AMERICAN JOURNAL OF INDUSTRIAL MEDICINE 38:489–497 (2000)

Patterns and Predictors of Employer Risk-Reduction Activities (ERRAs) in Response to a Work-Related Upper Extremity Cumulative Trauma Disorder (UECTD): Reports from Workers' Compensation Claimants

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Background *Despite being preventable, work-related upper extremity cumulative trauma disorders (UECTDs) remain problematic. This study is unique in its focus on predictors of employer risk-reduction activities (ERRAs) in response to a UECTD case.*
Methods *Workers' compensation claimants (N = 537) completed a telephone survey about employer risk-reduction activities, workplace characteristics, safety programs, and physician recommendations for job modifications.*
Results *Only 52% of respondents reported employer actions to investigate or reduce UECTD risk. Engineering and pace changes were prominent for keyboard workers and transfer to another job for manufacturing workers. Safety programs and physician recommendations increased the likelihood of risk-reduction activities.*
Conclusions *An opportunity to intervene post-injury to reduce risks for the injured worker and prevent new UECTD cases is being missed. Physician recommendations are strongly associated with specific ERRAs thought to be most effective. Educating employers and physicians about ergonomics could result in prevention of UECTDs.* Am. J. Ind. Med. 38:489–497, 2000.

KEY WORDS: carpal tunnel syndrome; risk-reduction; occupational disease; follow up studies; workers' compensation; rehabilitation; prevention; physician recommendations; safety committees

INTRODUCTION

Work-related upper extremity cumulative trauma disorders (UECTDs) have been recognized as a major contributor to work-related disability. Work-related musculoskeletal disorders account for one third of all occupational injuries and illnesses reported to the Bureau of Labor Statistics by employers each year. Employers pay more than $15–20 billion in workers' compensation costs for these disorders annually [Department of Labor, 1999]. In a companion article in this issue [Keogh et al., 2000], the

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Contract grant sponsor: National Institute for Occupational Safety and Health; Contract grant number: 5 RO1/CCR312140

Accepted 22 May 2000

authors report on striking and long-lasting social, economic and functional outcomes experienced by workers with UECTDs.

Numerous epidemiological studies have shown a strong association between the incidence of UECTDs and specific industries. Investigations looking at incidence have shown strong links to specific job tasks involving repetition, forceful exertions, and constrained or static postures, usually found in combination [Bernard, 1997]. The rising incidence of these conditions during the last two decades has been attributed to better disease recognition, to the explosive increase in the use of computers (without a corresponding increase in sophistication about people/machine interfaces) and to manufacturing process improvements that incorporate faster speeds and shorter work cycle times. As investigations by NIOSH and others have elucidated the nature of the problem [Rempel et al., 1992] it has become possible for employers to redesign and adapt equipment, to modify tools, and to reorganize workplaces in order to prevent UECTDs. Many employers have reported successful ergonomic interventions that have reduced incidence in specific operations [Aaras, 1994; Kemmlert, 1996; Ergoweb, 1999]. Proposals for regulation have generated substantial attention at both state and national levels, trade journals have covered issues extensively, and expertise is increasingly available from public sources and private consultants. The 1997 BLS report of 276,600 new cases of repeated trauma [Bureau of Labor Statistics, 1999a] was 10% lower than the 1995 figure of 308,000 and 17% lower than the record high 1994 figure of 332,000, suggesting that steps taken by employers in response to this epidemic may be having some effect. Issuance of OSHA's Ergonomics Program: Proposed Rule (November 23, 1999) reaffirms the urgent need for efforts to reduce ergonomic risks.

While regulation likely remains the strongest catalyst for risk-reduction activities, other factors may also exert an influence. Lower injury rates and faster returns to work have been reported when physicians and employers are both involved in the workers' rehabilitation experience [Habeck et al., 1998a]. This finding suggests that physicians may also play a role in what happens post-injury.

The literature also includes reports of the effectiveness of workplace-based safety programs in reducing injuries and illnesses, and the frequency and severity of related disability. Injury rates decline when: (1) strong management commitment to safety exists [Tuohy and Simard 1993; Shannon et al., 1996], (2) workers participate in decisions [Shannon et al., 1996; Habeck et al., 1998b], and (3) safety committees have empowered, committed members with equal management/labor representation [Tuohy and Simard 1993; Shannon et al., 1996; Habeck et al., 1998b].

Despite documented successes in reducing injuries in some workplaces, the high incidence of UECTDs continues to represent a significant problem for employees and employers. Appropriate attention to human factors during the design of tools and equipment, and in the layout and organization of workplaces, could provide primary prevention of these injuries. At present, however, most ergonomic changes are made only in response to a UECTD case, rather than proactively.

When a UECTD case is recognized, how often do employers modify the job in order to protect and accommodate the injured worker? Are these modifications extended to other workers also at risk? What factors influence the likelihood that employers modify the job to reduce risk? What role do employer safety programs play? Do physicians make recommendations about changes in the workplace, and how effective are these recommendations?

To answer these questions we surveyed Maryland UECTD Workers' Compensation claimants and asked specific questions about employer job modifications and related efforts to prevent new injuries.

METHODS

Five hundred and thirty-seven individuals with work-related UECTDs, filing workers' compensation claims in Maryland between January 1, 1994 and September 30, 1996, responded to a telephone survey about the injury, work activities, workplace, medical care and ERRAs in response to the injury, as well as to demographic questions including age, gender, ethnicity, and education. The authors provide full details on the identification of eligible respondents in a companion article [Keogh et al., 2000] in this issue.

"Employer risk-reduction activities (ERRAs)", as reported by injured workers, were the outcomes of interest (dependent variables) in this study. These variables were constructed from responses to six questions which were grouped as follows: (1) **engineering change**—made engineering changes, altered the work site or changed tools or equipment, (2) **duties change**—changed the job assignment or the duties performed by the injured worker, (3) **work-pace change**—changed the pace of the job, or allowed the injured worker to set the pace. Each of these three outcome variables was scored '0' for no and '1' for yes. Respondents were asked if changes were made for other workers performing the same job or a different job which had similar risk factors (scored '0' for no and '1' for yes).

In addition, a global measure of employer response to the injury was constructed and scored 'yes' if the employer did any of the above or conducted a safety evaluation. Independent variables included physician recommendations and employer safety programs.

Worker characteristics are described in Table I and workplace characteristics in Table II.

TABLE I. Respondent Characteristics (N = 537)

	Values	Numbers	Percent
Gender	Male	163	30.4
	Female	374	69.6
Age at injury			
Mean	42.2		
SD	9.5		
N	528		
Education	Less than high school	87	16.2
	12 years	194	36.1
	Some college or more	256	47.7
Ethnicity	White	367	68.3
	African American	138	27.3
	Other	32	6.0
	(missing value)		
Weekly wage at injury	up to $313	104	19.8
	$313–$395	91	17.4
	$396–$498	106	20.2
	$499–$682	117	22.3
	$683–$1600	106	20.2
Marital status	Single	182	34.8
	Married	341	65.2
Carpal tunnel syndrome diagnosis	Yes	417	77.9

Physician Recommendations

Respondents were asked a series of questions about whether the physician[1] caring for them had recommended specific workplace changes. These questions mirror those previously described, and are likewise grouped as engineering, duties, and work-pace changes.

Employer Safety Programs

Respondents were asked whether the employer had someone designated as responsible for health and safety, whether there was a nurse on-site, and whether there was a company doctor. Additional questions were asked about whether there was a safety committee, any medical examinations or training about safety hazards.

The questionnaire also collected information about several potential confounding and control variables.

Workplace Characteristics

The literature has identified several workplace characteristics that influence injury rates. These characteristics merit attention as they may also influence ERRAs in response to a UECTD injury. Employer size and stable workforces predicted lower lost work-day cases [Habeck et al., 1998b]. Stable workforces were also associated with lower injury rates [Tuohy and Simard, 1993; Shannon et al., 1997]. While not looking specifically at ERRAs in response to a UECTD injury, unionized work places have been shown to be linked to increased OSHA enforcement [Weil, 1999] and higher lost work days [Habeck et al., 1998b], which may indicate increased reporting.

This survey included questions about years on the job, type of industry/job, union representation, and size of workforce. Tenure in years was measured by asking "How long were you in this job before you developed this problem?" Two dichotomous task variables, keyboarding and manufacturing/assembly, were constructed from the free text description of major work tasks, job title, and industry. Union representation was ascertained by asking, "Was there a union at your workplace?" In fact, 90% of respondents in unionized work sites were union members. Because it is unlikely that respondents would know their employers' total workforce we specifically asked respondents, "How many employees worked at your location?"

Characteristics of the Respondents

Age, weekly wage, and marital status were available from the Workers' Compensation database. The interview collected data on ethnicity, education, gender, diagnosis of carpal tunnel syndrome, and whether others who were doing the same job, or a job with similar risk factors, had experienced UECTDs.

Data Analysis

We hypothesized that the frequency and type of ERRAs in response to injury would be associated with characteristics of the worker, the employer, and the injury. In addition, we wanted to look at the effect of workplace occupational safety programs and the impact of recommendations from treating physicians.

We tested bivariate associations between specific ERRAs and the above factors using the χ^2-statistic. On many questions, individuals were allowed the option of not responding when they were unsure of their answer. For each of these questions there was a small percentage who did not respond. These individuals were excluded from specific analyses involving those variables.

Due to concern for confounding, we subsequently used logistic regression to assess the strength of association between ERRAs (dependent variables/outcomes) and physician recommendations and employer safety programs (independent variables), after adjusting for characteristics of worker and workplace.

[1] These questions referred to care provided by a doctor or other health professional to capture all sources of care. Because physicians were reported by 96% of respondents as the source of their initial care and 95% of respondents as the source of the majority of their care we report findings as physician recommendations.

TABLE II. Workplace Characteristics (N = 537)

	Values	Numbers	Percent
Number employees at work site	= < 10	103	20.8
	11–40	118	23.8
	41–100	92	18.5
	101–500	115	23.2
	> 500	68	13.7
Years on job			
mean	8.76		
SD	8.12		
N	524		
Keyboard work		132	24.6
Manufacturing/assembly work		146	27.2
Unionized workplace		222	41.7
Workplace safety programs			
Nurse, M.D. or other at work responsible for safety		365	70.9
Training or medical surveillance program at work		258	49.0
Safety committee at work		195	38.4
Physician recommendations for job modification			
Pace: change/permit pace change		176	33.5
Duties: change duties		382	72.1
Engineering: change tools, equipment, work setup		229	56.4
Employer risk-reduction activities for injured workers (composite outcome variables)			
Pace: change/permit pace change		139	26.3
Duties: change job or some duties		151	28.5
Engineering: change tools, equipment, work setup		149	28.4
Employer made job modification for others (N = 222)		106	40.1
Other employees do same job		450	83.8
Other employees have similar problems		334	74.2

A model was developed for each of the three dependent composite risk-reduction variables (changes in **engineering, duties**, and **work pace**), and independent variables were added in blocks. The first block included demographic variables, the second included characteristics of the workplace, the third was employer safety programs, and the fourth was whether the physician had recommended the specific employer risk-reduction activity. Each block and equation was tested with the χ^2-statistic to determine whether the prediction was better than expected by chance. We determined which of the variables in the blocks were significant predictors, using the odds ratio and the 95% confidence interval. Even when a variable was not found to be significantly associated with a specific composite risk-reduction activity, it was kept in the final equations for simplicity in comparisons. This did not substantially change any of the odds ratios or confidence intervals.

Finally, we used logistic regression to assess the strength of association between the likelihood that an employer performed any risk-reduction activities to prevent injuries to other employees, doing the same job or a job which had similar risk factors, and physician recommendations and employer safety programs, after adjusting for characteristics of the workplace. 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

Worker Characteristics

Respondents were predominately female (70%), and 65% of all respondents were married. African Americans

were slightly more represented than in the general Maryland population, 27% versus 25% [U.S. Census, 1994]. Our respondents had slightly higher levels of education than the general Maryland population; 84% had a high school degree or further education versus 78% [U.S. Census, 1990]. Sixty-three percent earned over $396 per week at the time of injury and 20% earned over $683 (Table I).

Medical Diagnoses

Carpal tunnel syndrome (CTS) was the most common diagnosis, reported by 78%. Many respondents (71%) reported multiple diagnoses. We analyzed employer responses by CTS diagnosis vs. no CTS diagnosis. As patterns were similar, findings are reported for all UECTDs. However, in the logistic regressions, CTS diagnosis was entered as a control variable.

Workplace Characteristics

The employers' two-digit Standard Industrial Codes (SIC), obtained for claims from the Maryland Workers' Compensation Commission (MWCC) showed that the majority of respondents were employed in three of the 10 broad SIC categories: manufacturing (28%), government (12%), or other (43%), which includes all food processing, warehousing, and retail. Based on each respondent's description of job title, major duties, and industry we classified 27% as performing manufacturing tasks (assembly, production of goods); and 25% keyboarding (working primarily at a computer, typewriter or keyboard). The remaining 48% of respondents could not be meaningfully grouped. Women outnumbered men in all job groupings, most strikingly in the keyboard category, where they were 92% of respondents. Individuals with more than a high school education were most likely to be in the keyboard group. The average time on the current job was 8.8 years (SD 8.1 years) for the 524 individuals responding. Forty-two percent of those interviewed reported there was a union at their workplace, and 90% of this group reported that they were themselves union members. This far exceeds the 14.1% unionization rate of Maryland workers [Bureau of Labor Statistics, 1999b]. (Table II)

Respondents' work sites were of widely varying size. Of 496 individuals who answered the question ''How many employees worked at your location?'', 103 (21%) worked in workplaces with 10 or fewer employees, 118 (24%) in those with 11–40 employees, 92 (19%) in those with 41–100 employees, 115 (23%) in those with 101–500 employees, and 68 (14%) in those with over 500 employees.

Of 526 employees responding to a question about risks to other workers, 450 noted there were other employees doing the same job. Of these, 334 (74%) reported that these other employees also had experienced similar problems.

Seventy-one percent of employees (365 of 515) responding indicated that their employer had someone designated as responsible for health and safety, 49% (258 of 526) reported employer safety training or medical surveillance, and 38% (195 of 507) reported there was a health and safety committee at the workplace.

Employer Actions to Investigate or Reduce UECTD Risk

Of the 533 employees responding to a question about post-injury employer actions, 254 (48%) reported that their employers did nothing. Of the 52% (279) who reported any employer action, 21% identified a safety evaluation (Table III), 28% an engineering change (tools, equipment, and/or work setup), 29% a change of job or duties, and 26% a work-pace change (Table II).

Larger employers were more likely to engage in at least one risk-reduction activity, more likely to conduct a safety evaluation, and more likely to move the injured worker to a completely different job. The type of employer risk-reduction activity in response to an injury differed by the type of work employees performed. Employers of workers who did manufacturing tasks were more likely to conduct safety evaluations, switch workers' duties and move workers to another job. Employers of workers who did keyboard work were the most likely to change the work setup and equipment and make changes in job pace or output requirements. Employers of workers with duties categorized as other were the least likely to make most changes (Table III).

Type of employer actions to investigate or reduce UECTD risk for an injured worker did not seem to be influenced by whether other employees did the same job. However, if the respondent reported that other workers doing the same job had experienced similar problems, the employer was more likely to move the injured worker to a completely different job and allow the employee latitude in adjusting the job pace or production requirements (Table IV).

Even when changes were made for the injured worker, only 36% of employers were reported to have made the same change for other workers doing the same job, and only 31% made the change for workers with a different job posing the same risk factors who might also benefit.

Physician Recommendations

Fully 76% of the physicians seen by respondents initially for the problem considered it to be work-related. Of the physicians who provided respondents with the majority of their care, 89% told the worker the problem had been caused by work. In addition 88% of physicians were reported as recommending some type of job change

TABLE III. Employer Actions to Investigate or Reduce UECTD Risk by Worker Duties

	Type of worker duties			
	Keyboarding	Manufact./Assemb.	Other	Total
Number of respondents	132	146	259	537
Type of response	%	%	%	%
Safety evaluation of job**	14.7	30.7	19.5	21.3
Change work setup**	35.7	19.4	9.2	18.5
Switch some duties*	19.1	31.0	18.9	22.3
Move to another job**	6.9	35.2	13.0	17.5
Change equipment/tools**	35.4	22.5	13.7	21.4
Change pace	9.2	9.2	10.6	9.9
Let employee change/set pace	29.2	16.2	25.2	23.8
Made at least 1 response*	47.1	55.2	47.1	52.3

*$P < 0.05$; **$P < 0.01$.

(including quitting the job, restricting some activities). Recommendations about specific job modifications were less common. For 36% of respondents, the physician recommended a change of job, for 75% that changes be made in the current job. Only 30% recommended reduction in hours, 32% changes in the work area design, 32% a change in tools, 34% a change in work pace.

TABLE IV. Employer Actions to Investigate or Reduce UECTD Risk by Presence of Employees in the Same Job with Similar Injuries

	Other employees injured		
	Yes	No	Total
Number of respondents	334	116	450
Employer Response	%	%	%
Safety evaluation	23.7	16.1	21.7
Change work setup	20.5	13.5	18.7
Switch some duties	23.3	21.2	22.7
Move to another job*	21.8	11.5	19.1
Change equipment/tools	21.0	20.4	20.8
Change pace of job	8.8	14.0	10.2
Let employee change pace*	20.4	31.3	23.2
Made at least one response	47.9	45.8	47.3

*$P < 0.05$; **$P < 0.01$.
76 employees had no co-worker doing the same job.17 respondents had missing values.

There was a strong association between these more specific physician recommendations and employer actions. While 48% of employers took no action in response to an injury, physician recommendation more than doubled the likelihood of several specific responses.

These included moving the injured worker to a completely different set of duties, switching some of his/her duties, changing some of his/her work tools, and changing the setup of the immediate work area (Table V).

TABLE V. Employer Actions to Reduce UECTD Risk: by Physician Recommendations

	Physician recommended this change		
	Yes	No	Over all response[a]
Employer response	%	%	%
Move to completely different set of duties**	25.1	9.8	17.6
Switch some duties**	27.4	13.1	22.4
Change work tools/equipment**	48.2	9.2	21.9
Change immediate work area**	38.3	9.3	18.8
Change speed/pace**	37.9	21.2	26.8

[a]Number responding to each combination of questions varies from 459 to 471.
**$P < 0.01$.

Multivariate Analysis

Employers were three times more likely to make engineering changes for an injured worker with keyboard duties (after adjusting for other variables). The presence of a safety program (medical surveillance or safety training) doubled the chances that an employer would make engineering changes, as did the presence of a safety committee. Physician recommendations for specific changes, added as a last step in the model, significantly improved the prediction of the corresponding employer risk-reduction activities. The employer was almost seven times more likely to make an engineering change if the treating physician recommended it, adjusting for all other variables (Table VI).

Employers were more than twice as likely to switch duties for workers with UECTDs who described their tasks as assembly or manufacturing (after adjusting for all other variables). The presence of a safety committee almost doubled the likelihood that an employer would change duties of the injured worker. The employer was five times more likely to make a change in duties if the treating physician recommended it.

A change in work pace was not associated with characteristics of the workplace or respondent, or presence of an employer safety program. The only factor in the model linked to the employer changing work pace is physician recommendation, and here the impact of such a recommendation (odds ratio of 2.15) was quite a bit less than for other types of employer actions.

When an employer acts to reduce the risk to an injured employee, is that action extended to other vulnerable employees? What promotes this prevention-oriented approach? Among those employers who performed any risk-reduction activity for the injured worker, 41% also made changes for other employees doing the same job or employees with a different job who might also benefit from the change. Larger companies, and those with employees with keyboarding duties, were more likely to perform any one of the three types of risk-reduction activities. A change

TABLE VI. Predictors of ERRAs*

	Engineering change N = 403		Duties change N = 408		Work pace change N = 404		Change for other workers N = 232	
Predictor variables	**OR**	**(95% CI)**	**OR**	**(95% CI)**	**OR**	**(95% CI)**	**OR**	**(95% CI)**
Worker characteristics								
Female (vs. male)	1.46	(.74–2.89)	0.82	(.45–1.51)	0.86	(.47–1.58)		
Age	1.01	(.98–1.05)	1.00	(.97–1.03)	1.00	(.97–1.02)		
Education	0.93	(.62–1.38)	1.05	(.72–1.53)	0.85	(.60–1.22)		
African American (vs. White)	0.79	(.43–1.46)	1.17	(.67–2.06)	0.97	(.55–1.69)		
Married (vs. not married)	0.76	(.43–1.32)	0.97	(.58–1.65)	0.93	(.56–1.54)		
Wage quintile	0.91	(.73–1.15)	0.88	(.71–1.09)	0.97	(.79–1.18)		
CTS diagnosis (vs. no CTS diagnosis)	1.14	(.59–2.20)	0.88	(.48–1.63)	1.13	(.63–2.01)		
Characteristics of workplace								
Working at a keyboard	**3.02**	(1.47–6.21)	1.31	(.64–2.71)	1.59	(.85–2.98)	**2.41**	(1.15–5.07)
Working in manufacturing/assembly	1.57	(.80–3.09)	**2.44**	(1.32–4.51)	0.69	(.36–1.32)	1.14	(.54–2.40)
Number of workers at work location	1.07	(.86–1.33)	0.95	(.77–1.18)	0.85	(.69–1.03)	**1.38**	(1.08–1.77)
Time on job	1.01	(.97–1.05)	1.01	(.97–1.04)	0.97	(.94–1.01)		
Presence of a union	0.63	(.35–1.14)	1.05	(.61–1.83)	0.88	(.52–1.50)	0.58	(.31–1.08)
Safety programs								
Presence of safety personnel	0.63	(.32–1.25)	1.54	(.78–3.03)	1.31	(.73–2.34)	0.84	(.37–1.90)
Presence of training/medical surveillance	**2.07**	(1.11–3.87)	1.45	(.82–2.58)	0.82	(.47–1.42)	1.62	(.81–3.26)
Presence of safety committee	**2.81**	(1.46–5.42)	**1.86**	(1.04–3.32)	1.18	(.66–2.10)	**2.19**	(1.05–4.56)
Doctor recommends	**6.51**	(3.72–11.41)	**5.02**	(2.40–10.51)	**2.15**	(1.13–3.53)	**12.63**	(1.58–100.92)
Model χ^2 (df)	**98.51**	(16)	**61.53**	(16)	**27.69**	(16)	**39.14**	(8)

*Odds ratios (O.R.) and confidence intervals (C.I.): final model with all variables added.
Bolded numbers are statiscally significant with $P < 0.05$.

affecting other workers was much more likely to happen if a physician had recommended a change for the injured worker.

The original analysis compared each of the three composite ''ERRAs'' to ''not taking that specific action.'' The analyses were repeated for each risk-reduction activity with a somewhat more restrictive reference category; ''no action of any kind.'' In addition ''number of employees'' was altered by disaggregating the categorized variable and converting it to the natural log. Also the weekly wage category was disaggregated. The findings did not change.

DISCUSSION

This study is the first attempt to look at employer risk-reduction activities in response to the occurrence of work-related UECTDs in Maryland and is part of a larger research program to look at the occurrence of these disorders and their prevention. We were able to demonstrate that even a workers' compensation administrative database, designed for other purposes, could be used to find individual respondents most likely to have had UECTDs. Phone calls after initial mailing resulted in a 69% response rate and subsequent screening permitted cost-effective identification of a large number of Maryland workers with work-related UECTDs.

Despite their advantages, these study methods also impose some limitations that should be considered in interpreting our results. We are reporting data from only those Marylanders with work-related UECTDs who filed for workers' compensation and whom we could reach by telephone. Data available from the MWCC database let us demonstrate that those workers' compensation claimants we were able to reach were more likely to be women, older, married, and reported higher income than those we could not reach. Those claimants who could not be reached because they no longer had a phone or could not be tracked through address changes may be less socially secure than were those who could be reached. While we adjusted for age, marital status, wages, and gender in multivariate analyses, respondents could have differed from non-respondents in ways that might influence ERRAs, in directions that we cannot know or predict.

This project was not designed to ascertain the proportion of Marylanders who develop a work-related UECTD but do not file a workers' compensation claim. However, a Connecticut study involving random-digit dialing of state residents found a compensation filing claim rate for work-related musculoskeletal disorders as low as 11% [Morse et al., 1998].

Although we were unable to confirm diagnoses from medical records, in our analysis reported diagnoses did not seem to influence ERRAs in response to the injuries. The very high proportion of respondents whose physicians had told them their problems were work-related is at first surprising. However, a worker might be discouraged from filing a claim if the treating physician was uncertain about work-relatedness. Likewise, the high proportion of union members among those interviewed in Maryland, and the high proportion that reported being aware of other workers with similar injuries might be due in part to a relationship between these factors and the decision to file a claim.

Finally, we had no means to systematically confirm individuals' reports of ERRAs in response to injuries. Particularly for those individuals who lost their jobs, or had not yet returned to work, knowledge of workplace changes may be incomplete.

Despite these limitations, the extensive data collected from the respondents who were interviewed provided a unique opportunity to see what is happening when UECTDs occur in a broad cross-section of Maryland workplaces.

Job modifications made for an injured worker may not improve his or her degree of functional impairment, but could allow that individual to continue to work productively and reduce job loss and the need for retraining. Moreover, each case of work-related UECTD is also a sentinel event, warning the employer of the possibility of others at risk. Current voluntary approaches to UECTD prevention have as their cornerstone the initiation of ergonomic intervention in response to identified cases. To a large extent proposed regulations echo this approach.

The fact that only slightly over half of the respondents we interviewed reported any employer action to investigate or reduce UECTD risk in response to their injury is disturbing. If the presence of multiple workers with similar cumulative trauma injuries is sounding an alarm in Maryland workplaces, it is an alarm that is often ignored.

Not surprisingly, the single most common employer risk-reduction activity reported was to move the injured worker to a completely different job assignment. That larger employers were the most likely to take this action probably reflects a greater variety of tasks and flexibility in assignments. As expected, the presence of safety personnel and a safety committee was associated with employer job modifications designed to protect the injured worker from further injury. It is also not surprising that different actions were taken for injured workers in keyboarding than for those doing assembly type tasks. For keyboarding employees, changes in equipment and job setup were more common, while in manufacturing operations, where change in equipment and tools may be more expensive, the employee was more likely to be reassigned to different tasks.

Employer failure to reduce risks for other employees may signal that employers see the injury as a problem of the individual; not meriting a more comprehensive response. Physician behavior emerges from this study as a potent factor for change. It seems clear that practicing physicians do recognize the connection between UECTDs and work activities. Combining the responses of all doctors seen by

respondents, 90% told their patients that their UECTD was work-related. Since 86% of the individuals reported that workers' compensation was covering medical expenses, income replacement or both, it is likely that the issue of work-relatedness was not seriously in question for most respondents. Physician recommendations dramatically increased the occurrence of those specific ERRAs with the greatest likelihood of reducing injuries. Most physician recommendations were for changes in their patients' duties, but 44% had recommendations about tools or equipment. These findings suggest a unique opportunity for physicians to influence prevention of UECTDs and, possibly, other work-related injuries and illnesses as well. To realize this opportunity medical education for undergraduate, post-graduate, and practicing physicians must include a strong foundation in the prevention, recognition, diagnosis, and treatment of occupational and environmental disease. Equally important, physicians must embrace the dual role of both patient and public health advocate; demonstrating this commitment by talking with the individual patient about work and reaching out into the workplace environment to advocate for changes that will promote health and safety.

What is the best way to encourage employers to engage in risk-reduction activities in response to work-related UECTDs? The evidence that UECTDs occur in clusters suggests that a targeted educational campaign, focusing on workplaces with identified UECTDs, could have greater impact than a more general educational campaign. Employers are apparently listening to practitioners who treat UECTDs, and the physician community could well serve as a useful conduit to reach those employers unaware or uncertain about initiating ergonomic improvements.

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