function Scale[10]	7
SF-12[13]	12
Overall satisfaction with condition	2
Reinjury	4
Economic and social consequences	
Current income sources	7
Current financial status	2
Financial problems	14
Psychological well-being	5
Changes in social function	2
Concerns about future earning/work potential	4
Independent variable domains	
Employee characteristics	
Demographics	5
Job type	1
Job stability	2
Onset of injury	1
Medical/previous injury history	22
Employee job satisfaction	6
Employer characteristics	
Employer size	1
Job injury risk level	8
Response to employee injury	10
Preventive interventions	7
Employee satisfaction with employer response to injury	3
Insurer characteristics	
Method of payment for treatment of injury	1
Employee satisfaction with insurer response	4
Treatment characteristics	
Types of providers seen for treatment of injury	3
Employee perception of provider response to injury	5
Types of treatments for injury	11
Employee perception of treatment efficacy	12

All data were obtained from a mailed, self-report questionnaire sent directly to the respondent. The questionnaire took about 40 min to complete. The questionnaires were accompanied by a stamped, self-addressed envelope in which respondents could return their completed surveys. All

surveys were mailed out 9–15 months after the date of the injury of interest, between July and August, 1996.

The results reported herein are for the most part descriptive. In addition to variable proportions and means, simple subgroup analyses were done to compare outcomes for respondents with low back vs. upper extremity injuries and those with longer vs. shorter duration of time lost from work by using chi-square, *t*-tests, or ANOVA methods, as appropriate.

RESULTS

Four hundred and five cases met the eligibility requirements. However, despite multiple mailings and attempts to reach eligible subjects by telephone, addresses could be verified for only 208 potential subjects due to the large number of out-of-date or incorrect addresses in the NHDOL database. Twenty-two of these candidates refused participation, and another 15 stated they had not sustained a work-related injury. Two respondents were excluded from analysis because of large amounts of missing data on their returned questionnaires. The final sample size is thus 169, 46% of the original pool of eligible recipients, or 80% of those whose addresses could be verified in the sampling frame.

Respondents and non-respondents were compared for differences in proportion of gender, body part injured, and duration of injury-related work absence. These comparisons did not yield any significant differences by body part injured or time lost from work. Respondents were significantly more likely to be female than nonrespondents ($\chi^2 = 7.835$, $P = 0.005$). Study participants are not compared by race as 94.6% of the sample was Caucasian. This is representative of the population of New Hampshire as a whole [US Bureau of the Census, 1990].

Almost three-quarters (71%) of respondents had been working for the same employer for one year or more at the time of injury, and 38% had been with their employer for at least six years. No one job category predominated, although there were few participants (7%) who characterized their jobs as ''professional/managerial,'' and the majority worked in ''blue collar'' or service industry positions. Most employers of the injured workers in this study were small to moderate in size; 65.6% employed no more than 100 workers, and almost a third (32%) of these employed less than 25 individuals. This is representative of New Hampshire employers where the average company employs 14.4 individuals [NH Empl. & Security Economic & Labor Information Bureau, 1997]. The average age of respondents was 37.

There were no significant demographic differences between respondents with low back or upper extremity injuries. Analysis of pre-injury job characteristics again showed no significant differences by type of injury. Therefore, these results are reported in aggregate form (Table II). The preponderance of respondents (85%) claimed to have had an acute injury onset. There were more gradual-onset injuries in the group with upper extremity disorders than those with low back injuries (50% vs. 17%, $P = 0.05$). Characteristics of respondents are reported in Table II.

Outcomes

The amount of time lost from work is summarized in Table III. It can be seen that the majority of respondents eventually returned to work in some capacity. For those who had not returned to work after the injury, or who had gone back to work but were not working at the time of the survey (17% of all respondents), unemployment was due to the index injury in 16 (55%) of these cases. An additional 11 persons said that nonmedical reasons contributed to their unemployment, and nine study participants stated that they were unemployed due to other medical conditions or injuries (participants could endorse more than one reason

TABLE II. Characteristics of Respondents: New Hampshire Workers with Lower Back and Upper Extremity Injuries

Characteristics of respondents	N	Percentage[a]
Body part injured		
Upper extremity	70	41.4%
Low back	99	58.6%
Gender		
Male	106	62.0%
Female	64	37.4%
Education		
Less than High School	24	14.0%
High School Graduate or GED	65	38.0%
Post High School training	81	47.3%
Marital status		
Never Married	33	19.3%
Married	109	63.7%
Separated/divorced/widowed	28	16.3%
Job stability at the time of injury		
Less than 1 Year	50	29.2%
1–5 Years	62	36.3%
More than 5 Years	58	33.9%
Pre-injury job category		
Skill or craft	40	23.4%
Machine operator	20	11.7%
Manual labor	41	24.0%
Scientific/technical	6	3.5%
Service	31	18.1%
Clerical	15	8.8%
Professional/managerial	12	7.0%

[a]May not sum to 100% because of missing data.

TABLE III. Work Outcomes: New Hampshire workers with Lower Back and Upper Extremity Injuries

Outcome	Low back injury cases N (%)	Upper extremity injury cases N (%)
Time lost from work due to injury		
None	19 (19)	25 (35)
$<$ 1 week	24 (24)	16 (23)
$\geq$ 1 week, $<$ 1 month	25 (25)	6 (8.6)
$\geq$ 1 month	23 (23)	16 (23)
Out of work since injury	8 (8)	7 (10)
Work status		
Working	80 (80)	60 (86)
Full-time	76 (76)	53 (76)
Part-time	4 (4)	7 (10)
Not working[a]	19 (19)	10 (14)

[a]Includes both those who never returned to work and those who returned to work but were unemployed at the time of the survey (n = 14).

for their unemployment). Over half (60.5%) had gone back to work at the place of employment where the index injury occurred. Of these, 83.5% returned to the same job they had had prior to the injury. In contrast, those who changed employers usually changed jobs; only 10 (30.3%) of the 33 respondents working at a different place had the same type of job as the one they held at the time of their injury.

Table IV reports information about changes in the quality of work life experienced by respondents. Among those subjects who were working at the time of the survey, a nonsignificant trend was observed for more negative changes in those who had lost a week or more of work in comparison with those who were absent for less than a week from their jobs.

Respondents were queried about their present physical condition in several ways. Disease-specific functional status was measured using the Back Pain/Disability subscale of the North American Spine Society survey [Daltroy et al., 1996] for persons with low back injuries and the Upper Extremity Functional Status scale [Pransky et al., 1997] for those suffering from injuries to their upper extremities. A measure of generic functional status, the SF-12, was also included [Ware et al., 1995]. This instrument has two subscales, the PCS-12 (Physical Component Subscale) and the MCS-12 (Mental Component Subscale).

There were significant differences in reported functional status by amount of time lost from work due to the injury (see Table V). This was true for both disease-specific and generic physical function, but not for the psychological functioning subscale (MCS-12). Respondents who lost a week or more of work had a significantly ($t = 5.29$, $P < 0.001$) lower mean PCS-12 score (44.04) than that found in the general US population (50.12). Indeed, their scores were equivalent to those found in individuals 65–74 years of age (43.65).

The relationship between overall disease-specific functional status and time lost was linear and significant between all three groups (ANOVA, $F = 15.54$, $P < 0.001$), with those who did not return to work reporting the worst disease-specific functional status. Those who did not return to work had significantly less satisfaction with their overall physical condition than those who returned to work (ANOVA, $F = 4.77$, $P < 0.01$) but there were no significant differences between those who lost less than a week of work and those who lost a week or more.

Differences in overall satisfaction with physical condition were significant by time lost from work for those with low back ($F = 3.64$, $P < 0.05$) injuries but not for individuals with injuries to their upper extremities. Among respondents who lost a week or more of work, there were significantly more subjects with low back injuries. There were no significant differences in the number of subjects with low back injuries vs. upper extremity conditions for those respondents with less than a week of work absence.

The correlation between overall satisfaction with health and functional status has been found to be weak in other studies, suggesting that it may be a separate dimension of

TABLE IV. Reported Changes in Quality of Work Life from Pre- to Post-Injury for All Respondents who Returned to Work: New Hampshire Workers with Lower Back and Upper Extremity Injuries

	Low Back Injury, n = 91			Upper Extremity Injury, n = 64		
Quality of work life measure	Less (worse) than before injury N (%)	Same as before injury N (%)	More (better) than before injury N (%)	Less (worse) than before injury N (%)	Same as before injury N (%)	More (better) than before injury N (%)
Quality of work	16 (17.5)	69 (76)	6 (6.5)	6 (9)	51 (79)	7 (11)
Motivation to work	18 (20)	61 (67)	10 (11)	6 (9)	46 (72)	11 (17)
Job satisfaction	19 (21)	53 (58)	18 (20)	7 (11)	44 (69)	13 (20)
Ability to do one's share on job	18 (20)	61 (67)	11 (12)	7 (11)	50 (78)	7 (11)

TABLE V. Functional Status and Satisfaction by Time Lost from Work due to Injury: New Hampshire Workers with Lower Back and Upper Extremity Injuries

Measure	< 1 Week lost (n = 81)		≥ 1 Week lost (n = 70)		Out of work since (n = 15)	
	Mean	SD	Mean	SD	Mean	SD
Disease-specific function[m]						
NASS**	1.22[a]	0.32	1.42[b]	0.49	1.71[b]	0.72
UEFS***	1.30[a]	0.54	1.64[b]	0.80	2.57[c]	0.50
Generic function[n]						
PCS-12/Low back**	50.50[a]	6.93	41.82[b]	11.19	38.36[b]	8.61
PCS-12/UE**	52.22[a]	7.47	48.89[b]	9.30	29.84[c]	5.43
MCS-12/Low back	48.37	11.42	50.67	9.99	36.05	3.66
MCS-12/UE	50.76	10.37	49.92	10.72	42.69	13.08
Satisfied with overall condition?						
Low back**	3.41[a]	1.32	3.72[a]	1.19	4.12[a]	1.12
Upper extremity	2.56	1.70	2.63	1.64	4.50	0.83
Both***	2.98[a]	1.57	3.38[a]	1.43	4.28[b]	0.99

**ANOVA, $P < 0.01$ ***$P \leq 0.00$.
[m]for this scale, 1 = better function.
[n]for this scale, 100 = best score.
Note: The means have superscripts a, b, and c. Means with different superscripts are significantly different on the Tukey-Honestly Significantly Different follow-up contrast test. Those with no superscripts do not differ significantly by time lost.

health-related quality of life [Patrick and Bergner, 1990]. However, in the present study this measure was significantly correlated with both condition-specific functional status (correlation with UEFS = 0.37, $P < 0.01$; correlation with NASS = 0.42, $P < 0.001$) and generic functional status (correlation with the PCS-12 = −0.51, $P < 0.001$; correlation with the MCS-12 = −0.32, $P < 0.001$).

Although the MCS-12 data showed little relation to lost time, other measures demonstrated a significant toll on psychological status due to the occupational injury that were related to lost time from work. A scale of items designed to measure anxiety was included in the questionnaire. Injury-related anxiety was directly related to amount of time lost from work. Those who lost less than a week of work due to their injury had a mean anxiety score of 1.5, those who had a work absence of a week or more had a mean score of 2.3, and those who had not returned to work at the time of the survey had a score of 3.7 (scores ranged from 1 to 5, with 5 = highest anxiety level). These differences were significant between all three groups (χ^2 F = 44.52, $P < 0.001$). Anxiety due to the work injury was significantly correlated with self-reported functional status (r = 0.57, $P < 0.001$).

Although respondents with low back injuries had higher anxiety scores (mean = 2.24) than those with upper extremity injuries (mean = 1.72), these differences were not significant ($t = 3.14$, $P = 0.10$).

A large number of respondents (55.7%) who were working at the time of the survey said that pain due to the injury still bothered them, and increased by the end of their work day. This problem was significantly more pronounced for low back injured respondents; 61, or 76.2% of all those currently working said they suffered from residual pain. In contrast, only 17 (28.3%) of upper extremity-injured workers had this problem ($\chi^2 = 24.68$, $P < 0.001$).

Reports of reinjury during the observation period were common among respondents: of those who returned to work, 41% of low back injured patients and 26% of upper extremity cases reported reinjury. Forty-one percent of these reinjuries were caused by a work activity, 25% were not work-related; 22% were unsure of the cause, and 8.6% ascribed it to another medical condition. Respondents with low back injuries were significantly more likely to have had a reinjury of any type than those with upper extremity injuries ($\chi^2 = 4.11$, $P < 0.05$). Not surprisingly, those who suffered a reinjury were significantly less satisfied with the response of the workers' compensation insurer than those who did not experience another injury to the same body part ($t = 2.59$, $P < 0.01$).

Respondents suffered a number of economic consequences as a result of their injuries, as described in Table VI. There was a strong, significant association between the number of different adverse economic consequences reported and the length of time out of work (F = 34.3, $P < 0.001$). Those with more time lost (≥ 1 week) and those who had not returned to work since their injury had more adverse economic and social consequences.

TABLE VI. Economic Consequences by Time Lost from Work due to Injury: New Hampshire Workers with Lower Back and Upper Extremity Injuries

Economic consequence*	< 1 week lost N (%)	≥ 1 week lost N (%)	Out of work since N (%)	Total N (%)
Dipped into savings	12 (14.4)	35 (51.4)	10 (66.6)	57 (33.7)
Problems paying bills	8 (9.6)	32 (47.0)	13 (86.6)	53 (33.4)
Borrowed money	10 (12.0)	26 (38.2)	12 (80.0)	48 (28.4)
Sold belongings	4 (4.8)	15 (22.0)	6 (40.0)	25 (14.8)

*Numbers and percentages reflect those who answered Yes.

Respondents received a variety of treatments. Specialists (orthopedists or surgeons) were used by over half of the respondents; nearly half attended a physical therapy program. Of those with upper extremity (UE) injuries, 7% received chiropractic treatment, 20% were advised to rest in bed, and over half (54%) used a brace. Relatively few patients had been in a work rehabilitation program; only 11% of low back (LB) and 6% of UE cases. Prescribed fitness programs were more common; 43% of LB and 22% of UE cases.

Respondents reported on several aspects of access and perceived quality and satisfaction with the treatment they received for their injuries. Most respondents (70.2%) said that they were satisfied with their injury-related medical care. Despite this high level of satisfaction, many respondents were not entirely happy with the treatment they received. Overall, 14% of the workers stated that their primary-treating physician did not take them seriously; 20% felt that their doctor did not try to understand their daily job tasks or duties; and 60% of the workers claimed that they were given no advice on prevention of further injury by their treating physician. Those with upper extremity injuries were more likely than those with low back problems to say that their doctor did not make an attempt to understand their job (31% vs. 11.4%, $\chi^2 = 10.89$, $P < 0.01$).

Respondents were asked to list all sources of payment for treatments for their injury. The majority (80.5%) of respondents said that the workers' compensation insurer covered their medical expenses due to the index injury. However, 13.6% of workers used other types of insurance coverage to pay some or all of their treatments costs. More respondents with low back injuries reported out of pocket treatment costs than those who suffered upper extremity injuries (21% vs. 10%, $P < 0.05$). There were no other significant differences between these two groups in terms of method of payment for treatment.

Most study participants (68%) reported that they were satisfied with how the workers' compensation insurer helped to fulfill treatment needs. However, a sizable minority (26%) were dissatisfied with the insurer's handling of their perceived needs for medical care. Those respondents with low back injuries were more likely to be dissatisfied with how the insurer handled their claim than those with upper extremity problems (mean satisfaction with workers' compensation insurer scale score: low back-injured respondents = 2.60, upper extremity-injured respondents = 1.93, $t = 3.67$, $P < 0.001$).

DISCUSSION

As hypothesized, workers with occupational injuries experienced a number of long-term consequences due to their injuries. This community-based study documents the extent of some of these physical, psychological and economic sequel and raises a number of issues which must be addressed in designing interventions aimed to improve outcomes of workers compensation medical care.

The inadequacy of return to work as a sole measure of effective treatment for work-related injuries has been previously acknowledged [Baldwin et al., 1996], and was demonstrated by our results. Although most respondents were working at one year post-injury, many continued to experience injury-related pain at the end of the work day, and many were anxious about the effect of the injury on their future ability to provide for themselves and their families. As a group, these individuals experienced poorer physical functioning than is the norm for the working-age US population [Ware et al., 1995]; results suggest that their function was similar to much older individuals. Additionally, those who lost more work time experienced significantly more economic problems due to their injury than those with shorter periods of disability, suggesting that wage replacement under workers' compensation may be insufficient to meet basic needs in this population. Respondents who had lost a week or more of work also were less confident in their ability to produce quality work, were less motivated to work, and experienced less job satisfaction than before their injury.

Insufficient detail about either the respondents' injuries or the medical treatments they received was available to calculate treatment effectiveness. However, the high incidence of residual work pain and the relatively poor functional status of our subjects indicates that medical care for this population may not be entirely successful in

eliminating the effects of the injury, despite the fact that over 80% of our study population had returned to work by the time of the survey. Several of the findings shed some light on factors that may contribute to this problem.

Although respondents were generally satisfied with their care, their physicians frequently did not advise them on how to prevent injuries, and a significant minority felt that the physician did not try to understand their job. These problems with medical care may have contributed to the high rate of reinjury—35% overall—and suggest areas where improvement in physician practice and communication, especially links to preventive interventions, could result in significant benefit for injured workers.

Obtaining medical care was a problem for some respondents, who were not allowed by their insurer to seek specific treatments or who had to use alternative methods of payment for medical treatment. Some caution should be used in interpreting this last finding, however, it is not known if treatment access was limited due to insurer restriction, denied workers' compensation claims, or the desire on the part of the respondent for medically-inappropriate care that was legitimately refused by the insurer.

Most disease-specific studies of workers' compensation claimants have focused on low back pain, as this condition represents the majority of costs and lost time in workers' compensation cases. Although the incidence of upper extremity problems is increasing [US Department of Labor, Bureau of Labor Statistics, 1993], there is relatively little information on their associated costs and outcomes. As expected, respondents with the most negative outcomes in this study were those who suffered from injuries to their lower back. What is surprising is the number of consequences *not* affected by region of the injury. Significant differences by body part injured were most often found in the realm of physical function. There were no significant differences between the respondents with injuries to different body parts for many other consequences, including change in quality of work life, economic consequences, and anxieties due to the injury. These results may be due to the wide variety in type and severity of upper extremity injuries in the respondent sample, however, and await confirmation in a larger study that can accommodate subgroup analyses of different upper extremity injury types.

Some of the results, especially those related to return to work and job retention, can be compared to expected rates in the general working population. For example, based upon available national data, a sample of all employed workers with a job mix similar to ours (mostly blue-collar) who were followed for a year would be expected to have about a 6% job loss rate and a 12% job turnover rate [New Hampshire Employment and Security Economic and Labor Information Bureau, 1997]. These rates are far less than those observed in this investigation—17% job loss and 34% job turnover—and suggest that the difference is attributable to the injury.

Length of time away from work appears to be strongly correlated with a variety of adverse outcomes [Feuerstein, 1991]. As duration of work absence may be reflective of injury severity, the importance of employer attempts to provide even temporary changes in job tasks is highlighted. Those who do not return to pre-injury functional status quickly may need accommodations, temporary alternative duty, and other efforts to facilitate early return to work in order to mitigate some of these adverse consequences [Hunt et al., 1996]. However, the relatively high rate of reinjury observed here suggests that, in some cases, return to work occurred too quickly, before adequate recovery had taken place to allow safe resumption of work duties.

STUDY LIMITATIONS AND CONCLUSIONS

The generalizeability of the study is limited by the restriction of the sample to a single state, New Hampshire, and to two types of occupational injuries. Differences between outcomes in respondents with low back injuries and those with upper extremity injuries may have been obscured by the wide variety of upper extremity disorders. Others have shown that reports of activity can be influenced by the workers' compensation system [Anderson, 1998]. The cross-sectional nature of the study restricts our ability to make causal inferences without further, longitudinal research. In addition, the small sample size precludes high confidence in some of the findings. The self-report nature of the data implies that some information, such as the responsiveness of the insurer or the adequacy of medical care presents just one perspective. The views of insurers, providers, and employers would be helpful to complement the workers' perspectives. However, our objective was to understand how the workers' perceptions related to outcomes resulting from the injury, and we believe these results lend a unique perspective to what happens to injured workers and why.

The sampling criteria were based in part on the NHDOL definition of eligibility for workers' compensation benefits of a work absence of at least four consecutive days. However, it should be noted that questionnaire development focus groups and cognitive testing indicated that respondents were more able to recall work absence in terms of weeks rather than number of days. Thus, the survey was designed to reflect this and the subsequent analyses were performed by using categories of less than a week vs. a week or more of lost time. Cases that had an injury-related absence from their job of at least four consecutive days were oversampled. Therefore, our results may require some interpretation before extrapolation can be made to general populations of injured workers who cannot be expected to experience the same level of severe consequences.

Despite these limitations, this study had several features that make the results noteworthy. Although the persistent

negative effects of work-related injuries have been shown in prior investigations, few studies have documented these outcomes in a sample drawn from a community representing a wide range of industries and employers. Thus, these results may be a better representation of what happens to all injured workers than findings from other studies with highly-selected populations.

It should also be underscored that few of the outcomes documented in this study could have been ascertained through analysis of the secondary databases commonly used in the study of work-injured individuals, such as data from the Workers Compensation insurer, state administrative agency, or Department of Labor statistics. Given the non-interventional nature of the study, the population-based sampling pool, and the self-report nature of the data collection, the workers in the study are more likely to have had and to report more varied and typical experiences with employers, insurers, and providers than subjects studied in other published reports of occupational injury outcomes [Burton, 1993; Cheadle et al., 1994; Volinn et al., 1991].

This study reinforces the feasibility of conducting a retrospective survey of injured workers, with an acceptable rate of response from those whose addresses could be verified. A response rate of 80% was achieved for all cases that could be contacted, although only 46% of all potential subjects could be located. This rate is not unusual in community-based studies; a recent study by Reid et al. [Reid et al., 1997] using Department of Labor and Industry data from Vermont for purposes of identifying cases achieved a final sample size of only 48% of the original number of eligibles. Unfortunately, those with the most adverse social and economic outcomes may become transient and thus difficult to follow up. Future studies should consider prospective designs in order to minimize loss to follow-up and potential bias.

Occupational injuries have significant negative impacts that are persistent long after the occurrence of the injury. These injuries may have considerable negative impact on the quality of life of those who have these conditions. The consequences of an occupational injury may be much broader than simply lost time from work and include decrements in physical function, financial difficulties, and increased anxiety. Indeed, these non-work-related consequences may actually contribute to a more prolonged absence from the job marketplace. Future research should focus on understanding the relationships between the long-term injury consequences noted in our study, initial severity of the injury, and workplace factors, using larger worker samples in prospective study designs.

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