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The Impact of Occupational Injury on Injured Worker and Family: Outcomes of Upper Extremity Cumulative Trauma Disorders in Maryland Workers

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Background *Surveys have identified a dramatically rising incidence of work-related upper extremity cumulative trauma disorders (UECTDs). Outcome studies have addressed time lost from work and cost of compensation; omitting other significant consequences. We assess health, functional and family outcomes.*
Methods *We identified 537 Workers' Compensation UECTD claimants. A computer-assisted telephone questionnaire was used to elicit symptom prevalence, functional impairment, depressive symptoms (CES-D scale), employment status.*
Results *One to 4 years post-claim, respondents reported persistent symptoms severe enough to interfere with work (53%), home/recreation activities (64%) and sleep (44%). Only 64% of responses to the activities of daily living scale items indicated "normal" function. Job loss was reported by 38% of respondents, and depressive symptoms by 31%.*
Conclusions *Work-related UECTDs result in persisting symptoms and difficulty in performing simple activities of daily living, impacting home life even more than work. Job loss, symptoms of depression, and family disruption were common.* Am. J. Ind. Med. 38:498–506, 2000. *© 2000 Wiley-Liss, Inc.*

KEY WORDS: carpal tunnel syndrome; occupational diseases; outcome studies; follow-up studies; workers' compensation; rehabilitation; functional outcomes; musculoskeletal diseases; socioeconomic factors; activities of daily living; depression; job loss

INTRODUCTION

Cumulative trauma disorders (UECTDs) affecting the upper extremity have dramatically increased in incidence during the 1980s and early 1990s [Bureau of Labor Statistics, 1998a]. The conditions grouped under this heading include tendonitis of the shoulder, arm and wrist, tenosynovitis, deQuervain's syndrome, epicondylitis, ulnar nerve entrapment, and carpal tunnel syndrome (CTS).

UECTDs are recognized both as a major cause of lost work time injuries and prolonged incapacity among U.S. workers. The Bureau of Labor Statistics (BLS) 1997 Annual

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Survey of Occupational Injuries and Illnesses [Bureau of Labor Statistics, 1999a] reports a median of 25 lost work days for the 29,244 employees who lost time from work due to CTS. This condition kept people out of work longer than any other disabling condition. In comparison, the median lost work day rate reported for all illnesses and injuries was 5 days [Bureau of Labor Statistics, 1999b].

The well-documented underreporting of work-related musculoskeletal disorders suggests that even this picture likely underestimates CTS disease rates [Higgs et al., 1992; Oleinick et al., 1993; Jefferson and McGrath, 1996; Weddle, 1996; Pransky et al., 1999]. BLS underreporting may not be limited to disease rates. A recent report from a large dataset tracking the length of disability across years suggests persistence of disability to be very long: a mean of 87 lost work days due to UECTDs [Hashemi et al., 1998].

While the extent of the problem is well established, less attention has been paid to outcomes or consequences of these disorders. When outcomes are measured, most reports address lost work days and related costs for wage replacement, disability, medical care and replacement labor. Both the National Institute for Occupational Safety & Health and the Robert Wood Johnson Foundation have recently supported research on a broader scope of outcomes including social, economic, and functional consequences for injured workers and their families [Pransky et al., 1997; Morse et al., 1998]. It is hoped that this body of research will be expanded to include the long-term impact of injuries, adding an important dimension to a full understanding of the costs of inaction.

To more fully measure the health outcomes associated with these conditions in Maryland we conducted a survey of individuals with work-related UECTDs. We used a structured telephone interview, which contained instruments for measuring health outcomes. To explore factors that might influence outcomes we gathered information about both the injured worker and the workplace. We also gathered information from respondents on actions taken by employers to reduce the risk of further injuries, reported in a companion article in this issue [Keogh et al., 2000].

METHODS

Identification of Eligible Participants

Individuals who incur medical expenses or lose time from work because of work-related injury may file a claim for benefits with the Maryland Workers' Compensation Commission (MWCC). As in most states, employers purchase workers' compensation insurance from private insurers, although some are self-insured. The Commission maintains an administrative data system for claims filing and adjudication. This database tracks all claims, and contains some demographic information and some information on the employer. Since private insurers handle medical payments, the MWCC data system does not contain medical diagnoses or medical procedure or billing information. At the time the claim is filed, however, it is coded by body part(s), cause of injury and nature of injury based on the claimant's one or two-sentence description of the injury on the claim form. With the assistance of MWCC staff we developed an algorithm using these codes to identify a group of claims likely to include most UECTDs. This algorithm identified claims involving the body parts of the upper extremity, coded as a ''strain or dislocation'' and caused by ''handling.'' Using data obtained from a major insurance carrier we were able to demonstrate that this algorithm captured 80% of their claims in which the ICD-9 code for carpal tunnel syndrome had appeared in medical bills. The algorithm was applied to all workers' compensation claims filed during a 33-month period between January 1, 1994 and September 30, 1996 to identify 5,257 individual claimants. Information from these claims was transferred to a confidential database used by investigators.

Survey Technique

A standard questionnaire was administered by trained interviewers using a computer-assisted telephone interview (CATI) system (VOXCO, Montreal). Missing or inaccurate phone numbers were checked against electronic telephone directories. All addresses were checked against a database containing deliverable addresses and containing post office changes of address covering a 3-year period. We sent an introductory letter to all claimants for whom we had deliverable addresses, explaining the study and requesting that they call if their phone number differed from the one printed on the letter. The CATI system schedules numbers to call and tracks the outcome of each call. If the phone was not answered, interviewers tried it again according to a programmed algorithm which included prompt recalls of busy numbers and distribution of unanswered calls to a specific number to different times of day (morning, afternoon and evening) and days (weekday and weekend). Most calls were completed late afternoons, evenings and Sundays. Each number was tried until successful contact was made or until up to 20 tries over several weeks had been attempted. When the individual claimant was successfully contacted the study was explained, verbal consent was obtained and a series of screening questions were asked to verify that the injury was a UECTD. The screening technique excluded injuries which did not involve the upper extremity and injuries caused by acute traumatic events. If eligible, the claimant was asked to complete a 30-minute interview and was offered a $25 incentive as compensation for his or her time. A final eligibility check was conducted after the data were collected.

Data Collection

The questionnaire, administered with the CATI, combined questions about the nature of the injury, the diagnosis given by the treating physician, treatments received, usual sources of medical care and delay before seeking treatment. In addition it identified a number of personal characteristics (age, gender, education, marital status, family income, health insurance, etc.) and characteristics of the workplace (type of industry, number of employees, unionization, relations with supervisors, etc.) and of the specific job (including risk factors for UECTDs). Participants were asked about outcomes, including lost work time and return to work, functional capacity for work, activities of daily living, financial impacts and emotional state. A functional impairment scale (the UM-ADL scale) constructed at the University of Maryland, and a scale (CES-D) [Radloff, 1977] previously validated for measuring general population symptoms of depression were incorporated. Interviewers read the questions from the screen and entered the respondent's answer. For some forced choice questions, if a respondent was unable or unwilling to select one of the choices, the interviewer could mark the question not answered and continue with the next question.

UM-ADL Scale

The investigators and colleagues from the Department of Physical Therapy, University of Maryland developed the impairment to activities of daily living (UM-ADL) scale. It was designed specifically for use in a telephone survey, using simple sentences with four response options. Each respondent's score was the average of responses to 21 items which used ''ease of performance of routine daily activities'' as a proxy for functioning of the upper extremities (Table IV). Response options were 1 ''no problem;'' 2 ''can do but with difficulty;'' and 3 ''can't do by myself.'' The fourth response option allowed the respondent to identify those activities ''you just don't normally do, and never did even before you got hurt.'' When the fourth response was given, the item was excluded from analysis and did not affect mean scores. The higher the mean score on the UM-ADL scale, the greater the difficulty with everyday activities.

UM-ADL Reliability

Internal consistency (Cronbach's α) of the UM-ADL scale across the 21 items is 0.93. Principal component (factor) analysis yielded one component that accounted for 41% of inter-item variance, and no other component had high eigenvalues. Correlations between individual items and the first component ranged between 0.338 and 0.754.

UM-ADL Validity

We assessed validity of the UM-ADL scale by comparing it to a single question asking how the respondent functions now compared to before the problem developed. It has five responses ranging from 1 ''less able'' through 5 ''more able.'' The correlation was -0.563.

The 21 items in the UM-ADL scale are similar to the functional status scale reported by Pransky et al. [1997]. Only two items in this scale, ''driving for more than thirty minutes'' and ''sleeping'' had no equivalent in the UM-ADL scale. The internal consistency rate of 0.93 for the UM-ADL scale is similar to the range of 0.83–0.93 reported by Pransky et al. The results of factor analysis are also similar: Pransky et al. reported that 42–56% of inter-item variance was accounted for by a single component. Similarly, a single factor accounted for 41% of inter-item variance in the UM-ADL scale.

Dichotomous ADL Variable

A dichotomous variable measuring functional status was constructed for use as an outcome variable in logistic analysis. If an individual's response to all valid UM-ADL items was ''no problem,'' the variable was scored ''0'' (normal). If the individual chose any response indicating difficulty the variable was scored ''1'' (abnormal).

Data Analysis

Data were reviewed for completeness. Participants' free text descriptions of the circumstances of injury as well as their reports of medical diagnoses were reviewed by investigators to identify inconsistencies with the forced choice questions designed to determine eligibility. After bivariate analyses were completed, multivariate analyses using logistic regression were used to identify variables predictive of main outcomes. Variables of interest were added in blocks, beginning with a block including gender, age, education, marital status, income and presence of carpal tunnel as a diagnosis. Additional variables of interest were added in subsequent steps. Statistical analysis was performed using SPSS Version 8.

Approval for the research protocol was received from the University of Maryland School of Medicine Institutional Review Board.

RESULTS

Demographics

Of the 5,257 claimants identified from MWCC data, 2,225 individuals (42%) were successfully reached by phone. While a higher ''contact rate'' would have been

TABLE I. Characteristics of Claimants by Interview Status

	Not contacted	Refused	Ineligible: not a UECTD	Interviewed
Total claimants	3,032	698	990	537
Gender**				
Male	1,607	408	546	162
Female	1,407	287	434	373
Marital status**				
Married	1,465	439	70	341
Single	1,475	237	388	182
Mean age at claim**	37.3	41.9	41.0	42.2
(SD)	(10.0)	(10.9)	(10.8)	(9.5)
N	2,969	686	973	528
Mean weekly pay**	$456	$526	$515	$508
(SD)	(233)	(225)	(247)	(225)
N	2,442	570	805	452

*$P < 0.05$, **$P < 0.01$.
Data as available from MWCC data system. The MWCC database did not have complete data on all claims.

desirable, the investigators anticipated this rate because calls were made 11–46 months post-claim date (see Table I for demographic comparisons by contact status). Disconnected phone numbers were the primary reason for non-contact. Of those contacted, 1,527 (69%) agreed to be interviewed and responded to a set of screening questions designed to separate those with UECTDs from those with acute injuries. Of these 575 (38%) were determined to have a UECTD and were eligible to complete the survey. Subsequent review of the data identified and removed 38 individuals with inconsistencies between responses to the eligibility screening questions and free text description of the injury. Data on the remaining 537 claimants (35%) were used for analysis. Among those who were eligible, less than 1% failed to complete the entire questionnaire.

Using data from the MWCC administrative system, which were available on most claimants, the investigators were able to review demographic characteristics of those claimants we were unable to contact as well as those with whom we spoke on the telephone. The latter included individuals: (1) declining participation; (2) deemed ineligible; and (3) completing the interview (Table I). Compared to those who agreed to do the interview, those not reached or who refused were younger (mean age 38 vs. 41 years), more likely to be male (54 vs. 47%), had lower weekly pay (mean weekly wage $469 vs. $512), and were less likely to be married (43 vs. 62%). While we were unable to interview this group of non-respondents, we did look at mean UM-ADL scores for respondents who matched non-respondents in age, marital status, and gender. In interpreting UM-ADL scores, it should be noted that lower scores indicate better functioning, with 1 being ''no problem,'' and 3 ''can't do it by myself.'' Respondents who were 37 or younger had a mean UM-ADL score of 1.3, lower than the means for older workers (1.4 for 38–46 year olds, and 1.5 for those over 46), but still indicating some impairment. The average UM-ADL score for men was 1.3, again somewhat lower than the 1.4 experienced by women, but also reflecting impairment. There were no differences in UM-ADL scores by marital status. This review suggests that had we reached all 5,257 claimants the mean UM-ADL score might have been slightly lower, but not quite normal.

Industry/Job Duties

Two-digit Standard Industrial Codes (SIC) obtained from the MWCC, showed that the majority of eligible respondents were employed in three of ten broad categories: manufacturing (28%), government (12%), or other (43%) including all food processing, warehousing, and retail. We also categorized jobs into three groups based on the respondent's report of job title and main duties: manufacturing (27%) including assembly and production of goods; keyboard (25%) including working primarily at a computer, typewriter or keyboard; or all other (48%) including service, retail, and finance. Women outnumbered men in all groupings, most strikingly in the keyboard category where 92% of claimants were women. Asked ''How many employees worked at your location?'' 21% responded that they worked at sites with 10 or fewer workers. Most respondents reported the presence of ergonomic risk factors at work. Almost all reported repetitive motion (96%) and working with wrist flexion or extension (95%). Most reported working with pinching motions (76%) and forceful use of hands (76%). Eighty-four percent of respondents had at least a high school education. Respondents with more than a high school education were more likely to be in the keyboard group.

Diagnoses

Based on respondents' report of physician diagnoses, carpal tunnel syndrome was overwhelmingly the most common diagnosis, reported by 78% of interviewees (Table II). Many individuals (71%) indicated they had been given more than one UECTD diagnosis.

As so many respondents reported a diagnosis of carpal tunnel syndrome (CTS), data were analyzed separately for those with CTS and those without a CTS diagnosis. We also adjusted for CTS diagnosis in logistic regression. In most analyses, patterns of response were similar, regardless of diagnosis.

OUTCOMES

Persisting Symptoms

Claimants were interviewed an average of 28 months (range from 11 to 46 months) after filing their claim, at a time outcomes might be thought to have stabilized. Eighty-four percent reported having some of their medical care paid for by workers' compensation, indicating that relatively few were still involved with contested claims. When asked if they felt they had recovered as much as they were going to, 79% answered affirmatively.

Symptoms were still being experienced by most of those interviewed. When asked about symptoms at the initial doctor visit, 96% recalled their symptoms as interfering with work, 94% with home/recreation activities, and 88% with sleep. Asked about symptoms at the time of the interview, symptoms severe enough to interfere with work, home activities or sleep were still present for about half of the respondents. Interestingly, the impact of symptoms was felt more at home than on the job (Table III). This was most striking for female respondents. Current ability to function at work, home, and play and to sleep was not associated with length of time between filing the claim and the interview, suggesting the symptoms were now stable and chronic.

TABLE II. Reported Diagnoses, 537 MWCC Claimants with UECTDs

	Men (163)	%	Women (374)	%	Total (537)	%
Carpal tunnel syndrome	121	75.2	296	79.1	417	77.9
Tendonitis in arm or wrist**	46	28.8	149	40.2	195	36.7
Shoulder tendonitis or rotator cuff	45	27.8	121	32.4	166	31.0
deQuervain's syndrome	20	12.3	79	21.1	99	18.5
Epicondylitis/tennis elbow	27	16.8	66	17.8	93	17.5
Pinched nerve in the neck	15	9.3	30	8.1	45	8.4

*$P < 0.05$, **$P < 0.01$.
Percentages add to > 100 because of claimants with more than one diagnosis.

TABLE III. Current Impact of Symptoms by CTS Diagnosis

	Received CTS diagnosis		
Current impact	Yes	No	Total
Symptoms interfere with:			
performing job	198 (54.0%)	53 (51.0%)	251 (53.3%)
home/recreation	274 (65.7%)	67 (57.3%)	341 (63.9%)
sleep	189 (45.5%)	46 (39.0%)	235 (44.1%)

Symptom impact not significantly different by diagnosis.

TABLE IV. Activities of Daily Living in MWCC Claimants with UECTDs

Specific activity	1 No problem	2 Only with difficulty	3 Can't do by myself	4 Not answered
Push window open	258 (50.9%)	216 (42.6%)	33 (6.5%)	30
Push door open	430 (80.4%)	101 (18.9%)	4 (0.7%)	2
Pull door open	375 (70.2%)	152 (28.5%)	7 (1.3%)	3
Push up from armchair	294 (57.1%)	195 (37.9%)	26 (5.0%)	22
Carry small bag of groceries	299 (56.2%)	203 (38.2%)	30 (5.6%)	5
Hold umbrella over head	335 (69.2%)	135 (27.9%)	14 (2.9%)	53
Turn doorknob	326 (61.0%)	202 (37.8%)	6 (1.1%)	3
Hold phone to ear	336 (62.8%)	193 (36.1%)	6 (1.1%)	2
Pour from container	304 (56.8%)	217 (40.6%)	14 (2.6%)	2
Turn a key	389 (73.0%)	135 (25.3%)	9 (1.7%)	4
Pick up coin	377 (71.1%)	139 (26.2%)	14 (2.6%)	7
Write with pen	275 (51.4%)	249 (46.5%)	11 (2.1%)	2
Switch car lanes	376 (74.9%)	117 (23.3%)	9 (1.8%)	35
Use side mirror	480 (95.2%)	20 (4.0%)	4 (0.8%)	33
Turn head over shldr.	392 (74.0%)	124 (23.4%)	14 (2.6%)	7
Lift child over crib rail	170 (46.3%)	143 (39.0%)	54 (14.7%)	170
Lower self into tub	293 (62.2%)	156 (33.3%)	19 (4.1%)	69
Mop floors	236 (49.8%)	206 (43.5%)	32 (6.8%)	63
Cook at stove top	373 (72.9%)	133 (26.0%)	6 (1.2%)	25
Scratch your back	285 (54.7%)	163 (31.3%)	73 (14.0%)	16
Put items up high	272 (52.2%)	198 (38.0%)	51 (9.8%)	16

Functional Impairment

Asked for a global assessment of their functioning, 81% of the respondents felt they were not able to "do as much as before the injury." Responses to each item in the UM-ADL scale are presented in Table IV. While some activities were minimally impacted, many respondents reported difficulty with activities involving strength, such as pushing open a window (49%) or pushing up from an armchair (43%). Activities requiring grip strength and coordination such as writing with a pen (49%) and pouring from a container into a glass (43%) were also problematic. Looking at all 10,708 responses to UM-ADL items, only 6,875 (64%) indicated that individuals could perform the activity normally, 3,397 (32%) indicated the activity could be performed only with difficulty, and 436 (4%) indicated that the activity could no longer be done. The mean score of all questions answered was 1.4 (SD 0.35).

Individuals who had received a CTS diagnosis were more likely to report difficulty with these activities than those who had other diagnoses (Table V). Mean UM-ADL scale scores improved slightly over time. Average scores were worse in women (1.44, SD 0.34) than in men (1.31, SD 0.33) and became significantly worse with increasing age.

TABLE V. Impact of UECTDs: Carpal Tunnel Diagnosis

	Received CTS diagnosis		
	Yes	No	Total
Mean score activities of daily living*			
(UM-ADL)	1.43	1.33	1.41
(SD)	(0.35)	(0.34)	(0.35)
N	417	118	535

*$P < 0.05$, **$P < 0.01$.

Logistic regression showed that the likelihood of normal ADL was reduced by female gender (OR = 0.37 with 95% C.I. 0.21–0.66), by increasing age (OR = 0.94 with 95% C.I. 0.91–0.97) and by reported severity of symptoms (OR = 0.61 with 95% C.I. 0.49–0.77).

Impact on Employment and Family Life

Job loss was a common event after the injury with 38% of respondents indicating that they had been laid off, fired, or quit the job they had at the time of injury. Twenty-eight percent were out of work at the time of interview. Job loss was lowest in those interviewed within a year of filing the claim. It was otherwise not related to length of time since claim date, suggesting that most job loss occurred relatively early in the disease course. Job loss was more common in women (44%) than in men (31%), and about the same in African Americans (41%), whites (40%) and others (43%). Of the 425 individuals who reported losing time from work, 333 (78%) reported receiving workers' compensation benefits for wage loss. Replacement for lost wages had come from a variety of other programs as well (Table VI).

TABLE VI. Benefits Received Since the Injury by CTS Diagnosis

	Received CTS diagnosis		
Source of benefit	Yes	No	Total
Received disability benefits	104 (25.1%)	26 (22.2%)	130 (24.4%)
Received unemployment benefits	67 (16.2%)	19 (16.1%)	86 (16.2%)
Received welfare	29 (07.0%)	7 (05.9%)	36 (06.7%)
Health care paid for by:			
Workers' comp	350 (85.8%)	90 (79.6%)	440 (84.5%)
Health insurance	200 (48.5%)	49 (43.0%)	249 (47.3%)
Public/government insurance	11 (02.7%)	5 (04.3%)	16 (03.0%)
Self/family	120 (28.8%)	40 (33.9%)	160 (30.0%)
Some not paid for *	59 (14.3%)	7 (06.1%)	66 (12.5%)

*$P < 0.05$, **$P < 0.01$.

Logistic regressions showed an association between the participant keeping the job held at time of injury and higher income at the time of injury (OR = 1.31 with 95% C.I. 1.11–1.55). There was an even stronger association between keeping one's job and being a member of a labor union (OR = 2.68 with 95% C.I. 1.71–4.18).

There was an association between being employed in any job at the time of interview and male gender when only demographic variables were considered (OR = 0.56 for being female with 95% C.I. 0.33–0.96). In the full model, however, gender was no longer significant (OR = 0.66 with 95% C.I. 0.37–1.2). The following were predictors of being employed: having CTS as a diagnosis (OR = 1.7 with 95% C.I. 1.01–2.89), current ADLs being normal (OR = 3.67 with 95% C.I. 1.65–8.14) and being a member of a union at the time of the injury (OR = 1.92 with 95% C.I. 1.19–3.13).

About half of those interviewed indicated their condition had resulted in ''family problems.'' Those who received a CTS diagnosis were more likely than those who did not to have been contacted by collection agencies (Table VII).

Previous studies of postal workers with UECTDs, seen at our clinic, revealed a high proportion of patients with symptoms suggestive of clinical depression. Hence we included a measure of depression, the Center for Epidemiological Studies Depression questionnaire (CES-D) in the study interview. Used in epidemiologic studies, a score greater than 16 on this instrument has been associated with a higher likelihood of a diagnosis of clinical depression. In general population surveys, about 20% of those surveyed have scores greater than 16 [Comstock and Helsing, 1976]. Of the 497 who completed this questionnaire 156 (31%) scored over 16, with little difference between those who had received a CTS diagnosis and those who had not. Those with less education had higher CES-D scores. Forty-one percent of those with less than high school had scores over 16. There was no association with age, ethnicity, or gender.

TABLE VII. General and Specific Family Problems Resulting from Injury by CTS Diagnosis

	Received CTS diagnosis		
Problems	Yes	No	Total
Had family problems	203 (48.7%)	53 (44.9%)	256 (47.9%)
Separated from spouse or partner	43 (11.7%)	8 (08.1%)	51 (10.9%)
Couldn't afford to maintain car	64 (16.2%)	15 (13.4%)	79 (15.6%)
Moved to less expensive residence	25 (06.0%)	5 (04.3%)	30 (05.6%)
Borrowed money from friends and family	141 (34.0%)	29 (24.6%)	170 (31.9%)
Contacted by collection agency**	162 (38.9%)	30 (25.4%)	192 (36.0%)

*$P < 0.05$, **$P < 0.01$.

Logistic regression demonstrated that a CES-D score greater than 16 (abnormal) was inversely associated with educational level (OR = 0.66 with 95% C.I. 0.49–.91), inversely associated with having normal activities of daily living (OR = 0.24 with 95% C.I. 0.11–0.52) and inversely associated with being currently employed (OR = 0.44 with 95% C.I. 0.28–0.71).

DISCUSSION

In 1997, the last year for which data are available, the Bureau of Labor Statistics estimated there were 429,800 newly reported cases of occupational illness in private industry in the United States [Bureau of Labor Statistics, 1998b]. Disorders associated with repeated trauma, the category which includes UECTDs (along with noise-induced hearing loss) represented 276,600 [Bureau of Labor Statistics, 1999c] or 64% of these cases.

Ergonomic interventions are often successful in reducing musculoskeletal disorder incidence [Aaras, 1994; Kemmlert, 1996; NIOSH, 1999]. Despite the documented successes that some employers have had in reducing injuries, the high incidence of UECTDs continues to represent a significant problem for employees and employers. In a national debate about regulatory approaches, costs of ergonomic changes are being weighed against the costs of the conditions themselves. Much of this dialogue has been limited to financial costs measured or estimated from existing administrative data, such as the BLS surveys and workers' compensation payments. Less attention has been paid to those costs that are not captured by data systems that have been designed to fulfill administrative functions.

Outcomes of UECTDs have been studied by a number of researchers. There is extensive literature on evaluating outcomes of surgical treatment of CTs, the most common of these conditions. Most studies report good outcomes, often using return to work as one of the measures of success [Nolan, III et al., 1992; Higgs et al., 1995; DeStefano et al., 1997]. It has been noted that individuals with work-related UECTDs had slower return to work than those whose injury was not thought to be work-related [Frieman and Fenlin, 1995; Higgs et al., 1995]. In a systematic look at outcomes of occupational CTS, using workers' compensation data from Washington State, Adams showed that 41% of patients had experienced complete relief of symptoms, with another 45% reporting moderate relief and 14% no relief [Adams et al., 1994]. These results contrast with the more optimistic results in the surgical series.

Using patient interviews to assess outcomes adds dimensions missing from administrative data or even medical records. With appropriate assurances of confidentiality, an interview over the phone may yield more frank information about sensitive subjects than one might reveal to a physician. Katz and colleagues have shown that this approach gives results that correlate with objective measures and have demonstrated that subjects receiving workers' compensation gave equally reliable information as non-recipients [Katz et al., 1994, 1996].

The present survey provides the best available information to date on the total impact of UECTDs in Maryland. It also demonstrates the utility of a method that can be used in the future to measure outcomes in other conditions and to evaluate interventions designed to improve these outcomes. Use of a phone survey made it feasible to gather information from a large enough number of individuals with UECTDs to allow us to begin to examine the association between individual and workplace characteristics and outcomes.

At the same time, our results need to be interpreted with an awareness of the limitations imposed by this choice of study method. We did not attempt to confirm diagnoses with medical records, examine individuals to correlate mean UM-ADL scale scores with dynamometry or other objective tests, or verify respondent reports about job loss, marital disruption, and money problems. We did not have access to a comparison population of individuals without injury of similar age and education to help us interpret rates of job loss, divorce, calls from collection agencies, etc. Most importantly, the claimants we were unable to reach because they had moved without forwarding addresses, never had phone numbers, or had telephones disconnected may have differed from those we interviewed in ways beyond their demographic differences. The outcomes of this less socially integrated group might be different than those we report, although we have made efforts to take the known differences in age, gender, and socioeconomic level into account by adjusting for them in logistic regression.

While respondents reported symptomatic improvement from time of onset, a high proportion were still experiencing symptoms that interfered with their work, home life, and their sleep. Somewhat surprisingly, symptoms presented more of a problem for the respondents at home than at work. The response to questions about activities of daily living show most injured workers report long lasting difficulty doing the simple ordinary tasks of life. The respondents' own assessment of no continuing improvement and the high rates of persisting symptoms and abnormal mean UM-ADL scale scores, even in those furthest from onset, would indicate that these impairments will be chronic and perhaps permanent.

Beyond symptoms and functional impairment, these results suggest that these conditions are having a severe societal impact. Despite the fact that almost all respondents had received workers' compensation payments by the time of interview, a third had needed to borrow money from family members and an equal number had heard from collection agencies. These financial difficulties may relate more to delays in receiving compensation than the actual amount received. The high rate of symptoms of depression

on the CES-D may reflect the social as much as the physical impact of the injury.

The use of multivariate analyses on this large and broadly representative population makes it possible to identify factors that predict better or worse outcomes. Many authors have noted great variability in return to work after occupational injury and have called for identifying those attributes of the individual worker that predispose to poor outcome. In this population, age and gender influenced mean UM-ADL scores, but neither these nor income or education had predictive value for reported symptoms of depression or loss of employment. Reported diagnosis made surprisingly little difference, perhaps because these conditions often occur together and may be imprecisely diagnosed and distinguished. The nature of the task performed (keyboarding, manufacturing, or other) made little difference.

The factors that do emerge as the most important predictors will come as no surprise to patients or those involved in their care and rehabilitation. The worse the injury, judged by persisting symptoms and functional impairment, the more likely you are to lose your job. Having more impairment and being out of work makes it more likely that you will experience symptoms of depression. Having a better paying job, and especially belonging to a union, makes it more likely that you will keep your job when you get injured.

This survey begins a process of identifying and quantifying the impact of UECTDs in Maryland and has answered several basic questions: occupational UECTDs are common; they cause severe lasting symptoms and functional impairment; they impose costs on employers, workers, and families. The next question is, do we have the knowledge and the resolve to prevent them?

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