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Memorandum

Date: June 1, 2001

From: Roy M. Fleming, Sc.D., Director, Research Grants Program *Rmf*
Office of Extramural Programs, NIOSH, D30

Subject: Final Report Submitted for Entry into NTIS for Grant 1 R03 OH003792-01.

To: William D. Bennett
Data Systems Team, Information Resources Branch, EID, NIOSH, P03/C18

The attached final report has been received from the principal investigator on the subject NIOSH grant. If this document is forwarded to the National Technical Information Service, please let us know when a document number is known so that we can inform anyone who inquires about this final report.

Any publications that are included with this report are highlighted on the list below.

Attachment

cc: Sherri Diana, EID, P03/C13

List of Publications *None*

NIOSH Extramural Award Final Report Summary

Title: CTS Incidence and Correlates of Worker's Compensation Claims
Investigator: Laura Punnett, Sc.D.
Affiliation: University of Massachusetts
City & State: Lowell, MA
Telephone: (978) 934-3269
Award Number: 1 R03 OH003792-01
Start & End Date: 9/30/1998–9/29/2000
Total Project Cost: \$74,000
Program Area: Musculoskeletal Disorders: Upper Extremities
Key Words:

Abstract:

Data are sparse on the incidence of carpal tunnel syndrome (CTS) in the general population, and estimates from workplace settings vary widely among workers' compensation, OSHA logs of recordable illnesses, and other administrative data sources. The reasons that some people with work-related CTS do not file compensation claims are believed to include factors as varied as access to medical care and information about work-related morbidity, employers' medical management and return-to-work programs, and workers' perceived job security and expected success in filing compensation claims.

This pilot study was designed to determine the feasibility of using data from a large health maintenance organization (HMO) to estimate the incidence of carpal tunnel syndrome from a relatively well-defined sample of the Massachusetts general population and to estimate the proportion of those incident cases that are likely work-related. Using a retrospective, dynamic cohort study design, computerized files and medical records were used to identify and characterize probable CTS cases. The incidence density rate of diagnosed CTS in this HMO population was estimated as 4.34 cases per 1,000 person-years. Agreement was good (82% overall) between medical diagnoses and record reviews.

A number of study instruments were developed for this investigation. Four algorithms for searching the HMO medical record database were developed and compared for their utility in locating CTS cases, and final selection has been made for future use. The standardized interview was finalized and evaluated during the course of ten interviews, and a list of revisions for future use has been noted. The decision rules for determination of probability of CTS and of work-relatedness were also revised and evaluated. Data entry templates were developed and utilized for both the chart reviews and case interviews.

Several logistical delays impeded the performance of two intended data collection activities. Time did not permit either interviews of cases' employers, or review of workers' compensation records from the state Department of Industrial Accidents. Nevertheless, the primary objective of the project has been fulfilled. Data from this HMO have proved a feasible and effective means of identifying incident CTS cases within a well-defined sample of the general population. In addition, the procedures and decision rules necessary for identification of likely work-related cases have been

developed. Although only a small number of cases was evaluated in this pilot study, a future large-scale investigation using the same study methods will likely be able to achieve the substantive goals that motivated this project. Information about etiologically relevant occupational exposures was obtained from a structured interview and scored as to probability of work-relatedness. Among eleven CTS cases interviewed, five (45%) were judged to be definitely or probably work-related.

Publications

No publications to date.

Incidence of Carpal Tunnel Syndrome (CTS)
in a Sample of the General Population

Final Report

Award R03-OH03792

National Institute for Occupational Safety and Health

Submitted by:

Laura Punnett, Sc.D.
Department of Work Environment
University of Massachusetts Lowell

April 4, 2001

Executive Summary

Data are sparse on the incidence of carpal tunnel syndrome (CTS) in the general population, and estimates from workplace settings vary widely among workers' compensation, OSHA logs of recordable illnesses, and other administrative data sources. The reasons that some people with work-related CTS do not file compensation claims are believed to include factors as varied as access to medical care and information about work-related morbidity, employers' medical management and return-to-work programs, and workers' perceived job security and expected success in filing compensation claims.

This pilot study was designed to determine the feasibility of using data from a large health maintenance organization (HMO) to estimate the incidence of carpal tunnel syndrome from a relatively well-defined sample of the Massachusetts general population and to estimate the proportion of those incident cases that are likely work-related. Using a retrospective, dynamic cohort study design, computerized files and medical records were used to identify and characterize probable CTS cases. The incidence density rate of diagnosed CTS in this HMO population was estimated as 4.34 cases per 1,000 person-years. Agreement was good (82% overall) between medical diagnoses and record reviews.

Information about etiologically relevant occupational exposures was obtained from a structured interview and scored as to probability of work-relatedness. Among eleven CTS cases interviewed, five (45%) were judged to be definitely or probably work-related.

A number of study instruments were developed for this investigation. Four algorithms for searching the HMO medical record database were developed and compared for their utility in locating CTS cases, and final selection has been made for future use. The standardized interview was finalized and evaluated during the course of ten interviews, and a list of revisions for future use has been noted. The decision rules for determination of probability of CTS and of work-relatedness were also revised and evaluated. Data entry templates (in Microsoft Access) were developed and utilized for both the chart reviews and case interviews.

Several logistical delays impeded the performance of two intended data collection activities. Time did not permit either interviews of cases' employers, or review of workers' compensation records from the state Department of Industrial Accidents.

Nevertheless, the primary objective of the project has been fulfilled. Data from this HMO have proved a feasible and effective means of identifying incident CTS cases within a well-defined sample of the general population. In addition, the procedures and decision rules necessary for identification of likely work-related cases have been developed. Although only a small number of cases was evaluated in this pilot study, a future large-scale investigation using the same study methods will likely be able to achieve the substantive goals that motivated this project.

Background

In 1996, NIOSH identified musculoskeletal disorders of the upper extremity as a national occupational research priority. Carpal tunnel syndrome (CTS), or entrapment of the median nerve in the wrist, accounted for 13% of all repetitive trauma disorders reported by the Bureau of Labor Statistics (BLS) in 1996 (1).

Accurate data are sparse on the incidence density of carpal tunnel syndrome in the general population. From 1961 to 1980, the incidence of CTS leading to medical attention was approximately 1 case per year per 1,000 people living in Rochester, Minnesota (2). These rates also were higher among women and older persons and increased over calendar time, possibly due to improved recognition. Vessey et al. reported crude rates of hospital referrals for CTS of 0.39 to 1.65 per 1,000 woman-years in England during the period, 1968-1974 (3). A study of newly diagnosed CTS cases in Wisconsin, 1994-1995, found an 18-month incidence rate of about 4.58 cases per 1,000 person-years (4), while the incidence of CTS surgery (a subset of all cases) in Wisconsin, 1990-1993, was 1.48 cases per 1,000 person-years (5). The variation among these rates has not been explained but is likely due to several factors, including age and gender distribution, occupation and industry mix in the population, and the sensitivity of the case definition. In addition, assumptions made in defining the population at risk may have a substantial impact on the estimate obtained.

It is not known what proportion of CTS in the general population is work-related. Only 26.2% of the Wisconsin cases in 1990-93 had workers' compensation listed as the expected source of payment (5). However, health care providers in Santa Clara County, California, judged that 47% of the 7,214 cases that they diagnosed in 1987 may have been work-related (6). Findings from the NHIS also suggested that as much as 50% of all CTS is work-related (7).

Estimates of the frequency of work-related carpal tunnel syndrome are most commonly derived from systems of workers' compensation. North Carolina workers' compensation lost time claims for CTS in 1986 through 1988 had an average annual rate of only 0.04 cases per 1,000 workers (8). In contrast, the annual incidence of paid workers' compensation claims for CTS in the state of Washington was estimated at 1.74 cases per 1,000 full time employees; this rate increased significantly among women, but not men, from 1984 to 1988 (9). The trend continued at an even steeper pace into the 1990's, with a CTS incidence rate in the same state of 3.2 compensated cases per 1,000 workers (10). However, national estimates of the incidence of work-related CTS from the BLS were one order of magnitude lower, ranging from 0.43 to 0.52 cases per 1,000 workers in 1992-1994 (1, 11). Again, such geographical variation may be due to the occupational and industrial composition of the workforce, medical practices in different regions, and state rules governing compensability.

Further, several studies have shown major discrepancies between morbidity rates estimated from compensation data as compared with rates from OSHA 200 logs, medical records, physician reports of work-related injuries and illnesses, and claims filed with workers' compensation systems (12-15). The reasons for these differences are not well documented, although they

probably include factors as varied as access to medical care, information about work-related morbidity, employers' medical management and return-to-work programs, and workers' perceived job security and expected success in filing compensation claims.

From 1992 through 1996, only 6% of all work-related CTS cases reported by physicians to the Massachusetts Department of Public Health filed a lost-time claim for workers' compensation (WC) (16). Korrick et al. found that underascertainment and potential ascertainment biases limited the feasibility of using WC claims data for surveillance of work-related CTS in Massachusetts (17). Another recent study showed that from 55% to 90% of individuals in Michigan identified by a physician as having a work-related illness did not file claims for lost-time benefits (18).

In Massachusetts in 1992-1996, CTS cases ascertained by physician report were similar to those with lost work time WC claims with respect to age and occupation, but they were significantly more likely to be male and to be employed in manufacturing (16). Large manufacturing facilities are more likely to provide occupational medicine or nursing services than employers in the service sector, increasing the likelihood that work-related conditions will be recognized and reported accordingly and leading to possible under-representation of service occupations in surveillance data bases. (However, cases in large manufacturing firms may also be underestimated if their diseases are recognized earlier and they have more options to transfer to jobs with lower ergonomic strain, instead of losing work time.) It could not be determined from the Massachusetts data whether manufacturing workers were more likely to develop CTS, to be diagnosed, to become disabled, or to file claims for CTS of the same severity than other workers.

Worker characteristics may also influence disease reporting. Women are more likely than men to experience work disability (19-21) and lose more days from work (20, 22) due to CTS. Since women generally have more responsibility for household work and care of family members, the family burden of CTS may have more influence on return-to-work decisions by women than by men. On the other hand, WC claims by women workers in Massachusetts have decreased in frequency in recent years. It is not known whether this represents a true decrease in incidence or decreased reporting if, for example, women's expectations of receiving awards have changed over time. Other factors, such as physicians' perceptions of the work demands in men's and women's jobs (23), may also differentially affect the probability that men and women will receive compensation. Increased understanding of the factors that influence disease reporting by employers and employees is essential to a correct interpretation of the distribution of morbidity in the U.S. working population, as well as to appropriate allocation of surveillance and prevention resources.

Objectives and Specific Aims

This pilot study was designed to determine the feasibility of using data from a large health maintenance organization (HMO) to estimate the incidence of carpal tunnel syndrome from a relatively well-defined sample of the Massachusetts general population and to estimate the proportion of those incident cases that are likely work-related. Using a retrospective, dynamic cohort study design, computerized files and medical records were used to identify and characterize probable CTS cases. Information about potentially relevant occupational and non-occupational exposures was obtained from the medical chart and a structured interview, and each case was scored as to probability of work-relatedness.

The specific aims of the project were to:

- a. Develop and refine a computerized search algorithm for the purpose of collecting data from a large health maintenance organization (HMO) on persons at risk for incidence of carpal tunnel syndrome and potential cases of carpal tunnel syndrome during a 12-month period.
- b. Conduct a chart review of a 50% sample of the potential incident cases to confirm the CTS diagnosis, and to abstract any occupational or exposure history data found in the charts.
- c. Use a standardized questionnaire to obtain information from all confirmed CTS cases on occupational history, working conditions, lost work time, and to a limited extent the social and family burden of work-related CTS.

- d. Identify the likely work-related cases among the persons with confirmed CTS, using an algorithm based on the NIOSH surveillance case definition for work-related CTS, and compute the incidence density of CTS and of work-related CTS in the study population, both overall and stratified on age and gender.
- e. With cases' permission, use a standardized questionnaire to obtain information from employers regarding in-house medical management programs, employee health benefits, and knowledge about and perceived importance of occupational ergonomics and upper extremity musculoskeletal disorders.
- f. Determine which cases of CTS have either workers' compensation as source of payment in the HMO record, or a recorded claim filed with or benefits paid for lost time from the Massachusetts Department of Industrial Accidents (DIA) since date of diagnosis.
- g. Compare cases of work-related CTS with and without workers' compensation claims or benefits with regard to employer characteristics (e.g., workforce size, presumed exposures, in-house medical management programs, employee health benefits, unionization) and employee characteristics (e.g., demographics, knowledge and attitudes about occupational ergonomics and upper extremity musculoskeletal disorders, perceived job security, medical insurance, economic and social costs of the disorder) that may influence the probability of filing a claim or receiving benefits.
- h. Compare cases of work-related CTS with and without workers' compensation claims or benefits with regard to the social and family burden of the disorder.

Due to administrative and logistical delays (see next section), employer interviews and review of DIA records (specific aims **e** and **f**) could not be carried out. No cases with workers' compensation claims or payments were found either through record review or by interview, so specific aims **g** and **h** could not be performed within this pilot study. The remaining aims were accomplished at least in part, albeit on a smaller scale than initially intended.

Study Narrative and Methods

Project Narrative

This project was funded with an official start date of September 30, 1998. Applications were submitted immediately to the Institutional Review Boards (IRBs) of the University of Massachusetts Lowell (UML) and Fallon Clinic. (The Fallon IRB has a policy of not reviewing proposals until after funding has been approved.) Several questions were raised during the Fallon IRB review, which were initially handled by mail and telephone. The discussion was carried over several monthly meetings of the IRB, and it was not until January of 1999 that the investigators were able to attend an IRB meeting in order to resolve fully all of the IRB concerns. Fallon IRB approval of the project was dated January 21, 1999. The UML IRB had already reviewed the protocol and approved the project almost immediately upon receipt of the Fallon informed consent form, in February, 1999, as did the IRB of the Massachusetts Department of Public Health (DPH). The N.I.H. Office of Protection from Research Risks (OPRR) lifted the bar on funding effective August 30, 1999, or almost one full year after the project start date.

The next critical step, upon which the remainder of the project depended, was development of the complex, interactive front end software to query the data warehouse. Enrolling subjects was contingent upon their identification via this query tool. Its development was carried out by another researcher (Dr. Don Milton, as part of a study of adult asthma), and the CTS project could not proceed until the new system was functioning first in the asthma study. There were

significant delays in this process for a number of reasons. First, the study site (Fallon Clinic) implemented a new computer system in the late fall of 1999. During the implementation phase of this transition (several months), the data warehouse was not available to us. Second, Dr. Milton's work was delayed by a dispute between the administrators of the study site and the external subcontractor engaged to develop the front end query tool, the complex software used to query the HMO's data warehouse to identify cases. This situation was eventually resolved, but the query tool was not completed until March of 2000. Once it had passed the beta tests and was operational, it was utilized to identify CTS cases. The search results were provided to us in mid-May, 2000.

Prior to this date, once the bar on study expenditures had been lifted by OPRR, study personnel were engaged in development and revision of the decision rules for the computerized search of Fallon medical records, the case questionnaire, and the decision rules for determination of CTS case status and work-relatedness.

In the same month in which the CTS case rosters were received, the key staff person on the project (Ms. Helen M. Wellman) left employment at DPH and UML for a permanent, full-time staff position with full benefits at another institution. To replace her, it was necessary to hire two individuals, one to carry out the computer data base management tasks and one to perform the medical chart reviews and interviews. Hiring and training of these staff was done by mid-June. There followed several periods of time in which either Dr. Punnett (P.I.) or Dr. Celona (Fallon Occupational Medicine), or both, were unavailable to the project because of previously scheduled conferences, summer vacations, and other commitments. In particular, there were some key

decisions regarding data to be abstracted from the nerve conduction records in the medical charts; these decisions had not previously been anticipated and required the consultation of Dr. Celona with the head of the Fallon Neurology Department, a process that was not completed until August of 2000.

As noted above, project funds could not be spent until almost one year after the project start date. A one-year no-cost extension was requested and received in August, 1999. However, our request for a second extension, in August, 2000, was denied. When project funds could no longer be utilized, personal overhead funds of the Principal Investigator were tapped to support completion of the activities described herein.

The series of logistical delays resulted in a substantial reduction of time available to carry out the study aims. A smaller number of chart reviews was completed than had been intended, and only a few cases could be interviewed before this final report had to be submitted. Time constraints prevented us from carrying out two subsequent data collection steps, namely, interviews of cases' employers, and review of workers' compensation records from the state Division of Industrial Accidents (DIA). A letter to employers of CTS cases was drafted (Appendix IX) but not piloted.

Study Design and Population

This study utilized a retrospective dynamic cohort, defined from persons who were enrolled in the Fallon Community Health Plan (FCHP) HMO in 1998. This HMO maintains enrollment, outpatient visit and hospitalization records with attached diagnosis codes in centralized computer

records. These records include medication and other treatments administered during a visit and prescriptions filled through the HMO (24, 25). Data on diagnoses and services provided are entered from "encounter forms" completed by providers at the time of service. To facilitate recording and data entry, the common diagnosis codes for each specialty are printed on the encounter forms so that they may be circled by the provider. Annual negotiation of capitation rates between the HMO and Fallon Clinic, the physicians' group practice that provides the services, creates significant financial incentive for complete and accurate recording of services and diagnoses on these forms. Pharmacy records are generated at the time medications are dispensed. The organization was recently rated as both the highest quality HMO in Massachusetts by the Massachusetts Healthcare Purchaser Group and the US by Newsweek (June 24, 1996). In addition, the HMO has a well established occupational medicine department. Dr. F. Joseph Celona, head of Occupational Medicine until the summer of 2000, was involved as a consultant in this project under the Fallon subcontract.

The Fallon HMO has Worcester County, in central Massachusetts, as its primary catchment area. The population is diverse with regard to age, gender, and industry sector of employment. A copy of the age and gender distribution of the HMO membership is attached (Appendix I). It is estimated that less than 50% of the population is white (Caucasian) [personal communication, Ellen Trencher, Director of Fallon Research Department]. A comprehensive list of employers is not available, but it includes: federal, state, and municipal government entities; Sears Roebuck Company; Marriott; a number of "high tech" companies such as Compaq, Data General, and IBM; service companies such as American Express and Allmerica Financial; and manufacturing operations such as Saint-Gobain/Norton.

The base population was comprised of FCHP members enrolled in a Fallon Clinic option (i.e., choosing to receive medical services at this facility) continuously in all of 1998. The criterion for continuous enrollment was one or no gaps in enrollment, and no gaps of greater than 45 days. This permitted inclusion of members who un-enrolled from one option and re-enrolled in another within a few days. The potential cohort was comprised of persons ages 15 through 55, in order to estimate the incidence of all CTS and of work-related CTS in the working-age population. The inclusion of subjects ages 15 to 18 reflected the fact that many people in this age group work in jobs associated with increased risk of CTS, such as grocery store cashiers (26-29).

Four separate search algorithms to identify potential incident cases of CTS were developed, in consultation with the Fallon Occupational Medicine Department. The first two of these search rules both required a diagnosis of CTS (9th international classification of diseases (ICD-9) code 354.0) in 1998, but the second screen excluded subjects with previous CTS diagnoses in 1996 or 1997 (Table 1 and Appendix II). Comparison of the results of these two searches was intended to address the question of the extent to which the exclusion would correctly limit the results to new cases or incorrectly exclude persons with prior diagnosis in one hand and a 1998 diagnosis in the other.

The third and fourth search screens were intended to explore the extent to which possible cases of CTS - that would meet the decision criteria of this study - were not so diagnosed in the computerized records, i.e., to determine what proportion of these additional charts might represent probable incident CTS cases by chart review. The third search criterion was, among population members not identified by the first screens, persons at risk who in 1998 had a

diagnosis of other median nerve lesion (ICD-9 code 354.1); Raynaud's phenomenon (ICD-9 code 443.0); or causalgia of the upper extremity (ICD-9 code 354.4), paresthesia of the upper extremity (ICD-9 code 782.0) or peripheral neuropathy (ICD-9 code 356.9) in combination with any current procedural terminology (CPT) code for wrist splint (29125-29126) or nerve conduction velocity testing (95860-95864).

The fourth search identified persons at risk, not already selected, who had been treated for CTS at the Fallon clinic without a related diagnosis. Five types of treatments were included in this search: 1) carpal tunnel surgery (ICD-9 04.43 or CPT 64721); 2) arthroscopy of the wrist with carpal ligament release (CPT 29848); 3) carpal tunnel injection with a diagnosis of CTS (CPT 20605); 4) wrist splinting (29125-29126); and 5) electrodiagnostic testing for CTS (95860-95864).

The population at risk of new CTS in 1998 was defined by enumeration of the base population, as above, with exclusion of individuals diagnosed or receiving treatment for CTS in 1996 and 1997. This exclusion was primarily based on comparison of search results for criteria 1 and 2; however, chart review of subjects in groups 3 and 4 found some past CTS diagnoses as well as some in 1998 (see Results). The denominator was therefore also adjusted for these past cases, on the assumption that the proportion of new and previous CTS in a small sample could be applied to the full group of persons with the same diagnoses and treatments.

Chart Review

A standardized protocol was developed for chart review of the potential cases identified by computerized record search. The primary goal of the chart review was to compare the four search algorithms in terms of their likely sensitivity and specificity. This was done by seeking information that would confirm the physician diagnosis of CTS during 1997, for those charts selected by codes for CTS, and to determine whether there are any potential CTS cases among the charts selected by codes for Raynaud's phenomenon or causalgia, paresthesia or peripheral neuropathy of the upper extremity. Secondary goals were to document the medical care provided and to determine what information, if any, was recorded regarding work and exposure history by different types of medical care providers.

The protocol (Appendix III) included abstracting of clinical information on dates of first symptoms, seeking medical attention, and physician diagnosis of CTS; specific CTS symptoms and signs recorded; diagnostic tests performed and their results; co-morbidity (rheumatoid arthritis, diabetes mellitus, and other systemic diseases correlated with CTS), obesity, and other predisposing factors; and types of providers seeing the patient. The chart reviewer also recorded whether or not any occupational information was recorded in the chart. Occupational information sought included job title and industry sector; past or present exposure to ergonomic risk factors for CTS such as repetitive hand motion, forceful exertions, wrist bending, and segmental vibration.

Worker's Compensation information is available for each visit by a FCHP member seen by a Fallon Clinic provider. All procedures flagged with WC as the source of payment were to be so identified.

A random sample of the potential CTS cases was selected for chart review. Fifteen records from each of the four search algorithms were identified, in order to compare their utility for locating new CTS cases. The first five charts were utilized to pilot-test the review form and subjected to duplicate chart review by Ms. Sharon Cotnam, R.N., of the project staff and Ms. Janet Guilbert, R.N., a staff member of the Research Department of Fallon Clinic with extensive experience in chart review. Any discrepancies in the review results were reviewed immediately and all questions for clarification were referred to Dr. Punnett and Dr. Celona. Recommendations for revisions in the chart review form were noted and forwarded to Dr. Punnett, as well.

All chart reviews, including coding of the probability of CTS (see below), were conducted blinded to the search criterion that had identified the case in question.

Case Questionnaire

Subjects whose chart review did not indicate a case of CTS during the study period were excluded from further investigation. A random sample of confirmed or likely CTS cases was selected for interview. For each such case, permission was sought from the primary care provider (PCP) at Fallon to contact the patient by mail and telephone. Unless permission was denied, the questionnaire was mailed to the case with a cover letter explaining the study and

procedures for informed consent, plus a stamped, self-addressed envelope (Appendix IV). A form was also provided on which the subject could indicate refusal to participate and thus avoid future contacts from study personnel. Non-respondents to the mailing were contacted within a week by telephone for an interview by a member of the research team.

The standardized questionnaire (Appendix V) was designed to obtain information from CTS cases on current occupation, employer and industry; any other job(s) held in the past two years and at the time that hand or wrist symptoms began; reason for leaving last job, if relevant; two-year occupational exposure history, including duration, frequency and intensity of exposure to ergonomic stressors and neurotoxic agents; employer efforts to remediate any hazards; specific symptoms of CTS and other upper extremity soft-tissue disorders; history of acute trauma to the wrist; whether or not a WC claim has been filed; and CTS outcomes such as medical attention sought since onset of symptoms, functional impairment and disability, participation in family or community activities, and ability to care for self and family members. The questionnaire was based on that used previously by the Massachusetts Department of Public Health (DPH) SENSOR program to interview physician-reported CTS cases, with additional items derived from the National Health Interview Supplement (7, 19), the DASH (30), and instruments in use in other studies of CTS etiology and outcomes (31-33). New items were developed regarding potential determinants of claim filing, such as worker knowledge about workers' compensation and thresholds for filing claims, perceived likelihood of success of a compensation claim, and type of employer response anticipated by the worker in the event of filing a claim.

For pilot-testing of the questionnaire, Massachusetts DPH staff selected a total of 60 CTS cases, in three waves of 20, from workers' compensation claims for CTS forwarded routinely by the Massachusetts DIA. A total of 9 interviewer- or self-administered questionnaires were completed by persons with CTS claims or First Reports of Injury (Appendix VI). Ambiguous, unclear, and otherwise problematic items were identified and used in revisions of the questionnaire. Once it appeared that sufficient pilot-testing had been carried out, follow-up on the remaining WC cases was discontinued.

All interviews, including coding of the probability of work-relatedness (see below), were conducted blinded to the search criterion that had identified the case in question.

Definitions of Case and Exposure Status

Identification of likely work-related CTS cases used a set of decision rules based on the NIOSH 1988 surveillance case definition for work-related CTS (6). Potential cases were scored separately as to the likelihood of having CTS and of having been exposed to relevant occupational ergonomic factors, using information obtained from both the chart review and the questionnaire. Scoring of each dimension (CTS and exposure status) was performed by the P.I. without regard to the results of the other dimension.

The NIOSH case definition of carpal tunnel syndrome requires that the subject have symptoms consistent with CTS, such as paresthesia, hypoesthesia, pain or numbness affecting at least part of the median nerve distribution of the hand; and objective findings consistent with CTS such as

Tinel's sign, Phelan sign, decreased or absent sensation to pin prick in the median nerve distribution, or electrodiagnostic findings of median nerve dysfunction across the carpal tunnel. For this study, the probability of CTS was scored from 0 (unlikely) to 3 (definite) based on the specific symptoms and findings present; the algorithm is included in Appendix VII.

The NIOSH surveillance case definition defines evidence of work-relatedness as a job history involving exposure to one or more of the following: frequent, repetitive or forceful hand work on the affected side; sustained awkward wrist posture; use of vibrating hand tools; prolonged pressure over the wrist or base of the palm; and temporal relationship of symptoms to work or CTS documented in co-workers (6). For this study, the probability of work-relatedness was scored from 0 (unlikely) to 3 (definite) based on the duration, frequency and intensity of exposure to ergonomic stressors in the present job or the job held just before onset. The algorithm for scoring work-relatedness, based on the combined information from chart review and interview, is included in Appendix VII. In this protocol, somewhat more weight was given to repetitive motion and to vibration exposure than to postural stress, based on the recent determination by NIOSH that there is definite evidence of the etiologic role of repetition and vibration alone or together in the development of CTS, whereas the evidence is less conclusive for exposure to awkward postures (10).

Results

Medical Chart Reviews

Agreement between medical diagnosis and chart review

Sixty medical charts were selected at random for review, 15 from each of the four search algorithms. Four records were not available in hard copy at that time and were replaced by those of other subjects from the same case groups. Thus, 60 charts in all were reviewed and abstracted. Three charts (convenience sample) were reviewed in duplicate by the same reviewer, about ten days apart; these duplicate reviews revealed few substantive discrepancies.

One key issue to be addressed by this review was the desirability of excluding CTS cases diagnosed in 1998 who had previous CTS diagnoses in 1996 or 1997 (as described in Methods). Towards this end, it was of interest to determine whether these cases (found in group 1) were actually incident in the other hand, or whether the recorded diagnosis represented a recurrence of an extant condition. Chart reviews showed that 6 of the 15 cases (40%) selected at random in group 1 had had a prior CTS diagnosis, and at most one of those prior diagnoses had been in the contralateral hand. Two of these patients had in fact been diagnosed prior to 1996; one had a carpal tunnel release in 1990 and one in 1991. A separate issue, of course, is that two other subjects had experienced onset of hand symptoms in an earlier year, with treatment (splints and/or medication), although CTS was not diagnosed in them until 1998.

As suggested above, exclusion of CTS diagnoses in 1996 and 1997 is not sufficient to ensure truly incident cases. In fact, in group 2, where this exclusion had been applied, two charts showed earlier CTS diagnoses (one bilaterally in 1992, one in 1995 possibly in the contralateral hand) and two contained notations that the patients self-reported previous CTS, with treatment obtained elsewhere. Again, several patients had experienced earlier onset of symptoms.

Overall, there was good agreement between the medical diagnosis and the probability of CTS according to the study decision rules (Table 2). Of the 29 cases with diagnosed CTS, the chart review showed 15 with probable or definite CTS and 8 with possible CTS (79% agreement). Of the 31 cases with no CTS diagnosis, 26 were judged unlikely to have CTS on the chart review (84% agreement). Thus there was agreement on 49 (82%) of the 60 records, overall.

The 11 cases for which there was disagreement are shown in Table 2. Seven of the 11 discrepant judgments were from case group 2, and only two of these had notations regarding previous episodes of CTS. Six subjects (4 female) were diagnosed with CTS but judged as unlikely on chart review, while 5 (4 female) were judged as possible or probable but did not have a CTS diagnosis recorded. Thus, in this small sample, there was no evidence of gender bias in the probability of a medical diagnosis of CTS.

When symptoms were not recorded in much detail, which was a common occurrence, they were coded only as “possibly” consistent with CTS. Since the study decision rules emphasized the quality, distribution and nocturnal occurrence of symptoms for a determination of CTS, 12 subjects were judged only to have “possible” CTS. This accounted for 5 of the 6 subjects

diagnosed with CTS but judged “unlikely” on chart review. If the diagnosing provider did not chart relevant information obtained during the medical visit, this would be an overly conservative judgment of the chart review. Any future use of this study protocol may require revision of the decision rules to account for this situation. For these pilot analyses, CTS chart review was considered to be positive if the case was judged as possible (12), probable (4), or definite (12) CTS.

Of the 5 subjects with at least possible CTS on chart review but no CTS diagnosis, one was diagnosed with “upper extremity mononeuropathy” and two charts showed that the diagnosing provider suspected possible CTS on the basis of typical symptoms but equivocal or negative test results (Table 2). The other two charts provide evidence highly suggestive of undiagnosed CTS, in particular one case who went on to have a surgical carpal tunnel release in 2000.

A total of 34 subjects were either diagnosed with CTS or judged by reviewer to have possible, probable, or definite CTS by the study decision rules, or both. These cases were further examined with regard to personal and occupational characteristics. The remaining 26 subjects were excluded from further analysis and follow-up.

Description of CTS cases

Among the CTS cases, the patients were predominantly female and white (Table 3). On average, they were 66.7 inches tall (standard deviation 4.2) and weighed 188 pounds (SD 56.2) (Table 4). The Quetelet body mass index averaged 30.8 (SD 7.8); a value above 26 is generally considered “high.”

The diagnosing or treating physicians were primarily internists (n=19). Smaller numbers were from rheumatology (n=6), neurology (n=4), and pediatrics (n=2). Two were Physician Assistants.

Nearly all of the 34 subjects reported tingling and/or numbness in the hand (Table 5). Pain was also commonly noted (n=19). Hand and wrist symptoms were generally not described in much detail in the medical records. Especially lacking was specific information about the distribution of tingling or paresthesia, whether or not nocturnal, and the temporal relationship of symptoms to work (see below). Of the 26 cases with information recorded about symptom onset, 19 charts stated that onset had been gradual, 5 reported sudden onset, and 1 gradual onset with sudden worsening.

With regard to physical findings, Phalen's test was performed less often but was more often positive than the Tinel's sign, which was nearly always recorded but was negative in about one-half of the cases on each side (Table 6). Sensory testing, such as Semmes-Weinstein, was done only in about one-third of cases but was rarely positive. Thenar atrophy was looked for in nearly one-half of cases but also rarely seen. (The observed pattern of testing might lead one to speculate whether medical providers are less likely to perform the tests that require more time during the visit.) Nerve conduction velocity (NCV) testing was done for about one-half of the cases on each side, with 90% positive results that were usually judged to be of mild severity (Table 7).

As noted above, among these 34 possible or probable CTS cases, CTS was clinically diagnosed in 29 subjects and most of these had the condition bilaterally (Table 8). Three other cases were suspected by the medical provider but not diagnosed as CTS, although they met the study classification rules; only one of these was bilateral.

The most common systemic condition among the 35 cases was obesity (Table 9). None of the diseases sought in the medical record had a prevalence over 10% among these cases. Two women were pregnant at the time of seeking attention for CTS; in another case the treating physician attributed the CTS to an earlier pregnancy.

Two subjects were out of work due to disability at the time of CTS onset or diagnosis, and another was taking care of children on a full-time basis. All but three charts contained at least the patient's job title. The two largest occupational groups were 5 keyboard operators and 4 nurses; there were also 2 cake decorators, 2 high-school students, and 2 carpenters (1 contractor, 1 cabinet-maker).

As anticipated, the medical records did not contain detailed enough occupational information to evaluate the probability of work-relatedness. However, it could not usually be determined whether absence of a particular item of interest represented an absence of querying or a "no" response from the patient. In any case, only 13 (38%) charts included a job description or information on specific ergonomic exposures. Of these, repetitive motion and intensive and/or continuous keyboard use were the most commonly noted exposures (Table 10 and Appendix VIII). Both high-school students had "typing" noted in their charts. In six records, recreational

activities were noted that might have caused or were observed to aggravate the symptoms, such as cheerleading, softball, drumming, needlepoint, typing class, and use of a rowing machine.

Three charts noted that symptoms were provoked or aggravated by work; none specified whether or not they improved after a vacation. One record contained a clinical opinion that the condition was work-related, one specified both work and leisure-time needlework, and two others strongly implied work-relatedness by the relatively detailed description of work duties and the recommendations to modify work tasks. Thus, occupational and non-occupational hand usage had been explored at least briefly by most providers, but few had made an explicit statement in the record regarding etiology.

Compared with the number of charts where manual usage was noted, relatively few interventions in occupational or other activities were recommended by providers to patients (Table 11). No chart listed workers' compensation (WC) as the payer during the study period, although one CTS case began receiving WC payments in May of 2000. (That subject, a female industrial worker, was later contacted for an interview and refused.)

Incidence of Diagnosed Carpal Tunnel Syndrome in Fallon HMO Records

A total of 70,883 persons were determined to be enrolled in the Fallon HMO during 1998 and thus to be at risk. Of these, 691 were recorded with a diagnosis of CTS during the same year (Table 1). When subjects with a diagnosis of CTS in 1996 or 1997 ($n=170$) were excluded, there were 70,713 persons at risk and 521 cases, or an apparent incidence rate of 7.37 per 1,000

person-years. Chart review (see above) suggested that 8 of 30 CTS cases (26.7% of groups 1 and 2) had previously had CTS in the same hand(s) that were diagnosed in 1998. If this proportion is generalizable to the larger sample, then 139 cases should be subtracted from both the numerator (not incident cases) and from the denominator (not at risk). In addition, as many as six of 30 cases diagnosed with CTS in 1998 (20%) had conditions other than CTS. Again, assuming that this proportion would hold in the entire sample, the appropriate correction produces a revised numerator of 306 cases, and an incidence density of diagnosed CTS of 4.34 per 1,000 person-years.

	Raw data	Exclude previous onset	Exclude non-CTS cases
Numerator	521	- 139 = 382	- 76 = 306
Denominator	70,713	- 139 = 70,574	70,574

This incidence rate is comparable to that found by Nordstrom and colleagues (4) in Wisconsin in 1994-1995, and somewhat higher than the rates cited by other authors (2, 3, 5). As noted above, it would be necessary to compare the characteristics of the population at risk in order to interpret these differences appropriately. Overall, the Fallon HMO members have an age and gender distribution that appears to be consistent with the general population of Massachusetts.

Interview Response Rate

Persons who did not have CTS were not eligible for interview. The primary care providers of five cases could not be located to seek their permission for case contact, and the physician of one

CTS patient refused permission to interview the subject. In all, 23 subjects were sampled for interview, predominantly from the first two case groups. There were only three (14%) refusals (Table 12), but nine subjects (41%) could not be located (no answer on multiple telephone attempts, telephone number disconnected, etc.). The end of the funded study period truncated further follow-up attempts.

Frequency of Work-Relatedness

Of the 11 completed questionnaires or telephone interviews, one was a subject who had had epicondylitis during the intervening period and declined to answer a large number of questions pertaining to her earlier CTS, including the questions regarding occupational exposures. Another case had been on long-term disability leave for another condition and had no work history for the time period in question.

The nine remaining interviews obtained sufficient information to judge work-relatedness. However, one interview (for subject #22) was conducted with a proxy respondent (the mother of a student away at college) who knew some but not all information sought regarding her son's summer work experience. One interviewed subject was judged unlikely to have a work-related condition (Table 13). Three were judged as definitely work-related on the basis of the exposures described in the interview, 2 as probably and 3 as possibly work-related. The finding of 45% work-related cases is comparable to two other estimates from other samples of the general population (6, 7).

The medical records for two of the 5 probably or definitely work-related cases also contained similar opinions, while three charts had shown no evidence of such a judgment. Of note, one subject (subject #18) who had been listed in the medical record as a security guard was found on interview to be an administrative assistant for a security firm who performed clerical duties full-time. The high-school student (#22) with a full-time summer job in a computer programming firm had apparently not discussed this position with his pediatrician at all.

Another subject (#24), who was diagnosed with CTS in 1998 and described mild but classic symptoms on interview, reported that his previous PCP had attributed these symptoms to “low blood pressure” for about 12 or 15 years, and that the CTS diagnosis had been immediate upon change of PCP in 1998. However, the new provider also did not appear to have explored the work-relatedness of the condition with this patient.

No interviewed subject reported filing a workers' compensation (WC) claim for CTS. One of the specific aims had been to compare work-related cases who did and did not file claims in order to identify individual and occupational factors that might act as barriers or incentives to claim filing or receiving benefits. However, since there was no evidence of either WC payments or claims for the 60 study subjects, this analysis could not be carried out.

Study Instruments

A number of study instruments were developed for this investigation. Four algorithms for searching the HMO medical record database were developed and compared for their utility in locating CTS cases and desirable revisions in the search strategy have been noted for future use. The standardized interview was finalized and evaluated during the course of ten interviews, and a list of revisions for future use has been noted. The decision rules for determination of probability of CTS and of work-relatedness were also revised and evaluated. Data entry templates (in Microsoft Access) were developed and utilized for both the chart reviews and case interviews.

During the conduct of this pilot study, several necessary revisions to the study instruments were identified (listed below) beyond those done during the pilot-testing stage. These revisions will be made before any future use of the same study protocol.

In sum, the procedures and decision rules necessary for identification of likely work-related cases have been developed. Although only a small number of cases was evaluated in this pilot study, a future large-scale investigation using the same study methods will be able to achieve the substantive goals that motivated this project.

Medical Record Search Code:

- Use an upper age limit of 65, not 55. (This had initially been the intention, but a programming error was not caught early enough to permit re-running the program.)

- ▶ Separate the search criteria in Run 3 so that subjects can be linked back to the diagnosis that led to their inclusion.

Medical Chart Review Form:

- ▶ Add item on hand dominance.
- ▶ Provide more specific instructions on the chart regarding the time period of interest for weight gain, pregnancy, work history, etc.
- ▶ In section F (hand/wrist symptoms), drop “burning” or combine with “pain,” because it was found in so few records; “weakness” and “clumsiness” will be combined for the same reason. The item, “distribution of symptoms (code 1, 2, 3)” will also be dropped because no record provided the necessary information to make such a judgment.
- ▶ Add item to note if CTS was accompanied or preceded by tendon inflammation (deQuervain's disease, wrist ganglion, etc.) on same side. Also add item regarding other hand or wrist surgery for these symptoms (e.g., trigger thumb release on the same side).
- ▶ As noted above, the study decision rules for probability of CTS were probably too conservative, in that they required details regarding symptom quality, distribution and temporal pattern that were generally not addressed in the charts. The decision rules will need to be revised to address these findings.

Case Interview:

- ▶ Pages 1-2: Add work history response categories of student, homemaker, self-employed, holding two jobs simultaneously.

- ▶ Add clarification: If subject was performing housework and/or childcare but not working outside the home, refer to as “Job A”
- ▶ Add item: Job was temporary only, e.g., summer employment.
- ▶ Add item: If subject was disabled and not working at all (and then skip to item 36. If still not working at all, skip again to item 46).
- ▶ Page 4: Add item re: whether work demands are constant or vary from day to day.
- ▶ Page 5: Add item re: past or present occupational exposure to heavy metals, solvents, and other neurotoxic chemical agents.
- ▶ Item 30: Delete (ambiguous; not referred to in decision rules for work-relatedness)
- ▶ Item 32: Add workstation or keyboard edge to “e.g., a tool handle”
- ▶ Page 6: Add items re: aggravation of symptoms by work activities; improvement in symptoms if away from work for one week or more.
- ▶ Item 34: Resolve ambiguity as to whether “have a problem” means “unable to do,” “find difficult but know how to compensate,” or “do even though uncomfortable.”
- ▶ Item 37: Add reply option, “(4) Because it was a temporary situation”
- ▶ Page 11: Add items re: hand dominance and non-occupational risk factors (e.g., hours per week in hand-intensive hobbies, history of wrist injury).
- ▶ Item 57: Add reply options, “(a) In my opinion, the problem was not related to my work” and “(b) I did not want to get involved with the workers' compensation system.”
- ▶ Page 18: Add item requesting the subject's permission to contact the employer for whom s/he was working when CTS symptoms began, without identifying him/her by name, in order to obtain additional workplace information. (This item was originally to have been included,

but it was deleted when delays in the work plan made it evident that employer interviews could not be conducted.)

Conclusions

The primary objective of this pilot study project has been fulfilled. Data from this HMO have proved a feasible and effective means of identifying incident CTS cases within a well-defined sample of the general population. Searching for CTS diagnoses, after exclusion of persons with the same diagnosis in preceding years, was a fairly efficient strategy, although even extending the exclusion period backward will not eliminate all recurrences, since some persons will have been previously treated for CTS at other facilities. It was also effective to include diagnoses of “median nerve lesion, not elsewhere classified” and “causalgia” in combination with NCV testing or splinting, and this last sub-group might be enlarged slightly in future with other treatment codes. Even with these additions to the case mix, agreement was good (82% overall) between medical diagnoses and record reviews.

After identifying recurrent CTS cases on chart review and adding those subjects with likely CTS although not (yet) so diagnosed, the incidence density rate of diagnosed CTS in this HMO population was estimated as 4.34 cases per 1,000 person-years. Among ten CTS cases interviewed, four (45%) were judged to be definitely or probably work-related. None of these had filed worker's compensation claims in 1998, although one person went on to do so by 2000. Anecdotally, two interviewees expressed strong aversion to involving themselves with the compensation system.

In this pilot study sample of 35 medical charts, medical care providers appeared fairly consistently to have ascertained the patient's occupation but infrequently to have asked detailed questions about specific ergonomic exposures or to have recommended changes in work practices or duties. Certainly it would be desirable if providers made a systematic attempt to obtain exposure history from patients seeking medical attention for hand and wrist symptoms, whether or not the diagnosis is CTS. Judging from these preliminary data, there may be a substantial number of CTS cases, and perhaps cases of other upper extremity conditions as well, coming to medical attention where opportunities for prevention or early intervention are lost.

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Table 1. Search algorithms for incident carpal tunnel syndrome (CTS) among health maintenance organization (HMO) members, 1998.

Algorithm	Search criterion(a)	No. of records identified	Specific selection criteria (n)
1 (106)	CTS diagnosis in 1998 *	691	
2 (107)	CTS diagnosis in 1998; <u>Exclude</u> CTS diagnosis in 24 months before index month	521	
3 (108)	Other UE diagnosis in 1998; <u>Exclude</u> CTS diagnosis in 1998 and back to 24 months before index month	108	Raynaud's syndrome (81) Other median nerve lesion (12) Causalgia <u>with</u> Short arm splint or nerve conduction velocity (NCV) testing (arm) (15)
4 (109)	CTS treatment in 1998; <u>Exclude</u> CTS diagnosis in 1998 and back to 24 months before index month	545	Carpal tunnel surgery, wrist arthroscopy, wrist arthrocentesis, short arm splint, or NCV testing (arm) (545)

* Includes 170 cases with earlier CTS diagnosis in a previous year, in either hand (i.e., subjects in Group 1 but not Group 2)

Table 2. Results of 60 medical chart reviews for potential cases of incident carpal tunnel syndrome (CTS), HMO members in 1998.

Group*	CTS diagnosis	Probability of CTS by chart review	Frequency n (%)	Other chart notations, diagnoses, etc. (n)
1	Yes	Definite/Probable	11 (18.3)	(1) DNS sx distribution; neg. Tinel's and Phalen's, no other tests
		Possible	2 (3.3)	
		Unlikely	1 (1.7)	
	No	Unlikely	1 (1.7)	
2	Yes	Definite/Probable	2 (3.3)	(1) Symptoms described in ulnar distribution (1) DNS sx distribution or whether nocturnal; no tests; prior bilateral CTS (1992); "pt. c/o bilateral CTS" in 1998 (2) DNS sx distribution or whether nocturnal; Tinel's and thenar atrophy negative or not done, no other tests (1) DNS sx distribution or whether nocturnal; pos. Tinel's and Phalen's (normal NCV in 2000)
		Possible	3 (5.0)	
		Unlikely	5 (8.3)	
	No	Possible	2 (3.3)	(1) "Probable upper extrem. mononeuropathy;" NCV normal 8 months later (1) Pt. reported prior CTS (n.d.); nocturnal tingling, but negative Tinel's and Phalen's signs
		Unlikely	3 (5.0)	

Group*	CTS diagnosis	Probability of CTS by chart review	Frequency n (%)	Other chart notations, diagnoses, etc. (n)
3	Yes	Definite	2 (3.3)	
		Possible	3 (5.0)	
	No	Probable	1 (1.7)	(1) Notation: "Possible CTS;" sx in median nerve distribution, weak pos. Tinel's, neg. thenar atrophy and sensory testing, no NCV (1) Nocturnal tingling, paresthesia, pain, DNS distribution; pos Tinel's, neg thenar atrophy, no other tests; "wrist sx due to weight gain during pregnancy"
		Possible	1 (1.7)	
		Unlikely	8 (13.7)	
4	No	Possible	1 (1.7)	(1) DNS sx distribution or whether nocturnal; no tests; "bilateral hand paresthesia" in 1991, 1994; "peripheral nerve compression, ... no treatment advised" in 1995; diagnosis of moderately severe CTS by NCV in 2000 with surgical release
		Unlikely	14 (23.3)	

* See Table 1 for group definitions

Abbreviations:

CTS	carpal tunnel syndrome
c/o	complains of
DNS	did not specify
dx	diagnosis
NCV	nerve conduction velocity
n.d.	no date
neg.	negative
pos.	positive
pt.	Patient
sx	symptoms

Incidence of CTS in a HMO Population

Table 3. Demographic data for 34 possible or likely CTS cases whose medical charts were abstracted

	Male	Female	Total
White	5	18	23
Black	0	2	2
Asian	0	1	1
Other / Did not specify	4	4	8
Total	9	25	34

Table 4. Age, height and weight of 34 possible or likely CTS cases whose medical charts were abstracted

Variable (n*)	Mean	Std. Dev.	Minimum	Maximum
Age, years (32)	43.5	10.6	19.0	57.9
Height, inches (24)	66.7	4.2	61.0	75.0
Weight, pounds (27)	188.4	56.2	115.0	348.0
Body mass index (24)	30.8	7.8	21.5	54.7

* Number of subjects with non-missing values

Incidence of CTS in a HMO Population

Table 5. Hand and wrist symptoms (as of date of diagnosis) in 34 possible or probable CTS cases whose medical charts were abstracted.

<u>Symptom</u>	<u>Right (only)</u>	<u>Left (only)</u>	<u>Both</u>
Tingling/Paresthesia	8	9	14
Burning	1	0	1
Pain	5	7	7
Weakness	1	2	1
Clumsiness	1	1	0
Nocturnal?	6	2	5
Median nerve distrib. specified (esp. digits 2,3)	4	4	5

Table 6. Examination findings (as of date of diagnosis) in 34 possible or probable CTS cases whose medical charts were abstracted. Findings were not mutually exclusive. Subjects not shown were not tested, or the information was missing in the chart.

	<u>Right</u>		<u>Left</u>	
<u>Examination</u>	Positive	Negative	Positive	Negative
Tinel's sign	11	11	9	8
Thenar atrophy	0	9	1	7
Phalen's test	13	2	7	4
Sensory testing*	1	6	1	5

* Pinprick, Semmes-Weinstein, two-point discrimination, etc.

Incidence of CTS in a HMO Population

Table 7. Electrodiagnostic results (as of date of diagnosis), according to the clinical impression of the neurologist, in 34 possible or probable CTS cases whose medical charts were abstracted. Findings were not mutually exclusive. Subjects not shown were not tested, or the information was missing in the chart.

	Normal or Inconclusive	Mild	Moderate	Severe
Right hand	1	8	1	0
Left hand	1	7	2	0

Table 8. Clinical diagnoses in 34 possible or probable CTS cases whose medical charts were abstracted.

	CTS	Possible CTS	Other diagnoses	N/A (no symptoms in this hand) or missing
Right hand	23*	1	Wrist tendonitis 3	7
Left hand	21+	0	Wrist tendonitis 1	10
			"Upper extremity mononeuropathy" 1	
			"Bilateral hand paresthesias"*** 1	

* Includes 1 subject who also had right "elbow tendonitis"

+ Includes 1 subject who also had cervical radiculopathy

** Same subject as one of the 3 with right wrist tendonitis

Incidence of CTS in a HMO Population

Table 9. Pre-existing medical conditions (as of date of diagnosis) in 34 possible or probable CTS cases whose medical charts were abstracted

	Yes	No	No information in chart
Diabetes mellitus	4	13	17
Pregnancy*	2	12	10
Hypothyroidism	0	13	21
Obesity	12	9	13
Recent rapid weight gain	2	10	1†
Rheumatoid arthritis	2	10	22
Systemic lupus erythmatosus	0	8	26
Gout	0	8	26
Colles wrist fracture	1	8	25
Estrogen medication*	4	8	13

* Among 25 female cases.

† Of 13 charts with no explicit notation regarding obesity, body weight was found in all but one and Quetelet body mass index could be calculated for all but 4 subjects (see Appendix VIII).

Incidence of CTS in a HMO Population

Table 10. Occupational exposure information recorded in 34 medical charts of possible or probable CTS cases.

	Yes	No	Did not specify
Intensive/continuous keyboard work	5	1	28
Other repetitive motion	8	0	26
Forceful manual exertion	2	0	32
Awkward posture	4	0	30
Pressure on palm or wrist	1	0	33
Vibration	0	1	33
Cold	0	1	33
Neurotoxic agents (metals, solvents, etc.)	0	2	32
Symptoms provoked by cold and/or vibration	0	1	33
Symptoms provoked/worsened by work	3	3	28
Symptoms improve after weekend or vacation	0	1	33

Incidence of CTS in a HMO Population

Table 11. Information on treatments and workplace interventions recorded in 34 medical charts of possible or probable CTS cases. Interventions were not mutually exclusive. Subjects not shown: no notation present in the chart.

	<u>Yes: Carried out</u>	<u>Recommended (only)</u>	<u>No</u>
Surgical Release:			
Right wrist	8	0	3
Left wrist	0	4*	4
Wrist splint(s)	21	3	4
Medication	9	4	7
Physical therapy	6	2	2
Reduce household activities	1	1	1
Leave job	0	1	1
Change workstation	0	2	2
Change work hours	0	2	2
Change work duties or equipment	2	3	2

* All 4 of these subjects had had right carpal tunnel releases

Incidence of CTS in a HMO Population

Table 12. Results of interview attempts, by case group: 22 subjects with CTS diagnosed or possible/probable/definite on chart review.

Group*	Interview obtained	Refused	Could not locate	Total attempts
1	7	1	4	12
2	2	1	3	6
3	2	0	1	3
4	0	1	0	1
Total	11	3	8	22

* See Table 1 for group definitions

Table 13. Work history and exposure information (as of symptom onset) for 7 interviewed CTS cases, and reviewer's judgment of probable work-relatedness.

Pt.	Job title (duration*)	Occupational exposures	Non-occupational risk factors	Probability of work- relatedness
1	H.S. student; Cashier (PT: 3 mo)	Typing on computer	Cheerleading, gymnastics; stress fracture (wrist) from softball	Unlikely
2	Transcriptionist: keyboard use and writing (FT: 8 yr.)	Rep. wrist bending: >8 h/d Static bent wrist: >8 h/d Repetition scale+: 4/10 Rep. hand/finger motions: 6-8 h/d Hands cold at work (winter only): >8 h/d	Pregnancy	Definite
3	Nurse: record review at keyboard, in risk management dept. (FT: 6 mo.)	Rep. wrist bending: 2-4 h/d Static bent wrist: 2-4 h/d Repetition scale: 4/10 Rep. hand/finger motions: 2-4 h/d Hand force scale: 1/7 High hand forces (DNS duration)	Recent rapid weight gain	Possible

Pt.	Job title (duration*)	Occupational exposures	Non-occupational risk factors†	Probability of work- relatedness
24	Sheet metal mechanic: handle sheet metal, operate power tools (FT: 6 yr.)	Rep. wrist bending: 2-4 h/d Static bent wrist: 2-4 h/d Repetition scale: 6/10 Rep. hand/finger motions: 2-4 h/d Hand force scale: 5/7 High hand forces: 4-6 h/d Segmental vibration: up to 2 h/d	None	Definite
25	Cabinet-maker: handle heavy stock, operate power tools (FT: 21 yr.)	Rep. wrist bending: >8 h/d Repetition scale: 4/10 Rep. hand/finger motions: 2-4 h/d Hand force scale: 6/7 High hand forces: 2-4 h/d Segmental vibration: 2-4 h/d	None	Definite
32	Data entry operator at computer key pad (FT: 1.5 yr.)	Rep. wrist bending: 4-6 h/d Static bent wrist: 4-6 h/d Repetition scale: 9/10 Rep. hand/finger motions: 4-6 h/d Hand force scale: 7/7	Home remodeling: painting, hammering, raking, etc.	Probable

Key to Table 13:

* FT= Full-time, PT = part-time

† Information taken primarily from medical record

+ Repetition scale adapted from Latko et al. [, 1997 #734] for self-report

§ Interview obtained from proxy respondent; not all items answered

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Appendix I.

Age and gender distribution of Fallon Health Maintenance Organization (HMO) members

FALLON COMMUNITY HEALTH PLAN
Membership by Age and Sex
at August 31, 1998

Regular Plan
All Programs

Age	Male		Female		Total	
	Number	Percent	Number	Percent	Number	Percent
<1	1,292	1.4%	1,192	1.3%	2,484	1.4%
1-4	5,603	6.3%	5,389	5.9%	10,992	6.1%
5-9	8,096	9.0%	7,602	8.3%	15,698	8.7%
10-14	7,977	8.9%	7,495	8.2%	15,472	8.5%
15-19	7,254	8.1%	6,959	7.6%	14,222	7.9%
20-24	4,701	5.2%	5,594	6.1%	10,295	5.7%
25-29	5,889	6.6%	6,677	7.3%	12,566	6.9%
30-34	7,882	8.6%	8,259	9.0%	15,941	8.8%
35-39	8,773	9.8%	9,081	9.9%	17,854	9.9%
40-44	8,737	9.7%	8,999	9.9%	17,736	9.8%
45-49	7,733	8.6%	7,814	8.6%	15,547	8.6%
50-54	6,366	7.1%	6,415	7.0%	12,781	7.1%
55-59	4,729	5.3%	4,921	5.4%	9,650	5.3%
60-64	3,565	4.0%	3,860	4.2%	7,425	4.1%
65-69	765	0.9%	643	0.7%	1,408	0.8%
70-74	309	0.3%	254	0.3%	563	0.3%
75-79	122	0.1%	100	0.1%	222	0.1%
80-84	33	0.0%	28	0.0%	61	0.0%
85+	18	0.0%	30	0.0%	48	0.0%
Unknown	0	0.0%	0	0.0%	0	0.0%
Total	89,644	100.0%	91,321	100.0%	180,965	100.0%
Percent	49.5%		50.5%		100.0%	

Senior Plan
All Programs

Age	Male		Female		Total	
	Number	Percent	Number	Percent	Number	Percent
<1	0	0.0%	0	0.0%	0	0.0%
1-4	0	0.0%	0	0.0%	0	0.0%
5-9	0	0.0%	0	0.0%	0	0.0%
10-14	0	0.0%	0	0.0%	0	0.0%
15-19	0	0.0%	0	0.0%	0	0.0%
20-24	1	0.0%	4	0.0%	5	0.0%
25-29	10	0.1%	13	0.1%	23	0.1%
30-34	22	0.2%	13	0.1%	35	0.1%
35-39	30	0.2%	23	0.1%	53	0.2%
40-44	36	0.3%	35	0.2%	71	0.2%
45-49	67	0.5%	60	0.3%	127	0.4%
50-54	109	0.8%	82	0.4%	191	0.6%
55-59	167	1.2%	125	0.7%	292	0.9%
60-64	290	2.1%	236	1.2%	526	1.6%
65-69	3,282	23.9%	4,240	22.2%	7,522	22.9%
70-74	3,854	28.1%	4,884	25.6%	8,739	26.6%
75-79	2,877	21.0%	4,103	21.5%	6,980	21.3%
80-84	1,888	13.8%	3,046	16.0%	4,934	15.0%
85+	1,091	7.9%	2,209	11.8%	3,300	10.1%
Unknown	0	0.0%	0	0.0%	0	0.0%
Total	13,724	100.0%	18,073	100.0%	32,797	100.0%
Percent	41.8%		58.2%		100.0%	

Appendix II.

Data extraction plan for identifying potential incident cases
of carpal tunnel syndrome (CTS)
from Fallon HMO records

Data Extraction Plan- CTS incidence Pilot

Study begin date is 1/1/98					
Data Extraction Run	Detailed Description	Include/Exclude Codes before index date		Include/Exclude Codes after index date	
		1996 Exclude	1997 Exclude	1998 Include	Exclude
#1 (CTS Diagnosis)	CTS Study design1: I.D. all cases of CTS in 1998 - no exclusions ICD-9 354.0 (may include non-incident cases already diagnosed with CTS in 1996 or 1997)	Number of months to apply EXCLUSIONS BEFORE index date is 0 months Number of months to apply EXCLUSIONS AFTER index date is 0 months		All CTS Diagnosis Criteria 1: (ICD-9 354.0) Number of months to apply INCLUSIONS BEFORE index date is 0 months Number of months to apply INCLUSIONS AFTER index date is 12 months	
#2 (CTS Diagnosis)	CTS Study design2: I.D. all incident cases who developed CTS for the first time in 1998 - excluding those cases with a CTS diagnosis in 1996 or 1997	All CTS Diagnosis Criteria 1: (ICD-9 354.0) Number of months to apply EXCLUSIONS BEFORE index date is 24 months Number of months to apply EXCLUSIONS AFTER index date is 0 months	All CTS Diagnosis Criteria 1: (ICD-9 354.0)	All CTS Diagnosis Criteria 1: (ICD-9 354.0) Number of months to apply INCLUSIONS BEFORE index date is 0 months Number of months to apply INCLUSIONS AFTER index date is 12 months	

ACTIONS:

- 1): Delete people identified in data extraction 2 from data extraction 1. Resulting table will be people already diagnosed with CTS in 1996 or 1997 and with another diagnosis of CTS in 1998. Pull 100% if few or 50% if many to determine if the 1998 diagnosis is a repeated diagnosis on the same hand or an incident case on the other hand
- 2): Resulting table from run #2 will be all incident CTS cases in 1998. Pull 50% for medical record review

Questions for Sue:

- 1) Extraction runs 1 and 2 together will be used to find: 1) which cases were incident only in 1998 and 2) which cases had been incident in 1996 or 1997 and so the 1998 diagnosis could be repetitive or could be the other hand. Will we have a unique variable which will identify a particular person to match on such as a Fallon account number?

Data Extraction Plan

Study begin date is 1/1/98					
Data Extraction Run	Detailed Description	Include/Exclude Codes before index date		Include/Exclude Codes after index date	
		1996 Exclude	1997 Exclude	1998 Include	1998 Exclude
#3 (Diagnosis of other U.E extremity disorders)	CTS study design3: I.D all incident cases of "Other UE disorders" to determine if they are missed CTS cases	All CTS Diagnosis Criteria 1: (ICD-9 354.0)	All CTS Diagnosis Criteria 1: (ICD-9 354.0)	All other U.E. diagnosis: Criteria 2: ICD-9 443.0 Criteria 3: ICD -9 354.1 Criteria 4: ICD 9 354.4 AND ((CPT 29125-->29126) OR ((CPT 95860-->95864)) Criteria 5: ICD 9 354.4 AND ((CPT 29125-->29126) OR ((CPT 95860-->95864)) Criteria 6: ICD 9 782.0 AND ((CPT 29125-->29126) OR ((CPT 95860-->95864)) Criteria 7: ICD 9 356.9 AND ((CPT 29125-->29126) OR ((CPT 95860-->95864))	All CTS Diagnosis *Criteria 1: (ICD-9 354.0)
		Number of months to apply EXCLUSIONS BEFORE index date is 24 months *Number of months to apply EXCLUSIONS AFTER index date is 12 months		Number of months to apply INCLUSIONS BEFORE index date is 0 months Number of months to apply INCLUSIONS AFTER index date is 12 months	

Data Extraction Plan

Data Extraction Plan					
Study begin date is 1/1/98					
Data Extraction Run	Detailed Description	Include/Exclude Codes before index date		Include/Exclude Codes after index date	
		1996 Exclude	1997 Exclude	1998 Include	1998 Exclude
#4 (Treatments for CTS without a related diagnosis)	CTS study design3: I.D all incident cases that received treatments usually performed on CTS patients to determine if they are missed CTS cases	All CTS Diagnosis Criteria 1: (ICD-9 354.0)	All CTS Diagnosis Criteria 1: (ICD-9 354.0)	All treatments specific to CTS Criteria 2: ICD-9 04.43 Criteria 3: CPT 64721 Criteria 4: CPT 29848 Criteria 5: CPT 20605 Criteria 6: CPT 95860-->95864 Criteria 7: CPT 29125->29126	All CTS Diagnosis *Criteria 1: (ICD-9 354.0)
		Number of months to apply EXCLUSIONS BEFORE index date is 24 months *Number of months to apply EXCLUSIONS AFTER index date is 12 months		Number of months to apply INCLUSIONS BEFORE index date is 0 months Number of months to apply INCLUSIONS AFTER index date is 12 months	

Questions for Sue:

2) For extraction run 3, we will want to know which ICD-9 codes provided which cases - our medical record sampling strategy may depend on this, and our next study design will depend on knowing this. Therefore if we cannot find this out from the printout in one criterion then we will need to set up separate criteria for each ICD-9 code.

106 CTS Study 1

Study Begin Date	01/01/1998	Study Department Name	Research/Occ Health	
General Description	No Excl, Incl CTS Dx for year of 1998 - 1 criterion			
Detail Description	Will include based on cts only for year of 1998, no exclusions. Standard membership criteria (6month window before index date). No controls.			
Row Create Date	04/13/2000	Last Update	04/27/2000	Updated By Sama
Fallon PI	Celona	Other PI	Punnett	Enroll End Date 01/01/1998
Follow-up End Date		Index Interval	Monthly	
Months of Membership Required Prior to Index Date	6			Include Female
Months of Membership Required After Index Date	1			Include Male
	Plan Type Include	FSC_CD	853	FALLON JUNIOR FC OPTION
Minimum Days Gap Before Index Date	0			Minimum Days Gap After Index Date 0
Maximum Days Gap Before Index Date	45			Maximum Days Gap After Index Date 0
Include Lowest Age	15	Include Highest Age	55	Exclude Deceased Member
Comment	Six months window before index date with 45 day max gap, 1 month window after index date with no gap allowed after index date, age 15-55, M&F.			
Require matching on gender		Max Age Difference (Months, 0=No age match)	12	Controls per case 0
Control Criteria Description	Age and gender matched, 0 controls per case			
Number of Months to Apply EXCLUSIONS BEFORE Index Date				0
Number of Months to Apply EXCLUSIONS AFTER Index Date				0
Number of Months to Apply INCLUSIONS BEFORE Index Date				0
Number of Months to Apply INCLUSIONS AFTER Index Date				12

Criteria Number	1	Include Exclude Code	Include
-----------------	---	----------------------	---------

Diagnosis Criteria

Low ICD-9 Code	354.0
----------------	-------

High ICD-9 Code	354.0
-----------------	-------

Primary Diagnosis Indicator	No
-----------------------------	----

Type of claim code	All
--------------------	-----

Same Criteria Count	1
---------------------	---

We select everyone who does meet this criteria.

This DX criterion is combined with other members of Study Number :106 Criteria Number : 1 as an AND condition.

Comment simple query for 354.0 CTS

107 CTS study 2

Study Begin Date	01/01/1998	Study Department Name	research/occupational health	
General Description	Incl CTS Dx for year of 1998, Exclusion of cts cases for 24 months prior to index month			
Detail Description	Will include based on cts only for year of 1998, Exclusion of cts cases for 24 months prior to index month. Standard membership criteria (6month window before index date). No controls.			
Row Create Date	04/13/2000	Last Update	04/28/2000	Updated By Sama
Fallon PI	Celona	Other PI	Punnett	Enroll End Date 01/01/1998
Follow-up End Date		Index Interval	Monthly	
Months of Membership Required Prior to Index Date	6			Include Female
Months of Membership Required After Index Date	1			Include Male
	Plan Type Include	FSC_CD	853	FALLON JUNIOR FC OPTION
Minimum Days Gap Before Index Date	0	Minimum Days Gap After Index Date	0	
Maximum Days Gap Before Index Date	45	Maximum Days Gap After Index Date	0	
Include Lowest Age	15	Include Highest Age	55	Exclude Deceased Member
Comment	Six months window before index date with 45 day max gap, 1 month window after index date with no gap allowed after index date, age 15-55, M&F.			
Require matching on gender		Max Age Difference (Months, 0=No age match)	12	Controls per case 0
Control Criteria Description	Age and gender matched, 0 controls per case			
Number of Months to Apply EXCLUSIONS BEFORE Index Date				24
Number of Months to Apply EXCLUSIONS AFTER Index Date				0
Number of Months to Apply INCLUSIONS BEFORE Index Date				0
Number of Months to Apply INCLUSIONS AFTER Index Date				12

Criteria Number	1	Include Exclude Code	Both
Diagnosis Criteria			
Low ICD-9 Code	354.0		
High ICD-9 Code	354.0		
Primary Diagnosis Indicator	No		
Type of claim code	All		
Same Criteria Count	1		

We select everyone who does meet this criteria.

This DX criterion is combined with other members of Study Number :107 Criteria Number : 1 as an AND condition.

Comment simple query for 354.0 CTS

108 CTS Study 3

Study Begin Date	01/01/1998	Study Department Name	Research/Occupational Health	
General Description	Incl Upper Extremity Disorders for 1998, Exclusion of cts cases for 24 months prior to index month			
Detail Description	Will include based on UE disorders only for year of 1998, Exclusion of cts cases for 24 months prior to index month. Standard membership criteria (6month window before index date). No controls.			
Row Create Date	04/13/2000	Last Update	04/28/2000	Updated By Sama
Fallon PI	Celona	Other PI	Punnett	Enroll End Date 01/01/1998
Follow-up End Date		Index Interval	Monthly	
Months of Membership Required Prior to Index Date	6		Include Female	
Months of Membership Required After Index Date	1		Include Male	
Minimum Days Gap Before Index Date	0	Minimum Days Gap After Index Date	0	
Maximum Days Gap Before Index Date	45	Maximum Days Gap After Index Date	0	
Include Lowest Age	15	Include Highest Age	55	Exclude Deceased Member
Comment Six months window before index date with 45 day max gap, 1 month window after index date with no gap allowed after index date, age 15-55, M&F.				
Require matching on gender		Max Age Difference (Months, 0=No age match)	12	Controls per case 0
Control Criteria Description	Age and gender matched, 0 controls per case			
Number of Months to Apply EXCLUSIONS BEFORE Index Date				24
Number of Months to Apply EXCLUSIONS AFTER Index Date				0
Number of Months to Apply INCLUSIONS BEFORE Index Date				0
Number of Months to Apply INCLUSIONS AFTER Index Date				12

Criteria Number 1 **Include Exclude Code** Both

Diagnosis Criteria

Low ICD-9 Code 354.0

High ICD-9 Code 354.0

Primary Diagnosis Indicator No

Type of claim code All

Same Criteria Count 1

We select everyone who does meet this criteria.

This DX criterion is combined with other members of Study Number :108 Criteria Number : 1 as an AND condition.

Comment simple query for 354.0 CTS

Criteria Number	2	Include	Exclude	Code	Include
Diagnosis Criteria					
Low ICD-9 Code	443.0				
High ICD-9 Code	443.0				
Primary Diagnosis Indicator	No				
Type of claim code	All				
Same Criteria Count				1	

We select everyone who does meet this criteria.

This DX criterion is combined with other members of Study Number :108 Criteria Number : 2 as an OR condition.

Comment Raynaud's Syndrome

Criteria Number	3	Include	Exclude	Code	Include
Diagnosis Criteria					
Low ICD-9 Code	354.1				
High ICD-9 Code	354.1				
Primary Diagnosis Indicator	No				
Type of claim code	All				
Same Criteria Count				1	

We select everyone who does meet this criteria.

This DX criterion is combined with other members of Study Number :108 Criteria Number : 3 as an OR condition.

Comment Median Nerve Lesion NEC

Criteria Number 4 Include Exclude Code Include

Diagnosis Criteria

Low ICD-9 Code 356.9

High ICD-9 Code 356.9

Primary Diagnosis Indicator No

Type of claim code All

Same Criteria Count 1

We select everyone who does meet this criteria.

This DX criterion is combined with other members of Study Number :108 Criteria Number : 4 as an OR condition.

Comment Peripheral Neuropathy

Procedure Criteria

Low Procedure Code 29125 APPLICATION SHORT ARM SPLINT

High Procedure Code 29126 APPLICATION, SPLINT, SHORT ARM, DYNAMIC

Type of claim code All

Same Criteria Count 1

We select everyone who does meet this criteria.

This Tx criterion is combined with other members of Study Number :108 Criteria Number : 4 as an OR condition.

Comment Short Arm Splint

Low Procedure Code 95860 NEEDLE EMG,ONE EXTREMITY WWO RELATED

High Procedure Code 95864 NEEDLE EMG FOUR EXTREMITIES WWO RELATED

Type of claim code All

Same Criteria Count 1

We select everyone who does meet this criteria.

This Tx criterion is combined with other members of Study Number :108 Criteria Number : 4 as an OR condition.

Comment Needle EMG Arm-4 extremities

Criteria Number 6 Include Exclude Code Include

Diagnosis Criteria

Low ICD-9 Code 782.0

High ICD-9 Code 782.0

Primary Diagnosis Indicator No

Type of claim code All

Same Criteria Count 1

We select everyone who does meet this criteria.

This DX criterion is combined with other members of Study Number :108 Criteria Number : 6 as an AND condition.

Comment skin sensation disturbance

Low ICD-9 Code 356.9

High ICD-9 Code 356.9

Primary Diagnosis Indicator No

Type of claim code All

Same Criteria Count 1

We select everyone who does meet this criteria.

This DX criterion is combined with other members of Study Number :108 Criteria Number : 6 as an AND condition.

Comment idio peripheral neuropathy nos

Procedure Criteria

Low Procedure Code 29125 APPLICATION SHORT ARM SPLINT

High Procedure Code 29126 APPLICATION, SPLINT, SHORT ARM, DYNAMIC

Type of claim code All

Same Criteria Count 1

We select everyone who does meet this criteria.

This Tx criterion is combined with other members of Study Number :108 Criteria Number : 6 as an OR condition.

Comment Arm Splint

Low Procedure Code 95860 NEEDLE EMG,ONE EXTREMITY WWO RELATED

High Procedure Code 95864 NEEDLE EMG FOUR EXTREMITIES WWO RELATED

Type of claim code All

Same Criteria Count 1

We select everyone who does meet this criteria.

This Tx criterion is combined with other members of Study Number :108 Criteria Number : 6 as an OR condition.

Comment UE EMG

Diagnosis Criteria

Low ICD-9 Code	356.9
----------------	-------

High ICD-9 Code	356.9
-----------------	-------

Primary Diagnosis Indicator	No
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Type of claim code	All
--------------------	-----

Same Criteria Count	1
---------------------	---

We select everyone who does meet this criteria.

This DX criterion is combined with other members of Study Number :108 Criteria Number : 7 as an AND condition.

Comment	idiopathic peripheral neuropathy
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Procedure Criteria

Low Procedure Code	29125	APPLICATION SHORT ARM SPLINT
--------------------	-------	------------------------------

High Procedure Code	29126	APPLICATION, SPLINT, SHORT ARM, DYNAMIC
---------------------	-------	---

Type of claim code All

Same Criteria Count	1
---------------------	---

We select everyone who does meet this criteria.

This Tx criterion is combined with other members of Study Number :108 Criteria Number : 7 as an OR condition.

Comment	Short Arm Splints
---------	-------------------

Low Procedure Code	95860	NEEDLE EMG,ONE EXTREMITY WWO RELATED
--------------------	-------	--------------------------------------

High Procedure Code	95864	NEEDLE EMG FOUR EXTREMITIES WWO RELATED
---------------------	-------	---

Type of claim code	All
--------------------	-----

Same Criteria Count	1
---------------------	---

We select everyone who does meet this criteria.

This Tx criterion is combined with other members of Study Number :108 Criteria Number : 7 as an OR condition.

Comment	Needle Emg
---------	------------

109 CTS Study 4

Study Begin Date	01/01/1998	Study Department Name	research/occ health	
General Description	Treatments for CTS without a related dx			
Detail Description	CTS Study Design4: ID all incident cases that received treatments usually performed on CTS pts to determine if they are cts cases. Standard membership criteria (6month window before index date). No controls.			
Row Create Date	04/13/2000	Last Update	04/28/2000	Updated By sama
Fallon PI	Celona	Other PI	Punnett	Enroll End Date 01/01/1998
Follow-up End Date		Index Interval	Monthly	
Months of Membership Required Prior to Index Date	6			Include Female
Months of Membership Required After Index Date	1			Include Male
	Plan Type Include	FSC_CD	853	FALLON JUNIOR FC OPTION
Minimum Days Gap Before Index Date	0			Minimum Days Gap After Index Date 0
Maximum Days Gap Before Index Date	45			Maximum Days Gap After Index Date 0
Include Lowest Age	15	Include Highest Age	55	Exclude Deceased Member
Comment	Six months window before index date with 45 day max gap, 1 month window after index date with no gap allowed after index date, age 15-55, M&F.			
Require matching on gender		Max Age Difference (Months, 0=No age match)	12	Controls per case 0
Control Criteria Description	Age and gender matched, 0 controls per case			
Number of Months to Apply EXCLUSIONS BEFORE Index Date				24
Number of Months to Apply EXCLUSIONS AFTER Index Date				12
Number of Months to Apply INCLUSIONS BEFORE Index Date				0
Number of Months to Apply INCLUSIONS AFTER Index Date				12

Criteria Number	1	Include Exclude Code	Exclude
Diagnosis Criteria			
Low ICD-9 Code	354.0		
High ICD-9 Code	354.0		
Primary Diagnosis Indicator	No		
Type of claim code	All		
Same Criteria Count		1	

We select everyone who does meet this criteria.

This DX criterion is combined with other members of Study Number :109 Criteria Number ; 1 as an AND condition.

Comment simple query for 354.0 CTS

Criteria Number	2	Include	Exclude	Code	Include
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Diagnosis Criteria	
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Low ICD-9 Code	04.43
----------------	-------

High ICD-9 Code	04.43
-----------------	-------

Primary Diagnosis Indicator	No
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Type of claim code	All
--------------------	-----

Same Criteria Count	1
---------------------	---

We select everyone who does meet this criteria.

This DX criterion is combined with other members of Study Number :109 Criteria Number : 2 as an OR condition.

Comment	carpal tunnel release
---------	-----------------------

Appendix III.

Medical chart review form

Template for data entry of chart reviews (in Microsoft Access)

Case tracking form

Coding sheets for chart reviews and case tracking

Medical Records Abstract Form

- Cover Page to be generated from Access Data Base -

Medical Record Number: _____

CTS Case Extraction Code:

a. ICD-9: _____ Date _____ OR
b. CPT: _____ Date _____

Patient's Name: Last _____, First _____

Date of Birth: ____/____/____

N.B. If any of the above items are incorrect or out of date, changes are to be recorded on the abstracting form.

Medical Records Abstract Form

Medical Record Number: _____ Date of review: _____
CTS Case Extraction Codes: a. ICD-9: _____ Date _____ b. ICD-9: _____ Date _____
(Circle diagnosis date) a. CPT: _____ Date _____ b. CPT: _____ Date _____

Diagnosing Physician Name: _____ Department: _____ Medical Specialty: _____

A. Patient Information

Patient's Name: Last _____ First _____

Patient's Address: _____

Home Telephone Number: () _____ Date of Birth: ____/____/____ Sex: Male (1) ____ Female (2) ____

Race: White (1) ____ Black (2) ____ Asian (3) ____ Other (specify) (4): _____

Hispanic: Yes (1) ____ No (2) ____ NA (9) ____ Height: _____ Weight: _____

Primary Language: English (1) ____ Other: _____ (Code: _____)

Occupation or type of work performed by patient: _____ (Code: _____)

Name of company where patient is currently employed: _____

Company address: _____

Type of operation or facility: _____ (Code: _____)

B. Pre-existing medical conditions (any time prior to date of diagnosis)

Diabetes Mellitus Yes (1) ____ No (2) ____ DNS (9) ____

Pregnancy (at time of dx) Yes (1) ____ No (2) ____ DNS (9) ____

Hypothyroidism Yes (1) ____ No (2) ____ DNS (9) ____

Obesity Yes (1) ____ No (2) ____ DNS (9) ____ Amount: _____ lbs

Rapid Weight Gain Yes (1) ____ No (2) ____ DNS (9) ____ Amount: _____ lbs

Rheumatoid Arthritis Yes (1) ____ No (2) ____ DNS (9) ____

Systemic Lupus Erythematusis Yes (1) ____ No (2) ____ DNS (9) ____

Gout Yes (1) ____ No (2) ____ DNS (9) ____

Colles/Wrist Fractures Yes (1) ____ No (2) ____ DNS (9) ____

Estrogen medication? Yes (1) ____ No (2) ____ DNS (9) ____

Prior Carpal Tunnel Syndrome Yes (1) ____ No (2) ____ Date: ____/____/____

Other: _____ Date: ____/____/____

Other: _____ Date: ____/____/____

C. Onset of symptoms Date: ____/____/____

Gradual (1) ____ Source (if specified): _____

Sudden (2) ____ Incident (if specified): _____

Gradual, with sudden worsening (3) ____ Source or Incident(circle one): _____

DNS (9) ____

D. Clinical Diagnosis

Right: CTS (1) ____ N/A (9) ____ Other: _____ (Code: _____)

Date of diagnosis: _____

Left: CTS (1) ____ N/A (9) ____ Other: _____ (Code: _____)

Date of diagnosis: ____/____/____

E. Etiology

Hand-intensive hobbies? Yes (1)___ No (2)___ DNS (9)___ Specify:_____

Sx provoked primarily by cold and/or vibration: Yes (1)___ No (2)___ DNS (9)___

Symptoms provoked/worsened by work: Yes (1)___ No (2)___ DNS (9)___ Specify:_____

Condition improves after weekend/vacation: Yes (1)___ No (2)___ DNS (9)___

Condition determined to be work related? Yes (1)___ No (2)___ DNS (9)___

Condition secondary to other (pregnancy, weight gain, etc.): _____

F. Symptoms in the hands/wrists as of date of CTS diagnosis (check all that apply):

	Left	Right
Tingling /Paresthesia	___	___
Burning	___	___
Pain	___	___
Weakness	___	___
Clumsiness	___	___
Nocturnal?	___	___
Median nerve distrib. specified (digits 2,3)	___	___
Distribution of symptoms (code 1, 2, 3)	___	___
Other (describe): _____		

E. Objective findings as of date of CTS diagnosis Results ("Positive" = test results support CTS dx)

Tinel's:	Right	Not tested (9)___	Positive (1)___	Negative (2)___	Inconclusive (0)___
	Left	Not tested (9)___	Positive (1)___	Negative (2)___	Inconclusive (0)___
		Date of test, if applicable _____			

Thenar Atrophy:	R	Not tested (9)___	Positive (1)___	Negative (2)___	Inconclusive (0)___
	L	Not tested (9)___	Positive (1)___	Negative (2)___	Inconclusive (0)___
		Date of test, if applicable _____			

Phalens:	Right	Not tested (9)___	Positive (1)___	Negative (2)___	Inconclusive (0)___
	Left	Not tested (9)___	Positive (1)___	Negative (2)___	Inconclusive (0)___
		Date of test, if applicable _____			

Sensory Testing : [Pinprick, Semmes- Weinstein, 2-pt etc]	R	Not tested (9)___	Positive (1)___	Negative (2)___	Results:_____
	L	Not tested (9)___	Positive (1)___	Negative (2)___	Results:_____
		Date of test, if applicable _____			

Electrodiagnostic tests: (EMG/NCV)	R	Clinical impression: Severe(3)___ Moderate(2)___ Mild(1)___ Inconclusive(0)___ or Normal			
	L	Clinical impression: Severe(3)___ Moderate(2)___ Mild(1)___ Inconclusive(0)___ or Normal			

Test results available? Yes (1)___ No (2)___ N/A (not done) (9)___

If yes: Right	M. Sensory: Segment W->II	Latency (ms)_____	Amplitude_____
	M. Sensory: Segment W->III	Latency (ms)_____	Amplitude_____
	M. Sensory: Segment P->III	Latency (ms)_____	Amplitude_____
	M. Sensory: Segment P->III	Latency (ms)_____	Amplitude_____
	M. Motor: Segment W->APB	Latency (ms)_____	Amplitude_____
	U. Sensory: Segment W->V	Latency (ms)_____	Amplitude_____
	U. Sensory: Segment P->W	Latency (ms)_____	Amplitude_____
	Date_____	Done at Fallon? Yes (1)___	No (2)___

Left M. Sensory: Segment W->II Latency (ms) _____ Amplitude _____
 M. Sensory: Segment W->III Latency (ms) _____ Amplitude _____
 M. Sensory: Segment P->III Latency (ms) _____ Amplitude _____
 M. Sensory: Segment P->III Latency (ms) _____ Amplitude _____

 M. Motor: Segment W->APB Latency (ms) _____ Amplitude _____

 U. Sensory: Segment W->V Latency (ms) _____ Amplitude _____
 U. Sensory: Segment P->W Latency (ms) _____ Amplitude _____

Date _____ Done at Fallon? Yes (1)___ No (2)___

Other testing: _____

Occupational information

Was work history/description obtained/recorded? Yes (1)___ No (2)___ DNS (9)___

If Yes, check all job characteristics whose presence or absence is noted in the record:

If yes:

Intensive/continuous keyboard:	Yes (1)___	No (2)___	Hours/day:_____	Describe:_____
Other repetitive motion:	Yes (1)___	No (2)___	Hours/day:_____	Describe:_____
Forceful manual exertion:	Yes (1)___	No (2)___	Hours/day:_____	Describe:_____
Awkward posture:	Yes (1)___	No (2)___	Hours/day:_____	Describe:_____
Pressure on palm or wrist	Yes (1)___	No (2)___	Hours/day:_____	Describe:_____
Vibration:	Yes (1)___	No (2)___	Hours/day:_____	Describe:_____
Cold:	Yes (1)___	No (2)___	Hours/day:_____	Describe:_____
Neurotoxic agent (heavy metal, solvent, etc.)	Yes (1)___	No (2)___	Hours/day:_____	Describe:_____

Other: _____

Treatments and Workplace Interventions

	No	Recommended (only)	Yes: Carried out	If yes (first date):
A. Surgical Release:				
Right wrist	(9)___	(2)___	(1)___	Date:_____
Left wrist	(9)___	(2)___	(1)___	Date:_____
B. Wrist splint(s)	(9)___	(2)___	(1)___	Date:_____
C. Medication	(9)___	(2)___	(1)___	Date:_____
D. Physical therapy	(9)___	(2)___	(1)___	Date:_____
E. Reduce household activities	(9)___	(2)___	(1)___	Date:_____
F. Change workstation	(9)___	(2)___	(1)___	Date:_____ Describe:_____
G. Change work hours	(9)___	(2)___	(1)___	Date:_____ Describe:_____
H. Change work duties	(9)___	(2)___	(1)___	Date:_____ Describe:_____
I. Leave job	(9)___	(2)___	(1)___	Date:_____
J. Other intervention(s):	_____			
K. Other recommendations (not implemented):	_____			

Billing:

CTS Payer: Health Plan (1) _____ Workers' Compensation (2) _____ Other (3): _____

Date of last CTS consultation: _____

	As of CTS diagnosis Date: ____/____/____	As of last exam/treatment Date: ____/____/____
Symptom distribution: 1=Classic/Probable 2=Possible 3=Unlikely		
Symptoms nocturnal: 1=Yes 2=No 9=Not specified		
Electrodiagnosis: 4=Severe 3=Moderate 2=Mild 1=Normal 9=Not done		
Physical Exam: 1=Yes 2=No 9=Not done		
Probability of CTS: 4=Definite 3=Probable 2=Possible 1=Unlikely		
Occupational exposures		
Non-occupational risk factors		
Probability of work-relatedness: 4=Definite 3=Probable 2=Possible 1=Unlikely		

Medical Records Abstract Form – Abbreviations and Coding

DNS = Does not state (specify) Medical chart does not contain this information

Language codes:

- | | |
|---|---------|
| 1 | English |
| 2 | Spanish |
| 3 | |

Symptom distribution: see diagram in Katz et al. [LP to provide]

- | | |
|---|------------------|
| 1 | Classic/Probable |
| 2 | Possible |
| 3 | Unlikely |

Occupation codes:

Industry codes:

Ergonomic exposures are defined as:

- a) frequent, repetitive hand or wrist motions on the affected side, including but not limited to intensive or continuous operation of a video display unit keyboard
- b) forceful manual exertions with the affected hand/arm
- c) sustained awkward hand position (e.g., pinch grip); or wrist posture (e.g., flexion, extension, ulnar deviation); or use of the fingers with the wrist flexed
- d) use of a vibrating hand tool or device (including steering wheel), or holding a part to a vibrating device (e.g., grinding wheel)
- e) frequent or prolonged pressure over the wrist or base of the palm on the affected side

Final Record's Abstract Form

Form 10-10-10

01/10/2010

Diagnosing Physician Name:

Department:

Medical Specialty:

Patient's Name: Last:

First

Patient's Address:

Home Telephone Number:

() - 0

Date of Birth:

Sex:

0

Race:

0

Other race:

0

Hispanic:

0

HEIGHT:

0

WEIGHT:

0

Primary Language:

0

Code:

0

Occupation or type of work performed by patient:

0

OCCCODE:

0

Name of company where patient is currently employed:

0

Company address:

0

Type of operation or facility:

0

Code:

0

Pre-existing medical conditions

1=Yes 2=No 9=DNS

Diabetes Mellitus:

0

Pregnant:

0

Hypothyroidism:

0

Obesity:

0

Amount:

0

Rapid Weight Gain:

0

Amount:

0

Rheumatoid Arthritis:

0

Systemic Lupus Erythematosus:

0

Gout:

0

Colles/Wrist Fractures:

0

Was patient taking estrogen medication:

0

Prior CTS:

0

Other1

0

Date of other1

0

Other2

0

Date of other

C. Onset of symptoms

0

Symptom date:

0

If gradual:

0

If sudden:

0

D. Clinical Diagnosis:

Right

0

Other diagnosis/es:

0

Date of diagnosis/es:

0

Left:

0

Other diagnosis/es:

0

Date of diagnosis/es:

0

HANDHOB:

0

HHSPEC:

0

Provoked primarily by cold and/or vibration:

0

Condition worsened by work:

0

Condition improves after weekend/vacation:

0

WORKREL

0

Condition secondary to other

0

F. Symptoms in the hands/wrists (check all that apply):

Left Right

Tingling/Paresesthesia:

0

0

Weakness:

0

0

Burning:

Clumsiness:

Pain:

Nocturnal?

(Classic/Probable, Possible, Unlikely)

Hand Symptom Rating:

L. (0-4) (0-4) (0-4)

Results: Positive = test results support diagnosis

Tinels:

Right

Left:

Date of Test, if applicable:

Thenar Atrophy:

Right

Left:

Date of Test, if applicable:

Phalens:

Right:

Left:

Date of Test, if applicable:

Sensory Testing:

[Pinprick, Semmes-Weinstein, 2pt etc]

Right:

Left:

Date of test, if applicable:

Test results available?

Electrodiagnostic tests:
(EMG/NCV)

Right:

Left:

Date of Test, if applicable:

RSLAT1:

RSAMP1:

LSLAT1:

LSAMP1:

RSLAT2:

RSAMP2:

LSLAT2:

LSAMP2:

RSLAT3:

RSAMP3:

LSLAT3:

LSAMP3:

RSLAT4:

RSAMP4:

LSLAT4:

LSAMP4:

RMLAT:

RMAMP:

LMLAT:

LMAMP:

RUSLAT1:

RUSAMP1:

LUSLAT1:

LUSAMP1:

RUSLAT2:

RUSAMP2:

LUSLAT2:

LUSAMP2:

RSMDATE:

RSMFALL:

LSMDATE:

LSMFALL:

Other testing:

Occupational Information

Yes=1, No=2, DNS=9

Work history/desc. obtained/recorded:

If yes, check below all job characteristics noted:

Use of keyboard

Length

Describe:

Repetition

Length

Describe:

Forceful exertions

Length

Describe:

Awkward wrist posture

Length

Describe:

Case Tracking Form

1. Medical chart available for review:

If no: chart to be replaced with another from same case group

2. Probability of CTS [medical chart]

a. Affected side (current episode):

b. Previous CTS, other side:

3. CTS case selected for interview:

4. Primary care provider contacted:

5. PCP permission to interview:

6. Letter sent to case:

7. Mail/telephone contact(s):

8. Probability of CTS [medical chart & interview]:

9. Probability of work-relatedness [medical chart & interview]:

**Medical Records Abstract and Tracking Forms:
Abbreviations and Coding**

DNS = Does not state (specify) Medical chart does not contain this information

Medical Specialty of diagnosing physician/provider (or dept where patient was seen):

- 1 = Internal Medicine
- 2 = Neurology
- 3 = Rheumatology
- 4 = Pediatrics
- 5 = Urgent Care
- 6 = Orthopedics

Language codes:

- 1 English
- 2 Spanish
- 3

Symptom distribution: see diagram in Katz et al. [LP to provide]

- 1 Classic/Probable
- 2 Possible
- 3 Unlikely

Code 1=yes, 2=no, 9=DNS: Nocturnal symptoms
 PE findings for CTS
 MD dx of CTS

Electrodiagnosis of CTS: 0 = Normal, inconclusive
 1 = Mild
 2 = Moderate
 3 = Severe
 9 = Not done

Abstracter's Judgment re: CTS

- 1 = Unlikely
- 2 = Possible
- 3 = Probable
- 4 = Definite

Other Dx: What disorder did patient have (instead of or in addition to)

- 1 = Cervical radiculopathy, cv neuropathy
- 2 = Tendonitis, etc. (only)
- 3 = Acute injury (incl. fracture, acute traumatic epicondylitis, etc.)
- 4 = Ulnar neuritis/neuropathy (w or w/o teno)
- 5 = Raynaud's
- 6 = Impingement at AC joint, subacromial, thoracic outlet
- 7 = Pregnancy
- 8 = Systemic disease (incl. viral neuropathy)
- 9 = Nothing evident in chart
- 10 = Scoliosis (reason for EMG)

Interview Attempts

- 1 = Successful
- 2 = Partially completed / proxy respondent
- 3 = Refused
- 4 = Could not locate (incl. address change, phone disconnected or number unpublished)
- 5 = Located but inappropriate (not CTS)

Full-time or part-time job

- 1 = Full-time
- 2 = Part-time

Suspected cause of problem

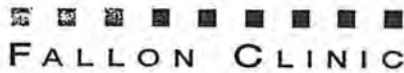
- 1 = Computer, keyboard, mouse or other pointing device
- 2 = Repetitive gripping and handling of heavy materials
- 3 = Writing by hand
- 4 = Both keyboard work and writing
- 9 = Don't know

Appendix IV.

Letter to case's primary care provider requesting permission to contact case with questionnaire

Cover letter to CTS cases, with enclosures

Informed consent form for human subjects, approved by the Institutional Review Boards
of University of Massachusetts Lowell and Fallon Clinic



Study of Carpal Tunnel Syndrome Incidence

December __, 2000

Dear Dr. _____:

We are conducting a study of patients in the Fallon Community Health Plan with new onset of carpal tunnel syndrome. We plan to contact these people by telephone to administer a questionnaire asking about their occupation and work environment, their home activities, and the onset and course of their medical condition. This study has been approved by the Fallon Institutional Review Board and is funded by the National Institute of Occupational Safety and Health through the University of Massachusetts Lowell.

We hope to include the following patient(s) from your practice in our study:

_____	_____
_____	_____
_____	_____

If you do not want us to include this (these) patient(s) in the study, please contact us within ten days of this letter. If we do not hear from you by that date, we will assume that we may proceed with mailing out recruitment letters describing the study to this (these) patient(s) and follow-up with telephone contact.

You may cross off any patient(s) from the above list whom you do not want us to include and fax this sheet to Dr. Punnett 978-452-5711. If you prefer, you may call Dr. Celona at 508-852-0600, ext. 51821, or Dr. Punnett at 978-934-3269 for any further information or to withdraw your patient(s) from this study. You may also contact Dr. Punnett by e-mail (LP@UML.EDU) with any questions.

Thank you very much for your assistance.

Sincerely,

F. Joseph Celona, M.D.
Department of Occupational Medicine
Fallon Clinic, Inc.

Laura Punnett, Sc.D.
Professor, Dept. of Work
Environment
University of Massachusetts Lowell



University of
Massachusetts
Lowell

One University Avenue, Kitson 200
Lowell, Massachusetts 01854-2867 USA
tel: 978.934.3250
fax: 978.452.5711
web site: <http://www.uml.edu/Dept/WE>

DEPARTMENT OF WORK ENVIRONMENT

February 15, 2001

<< Name >>

<< Address >>

<<City>>, <<State>> <<Zip>>

Dear <<Salutation>>:

The University of Massachusetts Lowell, the Massachusetts Department of Public Health, and Fallon Clinic are collaborating on a research study about carpal tunnel syndrome (CTS), a medical condition affecting the nerves of the hand and arm. As part of this study, we are interviewing people with CTS to learn more about factors that can cause or worsen the condition. Fallon Clinic has granted us access to medical records on condition that we keep all information strictly confidential. According to a review of Fallon Clinic records, you have been tested for and/or diagnosed with CTS. We have already obtained permission from your primary care physician to contact you.

A trained interviewer for this study will be contacting you within two weeks from the date that this letter is posted. The telephone interview will ask about your condition, your recent work experience and other life experiences. We expect that it will take between 30 and 45 minutes to complete. The information about your experiences would greatly help us to understand the causes of CTS, which will help us to work toward preventing it. The diagrams enclosed with this letter will be referred to during the interview; we ask that you keep them where you can locate them when the interviewer calls you.

The information that you provide will be kept strictly confidential. Your responses will be grouped with the responses of others in any reports that we write.

Please feel free to contact me at the telephone number or e-mail address below if you have any questions about this study. As you may be aware, CTS is a condition that can have serious consequences for those affected. We hope very much that you will be willing to participate and that you will return the informed consent form to us in the self-addressed stamped envelope. However, if you would prefer not to, simply return the refusal page in the envelope provided, or inform the interviewer when she calls that you do not wish to participate.

Thank you very much for your assistance with this research.

Sincerely,

Laura Punnett, Professor
Telephone: 978-934-3269
E-mail: LP@UML.EDU

Enclosures with each cover letter:

1. Informed Consent Form
2. Refusal Form
3. Stamped, self-addressed envelope
4. Questionnaire OR
5. Diagrams

REFUSAL FORM

I do not wish to participate in the study about Carpal Tunnel Syndrome. Please do not contact me again.

First Name
(Please Print)

Last Name
(Please Print)

Patient Signature

Date

It would be very helpful for us to know the reasons why people prefer not to participate. We appreciate you using the space below to tell us your reason.

Please return in the enclosed stamped and addressed envelope.

Fallon Clinic
Occupational Medicine Department
630 Plantation Street
Worcester, MA 01605

Informed Consent Form

APPROVED
SVH/FC/FCHP
INSTITUTIONAL REVIEW BOARD
Project # 589
Approval expires 2-15-2000
Revision # _____
Date of Rev. App'd _____

Date Prepared: January 28, 1999
Project Title: Incidence of CTS and Correlates of Workers Compensation Claims
Researcher: Dr. Laura Punnett, Sc.D.
Fallon Investigator: Dr. Joseph Celona, M.D.

Purpose

You are being asked to participate in a research questionnaire about carpal tunnel syndrome (CTS), a medical condition affecting the nerves of the hand and arm. Your experience can help us to understand the causes of this wrist disorder and help us take steps to prevent it from happening to others. We are asking you to participate in this study so that we can learn about the true occurrence of this problem among members of the Fallon Community Health Plan (FCHP). Your physician has also been contacted regarding your participation and understands that we will be contacting you.

Procedure and Duration

You are being asked to fill in this questionnaire, which will probably take you about 20 to 30 minutes. It will request information about your health, your work history, conditions of your job, and your family situation.

Risks and Discomfort

There are no significant risks involved in being a participant in this study. Your participation will not have an influence on your medical care or coverage at FCHP.

Benefits

Your participation in this study will help us to learn more about the causes of carpal tunnel syndrome and ways to treat and prevent it.

Refusal or Withdrawal of Participation

Participation in this study is completely voluntary and your participation or non-participation, will not affect any other relationships (e.g., with your physician or your employer). You may discontinue your participation in this research study at any time without penalty or costs of any nature.

Privacy and Confidentiality

Every precaution shall be taken to protect your privacy and the confidentiality of the records and data pertaining to you in particular, and the research program in general, disclosure of which may contribute to identifying you specifically to persons not related to this research program. Examples of precautions to be taken include destruction of raw data and removal of identifiers linking subjects to data.

Additional Information

If you do not understand any portion of what you are being asked to do, or the contents of this form, the researchers are available to provide a complete explanation. Questions relating to this research are welcome at any time. Please contact one of us at the following addresses:

Laura Punnett, Sc.D.
Department of Work Environment
University of Massachusetts Lowell
One University Avenue
Lowell, Ma 01854
Telephone: 978-934-3269

Joseph Celona, M.D.
Department of Occupational Medicine
Fallon Clinic
630 Plantation Street
Worcester, Ma 01605
Telephone: 508-852-0600, ext. 51224

The contact person for questions about the rights of research subjects, or any research-related injury is:

Dr. David H. Wegman
Department of Work Environment
University of Massachusetts Lowell
One University Avenue
Lowell, Ma 01854
Telephone: 978-934-3265

APPROVED
SVH/FC/FCHP
INSTITUTIONAL REVIEW BOARD
Project # 589
Approval Expires 2-15-2000
Revision: # _____
Date of Rev. App'd _____

I have been informed of any and all possible risks or discomforts. I have read the statements contained herein, have had the opportunity to fully discuss my concerns and questions, and fully understand the nature and character of my involvement in this research program as a human subject, and the attendant risks and consequences.

Participant

Date

Parent or Guardian
(required if participant is less than 18 years old)

Date

Researcher

Date

Appendix V.

Final CTS case questionnaire

Template for questionnaire data entry (in Microsoft Access)

CTS CASE ID# _____

Today's date / /
 Month Day Year

How to fill out this questionnaire:

Your answers to this survey will help us learn more about how people get hand or wrist injuries at work and the problems people have at work and at home after they have been injured. Please write your answers when a blank space is provided. When choices are listed, please check or circle the one that is closest to correct for you.. Thank you

1. We received a report that you were diagnosed with _____ sometime in the last year. The following questions concern this diagnosis. If you believe this information is not correct, please provide the correct information below:

- What month and year did you first start experiencing symptoms in your hand(s)/wrist(s)? If you can't remember the exact month, please fill in **at least the year** when your symptoms began. You may also be able to recall the season:

Month: _____ Year: _____ Season: ¹ _____ winter
² _____ spring
³ _____ summer
⁴ _____ fall

3. What is the name and address of the employer you were working for when your hand/wrist problems started?

Employer _____

Street _____ City _____ State _____ Zip _____

4. What does this company do or manufacture?

4a. If a manufacturing company, what is the main product? _____

5. Are (were) you represented by a union at this job?

1 — Yes
2 — No

10a. If YES, which union and local?

6. In what year did you begin working for this employer? _____

7. What department were you working in when your hand/wrist problems began?

8. What was your occupation or type of work when your hand/wrist problems began?

9. What were your job duties? _____

The Job that you have just described will be referred to as **JOB A** throughout this questionnaire.

10. When did you start working at this specific job, job A? _____
(month/year)

11. Is (was) there one particular job task, tool, or piece of machinery that you think caused or significantly contributed to your hand/wrist problems at this job, jobA?

¹ ☐ Yes
² ☐ No
³ ☐ Don't know

11a. If YES, please describe: _____

12. Please find the time difference between when you started working in job A (from question # 10) and when your symptoms began (from question #2). _____ years _____ months

If this difference is more than 2 years → **SKIP TO PAGE 4 QUESTION 24**

If this difference is less than 2 years



CONTINUE BELOW

13. If you worked at JOB A for less than 2 years before you experienced symptoms in your hand(s)/wrist(s), did you have another job just before JOB A?

³ ☐ No, I did not have another job in the 2 years before my symptoms started → **SKIP TO QUESTION 24**

¹ ☐ Yes, I had another job in the same workplace → **SKIP TO QUESTION 18**

² ☐ Yes, I worked in another workplace



(CONTINUE BELOW)

14. What is the name and address of the employer you were working for before JOB A?

Employer _____

Street _____ City _____ State _____ Zip _____

15. What does this company do or manufacture? _____

15a. If a manufacturing company, what is the main product produced? _____

16. Are (were) you represented by a union at this job?

¹ ☐ Yes
² ☐ No

16a. If YES, which union and local? _____

17. In what year did you begin working for this employer? _____

18. What department were you working in? _____

19. What was your occupation or type of work before JOB A? _____

20. What were your job duties? _____

The job that you have just described will be referred to as **[JOB B]** throughout this questionnaire.

21. When did you start working at this job, Job B? _____
(month/year)

22. When did you stop working at this job, Job B? _____
(month/year)

23. Is (was) there one particular job task, tool, or piece of machinery that you think caused or significantly contributed to your hand/wrist problems at this job?

- ¹ _____ Yes
² _____ No
³ _____ Don't know

23a. If YES, please describe: _____

Please continue on to Page 4, Question 24

If you have identified **BOTH** a JOB A and a JOB B, then please answer the questions in the next section for **BOTH** of these jobs. If you worked in JOB A for more than 2 years before your hand/wrist symptoms started, then please answer these questions **ONLY** for JOB A.

ON A TYPICAL WORK DAY...

JOB A

24. Did you have to bend or twist your wrists many times an hour?

1 ☐ Yes
2 ☐ No

24a. If yes: for how many hours per day?

1 ☐ 0-2 hours
2 ☐ 2-4 hours
3 ☐ 4-6 hours
4 ☐ 6-8 hours
5 ☐ more than 8 hours

25. Did you keep your wrists bent for a prolonged period while working? (e.g., typing at keyboard or using a tool)

1 ☐ Yes
2 ☐ No

25a. If yes: for how many hours per day?

1 ☐ 0-2 hours
2 ☐ 2-4 hours
3 ☐ 4-6 hours
4 ☐ 6-8 hours
5 ☐ more than 8 hours

JOB B

24. Did you have to bend or twist your wrists many times an hour?

1 ☐ Yes
2 ☐ No

24a. If yes: for how many hours per day?

1 ☐ 0-2 hours
2 ☐ 2-4 hours
3 ☐ 4-6 hours
4 ☐ 6-8 hours
5 ☐ more than 8 hours

25. Did you keep your wrists bent for a prolonged period while working? (e.g., typing at keyboard or using a tool)

1 ☐ Yes
2 ☐ No

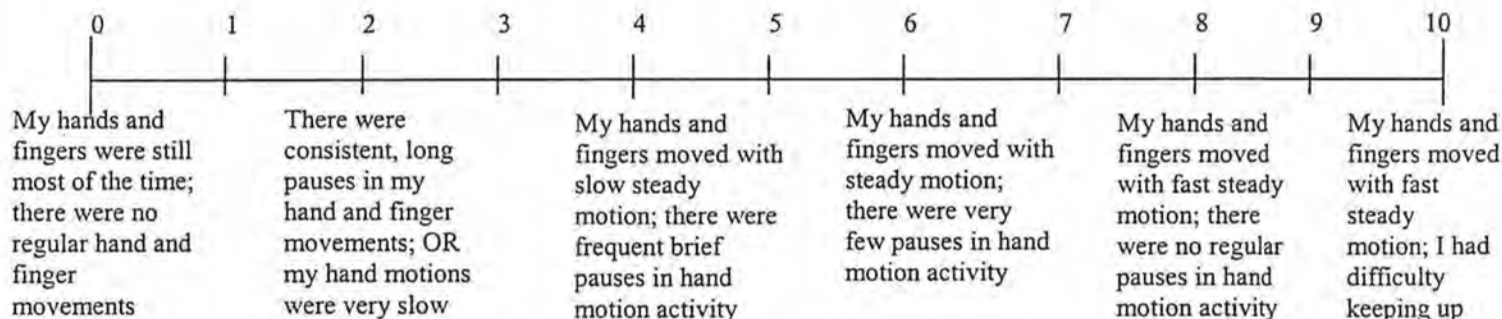
25a. If yes: for how many hours per day?

1 ☐ 0-2 hours
2 ☐ 2-4 hours
3 ☐ 4-6 hours
4 ☐ 6-8 hours
5 ☐ more than 8 hours

26. Please choose the number from the scale below that best describes the typical movement of your hands and fingers.

Choose a number for Job A: _____

Choose a number for Job B: _____



27. In this job, did you have to do the same hand and finger motions over and over again?

1 ☐ Yes
2 ☐ No

27a. If yes: for how many hours per day?

1 ☐ 0-2 hours
2 ☐ 2-4 hours
3 ☐ 4-6 hours
4 ☐ 6-8 hours
5 ☐ more than 8 hours

27. In this job, did you have to do the same hand and finger motions over and over again?

1 ☐ Yes
2 ☐ No

27a. If yes: for how many hours per day?

1 ☐ 0-2 hours
2 ☐ 2-4 hours
3 ☐ 4-6 hours
4 ☐ 6-8 hours
5 ☐ more than 8 hours

ON A TYPICAL WORK DAY...

JOB A



28. Overall, how much hand force did you have to use to do this job?

(Circle a number from 1 to 7 where 1 is "no force with hands and wrists" and 7 is "extremely high force with hands and wrists")

No force with
hands and
wrists

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Extremely high
force with hands
and wrists

29. Did your job require you to lift objects weighing more than 2 pounds, or to use high hand forces such as squeezing with a pinch grip, scooping very hard ice cream, or wringing out a full mop?

1 Yes
2 No

29a. If yes: for how many hours per day?

1 0-2 hours
2 2-4 hours
3 4-6 hours
4 6-8 hours
5 more than 8 hours

30. Did you have to exert a level of hand force that was physically difficult for you?

1 Yes
2 No

JOB B



28. Overall, how much hand force did you have to use to do this job?

(Circle a number from 1 to 7 where 1 is "no force with hands and wrists" and 7 is "extremely high force with hands and wrists")

No force with
hands and
wrists

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Extremely high
force with hands
and wrists

29. 1 Yes
2 No

29a. 1 0-2 hours
2 2-4 hours
3 4-6 hours
4 6-8 hours
5 more than 8 hours

30. 1 Yes
2 No

ON A TYPICAL WORKDAY ...

JOB A



31. Did you work with hand-held vibrating machines or tools (e.g., drilling machinery, grinder, bolting gun, power saw), or holding a part against a grinding wheel?

¹ ☐ Yes
² ☐ No

- 31a. If yes: for how many hours per day?

¹ ☐ 0-2 hours
² ☐ 2-4 hours
³ ☐ 4-6 hours
⁴ ☐ 6-8 hours
⁵ ☐ more than 8 hours

- 31b. If yes: How much vibration did you feel in your hand from the tool?

(Circle a number from 1 to 7 where 1 is "no vibration in hands or wrists" and 7 is "extremely strong vibration in hands and wrists")

No vibration
in hands and
wrists

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Extremely strong
vibration in hands
and wrists

32. Did you have a sharp edge of a hard surface (e.g., a tool handle) digging into your wrist or palm?

¹ ☐ Yes
² ☐ No

- 32a. If yes: for how many hours per day?

¹ ☐ 0-2 hours
² ☐ 2-4 hours
³ ☐ 4-6 hours
⁴ ☐ 6-8 hours
⁵ ☐ more than 8 hours

33. Did your hands get cold at work (e.g., from handling chilled items, working in a cold storage room, or working outside)?

¹ ☐ Yes
² ☐ No

If yes:

- 33a. Did this happen only or mostly during the winter?

¹ ☐ Yes
² ☐ No

- 33b. On a typical day, approximately how many hours out of the day would your hands be cold?

¹ ☐ 0-2 hours
² ☐ 2-4 hours
³ ☐ 4-6 hours
⁴ ☐ 6-8 hours
⁵ ☐ more than 8 hours

JOB B



31. ¹ ☐ Yes
² ☐ No

31a. ¹ ☐ 0-2 hours
² ☐ 2-4 hours
³ ☐ 4-6 hours
⁴ ☐ 6-8 hours
⁵ ☐ more than 8 hours

No vibration
in hands and
wrists

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Extremely strong
vibration in hands
and wrists

32. ¹ ☐ Yes
² ☐ No

32a. ¹ ☐ 0-2 hours
² ☐ 2-4 hours
³ ☐ 4-6 hours
⁴ ☐ 6-8 hours
⁵ ☐ more than 8 hours

33. ¹ ☐ Yes
² ☐ No

- 33a. ¹ ☐ Yes
² ☐ No

33b. ¹ ☐ 0-2 hours
² ☐ 2-4 hours
³ ☐ 4-6 hours
⁴ ☐ 6-8 hours
⁵ ☐ more than 8 hours

34. While working in this job, approximately how much of the time did you have problems with the following aspects of your job as a result of your carpal tunnel syndrome? If the activity described was not a part of the job, circle DOES NOT APPLY TO MY JOB, and go on to the next question.

FOR JOB A: HOW MUCH OF THE TIME DID YOU HAVE PROBLEMS...	Had problems all of the time (100%)	Had problems most of the time	Had problems half of the time (50%)	Had problems some of the time	Never had problems (0%)	Does not apply to my job
a. Sticking to your work routine or schedule without having to rearrange or reassign your work tasks.	1	2	3	4	5	0
b. Working without taking frequent rests or breaks to avoid discomfort.	1	2	3	4	5	0
c. Keeping up with the speed of work expected of you	1	2	3	4	5	0
d. Keeping up with the amount of work expected of you	1	2	3	4	5	0
e. Lifting, carrying or moving (objects or people) at work.	1	2	3	4	5	0
f. Using your arms to reach forward, backward, up, down, or to the side, repeatedly, or with force	1	2	3	4	5	0
g. Using hand operated tools or equipment (for example pen, drill, sander, keyboard or computer mouse)	1	2	3	4	5	0
h. Keeping your body in one position longer than 30 minutes at a time.	1	2	3	4	5	0
i. Concentrating on your work.	1	2	3	4	5	0
j. Helping others to get work done	1	2	3	4	5	0
k. Doing your work without making mistakes	1	2	3	4	5	0

JOB A

FOR JOB B: HOW MUCH OF THE TIME DID YOU HAVE PROBLEMS...	Had problems all of the time (100%)	Had problems most of the time	Had problems half of the time (50%)	Had problems some of the time	Never had problems (0%)	Does not apply to my job
a. Sticking to your work routine or schedule without having to rearrange or reassign your work tasks.	1	2	3	4	5	0
b. Working without taking frequent rests or breaks to avoid discomfort.	1	2	3	4	5	0
c. Keeping up with the speed of work expected of you	1	2	3	4	5	0
d. Keeping up with the amount of work expected of you	1	2	3	4	5	0
e. Lifting, carrying or moving (objects or people) at work.	1	2	3	4	5	0
f. Using your arms to reach forward, backward, up, down, or to the side, repeatedly, or with force	1	2	3	4	5	0
g. Using hand operated tools or equipment (for example pen, drill, sander, keyboard or computer mouse)	1	2	3	4	5	0
h. Keeping your body in one position longer than 30 minutes at a time.	1	2	3	4	5	0
i. Concentrating on your work.	1	2	3	4	5	0
j. Helping others to get work done	1	2	3	4	5	0
k. Doing your work without making mistakes	1	2	3	4	5	0

JOB B

35. In the job that you had when you first experienced hand/wrist symptoms, job A, had you or your employer ever discussed or made any of the following changes to your work situation after your hand/wrist pain started? CIRCLE ONE ANSWER FOR EACH LINE.

HAD YOUR EMPLOYER EVER ...	No	Discussed, but made no changes	Yes, made changes
a. Arranged for others to help you do the work	1	2	3
b. Shortened your work days	1	2	3
c. Changed the time you came to or left work	1	2	3
d. Arranged for more breaks and rest periods	1	2	3
e. Changed the tasks to things you could do more easily	1	2	3
f. Arranged for you to learn new job skills	1	2	3
g. Arranged for you to have special equipment or tools	1	2	3
h. Arranged for you to rotate between jobs	1	2	3
i. Arranged your workspace such as height of keyboard, chair or other equipment	1	2	3
j. Allowed you to work at a different location	1	2	3

36. Which of the following best describes your current work situation? (*Check one*)
Right now I am.....

- ¹ ☐ Working full time: _____ hours per week
² ☐ Working part time: _____ hours per week



STILL WORKING



- ³ ☐ Not working because of carpal tunnel syndrome
⁴ ☐ Not working because of other health problems
⁵ ☐ Not working for reasons unrelated to my health (retired, student, homemaker)
⁶ ☐ Out of work because I can't find work or I was laid off
⁷ ☐ Other: _____



NOT WORKING NOW



37. Are you still working in [JOB A]?

- ¹ ☐ Yes → **SKIP TO QUESTION 46**

- ² ☐ No
↓ (CONTINUE BELOW)

37a-1. Why did you change jobs?

- ¹ ☐ Because of carpal tunnel syndrome
² ☐ Because of other health problems
³ ☐ Because I was laid off
⁴ ☐ Other: _____

(CONTINUE BELOW)



37. Is [JOB A] the last job you worked in?

- ¹ ☐ Yes → **SKIP TO QUESTION 46**

- ² ☐ No
↓ (CONTINUE BELOW)

37a-2. If you are not currently working what is the last date you worked: ____/____/____
(month/year)



(CONTINUE BELOW)



38. What is the name and address of your current employer? (If you are not currently working, give the employer at your most recent job)

Employer _____

Street _____ City _____ State _____ Zip _____

39. What does this company do or manufacture? _____

37a. If a manufacturing company, what is the main product produced? _____

40. What department do you work in now (or most recently)? _____

41. What is your current (or most recent) occupation or type of work¹? _____

42. What are your current (or most recent) job duties? _____

43. When did you start working in your current (or most recent) job? _____
(month/year)

44. While working in your current (or most recent) job, approximately how much of the time do/did you have problems with the following aspects of your job as a result of your carpal tunnel syndrome? If the activity described is/was not a part of the job, circle DOES NOT APPLY TO THIS JOB, and go on to the next question.

HOW MUCH OF THE TIME DO/DID YOU HAVE PROBLEMS . . .	Had problems all of the time (100%)	Had problems most of the time	Had problems half of the time (50%)	Had problems some of the time	Never had problems (0%)	Does not apply to this job
a. Sticking to your work routine or schedule without having to rearrange or reassign your work tasks.	1	2	3	4	5	0
b. Working without taking frequent rests or breaks to avoid discomfort.	1	2	3	4	5	0
c. Keeping up with the speed of work expected of you	1	2	3	4	5	0
d. Keeping up with the amount of work expected of you	1	2	3	4	5	0
e. Lifting, carrying or moving (objects or people) at work.	1	2	3	4	5	0
f. Using your arms to reach forward, backward, up, down, or to the side, repeatedly, or with force	1	2	3	4	5	0
g. Using hand operated tools or equipment (for example pen, drill, sander, keyboard or computer mouse)	1	2	3	4	5	0
h. Keeping your body in one position longer than 30 minutes at a time.	1	2	3	4	5	0
i. Concentrating on your work.	1	2	3	4	5	0
j. Helping others to get work done	1	2	3	4	5	0
k. Doing your work without making mistakes	1	2	3	4	5	0

45. In your current (or most recent) job, have you or your employer ever discussed or made any of the following changes to your work situation because of your hand/wrist injury.

HAS/HAD YOUR EMPLOYER EVER . . .	No	Discussed, but made no changes	Yes, made changes
a. Arranged for others to help you do the work	1	2	3
b. Shortened your work days	1	2	3
c. Changed the time you came to or left work	1	2	3
d. Arranged for more breaks and rest periods	1	2	3
e. Changed the tasks to things you could do more easily	1	2	3
f. Arranged for you to learn new job skills	1	2	3
g. Arranged for you to have special equipment or tools	1	2	3
h. Arranged for you to rotate between jobs	1	2	3
i. Arranged your workspace such as height of keyboard, chair or other equipment	1	2	3
j. Allowed you to work at a different location	1	2	3

46. How did your hand/wrist problems begin?

- ☐ 1 Suddenly
☐ 2 Gradually
☐ 3 Started gradually, then suddenly got worse
☐ 4 Do not know

47. What seemed to cause the problem? [Read choices 1 through 5. Select the answer that comes the closest]

- ☐ 1 Acute injury: (describe: _____)
☐ 2 Sudden motion: (describe: _____)
☐ 3 Repetitive activity: (describe: _____)
☐ 4 Other at work (describe: _____)
☐ 5 Other at home (describe: _____)

48. Have you ever had any serious traumatic injuries to your fingers, hands, or wrists? This includes any fracture, dislocation, sports injury, industrial accident, frostbite, automobile accident, etc., that was treated by a doctor or chiropractor.

- ☐ 1 Yes ☐ 2 No

If YES:

Please describe those injuries below by giving the type of injury (e.g. break, cut, sprain), the body part (e.g., fingers, wrist), if it was your right or left hand, the month and year it happened, and if the injury has healed yet.

- a. Injury 1) _____
 b. Injury 2) _____
 c. Injury 3) _____

49. Do you have hand or wrist discomfort now (within the past two weeks)?

¹ ☐ Yes

² ☐ No

IF NO:

49a. When did you last experience this problem? _____ / _____
month/year

49b. Do you think the problem has gone away?

¹ ☐ Yes

² ☐ No

³ ☐ Don't know

49c. Why do you think the problem has stopped or doesn't bother you right now? _____

50. How severe were the following symptoms during a typical 24 hour period when your hand or wrist discomfort was at its worst? (Please circle *only one* number on each line)

HOW SEVERE WAS THE . . .	I didn't have this symptom	Mild	Moderate	Severe	Very Severe
a. Pain in your hand or wrist at night	1	2	3	4	5
b. Pain in your hand or wrist during the day.	1	2	3	4	5
c. Numbness (no feeling) in your hand.	1	2	3	4	5
d. Tingling sensations in your hand.	1	2	3	4	5
e. Night time numbness or tingling sensations in your hand	1	2	3	4	5
f. Weakness in your hand or wrist.	1	2	3	4	5
g. Difficulty grasping and using small objects.	1	2	3	4	5

51. How often did you have the following symptoms during a typical two week period when your hand or wrist discomfort was at its worst? (Please circle *only one* number on each line)

HOW OFTEN DID YOU HAVE . . .	Never	Once	Two or Three Times	Four or Five Times	More Than Five Times
a. Daytime pain in your hand or wrist	1	2	3	4	5
b. Pain in your hand or wrist that woke you up at night	1	2	3	4	5
c. Hand numbness or tingling that woke you up at night	1	2	3	4	5

52. On a typical day during a two week period when your hand or wrist discomfort was at its worst, did hand and wrist symptoms cause you to have any difficulty doing the activities listed below? Please circle one number on each line that best describes your ability to do the activity.

DID HAND AND WRIST SYMPTOMS CAUSE YOU TO HAVE DIFFICULTY ...	No difficulty	Mild difficulty	Moderate Difficulty	Severe Difficulty	Cannot Do At All Due to Hand Or Wrist Symptoms
a. Writing	1	2	3	4	5
b. Buttoning clothes	1	2	3	4	5
c. Holding a book while reading	1	2	3	4	5
d. Gripping the phone handle	1	2	3	4	5
e. Opening cans, jars or turning keys, taps or door knobs?	1	2	3	4	5
f. Doing household chores or looking after your family	1	2	3	4	5
g. Carrying grocery bags, cases of beer or soft drinks, or garbage bags?	1	2	3	4	5
h. Washing yourself, dressing, grooming or eating?	1	2	3	4	5
i. Washing the top of your head or washing, drying or arranging your hair?	1	2	3	4	5
j. Reaching behind your back (for example, to wash or dry your back get your wallet out of your back pocket or do up a bra or back zipper)?	1	2	3	4	5

53. On the diagram below, please shade in the areas where you usually have/had discomfort in your wrists or hands. Use the symbols that show the type of discomfort that you have/had: pain, tingling, numbness, or decreased sensation.

Pain



Tingling/Numbness



LEFT

RIGHT

LEFT

RIGHT

Back of the hand

Front of the hand

54. How often is the following true for you NOW BECAUSE OF YOUR INJURY? Now refers to the past 7 days. Please circle the number that best corresponds to how you feel this week.

HOW OFTEN DO YOU FIND YOURSELF . . .	Never	Rarely	Sometimes	Somewhat often	Often	Very often	All the time
a. Feeling anxious, nervous, worried or jumpy	1	2	3	4	5	6	7
b. Feeling sad, depressed or moody	1	2	3	4	5	6	7
c. Feeling irritable, frustrated or angry.	1	2	3	4	5	6	7
d. Feeling less pleasure in life.	1	2	3	4	5	6	7
e. Feeling like I can't take care of my family the same way I used to.	1	2	3	4	5	6	7
f. Being afraid that in the future I will be unable to earn my living.	1	2	3	4	5	6	7
g. Sleeping badly	1	2	3	4	5	6	7
h. Having pain or discomfort from the physical examinations, treatments or therapy for my hand or wrist	1	2	3	4	5	6	7

55. How much difficulty do you have or would you have NOW with the following activities or situations because of your hand/wrist injury. NOW refers to the past 7 days. Please circle the number that best corresponds to how you feel this week.

DID HAND AND WRIST SYMPTOMS CAUSE YOU TO HAVE DIFFICULTY ...	No difficulty	Mild difficulty	Moderate Difficulty	Severe Difficulty	Cannot Do At All Due to Hand Or Wrist Symptoms
a. Writing	1	2	3	4	5
b. Buttoning clothes	1	2	3	4	5
c. Holding a book while reading	1	2	3	4	5
d. Gripping the phone handle	1	2	3	4	5
e. Opening cans, jars or turning keys, taps or door knobs?	1	2	3	4	5
f. Doing household chores or looking after your family	1	2	3	4	5
g. Carrying grocery bags, cases of beer or soft drinks, or garbage bags?	1	2	3	4	5
h. Washing yourself, dressing, grooming or eating?	1	2	3	4	5
i. Washing the top of your head or washing, drying or arranging your hair?	1	2	3	4	5
j. Reaching behind your back (for example, to wash or dry your back get your wallet out of your back pocket or do up a bra or back zipper)?	1	2	3	4	5

56. Have you or your current employer, or any other former employers filed a workers' compensation claim for your hand/wrist injury?

¹ ☐ Yes



(CONTINUE BELOW)

² ☐ No → SKIP TO QUESTION 57

³ ☐ Don't know → SKIP TO QUESTION 58

56a. What employer was listed on the claim:

¹ ☐ Job A employer (page 1)

² ☐ Job B employer (page 3)

³ ☐ Job C employer (page 8)

⁴ ☐ Other: Describe _____

56b. What date did you file this claim ____/____.
month/year

56c. Have you hired a lawyer because of your injury?

¹ ☐ Yes (please circle a or b) --> a. case is in litigation

b. case has been settled

² ☐ No

³ ☐ Don't know

56d. What is the status of your claim?

¹ ☐ Awarded at least partial benefits

↓ (CONTINUE BELOW,
then skip to question 58)

² ☐ Claim pending

³ ☐ Denied any benefits

⁴ ☐ Other

→ SKIP TO QUESTION 58

56e. Which of the following types of benefits have you received from this workers' compensation claim (check all that apply)

¹ ☐ Wage replacement

² ☐ Medical bills were paid

³ ☐ Rehabilitation services were paid

⁴ ☐ Other: Describe _____

56f. Are you still receiving benefits

¹ ☐ Yes

² ☐ No

³ ☐ Don't know

56g. If you did receive wage replacement benefits, how many months have/did you received/receive benefits?

_____ months

56h. Have there been any disputes or disagreements with your employer or the insurance company over your claim?

¹ ☐ Yes

² ☐ No

³ ☐ Don't know

56i. If yes, which of the following issues were the source of the dispute (check all that apply):

¹ ☐ Whether or not your injury was work-related

² ☐ Whether or not you can do your usual job

³ ☐ Whether or not your medical treatment is appropriate

⁴ ☐ Whether or not you are able to work

⁵ ☐ Whether or not the employer will honor physical restrictions ordered by your physician

⁶ ☐ Other: Describe _____

**IF YOU ANSWERED QUESTION 56 BECAUSE YOU OR YOUR EMPLOYER FILED A WORKERS' COMPENSATION CLAIM DO NOT ANSWER QUESTION 57.
SKIP TO QUESTION 58.**

57. We are interested in the factors that entered into your decision not to file a workers compensation claim. The following are reasons people often give for not filing a claim. For each reason , please check yes or no depending on whether it was a part of your decision not to file a claim.

I DECIDED NOT TO FILE A WORKERS COMPENSATION CLAIM BECAUSE . . .	No, this was <u>not</u> part of my reason	Yes, this was part of my reason not to file a workers compensation claim	I am not sure
a. The injury was not serious enough.	1	2	3
b. I did not expect to miss work because of my injury.	1	2	3
c. My employer gave me other duties outside of my regular job.	1	2	3
d. I knew I would receive sick leave for the time I had missed.	1	2	3
e. I did not know about my right to file a workers compensation claim	1	2	3
f. I knew my medical expenses could be paid for by my HMO	1	2	3
g. I did not think my injury was work related	1	2	3
h. I was afraid I would lose my job.	1	2	3
i. I was afraid I would not get promoted.	1	2	3
j. I was afraid of what my supervisor would think	1	2	3
k. I was afraid of what my co-workers would think.	1	2	3
h. Other, please describe: _____			

To what extent do you disagree or agree with the following statements.

58. Someone who files a workers' compensation claim would be discriminated against or harassed

- ☐ 1 Strongly disagree
☐ 2 Somewhat disagree
☐ 3 Somewhat agree
☐ 4 Strongly agree

59. Someone who files a workers' compensation claim would be concerned that he/she might lose his/her job.

- ☐ 1 Strongly disagree
☐ 2 Somewhat disagree
☐ 3 Somewhat agree
☐ 4 Strongly agree

60. Someone who files a workers' compensation claim might lose out on future promotions and other job opportunities.

1 _____ Strongly disagree
2 _____ Somewhat disagree
3 _____ Somewhat agree
4 _____ Strongly agree

61. Sometimes physicians and other health care providers do not want to treat workers compensation cases.

1 _____ Strongly disagree
2 _____ Somewhat disagree
3 _____ Somewhat agree
4 _____ Strongly agree

62. Since your hand/wrist problems began, were you ever out of work for a full day or longer because of your hand/wrist injury.

1 _____ Yes
2 _____ No → **SKIP TO QUESTION 64**
3 _____ Don't know

62a. Approximately how many days of work have you missed because of your hand/wrist injury? _____ days

62b. If you were out of work a full day or longer because of your hand/wrist injury, how were you paid for the day(s) lost?

_____ days continued on the payroll.

+ _____ days receive lost wage benefits.

+ _____ days received **neither** lost-wage benefits **nor** pay. Explain? _____

= _____ total days (should equal answer to question 60a)

63. Did you work any restricted duty days?

1 _____ Yes → How many? _____ days
2 _____ No

64. Have you had surgery for your hand/wrist injury?

1 _____ Yes
2 _____ No

64a. If YES, indicate below which hand(s) was operated on and the date the surgery(ies) took place.

_____, _____
(hand) (month and year)

_____, _____
(hand) (month and year)

65. What is your date of birth? _____
month / day / year

66. Are you male or female?

¹ ☐ Male

² ☐ Female



Have you ever taken estrogen-containing medications e.g., birth control pills or estrogen-replacements, during or after menopause?

¹ ☐ No

² ☐ Yes, I took estrogen-containing medications from ____/____/____ to ____/____/____
month/year month/year

67. What is the highest grade or year of school you completed?

¹ ☐ Never attended school

² ☐ Grades 1 through 4

³ ☐ Grades 5 through 8

⁴ ☐ Grades 9 through 11 (some high school, no diploma)

⁵ ☐ Grade 12 or GED (high school graduate)

⁶ ☐ College 1 year to 3 years (some college or technical school)

⁷ ☐ College 4 years or more (college graduate)

68. Which of the following categories best describes your race?

¹ ☐ White

² ☐ Black

³ ☐ Asian/Pacific Islander [Please specify country: _____]

⁴ ☐ American Indian, Alaska Native

⁵ ☐ Mixed/Other, specify _____

69. Are you of Spanish/Hispanic origin?

¹ ☐ Yes

² ☐ No

70. What is your *average FAMILY annual income*. If you are not currently working, circle the income level your family was in when you last worked.

¹ ☐ Under \$10,000

² ☐ \$10,000 to \$14,999

³ ☐ \$15,000 to \$24,999

⁴ ☐ \$25,000 to \$34,999

⁵ ☐ \$35,000 to \$49,999

⁶ ☐ \$50,000 to \$74,999

⁷ ☐ \$75,000 to \$99,999

⁸ ☐ \$100,000 or more

Thank you very much for your time. If you have any questions, feel free to call Dr. Laura Punnett at: 978-934-3269. Please send the completed questionnaire in the envelope provided to:

Laura Punnett, Sc.D.
Department of Work Environment
University of Massachusetts Lowell
One University Avenue
Lowell, MA 01854

Occupational History

ID 2	CTS ID : 0	Today Date	Diagnosis	Sympton begin MONT	YEAR	SEASON 0
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Employer's name	Street	City	State	Zipcode
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Company do or manufacturer	If manufacturing, main product	UNION:	Which union or local	Year begin wor
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Department	Occupation	Job duties	Job A start	Job problem? 0	If yes, describe
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Time difference YEAR 0	MONTH 0	Other Job? 0	Employer's name	Address: Street
---------------------------	------------	-----------------	-----------------	-----------------

City	State	Zipcode	Company do or manufactur	Company's main product
------	-------	---------	--------------------------	------------------------

Union?	What union or local?	Year begin worki 0	Department	Occupation	Job duties
--------	----------------------	-----------------------	------------	------------	------------

Job B star	Job B sto	Job B proble 0	If yes, please describe
------------	-----------	-------------------	-------------------------

24 A 0	24a A 0	24 B 0	24a B 0	25 A 0	25a A 0	25 B 0	25a B 0	26 A 0	26 B 0
-----------	------------	-----------	------------	-----------	------------	-----------	------------	-----------	-----------

27 A 0	27a A 0	27 B 0	27a B 0	28 A 0	28 B 0	29 A 0	29a A 0	29 B 0	29a B 0
-----------	------------	-----------	------------	-----------	-----------	-----------	------------	-----------	------------

30 A 0	30 B 0	31 A 0	31a A 0	31b A 0	31 B 0	31a B 0	31b B 0	32 A 0	32a A 0	32 B 0	32a B 0
-----------	-----------	-----------	------------	------------	-----------	------------	------------	-----------	------------	-----------	------------

33 A 0	33a A 0	33b A 0	33 B 0	33a B 0	33b B 0
-----------	------------	------------	-----------	------------	------------

34a A 0	34b A 0	34c A 0	34d A 0	34e A 0	34f A 0	34g A 0	34h A 0	34i A 0	34j A 0	34k A 0
------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------

34a B 0	34b B 0	34c B 0	34d B 0	34e B 0	34f B 0	34g B 0	34h B 0	34i B 0	34j B 0	34k B 0
------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------

35a 0	35b 0	35c 0	35d 0	35e 0	35f 0	35g 0	35h 0	35i 0	35j 0
----------	----------	----------	----------	----------	----------	----------	----------	----------	----------

36 0	37 0	37a-1 0	37 0	37a-2	Most recent employer
---------	---------	------------	---------	-------	----------------------

Address: Street	City	State	Zipcode	Company do or manufact	Main product
-----------------	------	-------	---------	------------------------	--------------

Department		Occupation		Job duties		Start workin						
44a	44b	44c	44d	44e	44f	44g	44h	44i	44j	44k		
0	0	0	0	0	0	0	0	0	0	0		
45a	45b	45c	45d	45e	45f	45g	45h	45i	45j			
0	0	0	0	0	0	0	0	0	0			
46	47	If yes, describe		48	Describe Injury 1		Describe injury 2					
0	0			0								
Describe injury 3		Discomfort		49a	49b	49c						
		0			0							
50a	50b	50c	50d	50e	50f	50g	51a		51b	51c		
0	0	0	0	0	0	0	0		0	0		
52a	52b	52c	52d	52e	52f	52g	52h	52i	52j	Hand Diagram		
0	0	0	0	0	0	0	0	0	0			
54a	54b	54c	54d	54e	54f	54g	54h					
0	0	0	0	0	0	0	0					
55a	55b	55c	55d	55e	55f	55g	55h	55i	55j			
0	0	0	0	0	0	0	0	0	0			
File claim?	Employer lis	Claim dat	Hire lawyer	Claim statu	Type benefi	Still Benefit	How long	Dispute	Source			
0	0		0	0	0	0	0	0	0			
57a	57b	57c	57d	57e	57f	57g	57h	57i	57j	57k	57l	
0	0	0	0	0	0	0	0	0	0	0		
58	59	60	61	62	62a	62b	63	64	Right hand	Date	Left han	Date
0	0	0	0	0	0	0	0	0	0		0	
DOB	Gender	Have taken Estroge		If yes	From	To						
	0	0										
Education	Race	Spanish/Hispanic origi		Income								
0	0	0		0								

Appendix VI.

Results of preliminary pilot testing of case questionnaire by Massachusetts Department
of Public Health, with interviewer comments/recommendations for revisions

CTS Pilot Statistics

	<u>2/22/00</u>	<u>3/13/00</u>	<u>4/19/00</u>	<u>Total</u>
Completed	6	2		8
Wrong or no number/address	8	9		17
Refusal	2	4	1	7
Not CTS	2	0		2
Follow-up needed	2	5	19	26
Totals	20	20	20	60

Notes:

1. On 2/22 and 3/13, twenty packets, including questionnaires, were mailed to randomly selected cases.
On 4/19, twenty letters requesting a phone interview (no questionnaires) were mailed to randomly selected cases.
2. Of the CTS completions, one, case ID# 5681597 is actually a neck injury.
3. Of the 18 cases contacted over the phone (from the 2/22 and 3/13 mailings), 4 eventually completed the survey, 5 eventually refused, 2 indicated they did not have CTS, and 7 remain unresolved. Three additional cases were contacted with two already having sent in a completed survey and one indicating that the person did not live at that address.

Completed Returned Surveys:

<u>Case ID#</u>	<u>M/F</u>	<u># Jobs Held</u>	<u>Comments/questions re: specific case</u>
	F	1 + current	Need to note which employer filed the WC claim. Comments/dates on her question 41 are confusing. Question 54(f) appears confusing to patient. For her, most pain is in the arms, not hands.
4623299	M	1	Questions 2,28 and 33 - answers are inconsistent. Question 47(a) was not answered. Question 51 – shading seemed problematic for him. WC area incomplete and Q60 answer inconsistent NOTE: Patient also sent a refusal form back the same day as the completed survey was received.
5681597	F	1 + current	NOTE: Patient has a severe neck injury, not CTS See attached letters to Helen which accompany the questionnaire she nonetheless returned.
4283499	F	1	Question 54(f) appears confusing to patient. Question 60(a-3) not answered.
3801199	M	1	Question 2, year symptoms not filled out. Job B filled out throughout but not needed. Question 19,20 dates conflict with Q12. Question 51 shading may be problematic.
4622499	F	1 + current	Changed jobs within the same company. Question 51 – more detail than other cases it seems regarding the shading. WC area incomplete as patient seems quite uncertain as to status and benefits.
3865399	M	1	Currently out on WC for CTS and tendonitis. Question 48,49 – had some difficulty with the night time aspects of his pain. Question 51 – shading seemed problematic for him. Question 50 – CTS vs tendonitis is at issue for him. Question 52 – incomplete answers with explanation Questions 56-58 not answered by category.
4982799	F	1	Changed type of job within the same company. Question 24 not answered y or n – missed ? Question 47 inconsistently answered.

Completed Returned Surveys:

<u>Case ID#</u>	<u>M/F</u>	<u># Jobs Held</u>	<u>Comments/questions re: specific case</u>
5661298	M	1	Question 24 not answered y or n – missed. Questions 42 and 43 filled out – not needed. Question 54(f) – case indicated weeks, not months as length for benefits – change ? Question 67 – case strongly opposed to it.

Appendix VII.

Decision rules for determination of 1) probability of CTS, and
2) probability of work-relatedness

CTS Case Criteria⁶

<u>Classification</u>	<u>Symptoms: Median nerve distribution'</u>	<u>Electrodiagnostic Studies (EDS)²</u>	<u>Symptoms: Nocturnal³</u>	<u>Physical Exam (PE)⁴</u>
Definite	Classic/Probable	Severe, moderate, or mild ⁵ ND	Yes/No/NS Yes	Pos/Neg/ND Pos
Probable	Classic/Probable	ND ND Normal	Yes No/NS Yes	Neg/ND Pos Pos
	Possible	Severe Mild ⁵	Yes/No/NS Yes	Pos/Neg/ND Pos/Neg/ND
Possible	Classic/Probable	ND Normal Normal	No/NS Yes No/NS	Neg/ND Neg/ND Pos
	Possible	Mild ND ND Normal	No/NS Yes No/NS Yes	Pos/Neg/ND Pos/Neg/ND Pos Pos
Unlikely	Classic/Probable	Normal	No/NS	Neg/ND
	Possible	Normal Normal ND	Yes No/NS No/NS	Neg/ND Pos/Neg/ND Neg/ND
	Unlikely	Severe Mild ND Normal	Yes/No/NS Yes/No/NS Yes/No/NS Yes/No/NS	Pos/Neg/ND Pos/Neg/ND Pos/Neg/ND Pos/Neg/ND

- 1) Symptoms in the median nerve distribution categories are: 1) Classic/probable, 2) Possible, or 3) Unlikely to be carpal tunnel syndrome
Descriptions and criteria are from Katz, 1990
- 2) EDS results are: normal, mild or severe
- 3) Nocturnal symptoms are: Y=Yes, N= No or NS= Not specified
- 4) PE is "Pos" if one or more of the physical tests listed on the medical chart form were positive, "Neg" if at least one negative test was recorded on the medical chart, and "ND" if no physical examination was done.
Possible PE tests are: Tinel's, Thenar Atrophy, Phalen's, and Sensory Testing
- 5) Assuming reliable EMG lab
- 6) Rule out other diagnosis based on medical history and objective findings

Algorithm for scoring probability of relation to occupational ergonomic exposures
based on combined information from chart review and interview
(Revised March, 2001)

Probability	Documented exposures in the present job or the job held during/just before symptom onset	Aggravation of symptoms by work activities, and/or improvement in symptoms if away from work for one week
0 = Unlikely	No or infrequent exposure to any ergonomic exposures listed below	
1 = Possible	1) Full-time exposure (at least 6 hours per day) to one exposure; or 2) Part-time exposure (at least 4 hours per day) to two or more exposures; or 3) Occasional exposure (at least 2 hours per day) to three or more exposures	Yes / No / Not specified
2 = Probable*	1) Full-time exposure (at least 6 hours per day) to one exposure c or e at high intensity or frequency; or 2) Full-time exposure (at least 6 hours per day) to two or more exposures; or 3) Part-time exposure (at least 4 hours per day) to three or more exposures	Yes
	1) Full-time exposure (at least 6 hours per day) to one exposure of a, b, or d at high intensity or frequency; or 2) Full-time exposure (at least 6 hours per day) to any two or more exposures; or 3) Full-time exposure (at least 6 hours per day) to three or more exposures	No / Not specified

Probability	Documented exposures in the present job or the job held during/just before symptom onset	Aggravation of symptoms by work activities, and/or improvement in symptoms if away from work for one week
3 = Definite*	1) Full-time exposure (at least 6 hours per day) to one exposure of a, b, or d at high intensity or frequency; or 2) Full-time exposure (at least 6 hours per day) to any two or more exposures; or 3) Full-time exposure (at least 6 hours per day) to three or more exposures	Yes

* Also assumes that non-occupational causes (systemic disease, poorly healed wrist fracture, hand-intensive hobbies, etc.) have been ruled out.

Ergonomic exposures defined as:

- a) Frequent, repetitive hand or wrist motions on the affected side, including but not limited to intensive or continuous operation of a video display unit keyboard
- b) Forceful manual exertions with the affected hand/arm
- c) Sustained awkward hand position (e.g., pinch grip) or wrist posture (e.g., flexion, extension, ulnar deviation) or use of the fingers with the wrist flexed
- d) Use of a vibrating hand tool or device (including steering wheel), or holding a part to a vibrating device (e.g., grinding wheel)
- e) Frequent or prolonged pressure over the wrist or base of the palm on the affected side

Appendix VIII.

Tabulation of occupational and non-occupational risk factors in 34 medical charts of
diagnosed or likely CTS cases

Occupational and non-occupational risk factors, and attribution or suspected cause of CTS according to treating physician, in 34 medical charts of diagnosed, probable or possible CTS cases.

Pt.	Weight	BMI*	Medical and/or hormonal factors	Non-occup. activities+	Occupation	Occup. Exposures	Attribution by PCP
1	.	.	-----	Softball, cheerleading	Student	Typing class	DNS
2	80 lb. overweight		Pregnant	-----	Transcriptionist	Rep. keyboard op.	Work
3	Rapid wt gain(30 lbs.)			Computer use	Nurse		DNS
4	"Obese"		Pregnant	-----	Office worker	Keyboard op.	Pregnancy
5	"Obese"		Cervical spondylopathy & radiculopathy	-----	(Cable TV co.)		Neck dis.
6	122	.	-----	-----	Assembly line machine opr.	Rep. & forceful motions	Work†
7	229	30.3	-----	-----	Contractor		DNS
8	240	42.7	-----	-----	DNS		DNS
9	198	37.5	-----	Yes (NS)	Hair dresser		DNS
10	169	27.4	-----	Driving, riding	Nurse practitioner		DNS
11	227	29.3	Colles wrist fx‡, 1997	Rowing machine	Drummer	Rep. motion	DNS
13	147	26.1	-----	-----	Psychotherapist		DNS
14	283	36.5	Diabetes	-----	Metal mechanic /welder	Rep. manual bending of metal strips	DNS
15	215	33.8	Diabetes	Writing	Airline ramp worker	DNS	
16	"Obese"		Diabetes	-----	Waitress	Carry trays: pressure, awkward posture	DNS
17	162	.	Fibromyalgia	-----	DNS (on disability leave)		DNS
18	348	54.7	Fibromyalgia; estrogen med.		Security guard	Cradles telephone on shoulder	Work†

Incidence of CTS in a HMO Population

L. Punnett, Sc.D.

19	263	41.3	Rheumatoid arthr; diabetes; estrogen med.	Sewing	DNS		R/o hypothy- roidism?
20	125	21.5	----	Needlework	Cake decorator	Rep. squeezing of frosting bags	Work & hobby
21	128	22.4	----	----	Not employed		Recent preg.
22	181	25.3	----	Tennis; typing	Student		DNS
23	145	26.6	----	Snowmobiling	Secretary	Rep. keyboard op.	DNS
24	146	23.7	----	----	Sheet metal layout		DNS
25	189	23.7	Epicondylitis†, 1996	----	Cabinet-maker	Rep. handling of heavy boards	DNS
26	174	31.9	----	----	QC inspector§	Rep. motions	DNS
27	115	.	----	----	Restaurant cook		Bulemia?
28	253	36.4	----	----	DNS		DNS
29	138	23.0	Estrogen med.	----	Office manager	Rep. keyboard op.	DNS
30	200	32.4	----	----	Not employed		Weight gain
32	126	23.1	----	Painting	Keyboard opr.	Data entry	DNS
33	205	31.3	----	Sawing wood	Truck driver		DNS
35	192	29.7	Fibromyalgia; chronic fatigue syndr.; estrogen med.	----	Nurse (on disability)		DNS
36	168	28.5	----	----	Nurse	Lifting & carrying stretchers	DNS
40	"Obese"		Rheumatoid arthritis	----	Cake decorator		DNS

* BMI = Quetelet body mass index. **Boldface:** Obesity noted in medical chart

+ Hand-intensive hobbies; activities that provoke or aggravate symptoms

† Not explicitly stated, but PCP recommended change in work duties because of "repetitive nature" of job

‡ On same side as CTS

§ Industrial quality control inspector

Appendix IX.

Draft letter to employers of CTS cases



University of
Massachusetts
Lowell

One University Avenue, Kitson 200
Lowell, Massachusetts 01854-2867 USA
tel: 978.934.3250
fax: 978.452.5711
web site: <http://www.uml.edu/Dept/WE>

DEPARTMENT OF WORK ENVIRONMENT

<Date>

Dear <Safety Representative>:

The University of Massachusetts Lowell is working on a research study about work-related upper extremity musculoskeletal disorders. This study is funded by the National Institute for Occupational Safety and Health, a branch of the federal Centers for Disease Control and Prevention.

One goal of this study is to find out what employers perceive to be the magnitude of upper extremity musculoskeletal injuries in the workplace. We are also interested in hearing about economic burden associated with these disorders, including workers' compensation costs and employee lost time. We are sending the enclosed questionnaire to a sample of employers in Massachusetts. The questionnaire requests information about the magnitude of the problem, if it exists in your facility; your company's procedures for identification and management of workers with musculoskeletal injuries; and if appropriate, the challenges of implementing ergonomic interventions in your facility.

Completing this questionnaire is voluntary and your responses will be kept confidential. The information you provide will be grouped with the responses of other employers. No individual employer will be identified in the results. Your response is crucial in providing a better understanding of the impact of musculoskeletal disorders on Massachusetts workplaces.

In appreciation for your completed questionnaire we will send you: 1) a copy of the results of the grouped analysis from this survey; 2) a copy of your results along with summary results on your specific industry group for comparison; and 3) a copy of a recent publication titled "Elements of Ergonomics Programs: A Primer Based on Workplace Evaluation of Musculoskeletal Disorders."

If you have any questions about this study or the questionnaire, please call me at 1-800-338-5223 or 978-934-____. Thank you very much for your cooperation.

Sincerely,

Helen M. Wellman, M.S.
Department of Work Environment