

The Economic and Social Consequences of Work-related Musculoskeletal Disorders: The Connecticut Upper-extremity Surveillance Project (CUSP)

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A population-based telephone survey was conducted in Connecticut to determine the social and economic impact of work-related musculoskeletal disorders (WRMSDs). Only 10.6% of cases had filed for workers' compensation. Respondents had spent an average of \$489 annually out-of-pocket. Only 21% of individuals who had had medical visits or procedures reported having them paid for by workers' compensation. The WRMSD cases reported much higher levels of difficulty in daily tasks rated by the activities of daily living (ADL) scale, with odds ratios (ORs) ranging from 8.2 (child care) to 35.2 (bathing). The cases were significantly more likely to have moved for financial reasons (OR = 2.41), including having lost a home (OR = 3.44). The cases were also significantly more likely to have lost a car due to finances (OR = 2.45), more likely to have been divorced (OR = 1.91), and less likely to have been promoted (OR = 0.45). The study supports significant externalization of costs for WRMSD out of the workers' compensation system and a substantial social and economic impact on workers. *Key words:* ergonomics; work-related musculoskeletal disorders; cumulative trauma disorders; occupational disease; epidemiology.

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There has been little study of the economic and social consequences of work-related musculoskeletal disorders (WRMSDs) for the injured worker.

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Although workers' compensation is, at least theoretically, available to most workers with such disorders (with exceptions in certain jurisdictions), 1) workers' compensation does not reimburse all of the costs of an injury, nor does it address social consequences, and 2) it is thought that many people who have WRMSDs, like those with other chronic occupational diseases, do not receive workers' compensation benefits because of lack of recognition of work-relatedness, difficulties with getting workers' compensation for occupational disease, or other impediments to filing and/or collecting.¹⁻⁵ The cost of all WRMSDs has not previously been carefully defined.

Studies of people who have received workers' compensation have focused on the costs of various conditions to insurers and employers. Brogmus et al.⁶ found that WRMSD claims for 1992 paid by Liberty Mutual Insurance averaged \$6,760 per claim, 80% higher than the average for all claims of \$3,723. WRMSDs currently account for about 5% of all claims costs. Hashemi et al.,⁷ in a related study, found highly skewed costs, with a few claims comprising large percentages of overall costs and disability, and 60% of the claims amounting to \$1,000 or less.

Yassi et al.⁸ found that workers who had filed for workers' compensation for WRMSDs in Manitoba lost more time from work than did those in a control group with other upper-limb musculoskeletal injuries (71.4 days for WRMSDs vs 33.6 days for controls), cost more (\$5,569 vs \$2,480), and were less likely to be able to return to the same job (67.3% vs 81.0%). Additionally, they found that although 13% of the WRMSD cases returned to modified work with the same employer, a larger percentage of cases than controls were unable to return to any work at all (2.9% vs 0.5%). The WRMSD cases were also more likely to experience recurrences upon return to work (18.9% vs 9.6%).

Compiled anecdotal evidence has found that employers who institute ergonomic programs dramatically save

on workers' compensation costs, indicating that such claims are significant in terms of both costs and workplace causes. A Government Accounting Office study of five employers found reductions ranging from 35% to 91% in workers' compensation costs for WRMSD, resulting from both reductions in numbers of new conditions (ranging from 2.4 to 6.1 percentage point reductions in rates) and better medical management and return-to-work programs.⁹

However, these studies did not look at the costs borne by the worker and his or her family (uncompensated costs), costs covered by other employer-provided benefit systems (group health insurance, sick time, etc.), or other externalized costs covered by government social programs, such as Social Security.

In addition, because these studies were based on workers' compensation data, they cannot answer the question of what happens to people who, for a variety of reasons, do not access the workers' compensation system. Fine et al.¹⁰ found 4 to 10 times more WRMSDs in two automobile-manufacturing plants through personal medical records than through workers' compensation reports, and an unpublished non-randomized survey of unionized workers in Manitoba in 1992 found that only 47% of those who had been told by a doctor that they had a WRMSD had filed a workers' compensation claim.⁸

Studies of clinical populations have also been conducted.¹¹ Himmelstein, et al.¹² found that work-disabled patients reported less time on the job, more surgeries, more acute antecedent trauma, and higher numbers of "indeterminate" diagnoses. Friedman¹³ found that return to work was correlated with self-reported levels of disability, physical symptoms, and weeks of work absence. Katz et al.¹⁴ found that of 315 patients in Maine who had carpal tunnel syndrome, 45% were receiving workers' compensation and 45% either changed jobs or were absent from work during the 30-month follow-up period; factors correlated with work absence included worse functional status of the hand and involvement of an attorney. Clinical studies, however, tend to involve biased populations, and are not representative of the full range of conditions.

A third approach has been to study the workforce for particular employers. Helliwell et al.¹⁵ found low rates of domestic disability for WRMSDs, but common use of devices such as jar openers, in a sample of 63 employees in an industrial facility.

A population-based approach allows a more comprehensive description of the payment sources for WRMSDs. In 1988, the National Health Interview Survey (NHIS) used an occupational health supplement in an attempt to determine the extent of self-reported occupational diseases on a population basis. The survey found that 1.47% of the recently working population had self-reported carpal tunnel syndrome (CTS), and 0.53% reported that a medical provider had called their CTS

work-related.⁴ Katz et al.¹⁶ showed that self-reporting (in relation to CTS) was reliable, moderately valid in relation to grip strength, and unrelated to workers' compensation status. Blanc et al.¹⁷, using NHIS data, found that 11% of self-reported cases reported work disability caused by CTS.

This project replicates the NHIS study in the Connecticut working population and extends it by examining the economic and social consequences of WRMSDs for workers. The data were gathered in a population-based cross-sectional survey and nested case-control study of the Connecticut working population (see Dillon et al.¹⁸ for further methodologic details). This paper reports on the social and economic outcomes for workers with self-reported occupationally related neck, arm, and hand disorders compared with those who did not report such disorders.

METHODS

A random sample of working-aged individuals in Connecticut was identified by random-digit dialing of telephone numbers. Individuals were interviewed by telephone during the spring of 1996. The telephone numbers were chosen in a modified stratified procedure based on the proportion of the theoretical universe residing in each residential "block" identified with the use of published directories, and based on Census figures for towns. Households were given six distinct attempts at contact before another number from the same block was substituted. Calls were made on weeknights and weekends to reduce bias. Respondents were randomized within households by asking for the working-age person in the household who had the birthday closest to the date of the interview. Screening questions identified individuals who reported significant pain in the arm, shoulder, hand, or neck for five or more consecutive days, or 20 or more total days in the preceding year, that was not due to sudden injury. This case definition was designed to capture chronic upper-extremity conditions, whether work-related or not, to ensure identification of those individuals who might have undiagnosed work-related conditions. A subset of work-related musculoskeletal disorders (WRMSDs) of the upper extremity was then identified using the criteria listed below, as was a second subset using more conservative criteria ("doctor-called WRMSD," based on self-report). These subsets (and the controls) are the focus of this paper.

A work-related case was defined by a positive response to at least one of the following questions:

1. Was your pain or discomfort either due to or made worse by work?
2. Did you tell the medical person your problem was work-related?
3. Did they [the medical person] say that your pain or

discomfort (a) was caused by your job or (b) was made worse by your job?, or

4. Did the pain increase as the workday went on, increase as the workweek went on, or decrease when you were away from work? (three separate questions)

To allow comparability to the National Health Interview Survey, we also used a more conservative measure of WRMSD ("doctor-called," based on self-report) that focused only on those persons with WRMSDs who reported being told by a medical provider that the condition was caused or made worse by the job (question 3, above). Results for this group were for the most part similar to those of the larger WRMSD group, so the results for the "doctor-called" group are presented only where important differences appeared. Controls were defined as anyone who was not a case, with an additional exclusion of any others who reported a non-acute WRMSD (the latter included cases that had not lasted five consecutive days or 20 days during the year).

Demographics of the sample (see Dillon et al.¹⁸ for specifics) were similar to those of the general Connecticut population, based on 1990 Census data, except for education, where the sample included a smaller proportion of those with less than a high school education (6% for controls, compared with 20.8% for the population 25 years old and older), and ethnicity. This result is consistent with the use of a telephone survey, since individuals with minimal education are less likely to have telephones, and more highly educated households are more likely to have multiple telephone lines. There was a 78% interview response rate to the survey.

Respondents were asked about the social effects of the WRMSD in three primary areas: employment, family relationships, and housing. The economic analysis looked at the sources of payment for direct economic costs, including medical visits and tests, and the amount of out-of-pocket expenses. Indirect costs included qualitative assessment of lost wages and benefits. Loss of productivity in the home was not specifically addressed, although some measures such as activities of daily living (ADL) scales and questions about reduced work activities at home provide some qualitative information in this area. We used a prevalence-based model for costs that framed the economic burden in a base year of prevalent cases (expenses for the last 12 months prior to interview), as opposed to incident-based costs, due to the cross-sectional nature of the survey. One inconsistency in the prevalence-based comparisons is that some medical-visit questions referred to ever having seen a doctor, as opposed to having seen a doctor during the previous 12 months.

Out-of-pocket costs were measured by asking whether there had been any costs in the past year, and asking for the specific expenditures during the previous two weeks. This was designed to reduce recall bias. These costs were multiplied by 26 to give total estimated yearly

TABLE 1 Sample Characteristics, Respondents to a Telephone Survey in Connecticut, 1996

	No.	% of Sample
Working population in Connecticut	1,520,000	—
Population sample	3,200	100
Controls (n = 598, 551 used)	551	N.A.
Chronic upper-extremity pain	374	11.7
Work-related chronic upper extremity pain (WRMSD)	292	9.1
Doctor-called WRMSD	119	3.7

costs for the sample. This technique does not assume that the specific individual has exactly the same costs each week of the year, but rather that the previous two weeks are a random sample of the group as a whole.

Respondents were asked whether they had ever had any of a number of specific medical procedures or visits. Health provider visits were broken down by the type of practitioner. "Personal doctor" was possibly a repetition of other types of doctors, and was therefore reduced by the total number of other visits (to other types of physicians) reported. Walk-in medical centers offer treatment without appointments, and include industrial medicine programs.

Standard statistical univariate tests were used, including chi-square tests and odds ratios with confidence intervals. Logistic regression was used to explore a model for social impacts of WRMSDs. This was accomplished using a stepwise backward (conditional) removal procedure to eliminate nonsignificant variables. Alpha levels of less than 5% based on two-tailed tests were utilized for statistical significance. Data were evaluated using SPSS for Windows Version 7.5.1.

RESULTS

Table 1 shows the overall sample characteristics. Altogether, 3,200 people were screened in order to find 374 people with chronic upper-extremity pain. These individuals and 551 controls were interviewed by phone.

TABLE 2 Characteristics of Self-reported WRMSD* Cases and Doctor-called WRMSD Cases

	WRMSD Cases		"Doctor-called"	
	No.	%	No.	%
Cases	292	100.0	119	100.0
Filed for workers' compensation	31	10.6	25	21.0
Main wage earner in household	175	60.0	62	52.1
Cut down work pace due to WRMSD	102	34.9	56	47.1
Cut down on home activities	138	47.3	76	63.9

*Work-related musculoskeletal disease

TABLE 3 Social Factors Related to WRMSDs* in the Previous 12 Months as Self-reported by Work-related Cases (n = 292) and Controls (n = 551), Connecticut, 1996

	Cases		Controls		Odds Ratio†	95% Confidence Interval	
	No.	%	No.	%		Lower CI	Upper CI
Assigned lighter work	39	13.7	49	9.0	1.60	1.02	2.50
Time off	71	25.2	179	33.3	0.68	0.49	0.93
Promoted	22	7.9	85	16.0	0.45	0.28	0.74
Early retirement	6	2.1	25	4.6	0.45	0.18	1.11
Changed job	28	10.0	65	12.1	0.80	0.50	1.28
Stress at home	80	28.8	127	23.6	1.31	0.95	1.82
Divorce	20	7.1	21	3.9	1.91	1.01	3.58
Moved: financial reasons	18	6.4	15	2.8	2.41	1.20	4.86
Lost home	9	3.1	5	0.9	3.44	1.14	10.35
Lost car	12	4.4	10	1.9	2.45	1.04	5.74
Lost health insurance	18	6.6	19	3.5	1.91	0.99	3.71

*Work-related musculoskeletal disorders.

†Odds ratio in bold are significant at the 0.05 confidence level.

Of the 374 respondents with chronic upper-extremity pain, 292 (9.1% of the sampled population) were determined to be likely to have work-related disorders ("WRMSD cases") based on the four questions noted in the methods section, which covered both disorders *caused* by work and those *made worse* by work (both would qualify as work-related under the Connecticut workers' compensation definition). Of these 292 cases, 119 (3.7% of the overall population) reported that their medical providers had told them that their conditions were caused or made worse by work ("doctor-called WRMSD cases"). There had also been some potential cases of WRMSD among the controls, with 32 (5.8%) reporting having previously had carpal tunnel syndrome, and 58

(10.5%) reporting have had tendinitis. These respondents remained controls because they did not meet the definition of "significant" pain in the previous 12 months.

Table 2 shows characteristics of both the WRMSD cases as a whole and the doctor-called WRMSD cases based on a univariate analysis. Of the 292 WRMSD cases, only 31 (10.6%) had filed a workers' compensation claim. Of these 31, 25 were among the doctor-called cases, i.e., 21.0% of the 119 doctor-called WRMSD cases had filed. Of the 31 cases who had filed for workers' compensation, 23 (74.2%) had been accepted initially by the insurer. Cases were significantly more likely than controls to report that they were the main wage earner in the household (60% vs 52%, $p = 0.023$). However, 15 (13.4%) of the 112 cases who reported that they were not the primary wage earner said that, prior to the injury, they had been (9, or 8.3% of 108 for the doctor-called cases). More than one third of the WRMSD cases (102, or 34.9%) reported having had to cut down on their *work pace* because of the condition (56, or 47.1%, of the doctor-called cases). Almost half of the WRMSD cases (138, or 47.3%) reported having had to cut down activities at *home* because of the condition (76, or 63.9%, of the doctor-called cases).

Table 3 shows social factors for the WRMSD cases

TABLE 4 Logistic Regression for Social Effects, WRMSD* Cases and Controls, Connecticut, 1996

	Odds Ratio	Significance
Education	0.86	0.023
Doctor-called case	1.48	0.060
Initial -2 log likelihood	1,022	
Final -2 log likelihood	1,012	
Chi-square	9.87	0.007

*Work-related musculoskeletal disorder.

TABLE 5 Odds Ratios for "A Lot of" or "Some" Difficulty in Activities of Daily Living, WRMSD* Cases and Controls, Connecticut, 1996

	Cases		Controls		Odds Ratio	Lower CI	Upper CI
	No.	%	No.	%			
Writing	96	32.9	22	4.0	11.8	7.2	19.2
Gripping	69	23.6	14	2.5	11.9	6.5	21.5
Chores	135	46.2	26	4.7	17.4	11.0	27.4
Opening jars	142	48.6	42	7.6	11.5	7.8	16.9
Child care	69	23.6	20	3.6	8.2	4.9	13.8
Carrying bags	139	47.6	33	6.0	14.3	9.4	21.7
Brushing	80	27.4	9	1.6	22.7	11.2	46.1
Bathing	91	31.2	7	1.3	35.2	16.0	77.2
Driving	113	38.7	15	2.7	22.6	12.8	39.7

*Work-related musculoskeletal disorder.

TABLE 7 Out-of-pocket Expenses Paid Due to Injury by WRMSD* Cases Only, Connecticut, 1996

	Doctor-called (n = 119)				Work-related (n = 292)			
	No.	%	\$		No.	%	\$	
			Total	Average			Total	Average
Medical	15	12.6	3,728	249	22	7.5	4,158	189
Transportation	5	4.2	44	9	6	2.1	245	41
Equipment	0	0.0	—	—	4	1.4	112	28
Child care	2	1.7	345	173	2	0.7	345	173
Housework	1	0.8	400	400	3	1.0	640	213
TOTAL (any one)	19	16.0	4,517	238	31	10.6	5,500	177

*Work-related musculoskeletal disorder.

pocket expenses for WRMSD cases (31 cases × \$177 × 26 = total annual cost, divided by 292 WRMSD cases). Extrapolation to the estimated 145,000 period prevalence of WRMSD cases in Connecticut (based on 9.6% WRMSD cases in a labor force of 1.52 million) gives an estimate of \$71 million in out-of-pocket expenses per year for Connecticut alone. The 15,000 period prevalence of doctor-called WRMSD cases would give an estimate of \$15 million. There was no significant difference between those who filed a workers' compensation claim and those who did not on whether there were out-of-pocket costs, with about one third of those who filed claims still having out-of-pocket costs.

MEDICAL VISITS AND PROCEDURES: WHO PAYS?

Respondents were asked whether they had ever made visits to specific types of physicians, or had specific tests done, for their WRMSDs. If they had, they were asked who had paid for it, and how many such visits or tests they had had in the previous two weeks. The details of

the medical expenses of the WRMSD cases suggest that very high proportions of the medical visits and procedures were paid for either by general health insurance or out-of-pocket. Of the WRMSD cases, 174 (59.6%) reported having seen a doctor for the condition. Of the 722 who reported types of medical visits and procedures, only 142 (21.0%) reported being paid by workers' compensation, with 479 (70.9%) paid by general health insurance and 55 (8.1%) paying out-of-pocket. Table 8 lists characteristics of the individuals with medical visits and procedures. Individuals who had received occupational and physical therapy were more likely to have been paid under workers' compensation than were those undergoing other treatments, with 16 (29.6%) of those who had made visits covered. Individuals with surgical visits were also much more likely than were those reporting other types of visits to have been paid under workers' compensation, although this still represents only 21, or 28.8% of these individuals. In fact, subjects with WRMSD who had had surgery were 3.8 times more likely to have filed claims than were those without surgery (2.23–13.77 confidence interval). However,

TABLE 8 Respondents with Medical Visits for WRMSDs* and Procedures by Type of Payment, Connecticut, 1996

	Workers' Compensation		Health Insurance		Out-of-pocket		Total†
	No.	%	No.	%	No.	%	
Personal doctor	5	12.2	35	85.4	1	2.4	44
General practitioner	7	10.9	52	81.3	5	7.8	68
Surgeon	21	28.8	50	68.5	2	2.7	75
Specialist	8	15.1	40	75.5	5	9.4	55
Occupational/physical therapist	16	29.6	36	66.7	2	3.7	59
Massage	1	5.6	12	66.7	5	27.8	23
Chiropractor	9	14.1	44	68.8	11	17.2	71
Acupuncture	1	20.0	3	60.0	1	20.0	8
Counselor	1	20.0	3	60.0	1	20.0	6
Emergency room	4	23.5	11	64.7	2	11.8	19
Walk-in	4	25.0	10	62.5	2	12.5	17
X-ray	19	18.4	78	75.7	6	5.8	108
CT/MRI scan	6	22.2	20	74.1	1	3.7	28
EMG	11	30.6	23	63.9	2	5.6	36
Medication	12	20.3	43	72.9	4	6.8	64
First surgery	10	37.0	12	44.4	5	18.5	27
Second surgery	4	40.0	6	60.0	0	0.0	10

*Work-related musculoskeletal disorders.

†Total includes respondents who did not specify who paid.

compared with the controls. Cases were significantly more likely to have been assigned lighter work during the preceding 12 months (odds ratio = 1.6). Cases were half as likely to report being promoted in the preceding 12 months (OR = 0.45). Cases were also significantly more likely to have been divorced in the preceding 12 months (OR = 1.91), and to have moved for financial reasons (OR = 2.41), including being more likely to have lost a home (OR = 3.44) and car (OR = 2.45). Losing health insurance was just below statistical significance (OR = 1.91). Interestingly, even some of the *controls* who had had to move for financial reasons might have been affected in part by WRMSD. Of the 15 controls who reported moving in the preceding 12 months, one reported previously having had tendinitis, and two reported prior cases of carpal tunnel syndrome.

Cases were significantly *less* likely than controls to report having taken time off from work during the preceding 12 months (OR = 0.68). However, 43 WRMSD cases (14.7%) indicated that they had had to take time off work in the preceding year due to their WRMSDs (63, or 21.6%, reported ever taking time off due to the condition). For those reporting time off in the preceding year, lost days totaled 1,027 (mean = 23 days; median = 4.5 days, range 1-365 days). Of the cases, 21 (7.2%) reported losing their jobs due to the condition, and 12 (4.1%) reported having had to go on disability at some point (not necessarily in the preceding year).

A logistical regression model was created for the dependent variable of having experienced any one of the non-work social factors (stress, divorce, moving for financial reasons, losing car, or losing health insurance). A significant protective effect of a higher education level was found, and a nearly-significant effect was found for doctor-called cases. The model removed a variable for filing a workers' compensation claim, which had been significant in the model with all work-related cases. Other variables that were dropped as non-significant were race, gender, and age. Results are presented in Table 4.

Cases scored dramatically worse on activities of daily living (ADL) scales. Table 5 shows the odds ratios for responses of "a lot of" or "some" difficulty on the measures. Odds ratios included 8.2 for difficult in physically caring for a young child, 11.5 for difficulty opening jars, 11.8 for difficult writing or using small objects such as keys, 11.9 for gripping a telephone, 14.3 for carrying grocery bags, 17.4 for performing household chores, 22.6 for driving, 22.7 for brushing teeth or combing hair, and 35.2 for bathing.

ECONOMIC SUPPORT OTHER THAN WORKERS' COMPENSATION

Of the WRMSD cases, 85 (29.1%) had received some type of economic support other than workers' compensation (from government, employer, or personal

TABLE 6 Social Benefits for Work-related Musculoskeletal Disorder Cases (n = 292) Connecticut, 1996

	Received Benefits		Due to WRMSD	
	No.	%	No.	%
Government Sources				
Social Security	9	3.1	4	1.4
Unemployment	14	4.8	7	2.4
Food stamps	4	1.4	1	0.3
Welfare	4	1.4	2	0.7
AFDC	4	1.4	1	0.3
Retraining	4	1.4	4	1.4
Employer sources				
Medical insurance	51	17.5	42	14.4
Sick time/disability	24	8.2	17	5.8
Personal sources				
Borrowing	8	2.7	4	1.4
Gifts	9	3.1	4	1.4
TOTAL	131		86	
TOTAL: ANY ONE BENEFIT	85	29.1	63	21.6

sources) (45, or 37.8%, for doctor-called). Of these cases, 63 (or 21.6% of the total) indicated that the benefits had been needed because of the WRMSD (35, or 29.4%, for doctor-called). These benefits are detailed in Table 6. It should be noted that the figure for medical insurance is considerably lower than that elicited by a similar question that asked about medical visits and who paid (see Table 8 below). This could have occurred because this question was asked later in the survey than the question in Table 8, so respondents may have thought they had already answered. Controls were not asked these questions due to time limitations on the survey.

There was no significant difference between the responses of cases and controls to the question "compared with 12 months ago, would you say your financial situation is better today, worse today, or about the same?"

Respondents reporting any out-of-pocket expenses in the previous 12 months were asked how much they had spent in the two weeks prior to the interview (Table 7). In those two weeks, 31 (10.6%) of the WRMSD cases had had out-of-pocket expenses that they attributed to their WRMSDs (19 or 16.0%, of the doctor called). These expenses (for medical costs, transportation, equipment, child care and work around the house, etc.) averaged \$177 each, with a median of \$38 (\$238 mean and \$25 median for doctor-called). Individuals reported a range of \$1 to \$1,920. An additional five cases said that they had had expenses, but did not know the amounts.

Of these 31 cases, 22 reported paying an average of \$189 each for medical expenses. Although these questions inquired about out-of-pocket expenses, it is possible that some of these costs were eventually reimbursed.

Extrapolation of this total to the entire sample over the course of a year yields \$489 per case per year out-of-

even for the surgical cases, 50 or 68.5%, of the respondents reported procedures that had been paid for by general health insurance. This suggests a major surgical cost for WRMSDs paid outside the workers' compensation system.

More of the visits had been covered by workers' compensation for the doctor-called WRMSD cases. In this group, over 35% of individuals with surgeon visits and about 75% of individuals with surgeries had been covered by workers' compensation.

DISCUSSION

This study is limited by its cross-sectional design. While some associations are evident, it is often difficult to understand the directions of causality.

The study is also limited by the self-reporting nature of the survey. Although we included the NHIS' more conservative question, "Did they [medical person] say that your pain or discomfort was caused or made worse by your job?", this still elicited only the respondent's perception of the medical provider's opinion, and the medical condition was not confirmed in any independent fashion. In addition, retrospective assessments (of risks, costs, etc.) may be biased based on the respondent's medical condition, which differs according to whether the respondent is a case or a control. Attempts were made to minimize such biases through use of just the prior two weeks for costs, looking at current issues where possible, and utilizing questions used and validated in other studies. There may have been misunderstanding of some questions (such as whether the questions applied only to consequences of the condition, or applied to all expenses), or confusion about the differences between workers' compensation and group medical insurance. While these constraints are important, there is no feasible alternative to gain some understanding of the unreported cases of WRMSD (we plan to extend this investigation to a prospective study in the future).

The responses to this population-based interviewer-administered questionnaire suggest that about 90% of likely WRMSD cases (79% for "doctor-called" cases) are not reported to workers' compensation. The economic burden of these cases thus falls on government sources, other employer-provided benefits, and the individual and family.

The probability of filing is considerably higher where surgery is involved, indicating that more expensive cases are more likely to be filed (although it could also be true that workers' compensation cases are more likely to be treated by surgery). This may be related to the filing of claims by respondents with greater disability, as indicated by a statistically significant association between filing a claim and scores on the activity of daily living scale (Pearson's $R = 0.227$, $p = <0.001$).

In particular, general health insurance paid a high

proportion of the medical bills—71% of the respondents said their medical visits and procedures had been paid for by general health insurance, 8% had paid out-of-pocket, and only 21% had received workers' compensation. In addition, 5.8% of the WRMSD cases had received benefits for sick time or disability, and 2.4% had received unemployment compensation, attributed to the condition. This externalization of costs out of workers' compensation is important for a number of reasons:

- Other insurance programs are less likely to cover the full costs of such conditions, adding economic pressures to disabling conditions.
- Externalizing the costs reduces employer economic incentives to prevent WRMSDs, since there is typically not an experience-rating for other employer-provided insurance.
- Lack of reporting of such cases through traditional reporting mechanisms such as workers' compensation and OSHA/Bureau of Labor Statistics reduces the ability to target conditions for interventions such as OSHA inspections, cluster investigations, and educational efforts.

The economic burdens on individuals in this situation vary considerably. Although there was no significant difference between cases and controls in evaluation of their financial situations compared with a year earlier, a significant minority (13%) reported that they had gone from being the main wage earner in the family before onset of the WRMSD to not. However, this figure needs to be viewed guardedly, since we are without a comparable measure of such changes in the control group. Average out-of-pocket expenses, dominated by medical costs, were significant, averaging almost \$500 per year per case. A wide range (and lower median cost for the sample) meant that a few cases had a very large burden. When these costs are combined, they lead to a significant social cost that is externalized from the insurance system. In this report, we have not analyzed the economic value of lost productivity at home in terms of activities of daily living, but we did try to assess actual payouts for such work that could not be performed. Based on reported out-of-pocket expenses for transportation, child care, and housework due to the WRMSD, such expenses appear to have been incurred by only a small minority of the cases. However, the large differences in activities of daily living scale scores between cases and controls indicate that there are large losses in productivity in the home, and probably also in the work environment.

Impact on work is complex. Despite an overall average of 3.4 WRMSD-attributed days lost from work for all the 309 WRMSD cases, cases reported taking off *less* time overall than controls over the preceding year. This

could mean that they felt more obligation to continue working despite their pain, or possibly a differential interpretation of the question between cases and controls.

The social impact of WRMSD also seems to affect only a minority of cases, but with important individual impacts. Rates of divorce, moving, and losing cars due to financial hardship, and loss of health insurance, were all significantly increased. The multivariate analysis indicates that higher levels of education have a protective effect that reduces the impact of WRMSDs, but the WRMSD still has a negative social impact on the individual.

The overall results of this survey are contrary to the position that WRMSDs are over-reported. Such conditions are both quite common and quite disabling. Other payment systems such as group health insurance and out-of-pocket expenditure are covering much of the costs of such conditions. Though overall economic consequences for the workers were not found, a small number of individual workers appear to have suffered serious economic consequences from WRMSDs, losing homes, incurring large out-of-pocket expenses, being divorced, and facing economic insecurity. It may be an appropriate time to think of reversing the recent trend restricting eligibility for workers' compensation benefits, and to increase the emphasis on prevention.

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