

Use of Workers' Compensation Claims Data for Surveillance of Cumulative Trauma Disorders

Shiro Tanaka, MD; Paul Seligman, MD; William Halperin, MD, MPH; Michael Thun, MD, MS; Clifton L. Timbrook, MA; and James J. Wasil, BS

Workers' compensation claims in Ohio were evaluated as a source of surveillance data for identifying workplaces at high risk of cumulative trauma disorders (CTDs) and analyzed for their demographic and industrial characteristics. During a 5-year period (1980 to 1984), 6,849 workers' compensation claims met the case criteria for CTDs. Tenosynovitis due to continuous motion was the most frequently reported condition (58%), and the wrist was the body part most frequently affected (48%). The highest case rate was observed for female workers in the 36 to 45 age group. Incidence rates for individual companies were determined and those with the highest rates for CTDs were identified. The employer-specific rates for CTDs based on workers' compensation claims data can be used as an effective surveillance tool in locating high-risk operations where ergonomic interventions can be implemented to reduce CTD hazards.

Performing repetitive tasks cause pain and other local disorders of the musculoskeletal and peripheral nervous systems.¹ These conditions are collectively referred to as cumulative trauma disorders (CTDs),² occupational rheumatic diseases,³ or repetitive strain in-

juries,⁴ and include such conditions as carpal tunnel syndrome, epicondylitis, peritendonitis, tendonitis, and tenosynovitis.⁵⁻⁹ Although some of these illnesses (eg, carpal tunnel syndrome) are known to be related to non-occupational risk factors such as pregnancy or rheumatoid arthritis,^{10,11} occupational factors play an important etiologic role in other cases. There is epidemiologic evidence to indicate that many CTDs are the result of the overuse of the involved body part by repeated and forceful motions necessitated by a variety of occupational tasks.^{2,3,5}

CTDs are the second most frequently reported category of occupational illness after skin disease.¹² Between 15% and 20% of workers in the construction, food processing, manufacturing, and mining industries, and in office settings, are potentially exposed to repetitive musculoskeletal work.¹³ Because of their impact on the health, welfare, and productivity of workers, the National Institute for Occupational Safety and Health has designated musculoskeletal injuries (including CTDs) as one of the ten leading work-related diseases and injuries.¹⁴

To help establish a strategy for effective control and prevention, it is necessary to design and implement a surveillance system to identify industrial operations with a high risk of developing CTDs. Workers' compensation claims in Ohio were examined as a surveillance tool for CTDs.

Methods

For the 5-year period, 1980 through 1984, 11,033 workers' compensation claims were filed with the Ohio Bureau of Workers' Compensation for "inflammation or irritation of joints, tendons, or muscles (excluding

From the Division of Surveillance, Hazard Evaluations and Field Studies, National Institute for Occupational Safety and Health, Centers for Disease Control, US Public Health Service, Department of Health and Human Services, Cincinnati, OH 45226 (Dr Tanaka, Medical Officer; Dr Seligman, Medical Officer; Dr Halperin, Chief, Industrywide Studies Branch; Dr Thun, Chief, Epidemiology II Section) and the Division of Safety and Hygiene, The Industrial Commission of Ohio, 246 North High St, Columbus, OH 43215 (Mr Timbrook, Manager, Research Section; Mr Wasil, Science and Technical Advisor, Ergonomics Program).

Address correspondence to R-16, NIOSH, CDC, 4676 Columbia Pkwy, Cincinnati, OH 45226 (Dr Tanaka).

0096-1736/88/3006-0488\$02.00

Copyright © by American Occupational Medical Association

strains, sprains, or dislocations)." A claim was considered a case of cumulative trauma disorder if it met the following criteria: (1) the "type of accident" was the result of overexertion or non-impact repetitive motion and (2) the occurrence of the injury was over a protracted or unknown period of time (Table 1). Types of "accident" included were: by leaning, kneeling, or sitting on objects; by objects being handled; by vibrating objects; by repetition of pressure; bodily reaction, unspecified; overexertion, unspecified; in lifting objects; in pulling or pushing objects; in holding, welding, throwing, or carrying objects; and overexertion, not elsewhere classified. These criteria were used to exclude accidental musculoskeletal injuries (eg, "struck against or by an object," "motor vehicle accidents," etc). Of the 11,032 claims, 6,849 (62.1%) met the case definition. The possible impacts of these exclusions on the outcome of the analyses will be presented in the discussion section. The loss of work time due to the injury and the presence or absence of a diagnosis were not used as criteria for case selection.

Data available on the claimant included age, sex, length of employment, body part affected, work days lost (estimated in some cases), Standard Occupational Classification code,¹⁵ diagnosis of the condition, nature of "injury" and accident location (city/town). Data on the employer included the company identification code and the Standard Industrial Classification code.¹⁶ A more detailed description of Ohio's workers' compensation system has been presented elsewhere.¹⁷ The five CTD diagnoses coded for workers' compensation claims include: (1) tenosynovitis due to continuous motion, (2) tenosynovitis due to vibration, (3) bursitis due to continuous motion or pressure, (4) neuritis due to repeated motion, and (5) ganglion. Through 1984, certain common CTDs such as carpal tunnel syndrome were not

coded separately by the Ohio Division of Safety and Hygiene but are likely to be included in the aforementioned categories.

Companies with the highest rates of tenosynovitis of the wrist due to continuous motion (the most frequently reported diagnosis and body part) were ranked. The annual average incidence rate of the condition was calculated, if the employee population of a company was available through a directory,¹⁸ using the following formula:

$$\text{Annual incidence rate per 10,000 employees} = C/5 \times 10,000/E$$

where C = total number of wrist tenosynovitis cases due to continuous motion in a company over the 5-year period and E = employee population of that company.

Results

Among the defined 6,849 CTD cases, "tenosynovitis due to continuous motion" was the most frequently reported diagnosis (58.3%) and the wrist the most frequently affected part of body (48.4%) (Table 2). The wrist was affected in more than 60% of continuous motion tenosynovitis, vibration tenosynovitis, and ganglion diagnoses. Conditions involving the upper extremities (from the shoulders to fingers) composed 88.3% of the total cases.

The 6,849 cases originated from 3,242 employers. Of these, 2,592 employers (80%) reported only one case over the 5-year period, 491 (15%) reported two to four cases, and 159 (5%) reported five or more cases. Since "continuous motion tenosynovitis of the wrist" was the most common diagnosis, case rates by company were calculated using employee population information from the Ohio Industrial Directory. Ten companies with the highest rates for this condition are listed in Table 3.

Women had consistently higher rates for CTDs than did men for all age strata (Fig. 1) with the highest rate for female workers occurring in the 36-45 age group. The overall case rate per 10,000 workers was 4.1 for women and 2.3 for men.

Between 1980 and 1984 there was a threefold increase from 787 to 2,324 in the annual number of CTD cases (Fig. 2). This increase was mostly attributable to the category of "tenosynovitis due to continuous motion." The other four diagnoses combined and cases "without diagnosis" showed only a slight increase during the same period. Approximately 40% of the workdays lost from CTDs were accounted for by injuries necessitating between 30 and 60 calendar days (actual or estimated) of disability.

The highest rates of CTDs were observed in the manufacture of transportation equipment (17.7 cases/10,000 workers/yr) followed by furniture (12.8), leather (12.4), electric and electronic equipment (11.8), rubber products (11.6), and food products (11.3).

Over 60% of the total CTD cases were among "fabricators, assemblers, and hand working occupations," "machine operators," and "miscellaneous manual occu-

TABLE 1

Decision Logic Used to Identify Cases of Cumulative Trauma Disorders (CTDs)

Step A—Nature of injury (code 260)	11,032 Claims	
With a CTD diagnosis*	5,030 (45.6%)	
Without a CTD diagnosis	6,002 (54.4%)	
Step B—Type* (nature) of "accident"	Repetitive or overexertion	Not repetitive
With a CTD diagnosis	4,995	35
Without a CTD diagnosis	3,867	2,135
Total	8,862	2,170
		(Excluded)
Step C—"Accident" time	Over a long period of time or unknown	Clearly defined time
With a CTD diagnosis	4,873	122
Without a CTD diagnosis	1,976	1,891
Total	6,849	2,013
	"Cases"	(Excluded)
Step D (not used)—Degree of injury (lost time)	Yes	No
With a CTD diagnosis	3,628	1,245
Without a CTD diagnosis	1,950	26
Total	5,578	1,271

* CTD diagnoses and types of "accident" included in this analysis are listed in the "Methods" section.

TABLE 2
Parts of Body Affected by Cumulative Trauma Disorders and Disease Type

Part of Body	Tenosynovitis from Continuous Motion	Tenosynovitis from Vibration	Bursitis from Repetitive Motion or Pressure	Neuritis from Repetitive Motion	Ganglion	Without Diagnosis	Total	%
Trunk (including neck and back)	21	0	4	20	0	178	223	3.3
Shoulder and upper arm(s)	184	8	73 (28%)†	6	1	297	569	8.3
Elbow(s) and forearm(s)	365	10	30	114 (56%)	2	276	797	11.6
Wrist(s)	2,494 (62%)	193 (68%)	20	18	89 (68%)	502	3,316	48.4
Hand(s) and finger(s)	390	30	8	10	35	216	689	10.1
Upper extremities (unspecified)	411	28	12	18	3	207	679	9.9
Lower extremities (excluding knees)	25	0	15	3	0	89	132	1.9
Knee(s)	13	0	87 (33%)	0	0	127	227	3.3
More than one major body part	91	14	14	13	1	84	217	3.2
Total	3,994	283	263	202	131	1,976	6,849	100.0
%	58.3	4.1	3.9	2.9	1.9	28.9	100.0	

† A percentage in parentheses is for that column.

TABLE 3
Rank Order of Top Ten Companies with Highest Case Rates for "Tenosynovitis of the Wrist Due to Continuous Motion"

Company Rank	Total Cases	Employee Population	Annual Rate per 10,000 Workers*	Major Products/Services	SIC† Codes
1	19	380	100.0	Ovens and ranges	36
2	3	80	75.0	Industrial/garden hoses	30
3	6	161	74.5	Sporting goods	39
4	7	193	72.5	Automobile parts	22, 25, 35, 37
5	23	670	68.7	Television tube glass	32
6	10	325	61.5	Balloons and gloves	28, 30, 39
7	12	400	60.0	Auto parts	32, 34
8	8	271	59.0	Plated die cast	33
9	6	210	57.1	Plastics	30, 35
10	7	250	56.0	Women's footwear	31

* Overall, 1.1; derived from 2,494 cases of wrist tenosynovitis due to continuous motion over 5 years divided by the 1984 Ohio worker population.

† Standard Industrial Classification.

pations." The two highest CTD rates for the knee were in the "building construction" and "specialty trade contractors" industries and among kneeling workers such as carpenters, carpet, and soft-tile installers. CTD cases of the foot were highest in the "amusement and recreation" industry. Eleven (13%) of 83 foot cases were among dancers (including ballet dancers).

Discussion

Currently, there is no specific standard or regulation for repetitive motion work in the place of employment, nor assurance that uniform diagnostic criteria are being applied for many of these conditions. Despite these

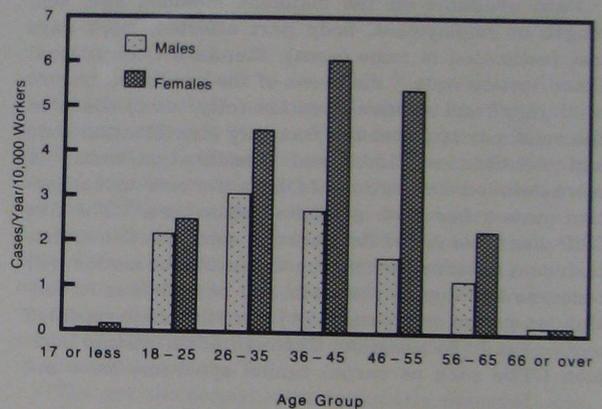


Fig. 1. Rate of cumulative trauma disorder cases by age and sex.

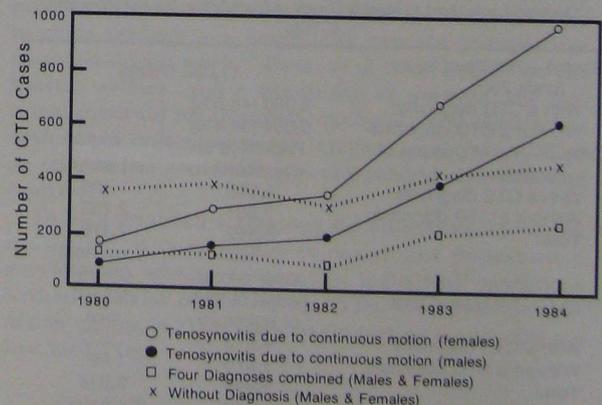


Fig. 2. Cumulative trauma disorder cases by diagnosis—5-year trend.

limitations, there is an urgent need for a workable surveillance system for CTDs, since control of these painful and disabling conditions could be expedited considerably by a system of identifying where cases are

occurring. This report demonstrates that workers' compensation claims can be used as a basis for a state-wide surveillance system to identify employers with high rates of CTDs.

By applying the criteria for the case definition, 4,183 of the initial 11,032 claims were excluded from analysis. Of these excluded claims, 2,170 were neither "repetitive" nor "overexertion" but were categorized by the type of the injury as "struck against (or by)," "fall from," "caught in (or under)," "transportation accident," etc. The remaining 2,013 claims were excluded because of a clearly defined "accident" time, and were, therefore, unlikely to be CTDs. However, cases of low back pain which manifested itself suddenly after a chronic disease process were probably excluded. The demographic characteristics of the excluded claims were distinctly different from those of the cases: for example, 94% of these claims were not accompanied by any CTD diagnosis; and the annual claim rates were higher for men than for women, and also for younger workers than for older workers. (The annual rate per 10,000 workers 17 years of age or younger was 15.2 for men and 9.6 for women. This is contrasted to the defined cases, in which higher rates were noted among women than men, and among the older than the younger workers as shown in Fig. 1.) It is possible, however, that exclusion of these 2,013 claims increased the specificity of the surveillance method at the cost of reduced sensitivity.

Our results confirm the importance of the wrist as the body part most frequently affected by CTDs.^{1,2,19} It is not a surprising observation considering the nature and extent of occupational tasks which require extensive use of the hands. Two interesting outcomes of analysis by Standard Industrial and Standard Occupational Classification were that kneeling workers in construction trades had a greater proportion of knee problems,²⁰ and dancers showed an increased share of CTDs of the foot.²¹

CTD cases increased dramatically during the period examined. One likely reason for this increase is the growing awareness and recognition among workers, employers, and health professionals that CTDs may be due to occupational exposure. A change in 1983 in the coding procedure for claims in Ohio, which resulted in all occupational disease claims being coded regardless of whether there were lost workdays or not, probably accounted for only 20% of the observed increase during the period following the change. Increases in Ohio's work force for 1983 (2%) and 1984 (4%) were insufficient to account for the rise in CTD cases over these 2 years.

The implementation of an effective control program for prevention of CTDs requires identification of high risk companies and processes. In-plant surveillance for CTDs has been successfully conducted at large corporations for the purpose of identifying jobs with a high rate of CTDs.^{22,23} Surveillance over the general industrial sector is currently dependent on the utilization of two existing data systems: (1) the systematic sampling of OSHA-200 forms by the Bureau of Labor Statistics,¹² and (2) the Supplementary Data System, an annual

Bureau of Labor Statistics analysis of workers' compensation claims data from participating states.¹⁹ The primary limitation of these data systems is that they do not identify the individual companies at high risk, although they do provide associations with broad industrial and occupational categories.

Analysis of workers' compensation claims data described in this report enables us to identify companies with high rates of CTD by specific diagnosis and part of body. This recognition should be followed by on-site ergonomic investigations of such companies. CTD cases frequently cluster in certain departments or job categories. Focusing on employers/processes with high CTD rates or larger numbers of cases will allow for the optimal use of precious resources to conduct ergonomic evaluations and consultations. Although this surveillance method remains to be validated, it appears to be a promising approach for identifying companies at high risk of CTDs.

Acknowledgments

The authors acknowledge assistance from Mr John A. Pompei, Superintendent; Ms Sandra Newman, Researcher; and Mr Gregory Gantner, Programmer; of the Division of Safety and Hygiene, the Industrial Commission of Ohio. Data processing and statistical analysis were conducted by Ms Dorothy B. Lowe of the Support Services Branch. Ms Frances Guerra assisted in the manuscript preparation.

References

1. Hunter D: *The Diseases of Occupations*. ed 6, London, Hodder & Stoughton Ltd, 1978, pp 786-789.
2. Silverstein BA, Fine LJ, Armstrong TJ: Hand wrist cumulative trauma disorders in industry. *Br J Ind Med* 1986;43:779-784.
3. Kuorinka I, Koskinen P: Occupational rheumatic diseases and upper limb strain in manual jobs in a light mechanical industry. *Scand J Work Environ Health* 1979;5(Suppl 3):39-47.
4. Browne CD, Nolan BM, Faithful DK: Occupational repetitive strain injuries: guidelines for diagnosis and management. *Med J Aust* 1984;140:329-332.
5. Armstrong TJ, Foulke JA, Joseph BS, et al: Investigation of cumulative trauma disorders in a poultry processing plant. *Am Indust Hyg Assoc J* 1982;43:103-116.
6. Cannon LJ, Bernacki EJ, Waiter SD: Personal and occupational factors associated with carpal tunnel syndrome. *J Occup Med* 1981;23:255-258.
7. Kurppa K, Waris P, Rokkanen P: Peritendinitis and tenosynovitis: A review. *Scand J Work Environ Health* 1979;5(Suppl 3):19-24.
8. Luopajarvi T, Kuorinka I, Virolainen M, et al: Prevalence of tenosynovitis and other injuries of the upper extremities in repetitive work. *Scand J Work Environ Health* 1979;5(Suppl 3):48-55.
9. The Division of Safety and Hygiene, Industrial Commission of Ohio: Workers' Compensation Claims Coding Manual, 1984 Revision, Columbus, OH.
10. Hadler NM: *Medical Management of the Regional Musculoskeletal Diseases*. Orlando, FL, Grune & Stratton, Inc, 1984, pp 143-155.
11. Hadler NM: Carpal tunnel syndrome—A compensable injury? *Occupational Problems in Medical Practice* 1986;1:6-8.
12. Bureau of Labor Statistics: Occupational Injuries and Illnesses in the United States by Industry—1984. Bulletin 2259, May 1986, pp 43-47.

13. National Institute for Occupational Safety and Health: National Occupational Hazard Survey, 1972-1974. DHEW (NIOSH) Publication No. 78-114, 1978.

14. Prevention of leading work-related diseases and injuries. *MMWR* 1983; 32:189-191.

15. US Department of Commerce: Standard Occupational Classification Manual. Statistical Policy Division, Office of Management and Budget, 1977.

16. Statistical Policy Division, Office of Management and Budget: Standard Industrial Classification Manual, 1972 (Stock No. 4101-0066).

17. Seligman PJ, Halperin WE, Mullan RJ, et al: Occupational lead poisoning in Ohio: Surveillance using workers' compensation data. *Am J Public Health* 1986;76:1299-1302.

18. *Ohio Industrial Directory—1986*, Harris Publishing Co, Twinsburg, OH, 1986.

19. Jensen RC, Klein BP, Sanderson LM: Motion-related wrist disorders traced to industries, occupational group. *Monthly Labor Review* 1983;106:13-16.

20. Thun MJ, Tanaka S, Smith AB, et al: Morbidity from repetitive knee trauma in carpet and floorlayers. *Br J Ind Med* 1987;44:611-620.

21. Rovere GD, Webb LX, Cristina AG, et al: Musculoskeletal injuries in theatrical dance students. *Am J Sports Med* 1983;11:195-198.

22. Fine LJ, Silverstein BA, Armstrong TJ, et al: Detection of cumulative trauma disorders of upper extremities in the workplace. *J Occup Med* 1986;28:674-678.

Redefining Responsibility

Few of us can escape being neurotic or character disordered to at least some degree (which is why essentially everyone can benefit from psychotherapy if he or she is seriously willing to participate in the process). The reason for this is that the problem of distinguishing what we are and what we are not responsible for in this life is one of the greatest problems of human existence. It is never completely solved; for the entirety of our lives we must continually assess and reassess where our responsibilities lie in the everchanging course of events. Nor is this assessment and reassessment painless if performed adequately and conscientiously. To perform either process adequately we must possess the willingness and the capacity to suffer continual self-examination. And such capacity or willingness is not inherent in any of us. In a sense all children have character disorders, in that their instinctual tendency is to deny their responsibility for many conflicts in which they find themselves. Thus two siblings fighting will always blame each other for initiating the fight and each will totally deny that he or she may have been the culprit. Similarly, all children have neuroses, in that they will instinctually assume responsibility for certain deprivations that they experience but do not yet understand. Thus the child who is not loved by his parents will always assume himself or herself to be unlovable rather than see the parents as deficient in their capacity to love. Or early adolescents who are not yet successful at dating or at sports will see themselves as seriously deficient human beings rather than the late or even average but perfectly adequate bloomers they usually are. It is only through a vast amount of experience and a lengthy and successful maturation that we gain the capacity to see the world and our place in it realistically, and thus are enabled to realistically assess our responsibility for ourselves and the world.

—From *The Road Less Traveled* by M. Scott Peck, MD, Simon and Schuster, New York, 1978, pp 36-37