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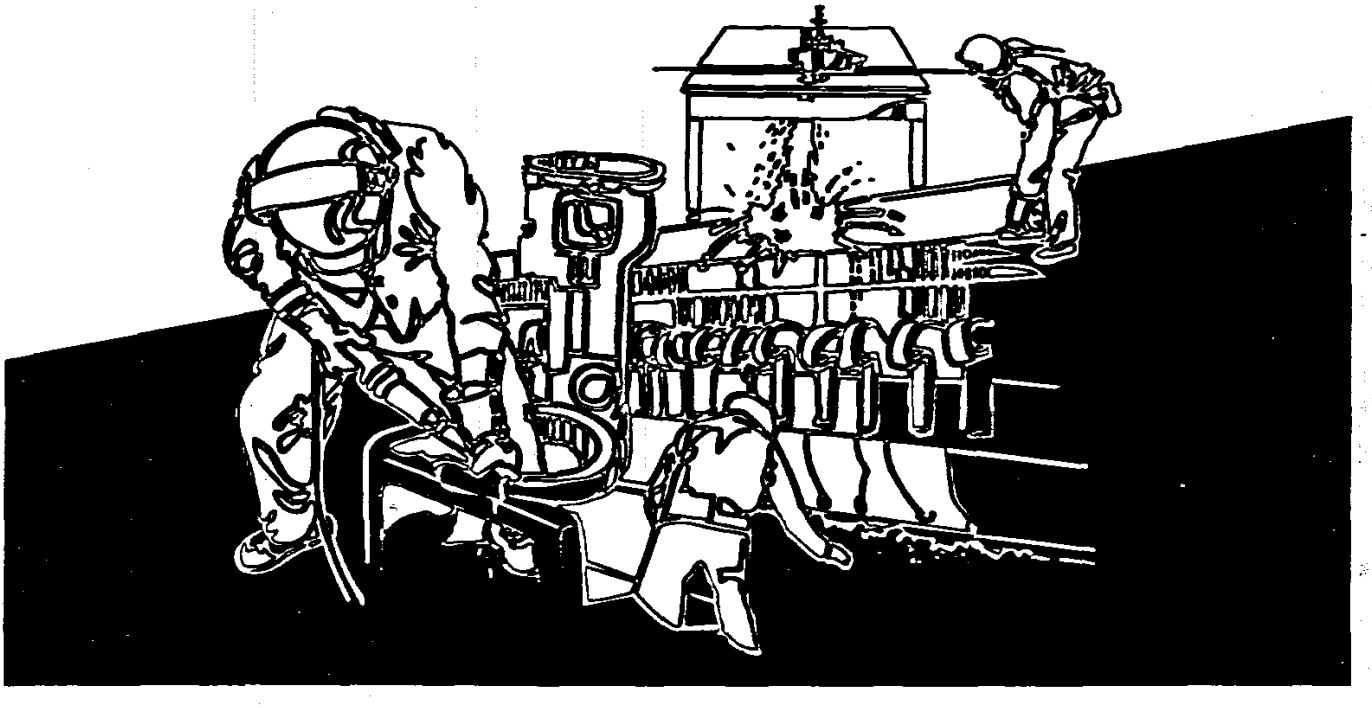

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

Upper Extremity Musculoskeletal Disorders among Newspaper Employees

UPPER EXTREMITY MUSCULOSKELETAL DISORDERS AMONG NEWSPAPER EMPLOYEES

HETA 90-013-2277
Los Angeles Times
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PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer and authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to federal, state, and local agencies; labor; industry; and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

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I. EXECUTIVE SUMMARY

In December 1989, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Los Angeles Times management for assistance in evaluating upper extremity work-related musculoskeletal disorders (WRMDs) among employees using video display terminals at two facilities, located in Los Angeles and Costa Mesa (Orange County), California. There was speculation among the editorial staff employees that the introduction of video display terminals, and, specifically, a keyboard designed for use in the Editorial department (with an increased number of editing keys compared to a conventional QWERTY keyboard and a particularly "hard-touch" when typing), may have been responsible for an increase in reported WRMDs at the newspaper.

To assess the nature and distribution of employee WRMD symptoms, four selected departments (Circulation, Classified Advertising, Accounting and Finance, and Editorial) were studied. Phase I, conducted during the weeks of July 23-27 and August 28-29, 1990, evaluated upper extremity symptoms through use of a self-administered questionnaire. Data on demographics, individual factors (medical conditions and outside activities), job history, job tasks, work organization factors and psychosocial aspects of the work environment, as well as upper extremity symptom information were obtained from participants. Case definitions for WRMD symptoms were based on frequency, duration, and intensity of symptoms in the affected area, and absence of previous acute injury.

On December 3-8, 1990, data was collected for Phase II, whose principal focus was on hand/wrist WRMDs. Phase II was a case-control study using selected participants from Phase I, and was conducted to determine whether Phase I risk factors would be confirmed using a more restrictive hand/wrist WRMD case definition. Randomly selected cases who fulfilled the criteria for a hand/wrist WRMD on the Phase I questionnaire were compared with controls with respect to results of an upper extremity physical examination (focusing on the hand and wrist), nerve conduction velocity testing, and vibration sensation testing (vibrometry).

Nine-hundred-seventy-three (93%) of 1050 eligible employees participated in Phase I. The mean age of the participants was 39 years, and the mean seniority on the current job was 11 years. Fifty-six percent of the participants were female.

Three-hundred-ninety-five (41%) participants reported symptoms meeting the case definition for at least one upper extremity WRMD. Neck symptoms (26%) were the most frequently reported, followed by hand/wrist symptoms (22%), shoulder symptoms (17%), and elbow symptoms (10%).

Employees in the Circulation Department had the highest prevalence of WRMDs (50%), followed by employees in the Accounting and Finance Department (39%), employees in the Classified Department (39%), then employees in the Editorial Department (38%).

For Phase I (the self-administered questionnaire), statistical analysis (multiple logistic regression) was used to determine significant risk factors for symptoms in the neck, shoulder, and hand/wrist separately. Elbow symptoms were not further analyzed because of the lower prevalence compared to the other body locations. The following work-related variables were found to be important:

I. The odds of having neck WRMD symptoms was increased for those reporting: 1) a greater number of hours on deadline; 2) an increased work variance (uneven load of work during the day); 3) more time on the telephone; 4) the perception that management did not value the importance of ergonomics.

II. The odds of having shoulder WRMD symptoms were increased for those reporting: 1) less participation in job decision-making, 2) a greater number of years employed at the LA Times and 3) greater job pressure.

III. The odds of having hand/wrist WRMD symptoms were increased for those reporting: 1) more time spent typing on computer keyboards, 2) a greater number of hours on deadline; and 3) less support from their immediate supervisor.

Women were more likely to report symptoms in all three upper extremity areas, but this may reflect the concentration of women in jobs involving more risk factors. A detailed discussion of these risk factors from Phase I are included in Section VII of the report.

Two-hundred and twenty-nine (97%) of 237 eligible employees participated in Phase II. One-hundred-thirty were randomly selected from among the 199 hand/wrist cases identified from Phase I, and 99 controls were randomly selected from among the 159 participants reporting no upper extremity or neck symptoms on the Phase I questionnaire. On physical examination, 53% of cases and 12% of controls had one or more positive hand/wrist findings. Thirty-one percent of cases had tendon-related physical findings and 18% of cases had nerve-related physical findings, compared to 5% and 6%, respectively, of controls. The ratio of cases defined by positive physical exam findings to those defined by symptoms alone (about 50%) is similar to that found in other WRMD studies conducted in a variety of industries, using comparable methods.

The Phase II hand/wrist cases with hand/wrist physical examination abnormalities (a more restrictive case definition than that based on symptoms alone) had their Phase I questionnaire results re-analyzed separately, to see if this more restrictive case definition would yield significant risk factors

similar to those from analyses using the Phase I symptom-based hand/wrist case definition. The risk factors associated with the more restrictive hand/wrist case definition were 1) female gender, and 2) percent of time spent typing on the computer keyboard, categorized by 20% increments. Similar variables were also important in the Phase I analyses (gender and number of hours spent typing on the computer keyboard). The other two important variables identified in Phase I (the number of hours spent on deadline and lack of support from an immediate supervisor) were not important risk factors using the more restrictive case definition.

Nerve conduction velocity (NCV) testing was performed on 96 Phase II participants randomly selected, separately from the cases and controls (61 cases and 35 controls). NCV was used as an objective measure to evaluate the symptom/physical exam-based hand/wrist case definition for carpal tunnel syndrome (CTS). Using logistic regression, our case definition for CTS, [the hand/wrist case definition with the added symptom of "being awakened at night with pain" (a common symptom of CTS)], was associated with decreased distal latency of the sensory branch of the median nerve, thought to be one of the earliest indicators of median nerve dysfunction and used in the definition of carpal tunnel syndrome in other studies. These results provide evidence to support the use, in epidemiologic studies, of our CTS case definition which requires both symptoms and physical findings.

Initial analysis of nerve conduction testing showed no important difference between the cases and controls, although most of the associations found were consistent in the direction of cases having decreased nerve function. When a more restrictive case definition, requiring symptoms and physical findings in the median nerve distribution of the hand, was used to compare to controls, there were important differences in the median motor distal latency, median motor conduction velocity, and sensory conduction velocity at the palm to wrist. However, the magnitude of the differences in NCV were small and may not reflect any clinically apparent impairment of nerve function.

Because of numerous changes in work station equipment and layout in several departments, which occurred throughout the study period, we were unable to study these factors, although other WRMD investigations suggest that work station equipment and design may be as important as the variables included in this study.

This investigation (both Phases I and II) provides additional evidence that increasing time spent typing on computer keyboards is related to the occurrence of WRMDs, particularly for symptoms and physical findings in the hand/wrist area, which confirms findings of a previous NIOSH study at another large newspaper facility. The psychosocial variables dealing job pressure and job demands were found to be importantly associated with upper extremity WRMDs. For the neck and shoulder, the lack of management support and lack of worker participation in decision making were important predictors. For the hand and wrist, psychosocial variables were not as strong predictors as the job task variables.

There were several limitations to this study. The cross-sectional study design makes temporal relationships of symptoms and some risk factors unclear. Self-reported symptoms may result in either an underestimate or an overestimate of WRMD prevalence. Those who reported symptoms may have been more aware of job-related physical and psychosocial stressors and may have reported these more readily than those without symptoms, resulting in incorrect or exaggerated associations between these factors and WRMDs. This study did not fully address the impact of non-work-related stress factors and their associations with WRMDs. Our results are based on the assumption that non-work stressors are probably similar between the two groups (symptomatic and non-symptomatic participants), and do not confound or modify the results to a large degree.

A comprehensive approach to the prevention of WRMDs, which addresses both ergonomics and work organizational elements, has the greatest likelihood of being successful in reducing the magnitude and severity of WRMDs. Since the interim report, the LA Times has begun to implement interventions with regards to work breaks and documenting workload in the Editorial Department. Recommendations to include these interventions in the other Departments, as well as recommendations pertaining to the findings of this study are included in Section VIII of the report.

On the basis of this evaluation, NIOSH investigators concluded that a high prevalence of possibly work-related musculoskeletal symptoms and disorders was observed at the Los Angeles Times's offices in Los Angeles, California. Recommendations to prevent and control musculoskeletal disorders are provided in Section VIII.

Keywords: SIC 2711 (Newspapers, Printing and Publishing), video display terminals, office automation, ergonomics, musculoskeletal disorders, cumulative trauma disorders, repetitive motion disorders, nerve conduction testing, carpal tunnel syndrome, tendinitis, psychosocial, work stress.

II. INTRODUCTION

In December 1989, the National Institute for Occupational Safety and Health (NIOSH) received a health hazard evaluation request from the management of the Los Angeles Times for assistance in evaluating work-related musculoskeletal disorders (WRMDs) of the neck and upper extremities among employees at two facilities, located in Los Angeles and Costa Mesa (Orange County), California. From January 1984 to September 1989, there were 239 employees, mostly from the Editorial department, who filed workers' compensation claims for cumulative trauma disorders to the upper extremities at the LA Times. For comparison, 44 WRMD workers' compensation claims were filed from a similar number of employees working at 4 other Times Mirror Co. newspapers during the same period.

The Hazard Evaluation was carried out at both facilities in two stages, Phase I and Phase II.

A. Objectives

1. Phase I

   The main objectives of the Phase I investigation were to determine the prevalence and characterize the risk factors for upper extremity WRMDs among active employees working in four departments (Editorial, Circulation, Classified, and Finance), and to suggest recommendations for their prevention. We set out to:

   a. Survey the nature, prevalence, and distribution of upper extremity WRMDs,
   b. Identify important job task risk factors for upper extremity WRMDs among newspaper personnel,
   c. Identify important work organization and psychosocial risk factors for upper extremity WRMDs among news personnel,
   d. Make recommendations to help reduce the occurrence and frequency of WRMDs.

   Phase I of the investigation was conducted during the weeks of July 23-27, 1990 and August 28-29, 1990 at both facilities.

2. Phase II

   The objectives of Phase II, a case-control study, were to examine risk factors associated with the development of hand/wrist WRMDs using a more restrictive case definition, to validate the hand/wrist case definition used in Phase I by use of further testing (including upper extremity physical examination and nerve conduction measurements), and to further

explore associations between working conditions and hand/wrist WRMDs. Phase II was also used to obtain information from a random sample of hand/wrist WRMD cases concerning their symptoms, the medical evaluation of their WRMDs, and changes which may have taken place in their workstation equipment subsequent to their WRMDs. Phase II was conducted December 3-8, 1990 at both facilities.

B. Interim Reports

An interim report describing the results of the Phase I hand/wrist WRMDs was sent April 5, 1991 to the LA Times management and employee representatives. Individual notification letters which reported results of the physical examination and nerve conduction results from Phase II were sent September 5, 1991. A letter summarizing the preliminary findings of the Hazard Evaluation was distributed in August 1992.

III. BACKGROUND

In the past ten years there has been a marked increase in reports of work-related disorders of the neck and upper limbs in the U.S. In 1990, the U.S. Bureau of Labor Statistics' Annual Survey of Occupational Injuries and Illnesses[1] reported that over 60% of all occupational illnesses were due to repetitive trauma disorders, an 8-fold increase during the preceding five years. Other surveillance data, such as worker's compensation records[2,3], have demonstrated similar increases in WRMDs. Several studies suggest that video display terminal (VDT) operators may be participating in this trend.[4,5,6] In the newspaper office environment, the VDT has altered the organization of work for the entire office staff, from receptionists to reporters. Immediate access to electronic news data-bases, immediate transference of information, computerized copy-editing, electronic monitoring, and electronic mail are all made possible by video display terminal networking. As a consequence, news-staff now spend a majority of working hours at computers, performing keying tasks.

A. Workforce

The Los Angeles Times is the largest city newspaper in the country, with a daily circulation of over 1.2 million, and a Sunday circulation of over 1.5 million papers. The paper employs over 6000 workers at the Los Angeles facility, and 1500 workers at Costa Mesa (Orange County). Several sections of the paper have undergone rapid expansion in the past five years, and these expansions have not always been met with an concurrent expansion in the employee staff. This has, at times, resulted in an increased workload for many of the newspaper staff, both in number of hours spent at work and number of stories written, ads sold, or phone calls handled.

B. Work Process

The four Departments included in the NIOSH evaluation had been identified on a walk-through inspection as having a wide range of computer keyboard use and job tasks.

1. Editorial:

   The Editorial employees collect and analyze facts about news events through interview, investigation, or observation. They check reference sources for additional relevant facts and assemble (write) stories using computer terminals with specially designed computer keyboards which have, in addition to the standard QWERTY configurated alphanumeric keys, additional editing and function keys. Editors also use these specially configurated keyboards to edit and correct news copy, write headlines, and set type electronically. Artists provide art-work services such as sketching, illustration, cartooning, and preparation of maps and graphs using drafting tables and computer graphics programs. Photographers use camera equipment to provide photographic coverage at events, supply all departments with photographic services, and have limited keying tasks at computer keyboards.

2. Classified Advertising:

   Classified Advertising employees sell and receive advertising by telephone, obtain sales leads from various sources, and receive and process over-the-counter classified advertisements. They operate video display terminals, keying in information to ensure correct and timely publication of advertisements, and read and edit classified ad copy. Telemarketing Sales Representatives are held accountable for specific production levels (ads, lines, revenue).

3. Finance and Accounting:

   Finance and Accounting employees receive and process financial transactions for the newspaper. They prepare invoices, accounts, and bills. They formulate fiscal plans and devise budgetary reports through the use of video display terminals, microfiche, or financial calculators.

4. Circulation:

   Circulation employees respond to and initiate customer telephone calls, receive and process requests for new subscriptions and changes in paper delivery, and enter information on video display terminals. A sales production standard must be met weekly. Supervisory monitoring of employee telephone calls with customers is periodically used for evaluating quality of work performed.

IV. EVALUATION DESIGN AND DATA COLLECTION METHODS

A. Phase I

Phase I used a cross-sectional study design using a survey questionnaire to analyze risk factors for reported upper extremity musculoskeletal disorders among newspaper personnel. The selected study sample of 1050 employees was drawn from the employees (approximately 3000) in the four departments of interest: Accounting/Finance, Circulation, Classified Advertising, and Editorial. Jobs were also selected within the departments to include those with at least 25 workers for meaningful statistical analysis. The departmental sample size was based on power calculations using estimates of disease prevalence from previous studies[7,8], an alpha=0.05 and beta =0.8., to find a significant difference in the proportion of WRMDs among editorial staff compared to other comparison groups.

Preexisting data sources (workers compensation information and Occupational Safety and Health Administration [OSHA] injury and illness logs) kept by the LA Times Safety Department, as well as in-house surveys, showed that WRMDs reports had predominated in the Editorial Department in the period from 1986-1990. Because of this predominance, we solicited 450 randomly selected Editorial Department employees, treating the Downtown Los Angeles and Orange County locations as a single group, 200 employees from the Classified Advertising Department, 200 from Finance and Accounting, and 200 from Circulation, all randomly chosen by department. These artificial sample sizes will affect overall prevalences, but not the associations of variables with WRMDs, which is the focus of this study.

The LA Times management provided NIOSH investigators with an employee roster including name, department, current job title, professional job code (e.g. manager, professional, clerical), and total number of years worked at the LA Times. From this employee roster, a random list was generated by department. From the random list, employees were notified of the investigation by mail and were asked to participate. They were also invited to participate by a letter signed by both an employee and management ergonomic committee representative in their department.

Participation was by informed consent. Persons under 18 years of age and women who were currently pregnant were excluded from participation in the study. (Pregnancy is one of the risk factors for carpal tunnel syndrome. We did not anticipate there would be enough pregnant newspaper employees to be able to control for this confounder and, therefore, they were excluded from participation.)

1. Questionnaire

A self-administered questionnaire was used to obtain information on demographics, upper extremity musculoskeletal symptoms, job tasks, work history, and the work environment. Similar questionnaires have been used and standardized in other NIOSH studies of upper extremity WRMDs.[7,9,10,11]

a. Content of the Phase I Questionnaire

1. Demographics and individual factors

The first section inquired about demographic information including age, race, gender, and height of participants. The questionnaire asked the total number of hours spent using computers outside of work and whether the participant had any physician-diagnosed conditions reported to be associated with musculoskeletal disorders (rheumatoid arthritis, diabetes mellitus, thyroid disease, disk disease in the lower back or neck, alcoholism, gout, lupus, and kidney failure).

2. Work practice, job history, job task, and work organization variables

The work practice variables included the use of glasses, contact lenses, or bifocals, typing skill and technique; length of time sitting continuously in the chair, and frequency arising from the chair. Job history variables included department, job, seniority on the current job, total years spent working at the Los Angeles Times, and total years spent working at any newspaper. Work organization information included number of hours worked per week, hours spent typing at the VDT workstation, percent of time spent typing, co-worker use of the same work-station, number of hours spent on deadline, presence of deadline work, number of daily stories, number of weekly stories, number of long-term special projects, number of hours spent on the telephone, and number and types of work breaks.

3. Work-station Equipment and Issues

Work station equipment characteristics were obtained, including the use of a chair, desk, telephone headset, type of computer and keyboard, and whether any changes within the past year was made. Participants were questioned whether they had received any training in the use of adjustable work station equipment and instruction in placement of work station equipment. Comfort of the chair was also assessed. Although questions about work station equipment were included in the questionnaire, because of numerous changes in work station equipment and layout in several departments that occurred both prior to and during our study period, we could not adequately assess relationships of symptoms to workplace equipment or layout.

4. Health Outcomes

Information was obtained concerning symptoms of pain, numbness, tingling, aching, stiffness, or burning within the preceding year in each of the affected areas of the neck and upper extremity. Frequency of these symptoms during the preceding year was determined by an "anchored" 5-point scale from "almost never (every 6 months)" to "almost always (daily)". Usual duration of the symptoms was ascertained using a 7-point scale of "less than 1 hour" to "more than three months". Intensity of symptoms was evaluated using a 5-point scale from "no pain" to the "worst pain ever in life". To provide an estimate of more recent symptom occurrence, employees were asked whether the symptoms had occurred in the week immediately preceding the survey. Questions about seeing a health care provider, missing work, restriction of job duties, and symptoms causing participants to awaken at night were asked as indirect indicators of severity of symptoms.

5. Psychosocial

Questions addressing psychosocial aspects of the work environment were taken from a separate NIOSH general job stress instrument which has had extensive use in occupational stress research.[12] This section consisted of multi-item scales related to job satisfaction, job demands, workload demands, job control, worker isolation, job security, hostility from clients, inter- and intra- group conflict, and social support from immediate supervisor, friends and relatives, and co-workers.

b. Pretesting of the Questionnaire

A pretest was designed and conducted to test and refine the questions, to explore the reliability of specific questions and the questionnaire design, to discuss confidentiality issues, and to test administration procedures. Twenty LA Times employees from the four departments participated in a pilot survey on March 20, 1990 to field-test the questionnaire. Many of the comments and suggestions made by the pretest group were incorporated into the final survey questionnaire.

c. Maximizing Respondent Participation

A comprehensive plan was developed and implemented to maximize participation:

1. Endorsement was secured from management and employees representatives and communicated to all employees prior to the survey by individual letter,
2. All employees were notified of the survey a few days before the distribution of the questionnaires,

3. Scheduling was completed through the supervisors and the ergonomics employee-management committee,
4. The questionnaires were tracked to ensure that every potential participant had more than one chance to participate,
5. Telephone calls and work-station visits were made to prompt "no-shows" to complete the questionnaire.

The plan assured that maximum effort was made to ensure employee understanding of the investigation and assurance of the confidentiality of their questionnaire responses. As part of this effort, a letter was sent to all employees from the Los Angeles Times management and the employee representatives of the four departments encouraging all employees to participate in the voluntary survey and assuring them that their responses would be confidential. A second letter was sent from the Los Angeles Times management to the supervisors explaining the nature of the survey and the procedures the NIOSH study would be following. A third letter was sent to all employees from the NIOSH researchers, introducing themselves and explaining the nature of the investigation and asking for participation. Included in the letter was the chief investigator's phone number that the respondents could use for any questions they might have regarding the questionnaire or its confidentiality.

d. Administration of the Questionnaire

The questionnaire was administered to employees in groups ranging in size from 5 to 40, in pre-scheduled, one hour time periods during work hours. NIOSH personnel were present to answer the participants' questions as well as review the questionnaire for completeness.

2. Phase I Case Definition for WRMD

An upper extremity WRMD was considered present if: symptoms (pain, numbness, tingling, aching, stiffness, or burning) in the affected part occurred within the preceding year and all of the following apply: 1) No previous accident or sudden injury that was not work-related (such as dislocation, sports injury, fracture, or tendon tear); 2) Symptoms began after starting the current job; 3) Symptoms lasted for more than one week or occurred at least once a month within the past year; 4) Symptoms were reported as "moderate" (the midpoint) or worse on a five-point scale intensity scale. All those participants who were not excluded because of previous injury and not fulfilling the case definition were considered non-cases for the analysis of Phase I.

B. PHASE II

Phase II was a case-control study designed to validate the hand/wrist case definition used in Phase I by use of further testing (including upper

extremity physical examination and nerve conduction testing), and to assess the risk factors for hand/wrist WRMD defined more rigorously (requiring both symptoms and physical examination findings).

1. Selection Criteria for Phase II

One hundred fifty randomly selected participants who fulfilled the Phase I hand/wrist WRMD case definition (cases) were asked to participate, along with 130 randomly selected Phase I participants who reported no upper extremity or neck symptoms (controls). Again, the sample size needed to ascertain an odds ratio of 2 or more was based on power calculations using estimates of disease prevalence from previous studies, an alpha=0.05 and beta=0.8.

2. The Phase II Questionnaire

To further characterize working conditions among the hand/wrist cases and to further explore associations with hand/wrist symptoms, individual factors, job tasks, work history, and the work environment, a new Phase II questionnaire was developed. Meetings were held with the employee/management committee and a separate Editorial Repetitive Strain Injury (RSI) group to discuss topics (including those not in the Phase I questionnaire) to be included in the Phase II questionnaire. These comments and suggestions were studied by the NIOSH investigators, and were incorporated into the Phase II questionnaire.

The Phase II questionnaire contained information directed at specific working conditions that participants experienced during 1-year intervals for the preceding three years (1988-1990). Participants were asked if conditions of a number of work organization factors had improved, worsened, or had not changed compared to the previous one-year interval. Information concerning number of hours worked, number of hours spent using the VDT, typing speed, supervisory support, job satisfaction, work load, work pace, and number of days per month working overtime was sought. Information concerning hobbies which might affect the hand/wrist region was also obtained. All participants were asked if they had developed symptoms during the 6 month interval between Phase I and Phase II. Cases (those whose hand/wrist symptoms met the Phase I WRMD case definition based on the Phase I questionnaire) were also asked information concerning current symptoms, medical evaluation, treatment, improvement of symptoms over time, work station equipment changes, and any perceived difference in their hand/wrist symptoms as a result of these things. Information concerning perceived difficulties with the Workers' Compensation system at the LA Times was also obtained at the request of the LA Times RSI group. There was concern that the internal system was not responsive to the needs of those who filed for compensation, in terms of available information or timeliness.

3. Physical Examination

A standardized physical examination of the upper extremities was performed on cases and controls in Phase II. The exam was developed by an internal NIOSH ergonomics medical team and focused on the musculoskeletal system; it has been used in other NIOSH WRMD studies.[13,14,15,16,17,18] The examination consisted primarily of inspection, palpation, and passive, active, and resisted motions. Table 1 lists the physical examination criteria used to define, for epidemiologic purposes, tendon-related disorders, peripheral nerve entrapment syndromes, and soft tissue disorders in the neck, shoulder, and hand/wrist regions. There were three medically trained examiners (two physicians and a nurse) who carried out the examinations. Examiners were blinded to the participant's job title and questionnaire responses.

Every 5th participant had a repeat examination by a second examiner, who was blinded to the results of the first examiner. This repeat examination was conducted to evaluate inter-examiner reliability.

4. Nerve Conduction Velocity

Nerve conduction testing, designed to measure the characteristics of an electrical impulse along peripheral nerves, was performed on the median and ulnar nerves of the dominant hand and wrist of randomly selected cases and controls. Nerve conduction testing is considered to be the "gold standard" for evaluating median nerve function.[19,20] Three measurements were assessed:

1. The latency period: the time from beginning of the stimulus and the beginning of the response;
2. The amplitude: the magnitude of the response of the nerve to a stimulus, which indicates the number of nerve fibers stimulated;
3. The conduction velocity: the rate at which a nerve conducts an impulse.

An increased latency period, decreased amplitude, and/or decreased conduction velocity suggests a dysfunctional or injured nerve.

A single physician performed all nerve conduction testing, using a TECA TD-20 Mk1 electromyograph[21] and standardized non-invasive techniques[22] (See Appendix A). Each participant also had his or her index finger circumference measured with a narrow cloth measuring tape around the middle of the proximal phalanx.

Selection of nerve conduction testing participants was by random selection with replacement among the cases and controls (for example, if

a case chose not to participate in the nerve conduction testing, the next randomly chosen case was asked to participate). One hundred Phase II participants (the maximum that could be done with available resources) were initially invited to participate in the nerve conduction evaluation. More cases were selected in order to increase the available data for the case definition validation objective of Phase II.

5. Vibrometry

Vibration perception threshold was measured in the 2nd and 5th fingers of the dominant hand of all the Phase II participants (130 cases and 99 controls) by a single technician, using a quantitative, non-invasive instrument, the Vibratron II.[23] Abnormal results are thought to give an early indication of peripheral nerve dysfunction[24]. A protocol using the method of limits procedure[25] was used (See Appendix B).

6. Work Sampling

Work sampling techniques were used to document the amount of time spent typing on computer keyboards over the course of the work day. Eighty Phase II participants were invited to take part in the work sampling evaluation. These were randomly selected, 40 from among the cases and 40 from among the controls. Work sampling was used because of the different tasks performed over the course of a day. Four different observers, blinded to case status, watched three to five participants every 15 minutes over the course of the work-shift, attempting to obtain 30 observations per participant. They noted the workers' tasks during each observation and recorded each period in which they were involved in computer keyboard typing tasks.

V. Statistical Analysis

A. Phase I

Several steps were used in the analysis of the Phase I questionnaire.

For the psychosocial scales, all multi-item scales were factor-analyzed to insure that they were uni-dimensional, and further analyses were carried out to examine their reliability (internal consistency). These analyses indicated that the factor-based scales had acceptable reliability (Cronbach alpha) co-efficients ranging from 0.6 to 0.9. Sum scores were derived for each psychosocial scale.

To identify important risk factors for neck, shoulder, and hand/wrist WRMDs, separate logistic regression models were developed for each of the three body areas. Statistical analyses used unconditional multiple

logistic regression. First, the independent variables were grouped into 3 sets: 1) work practices, work organization, work station equipment; 2) demographic and individual factors, and 3) psychosocial factors. Then, within set one, all independent variables were tested individually for a relationship with the specified WRMD. If the likelihood ratio test for a given independent variable had a p value greater than 0.10, the variable was not analyzed further. All of the remaining independent variables were placed in the model, and each variable was tested in the presence of the others. The likelihood ratio test was used with alpha = 0.05. Of all the variables which had $p > 0.05$, the one which had the largest p-value was deleted from the model, and the model was refit. This process was repeated until all the remaining variables had $p \leq 0.05$.

Next, if any continuous variables remained in the model, their quadratic forms were added to the model, tested simultaneously, and deleted from the model if $p > 0.05$. The process was repeated for cubics if quadratics remained in the model. This process was then repeated on all two-way interactions among the remaining variables. If $p \leq 0.05$ for the simultaneous test, interactions were removed one at a time as before.

Because changes in one's workplace was likely to be an effect rather than a cause, it was removed from any model in which it remained. (It was not used at all in the neck and shoulder analysis.) Starting with the resultant model, the same main effects analysis was repeated on the variables in set 2. This resulted in a model containing variables from sets 1 and 2. If any of the first set had $p > 0.05$ in this model, they were removed one at a time as before. For the psychosocial sum scores in set 3, Student t-test analyses were performed to compare the cases and non-cases on each scale. Scales which differentiated the cases and controls at the $p \leq 0.05$ level were introduced into the models with the other independent variables from set 1 and set 2 and tested simultaneously. If $p \leq 0.05$ for this test, the same main effects analysis was repeated for them. If percent of time typing remained in the model, it was replaced by time typing if the p value for time typing was smaller than that for percent of time typing. Each variable in the model was rechecked to assure $p \leq 0.05$. (This is for the hand/wrist model only; the neck and shoulder analyses used time typing instead of percent of time typing throughout the model building process.) This method of analysis resulted in the final models, with variables for which odds ratios were derived. For the psychosocial scales which remained in the models, odds ratios were derived from the 75-25% interquartile range difference of the responses for each scale, and not as a continuous score.

Use of Odds Ratios

Logistic regression was used for multivariate analyses in Phase I and Phase II. This technique calculates the odds ratio as a measure of association between predictor variables and outcome variables. The odds ratio above 1.0 indicates an association between the risk factor (predictor variable)

and the WRMD (outcome variable). The 95% confidence intervals (CI) indicates the probable range within which the odds ratio actually falls. Ordinarily, if the CI includes 1.0, the association between the risk factor and the WRMD could have occurred by chance alone and the elevated odds ratio is not considered statistically significant. For this study, CIs were derived from the Wald test and are sometimes wider than those which would have been derived from the likelihood ratio test, which is the test we used to determine if variables should be removed from or included in the models. Thus, a few of our CIs include "1.0" even though the variable is related to WRMD by our criteria. When the overall prevalence of the outcome variable is below 20 percent, the odds ratio provides a more accurate estimate of relationships and more closely approximates the relative risk. When the prevalence rates are higher, as in this study, and the relative risk is greater than 1, the odds ratio may substantially overestimate the relative risk, unless the relative risk is close to 1.

B. Phase II

The analysis plan for Phase II consisted of the following:

1. Questionnaire Data

Analyses of the questionnaire data were restricted to those Phase II hand/wrist symptom-based cases who had positive hand/wrist physical examinations (defined as at least one abnormality on hand/wrist physical exam maneuvers) compared to those controls who reported no symptoms (on both first and second questionnaire) and had no neck or upper extremity physical exam abnormalities. This more restrictive case definition (requiring both symptoms and physical findings versus symptoms alone) has been used in several previous NIOSH ergonomic studies.[10,11,26]

Controls who developed hand/wrist pain in the 6-month period between Phase I and Phase II (one control reported severe hand/wrist pain, and 20 (20%) others reported mild hand/wrist pain) were excluded from the Phase II analysis.

a) The Phase II hand/wrist symptom cases with hand/wrist physical examination abnormalities had their Phase I questionnaire results re-analyzed, along with the Phase II controls, to see if this more restrictive case definition would yield significant risk factors similar to those found using the Phase I symptom-based hand/wrist case definition. The methods used were identical to the Phase I analysis, except that in the model containing set 1 and set 2 variables, percent of time typing was replaced by a five level categorized version. Also, time typing was not examined as a final step.

b) Cases (as defined by positive symptoms and positive physical exam findings [as in section a, above]) and controls without symptoms or physical exam findings were compared with respect to their responses to the Phase II questionnaire using multiple logistic regression. All independent variables were tested simultaneously for a relationship with case status. If the likelihood ratio test (to assess whether any of these variables were related to the hand/wrist WRMD) was not significant with alpha = 0.05, all of these variables were assumed to be unrelated to the hand/wrist WRMD. If the test was significant, the following procedure was used to determine which variables were significant and which were not. Each variable was tested in the presence of the others. The likelihood ratio test was used with alpha = 0.05. Of all the variables which were not significant, the one which was furthest from significance (i.e. with the largest p-value) was deleted from the model, and the model was refit. This process was repeated until only significant ($p \leq 0.05$) variables remained.

c) Descriptive data were generated from the responses of the Phase II hand/wrist cases concerning the status of their symptoms, medical evaluation and treatment of their WRMD, work station equipment changes, and perceived difficulties with the Workers' Compensation system at the LA Times.

2. Analysis for Interrater Agreement of Physical Examination Results

Because more than one examiner was used to perform the physical examinations, we checked for the measurement of the interrater agreement (as to the presence or absence of the physical examination abnormalities), using the kappa statistic[27], which incorporates a chance-expected agreement into the assessment of interrater reliability.

3. Nerve Conduction Velocity Analysis

The analysis scheme for the nerve conduction velocity results was as follows:

a. Logistic Regression

1. Multiple logistic regression models using specific nerve conduction measurements as indicators of abnormal median nerve function were developed to test whether the Phase II hand/wrist WRMD (modified as described below) case definition using current symptoms and positive physical exam results were associated with abnormal nerve function, while controlling for age, height, and finger circumference.[28] The case definition

for CTS used in this analysis was: 1) having any hand/wrist symptoms AND 2) having a positive hand/wrist physical examination AND 3) symptoms of awakening at night due to hand symptoms. This last criteria was added to narrow the case definition to include only those cases suggestive of CTS. Nerve conduction results from all participants were used in the model building. Abnormal nerve function values were defined by the criteria used by Kimura[22] [Appendix A].

2. Other independent variables were tested using logistic regression for association with abnormal nerve conduction measurements, including gender, a variable which included all physician-diagnosed conditions reported to be associated with carpal tunnel syndrome, the individual physical exam maneuvers of the hand/wrist region (Phalen's and Tinel's tests), and vibrometry results. Abnormal nerve function values were defined by the criteria used by Kimura[22] [Appendix A].

b. Analysis of Covariance

1. A comparison of all cases and controls who received nerve conduction testing was performed using analysis of covariance, adjusting for age, height, and finger circumference.[28]

2. A comparison of controls with no physical findings with those cases whose symptoms were suggestive of nerve-involvement (symptoms of numbness and tingling restricted to the median nerve distribution) was performed. The motor and sensory nerve conduction velocities, amplitude, and latency measurements were compared between cases and controls in an analysis of covariance adjusting for age, height, and finger circumference.

3. A comparison of controls with no physical findings with those cases whose symptoms and physical exam findings were suggestive of median nerve involvement (numbness and tingling restricted to the median nerve distribution AND positive Phalen's and positive Tinel's tests) was performed. The motor and sensory nerve conduction velocities, amplitude, and latency measurements were compared between cases and controls in an analysis of covariance adjusting for age, height, and finger circumference.

4. After removing the results of one participant whose grossly abnormal test results were inconsistent with the lack of symptoms or physical exam findings, a comparison of controls with no physical findings with those cases whose symptoms and physical exam findings were suggestive of nerve-involvement was repeated. The motor and sensory nerve conduction velocities,

amplitude, and latency measurements were compared between cases and controls in an analysis of covariance adjusting for age, height, and finger circumference.

4. Vibrometry Analysis

The analysis scheme for the vibrometry results was as follows:

a. Multiple Logistic Regression

Multiple logistic regression models using specific nerve conduction measurements as indicators of abnormal median nerve function were developed to test whether vibrometry results for the 2nd (index) and 5th fingers and their arithmetic difference were associated with abnormal nerve function, while controlling for age, height, and finger circumference. Nerve conduction results from all participants were used in the model building. Abnormal nerve function values were defined using the criteria used by Kimura[22] [Appendix A].

b. Analysis of Covariance

1. The vibrometry results for the 2nd finger, 5th finger, and their arithmetic difference were compared for all cases and controls using analysis of covariance, adjusting for age, height, and finger circumference.[28]

2. Vibrometry results for the 2nd finger were compared between controls with no physical findings and cases whose symptoms were suggestive of nerve-involvement (numbness and tingling restricted to the median nerve distribution), using analysis of covariance adjusting for age, height, and finger circumference.

3. Vibrometry results for the 2nd finger were compared between controls with no physical findings and cases whose symptoms and physical exam findings were suggestive of nerve-involvement (numbness and tingling restricted to the median nerve distribution AND positive Phalen's and positive Tinel's tests), using analysis of covariance adjusting for age, height, and finger circumference.

5. Work Sampling

To assess the validity of the self-reported number of hours spent typing, the correlation between the observed and reported time spent typing (from the Phase I questionnaire) was also determined for the participating cases and controls using Pearson correlation analysis. Secondly, mean scores were derived for the observed

time spent typing on computer keyboards for the cases and controls, then Student T-Test analyses were performed on the data to see if there was a significant difference.

6. Analyses by Department

Included in Appendix C are the final logistic regression models for neck, shoulder, and hand/wrist WRMDs for each of the four departments. The important variables found to be associated with WRMDs were derived from the same statistical analysis techniques used in the previously mentioned models.

VI. RESULTS

The results are organized in the following manner:

Phase I:

1. Participation rates, overall and by department;
2. Demographics
3. Prevalence rates for overall results of neck, shoulder, and hand/wrist WRMD
4. Important Work-related variables associated with WRMDs:
    a. Individual factors
    b. Work practice and work organization factors
    c. Psychosocial variables
5. Multiple logistic regression model for overall results for the neck, shoulder, hand/wrist WRMDs.

Phase II:

1. Participation Rate
2. Questionnaire Results
    a. Analysis of Phase I questionnaire data for hand/wrist WRMDs using the Restrictive Phase II case definition
    b. Phase II questionnaire
        1. Demographics
        2. Descriptive results of Participants with hand/wrist WRMD
        3. Hand/wrist WRMD significant predictors
3. Physical Examination Results
4. NCV Results
5. Vibrometry Results
6. Work Sampling Results

The logistic regression results analyzed for each department and by gender are given in Appendix C.

A. Phase I

1. Participation Rate

Nine hundred and seventy three employees completed the questionnaire, for a 92% participation rate. The four departments had the following participation rates: Accounting and Finance 90%, Circulation 97%, Classified 86%, and Editorial 95% [Table 2].

2. Demographics

The mean age of the study participants was 39 years (range 19 years to 72 years); 56% were female. One percent were self-reported Native-American or Alaskan-Native, 10% were Asian, 14% were Hispanic, 17% were African-American, 56% were of non-Hispanic European ancestry, and 2% listed themselves as other. The mean length of employment was 9.0 years (standard deviation 7.6 years) at the LA Times, and 12.0 years (standard deviation 9.1 years) in the newspaper business. The Editorial Department had a lower percentage of women, and the employees had the longest tenure at the LA Times [Table 3]. Circulation employees had the least tenure, both in their current job and at the paper. Other differences between departments were minor.

3. Phase I Prevalence rates

Three hundred and ninety-five (41%) of the 973 participating employees reported symptoms in the last year meeting the case definition of any WRMD (of the neck, shoulder, elbow, or hand/wrist)[Table 4].

Of the 973 participants, a certain number were excluded from analysis in each body part because of previous injuries which were not work-related or because the onset of symptoms preceded working at the LA Times. The resulting prevalences of WRMD were: neck 26% (214/825), shoulder 17% (153/894), elbow 10% (98/939), and hand/wrist 22% (199/891). Table 4 lists these results and the percent of cases which reported daily pain in the affected areas. Table 5 lists the prevalences of any WRMD by department, Table 26 lists prevalences by department and location of WRMD symptoms.

Of those participants fulfilling the WRMD case definition in either the neck, shoulder, elbow, or hand/wrist regions, fewer than 50% had seen a health care provider, less than 25% had missed one work day because of the disorder, and less than 15% had been assigned to a different job for one work day due to symptoms [Table 6].

4. Important Work-related Variables Associated with WRMDs:

a. Individual Characteristics

Table 7 shows the prevalence of reported physician-diagnosed conditions in the current sample, which have been previously described to be associated with carpal tunnel syndrome. Thyroid conditions were reported by 47 (5%) of participants, rheumatoid arthritis was reported by 29 (3%).

b. Work Practices and Work Organization Characteristics

Sixty-two percent of employees wore glasses or contact lenses at work, and 11% wore bifocals [Table 8]. Fifty-six percent stated their typing speed as "medium" (between 30 and 60 words per minute), and 83% had a "touch typing" technique. The mean number of times per day arising from the chair was 5.6, while the mean length of time sitting in the chair continuously was 1/2 to 1 hour. The average time spent on the telephone was 2.9 hours per day.

Seventy-one percent of employees reported working on deadline, with 47% reporting 0-10 deadline hours per week (our question regarding number of hours on deadline asked "How many HOURS PER WEEK do you work ON DEADLINE ?", and clarified during the administration of the questionnaire as "how many hours do you change the way you normally work when faced with a deadline ?") [Table 9]. Twenty-one percent of employees reported working on deadline 30 or more hours per week. Fifty-six percent of participants reported typing on computer keyboards more than 4 hours per day; of these, 26% typed more than 6 hours. Seventy-four percent had their own workstation. Fifty-seven percent took less than three short breaks in a typical morning or afternoon, and 95% took less than three longer breaks per day; 79% less than two [Table 9].

c. Psychosocial Variables

The mean scores and standard deviations for the 14 psychosocial scales are found in Tables 10 and 11. When compared to the other three departments, the Circulation Department had scores indicating statistically significantly less control over their job situation (job control) and less participation in decision making in their job (job participation). Departments were not significantly different with respect to any of the other psychosocial variables. However, the Editorial Department had mean scores which reflected a slightly better (though not statistically significantly so) psychosocial environment than the other three departments. The prevalence of WRMDs in the Editorial Department, however, was similar to those in Classified and Finance, though less than that of Circulation [Table 5].

5. Multivariate Logistic Regression Results of the Phase I Questionnaire

The following work-related variables were found to be important (had $p \leq 0.05$, in the final models):

a. The odds of having neck WRMD symptoms was increased for those reporting: 1) a greater number of hours on deadline; 2) an increased workload variance (uneven load of work during the day); 3) more time on the telephone; 4) the perception that management did not value the importance of ergonomics [Table 12].

b. The odds of having shoulder WRMD symptoms were increased for those reporting: 1) less participation in job decision-making, 2) a greater number of years employed at the LA Times, and 3) greater job pressure [Table 13].

c. The odds of having hand/wrist WRMD symptoms were increased for those reporting: 1) more time spent typing on computer keyboards, 2) a greater number of hours on deadline; and 3) less support from their immediate supervisor [Table 14].

Women were more likely to report symptoms in the neck, shoulder, and hand/wrist areas. Race (non-white verus white) had initially been in the final model for Shoulder WRMDs, but because the variable was thought to be contrived and essentially meaningless (the variable implied that African-Americans, Hispanics, and Asians all have some common characteristic because they are not white) it is not included in the tables. However, the other odds ratios in the shoulder WRMD table remained adjusted for race (as its importance in the model may indicate its role as a surrogate for another variable).

B. Phase II Results

1. Participation Rates and Exclusions

Figure 1 depicts the selection strategy for Phase II. Of the original 280 participants chosen to participate in Phase II (150 randomly selected cases and 130 randomly selected controls), 38 were not present during our return visit (on vacation, etc.) and were never contacted, four were pregnant and excluded from the study, and nine refused to participate. Two-hundred and twenty-nine of 238 (97%) eligible employees (82% of the original 280) participated in Phase II. One-hundred-thirty were cases (fulfilling Phase I criteria for a hand/wrist WRMD from Phase I) and 99 were controls (Phase I participants who reported no upper extremity or neck symptoms).

Among the 99 controls, 21 developed some hand/wrist pain in the 6-month period between Phase I and Phase II (one control reported severe hand/wrist pain, and 20 (20%) reported mild hand/wrist pain). (These 21 did not meet the frequency and duration requirements of the case definition).

2. Phase II Demographics

For Phase II, the mean age of the participants was 38 years for the cases and 40 years for the controls; 68% of the cases and 47% of the controls were female. Table 15 lists their distribution by department.

3. Phase II Questionnaire Results

a. Phase II Hand/wrist Case Information

Table 16 lists the descriptive data obtained from the Phase II hand/wrist cases. Of the 130 Phase II participants fulfilling the symptom-based hand/wrist case definition, 68% described the intensity of their hand/wrist pain as at least "moderate" to "severe" pain (only one participant described it as "the worst pain in my life"). Fifty-two percent reported hand/wrist symptoms in the seven days preceding the Phase II exam. Seventy (57%) stated that when on vacation for more than one week their symptoms decreased. Only 32% had reported their hand/wrist pain to the LA Times medical department. Eleven percent had taken time off from work due to hand pain; of these, 9% had informed their supervisor of the reason. Fifty-five (44%) said that their symptoms had improved since they first noticed them. Thirty percent of the Phase II hand/wrist cases reported that they had received some type of medical treatment, 4% had received surgical treatment, and 24% had taken part in some type of exercise program [Table 17]. Of those participants who received new workplace equipment subsequent to their reporting of hand/wrist problems [Table 18], 51% of those receiving a wrist rest reported improvement in hand/wrist symptoms, 48% reported that an adjustable desk had made a difference in improving their symptoms, and 44% thought that a foot rest had helped with their symptoms.

However, aside from most cases receiving a new chair or telephone equipment, less than 50% had received any other new equipment at their work station. Eighteen percent of the Phase II cases had filed a worker's compensation claim; and of these, 73% reported they experienced no difficulty with the LA Times Worker's Compensation Procedures.

b. Phase I Questionnaire using Phase II Participants

The independent variables from the Phase I questionnaire which were

associated with the more restrictive (Phase II) hand/wrist case definition (current symptoms and positive hand/wrist physical examination, 58 cases) were: 1) female gender and 2) percent of time spent typing, categorized in 20% increments [Table 19]. The comparison group used in this analysis were the 67 controls with no symptoms or physical exam findings. The two other variables which were important in Phase I, the time spent on deadline and perceived lack of support from immediate supervisor were not found to be significant with the more rigorous case definition.

c. Phase II Questionnaire Logistic Regression Model

Multivariate logistic regression was used to analyze the Phase II questionnaire variables. The model was constructed using the 58 cases (Phase II definition) and the 67 controls who reported no symptoms and had negative physical exams. Changes in hours spent typing (an increase) from 1/89 to 12/89, and change in overall workload (an increase in workload), between 1/90 and 12/90 were associated with "positive physical exam/positive symptom hand/wrist WRMD" [Table 20].

4. Physical Examination Results

Physical examinations were performed on all 229 Phase II participants (130 cases and 99 controls). Abnormal tendon-related findings on the hand/wrist exam were the most common, 31% in the cases versus 5% in the controls. Abnormal nerve-related findings were found in 18% of the cases and 6% of the controls, ganglion cysts were found in 5% of cases and 1% of the controls, and joint-related findings were found in 2% of the cases and 1% of the controls [Table 21]. (These results sometimes differ from Table 21 in that they do not include the findings for the neck, shoulder, or elbow, which are included in the table.)

Forty-three participants had repeat physical examinations by two examiners to evaluate inter-examiner reliability. The kappa score for nerve-related findings was 0.44, which represents a fair to good agreement beyond chance between the examiners.[29] The kappa statistic could not be derived for tendon-related findings because there were only two persons with tendon-related positive findings among those participants who had repeat exams.

5. Nerve Conduction Results

Four participants refused testing following the initial stimulation (two cases and two controls). Data were incomplete for five additional participants: two requested discontinuation of testing before its completion, and subsequent quality control review identified uninterpretable waveforms for some measure on three participants. This yielded usable data from 61 cases and 35 controls.

The mean ages of the 61 hand/wrist symptom cases and 35 controls were 39 years (range 20-63 years) and 41 years (range 20-63), respectively. The cases had a higher proportion of women than the controls and had slightly smaller mean height and dominant hand index finger circumference [Table 22].

A. Logistic Regression

1. For the logistic regression models, the nerve conduction measurements were redefined as binary scores, using the normative data of Kimura[22] for purposes of establishing clinical abnormality. Sensory and motor nerve conduction measurements were used as dependent variables. After adjusting for age, height, and dominant finger circumference, the Phase II hand/wrist case definition for carpal tunnel syndrome was found to be significantly associated with 1) abnormal (increased) distal median sensory latency [Table 23] and 2) abnormal (decreased) sensory conduction velocity at the palm and wrist.

2. There was no association between abnormal (increased) distal median sensory latency or abnormal (decreased) sensory conduction velocity at the palm and wrist and the following variables after adjusting for age, height, and finger circumference: gender, the variable which included all physician-diagnosed conditions reported to be associated with carpal tunnel syndrome, or the individual physical exam maneuvers of the hand/wrist region (Phalen's and Tinel's tests).

B. Analysis of Covariance

1. Using analysis of covariance, cases had lower mean median motor conduction velocity than controls, but the groups did not differ significantly in any of the other parameters measured when controlling for age, height, and finger circumference.

2. A comparison of hand/wrist symptom-defined cases who reported numbness and tingling in the index and third finger (symptoms suggestive of median nerve involvement) were compared to the 30 controls without any positive physical findings. The cases had a lower mean median motor conduction velocity than controls, but the groups did not differ significantly with respect to any of the other parameters. However, with the exclusion of one participant whose grossly abnormal test results were inconsistent with the lack of symptoms or physical findings and therefore considered to be spurious, cases had a significantly higher mean median nerve distal motor latency and a lower mean median motor conduction velocity. Although not statistically significant, they also had a higher mean median sensory distal latency ($p = 0.06$) and a greater median-ulnar sensory conduction velocity difference ($p = 0.09$).

3. A comparison of hand/wrist symptom cases who reported numbness and tingling in the index and third finger (symptoms suggestive of median nerve involvement) and who had pertinent physical examination findings (positive Phalen's test and Tinel's test) were compared to controls without any positive physical findings [Table 24]. The mean median motor conduction velocity was significantly less among cases than controls. Again, although not statistically significant, the mean median motor and sensory distal latency were greater among cases, ($p = 0.07$ and $p = 0.09$, respectively).

6. Vibration Sensation Testing Results

The mean values of the vibrometry score results are shown in Table 25.

A. Logistic Regression

Using logistic regression, there was no significant association found between the vibrometry results for the 2nd, 5th fingers or their arithmetic difference and specific nerve conduction measurements as indicators of abnormal median nerve function.

B. Analysis of Covariance

1. Using analysis of covariance to analyze vibration threshold scores, the means of all cases and all controls were not significantly different for the 2nd (index) finger, 5th finger, or their arithmetic difference.

2. The mean vibration threshold score of the 2nd finger of the controls with no physical findings was not significantly different than either that of those cases whose symptoms were suggestive of median nerve involvement (symptoms of numbness and tingling restricted to the median nerve distribution) or that of those cases whose symptoms and physical examinations were suggestive of median nerve involvement (symptoms of numbness and tingling restricted to the median nerve distribution AND positive Phalen's and positive Tinel's tests).

7. Work Sampling Results

Work sampling was performed on 36 Phase II hand/wrist cases and 40 controls (90% and 100% participation, respectively). The arithmetic mean for the reported number of hours spent typing (from the Phase I Questionnaire) for the sampled cases was 4.5 hours; the mean for the sampled controls was 3.9 hours. For the observed number of hours spent typing, the arithmetic means were 2.5 hours for the cases and 1.9 for the controls [Figure 2]. The Pearson correlation coefficients for the

observed and reported times were 0.39 for the cases and 0.40 for the controls. Student t-test analysis of the observed times found that cases spent significantly more time typing than controls (an average of 2.5 hours compared to 1.8 hours; $p = 0.02$).

VII. DISCUSSION

The main objectives of our investigation were to determine the prevalence and characterize the risk factors of WRMD symptoms among active newspaper employees working in four departments. Of the neck and upper extremity disorders, employees reported neck symptoms to be the most prevalent, followed by hand/wrist symptoms, then shoulder symptoms, and finally elbow symptoms. Employees in the Circulation Department had the highest prevalence of WRMD symptoms (50%), followed by employees in the Accounting and Finance Department (39%), employees in the Classified Department (39%), then employees in the Editorial Department (38%).

Of the 4 demographic factors, women were found to be at higher risk than men for neck and shoulder symptoms. Neither the other three demographic factors nor any individual factors (either medical or hours spent typing away from work) were found to be significant predictors. The number of years employed at the Los Angeles Times, the only significant job history risk factor (of the five), was associated with shoulder symptoms. Of the 9 job task and work organization variables, the number of hours spent typing at the VDT was significantly associated with hand/wrist WRMDs. The number of hours spent on deadline was associated with both neck and hand/wrist WRMDs. Time spent on the telephone (the only significant work practices variable) was associated with neck WRMDs). For the 14 psychosocial variables, those employees who reported a marked increase in work variance, and a perceived a lack of importance given to ergonomic issues by management, tended to have a higher prevalence of neck WRMDs. Employees who reported a lack of participation in job decision-making and increased job pressure, tended to have a higher prevalence of shoulder WRMDs. Employees with a perceived lack of support from their immediate supervisors tended to have a higher prevalence of hand/wrist WRMDs.

The variables that were found to be important for hand/wrist WRMDs in both Phase I (questionnaire based definition) and Phase II (questionnaire and physical exam based definition) were the amount of time spent typing at computer keyboards (both hours spent typing and percent of time typing) and female gender.

A. Strengths and Limitations of Study

The study design used in this evaluation at the Los Angeles Times has a

number of strengths and weaknesses in assessing the risk factors for WRMDs at the LA Times. It is a study of a relatively large population at two facilities. A high response rate was obtained in both phases of the study (Phase I: 92%; Phase II: 97% of available workers), minimizing the potential for selection bias. This type of bias may be present with a low participation rate.

This is a cross-sectional study, which measures health outcomes and exposures at a single point in time. Although there was little potential for selection bias occurring among the current work force because of the high response rates in both phases of the study, inherent in this type of study is the potential for "survivor bias"; i.e. not including people who left their jobs because of the health problems of interest. This may result in an underestimation of association between risk factors and health problems. However, survivor bias was not considered to be a major problem in this study, as both records and accounts of LA Times employees indicate that the number of individuals who left the workforce during the previous year was small, and because of the substantial prevalence of WRMD among the workforce.

Because risk factors and health problems are measured at the same time in cross-sectional studies, it is not always possible to determine which occurred first. For example, an important association was found between hand/wrist symptoms and lack of support by the immediate supervisor, but with this study design we can't ascertain whether symptoms or the perceived lack of support came first.

Although the veracity of subjective symptoms might be questioned, where we had objective data to compare descriptions of the working environment by symptomatic and asymptomatic workers, the objective results supported the questionnaire derived associations. Our observation of a random sample of 36 workers fulfilling the hand/wrist case definition and 40 randomly chosen controls (without symptoms in the hand/wrist region) during work sampling (recording activities over the course of a work shift) showed that cases and non-cases similarly over-estimated their typing time.

The WRMD prevalence rates from Phase I were determined solely by self-reported symptoms from questionnaires; this may either overestimate or underestimate WRMDs. In the Phase II study, we found that 46% of those reporting hand/wrist symptoms within the past year had corresponding physical exam findings, and 57% of those reporting symptoms occurring within the week prior to the survey had physical findings. Participants in this study seemed to report a similar amount of pain as those in other studies, using similar methods, carried out in a wide variety of industries.[10,11,30] The ratio of cases defined by examination findings to those defined solely by symptoms at the LA Times is similar to that observed in other groups (a ratio of approximately 50%).[26,31] Additional support that the symptom reporting in this study relates to anatomical or

physiological changes at the tissue level is the mild reduction in median nerve function by CTD cases compared to the controls without physical examination findings in the Phase II study results.

While diagnostic criteria used to define tendon-related findings are based on standard clinical definitions for these disorders, it is not possible to determine the pathophysiology of most tendon-related positive physical findings in this study based on our findings. Whereas frank tendon disorders in high force/high repetition jobs (such as meat cutters) are thought to be well understood, the mechanism of upper extremity pain in office workers is not as straight forward in low force, repetitive jobs and has been a controversial area.

Another important factor to consider is that musculoskeletal symptoms are common in the general population, and not all are work-related. In this study, it is not possible to determine precisely the fraction of all complaints which are work-related and may respond to workplace preventive measures. In addition, it should be noted that symptoms range from intermittent complaints to daily pain, are of a wide range of severity, and may or may not require medical follow-up [Tables 6 and 17].

Those who reported symptoms may have been more aware of, and thus may have tended to over-report, job-related risk factors ("response bias"). For example, those who experience WRMD symptoms may have been more aware of time spent typing at computer keyboards, or to recount excess psychosocial problems, such as low supervisor support at work than those with no symptoms. If this occurred, associations between these factors and symptoms could be exaggerated. However, the fact that symptomatic and non-symptomatic individuals within the same jobs described the duration of keyboard use similarly suggests that this type of bias was not a major problem for job tasks. The consistency between studies for some of the present findings, such as duration of keying tasks, and the exposure/effect relationship observed in this study also suggests that response bias is not the principal explanation of the associations.

1. Non-work-related variables

This study did not fully address the impact of non-work-related variables and their possible associations with WRMDs. For example, we did address social support issues of spouses, friends, and relatives, but we did not cover issues such as child-care or home responsibilities, which may have some impact in the occurrence of neck and upper extremity symptoms.

2. Multiple Comparisons

In a study that examines numerous potential associations between possible exposure factors (like work pressure or hours of typing) and multiple different health outcomes, it is likely that a few of the associations are "statistically significant" by chance alone and are thus spurious (i.e.,

arose by chance). Differentiating spurious and non-spurious associations is a difficult task involving examination of observed effects in light of past findings, biological plausibility, and considering the strength of associations. In general, recurring associations in this study related to job tasks (such as typing hours and hand/wrist WRMDs) are not likely to be spurious.

3. Misclassification of Exposure

In a study like this, when it is not technically feasible to measure all of the possible exposure variables with equal precision, it is important to recognize that those variables that are not measured precisely are less likely to be included in the final models even if they are in fact causal determinants of the health problem.

B. Important Topics (Principal Findings and How They Relate to Other Studies)

1. Keyboards

Each of the four departments uses a different type of computer keyboard and keying tasks, with virtually no crossover use between departments. Since department was not a significant predictor in the simple model for hand/wrist WRMD, this suggests that no specific type of computer keyboard was a determinant of having developed a hand/wrist WRMD. However, because of substantial changes in equipment in both Editorial departments at the LA Times around the time of our study, with substitution and replacement of keyboards (particularly among those employees with upper extremity symptoms), we could not accurately study the relationship of particular computer keyboards in the Editorial Department and WRMDs. In this study, we did not investigate other specific keyboard-related factors, such as the issue of the force required to depress the alpha-numeric keys, or the placement of function keys, or the repetitiveness of keystrokes required by different jobs or departments per unit time. Further investigation would be required to determine the risks associated with these specific keyboard tasks.

2. Typing Hours

The odds for having a hand/wrist WRMD increased as number of hours typing increased in both Phase I and Phase II of our study. Several studies have looked at this issue, with conflicting results.[32,33,34,35] Controversy still remains as to whether a causal relationship exists with time spent typing on computer keyboards and a greater likelihood of developing musculoskeletal symptoms. Our results support a dose-response relationship; that is, the more hours one spends typing per day, the higher the odds are of developing hand/wrist WRMDs.

Through job sampling we were also able to assess the self reports of typing hours. For both cases and controls the correlation between observed and reported time typing was the same (both groups over-reported their typing in a similar manner). Using job sampling, we also found that the randomly selected hand/wrist cases spent significantly more time typing than the randomly selected controls, further confirming the questionnaire results that the cases spent a greater number of hours spent typing than controls.

Despite the limitations inherent in this type of study, this investigation provides additional evidence that repetitive use of the keyboard is related to the occurrence of WRMDs, particularly for symptoms and physical findings in the hand/wrist area. This study confirms our findings at another large newspaper facility[7]. The relationship between repetitive low-force tasks, constrained postures, and WRMDs, however, is not completely understood.

3. Deadlines

We found that the number of hours spent working on deadline increased the odds of developing hand/wrist WRMDs. Fifty-three percent of participants reported 10 hours or more per week on deadlines. Having more hours on deadline may invoke multiple mechanisms, each contributing to the development of symptoms. For example, increased deadline work may mean greater psychological stress and increased musculoskeletal tension or more "wear-and-tear" related to increased typing and repetition, time in constrained postures or other complex interactions. In his study of journalists using VDTs, Buckle[36] found that the extent and severity of reported pain and discomfort increased disproportionately during the two hour work period prior to the deadline for the first edition. He also found that keying activity increased by 50% during this period.

4. Gender

Our analysis found that the women participants are at higher risk of having symptoms of WRMDs. Because the proportions of women and men in different jobs varied, it is possible that the gender effect is the result of a partial confounding with job title. When we looked at jobs where an equal proportion of men and women perform similar work, female gender was not an important risk factor for hand/wrist WRMDs (gender may be a surrogate for job title). A recent NIOSH study[26] of video display terminal users at a telecommunications company found female gender as a risk factor for upper extremity symptoms, but not for physical examination-defined musculoskeletal disorders, in jobs where men and women performed the same jobs. Many older studies[37,38] also reported that female gender may be an important risk factor for WRMDs, but they did not compare the rate of hand/wrist WRMDs between men and women performing similar jobs. In these prior studies, wrist size and carpal tunnel area configuration, body weight, height, and hormonal factors have been suggested as reasons for this gender effect. It has also been suggested that gender may be a

surrogate for other important factors, such as a differing set of social stressors for women, and different (more stressful) non-occupational upper extremity usage than men, especially with regards to child-care and housekeeping.[39] It is quite likely that the gender differences noted in this study may relate to the confounding work and non-work factors.

5. Psychosocial Factors

Several studies of office personnel have related relatively high levels of worker stress to upper extremity WRMDs.[40,41,42,43,44,45] Such factors as lack of control over many aspects of the job, increased isolation, reduction of task diversity, and increased workload have been attributed to the introduction of VDTs into the workplace and to the increase in reports of WRMDs.[46,47] While several studies have associated psychosocial factors with WRMDs, the psychosocial scales identified as important have not always been consistent among studies.

In the overall logistic regression models which included individuals from all departments, the psychosocial factors were less powerful predictors of WRMDs compared to job task and demographic variables. However, in departments with a higher concentration of clerical and data entry VDT operators, psychosocial factors were more important predictors of neck, shoulder, and hand/wrist WRMDs. In contrast, there were no psychosocial predictors in the regression models of hand/wrist WRMDs in the Editorial Department, where jobs involve higher control, worker participation, and varied tasks [Appendix C].

To investigate the basis for this discrepancy we examined scores participants gave to work organization/psychosocial factors across departments. Results showed consistently more favorable conditions in the Editorial Department (although workload demands remained high) than in one of the departments dominated by more clerical tasks (i.e. Circulation). These results suggest that the reduced salience of work organization/psychosocial factors as disease predictors among the editorial staff may be due to reduced exposures to stressful levels of these factors among the editorial staff.

Psychosocial factors were more important in the neck and shoulder regions than in the hand/wrist area. Overall, our results provide some additional evidence that psychosocial factors such as work pressure, lack of social support, and lack of participation in decision making are probably important contributors to WRMDs in office workers.

The finding that psychosocial factors were associated with musculoskeletal symptoms in the present study should not be interpreted to mean that these symptoms are not real, or merely a psychological construction. The causal linkages between a demanding psychosocial environment at work and symptoms of WRMDs are not well understood, but several plausible mechanisms can be

postulated. Psychosocial demands resulting in stress may increase awareness of musculoskeletal symptoms or may affect perceptions of their cause, although validation of symptoms by nerve conduction studies, association with positive findings on physical examination, and similar ratio of symptoms to physical examination findings suggest that response bias due to "psychosocial demands" do not explain most of the associations observed in this study. Some demanding work conditions (i.e. lack of control over work practices, as in paced worked) may be associated with increased physical demands and biomechanical stresses. Additionally, such demands may produce increased muscle tension and consequent biomechanical strain.

6. Nerve Conduction Testing

Using logistic regression, we found that our case definition of hand/wrist symptoms, positive physical findings, and awakening at night from symptoms, was associated with abnormal median sensory latency and abnormal sensory conduction velocity at the palm and wrist. These two measurements are thought to be early indicators of median nerve dysfunction, are suggestive of carpal tunnel syndrome, and have been used as confirmation of carpal tunnel syndrome in other studies.[48,49] Although, in this analysis, the confidence intervals are wide and the exact point estimate is uncertain [Table 23], we believe these findings are important. These results provide some evidence to support the use, in epidemiologic studies, of our CTS case definition, which requires both symptoms and physical findings.

As has been found in previous NIOSH musculoskeletal studies, we found that most of the physical examination abnormalities in both the cases and controls were tendon-related, not nerve-related. Because of the small number of cases and controls with abnormal nerve findings, there may have been little statistical power to detect differences between cases and controls. The small numbers may have also influenced the confidence intervals, because they affect the standard error measurement (make it larger), upon which the confidence interval calculation is based.

Another reason for using nerve conduction testing was to determine if there was any significant difference in median nerve function measurements between the cases and controls. The Phase II nerve conduction results showed such a difference [Table 24]. And, although most of the case-control differences in the nerve conduction velocity parameters were not statistically significant, they tended to form a consistent pattern. Overall, however, the magnitude of the neurologic effects was small in most instances, and these effects may not reflect any discernable impairment of nerve function.

7. Vibrometry

Vibrometry testing, which measures vibration threshold (thought to be an

early sign of nerve damage[50,51]) was not found to be a useful predictor of median nerve abnormalities (as determined by nerve conduction testing) using logistic regression. We also found no statistical difference between the cases and controls, or between those cases with symptoms and physical findings suggestive of median nerve impairment and controls using analysis of covariance. These results do not contribute evidence to recommend the use of vibrometry as a screening tool for WRMD. (It was not found to predict abnormal nerve conduction.) An alternate explanation is that these results show no significant difference in vibration sensation threshold between the cases and controls, which may indicate that the nerves (which transmit vibratory sensation) in WRMD cases are no different than the controls.

8. Rest Breaks

Those employees without hand/wrist WRMDs tended to take more brief breaks (defined as 0.5 minutes to 10 minutes) than those with hand/wrist WRMDs ($p = .07$). However, it has been documented in other studies[52,53] that rest breaks are probably important in both muscle recovery and productivity gains. It has been found that single mid-morning and mid-afternoon breaks away from VDT work may have negligible benefits to employees.[52,53,54] Horie et al.[55] demonstrated that 10-minute hourly breaks were favored by clerical workers, and produced greater productivity gains in comparison to traditional one time 15-minute mid-morning breaks. Floru et al.[56] showed that 5 minute breaks inserted after a 40 minute period of work were effective in eliminating performance decrements which normally occurred after that period. Lack of sufficient breaks from repetitive tasks, allowing inadequate time for recuperation, has been proposed as related to the development of musculoskeletal problems.[57,58] Taylor and Pitcher[59] in their study of Australian Directory processing operators found that those with WRMDs tended to work through their work breaks. In a study by Kilbom et al.,[60] insufficient breaks and musculoskeletal problems were highly correlated. It is possible that breaks were not measured accurately in this study. It may be difficult for individuals to recall precisely their pattern of breaks if there are more than one or two per shift (especially short breaks lasting 1/2 to 10 minutes). In general, this lack of precision reduces our ability to confirm or refute a relationship between breaks and the prevention of WRMDs, although overall, the scientific literature is supportive that breaks are beneficial.[57]

C. Multiple Logistic Regression Models Analyzed by Department

Appendix C lists the results of the logistic regression models for each of the departments included in the study. The variables found to be associated with WRMDs in each of the four departments were, in general, the same or similar variables found in the overall models, including increased number of hours spent typing, perceived increased work variance (marked increase in workload concentration), and time spent on deadline. An

important variable not found in the overall models was "lack of training in posture/technique for performing job tasks". Learning how to properly adjust your workstation equipment and receiving training in posture techniques, as well as having adjustable furniture have been found to decrease musculoskeletal discomfort in VDT operators.[61,62] Adjusting an individual's workstation to within acceptable guidelines should lead to improved work postures and decreased musculoskeletal loads.[63]

D. Comparison with other Newspaper Studies

There have been few studies of WRMDs in the newspaper industry which have looked at risk factors associated with WRMDs. Most studies have only documented the existence of WRMD symptoms among newspaper employees. In 1979, a NIOSH survey[64] at a California newspaper found that VDT operators experienced elevated levels of arm and hand pain and stiffness compared to non-operators. A study of 437 VDT operators in the Japanese newspaper industry[65] in 1983 found that 17% reported "dullness" in their arms and 15% reported "dullness" in their fingers, compared to 12% and 5%, respectively, of keyboard operators not using VDTs. Sauter[66] and Eisen[67] surveyed editors at a large New York daily newspaper in 1981; 19% complained of sore wrists on the job in the month preceding the survey. In 1989, as part of a California Department of Industrial Relations compliance inspection, Rempel et al.[68] conducted a symptom survey of 136 employees in three departments at a newspaper in Fresno, California. From a 63% response, the prevalence of lower arm tendiniti^Dor car^Aunnel syndrome was calculated to be 26-40%.

In 1990, NIOSH and the University of Michigan completed a study of WRMD symptoms and risk factors among 834 employees at a major metropolitan newspaper[7] in New York. This study included a questionnaire for upper extremity symptoms and work-related risk factors and a case definition for WRMD that is similar to, but possibly more sensitive, than the one used in this study. In that study, 40% of 834 participating employees reported symptoms consistent with upper extremity WRMDs. Hand/wrist symptoms were most common (23%), followed by symptoms in the neck (17%), elbow/forearm (13%) and shoulder (11%). Percent of time spent typing at computer keyboards was associated with symptoms in each of the four upper extremity joint areas. Working as a reporter, as opposed to working at other editorial jobs, was significantly associated with hand/wrist, elbow/forearm, and neck symptoms, [whereas in the present study, the department including reporters (Editorial) had the lowest prevalence of WRMDs].

A follow-up of the same newspaper employees, using the same self-administered questionnaire, was completed in late spring of 1991.[69] The purpose of the repeat survey was to determine if there was any change in prevalence of WRMD symptoms between 1989 and 1991 for those participating in both surveys. Participation rate for the repeat survey was 53%.

Overall, among 294 Editorial Department participants there was a higher proportion of new cases of neck, shoulder, and elbow WRMDs than there was a decline in "old cases"; however, the severity of symptoms was reduced. There was a decrease in the number of new cases in Classified Advertising (approximately 20) compared to the previous survey. As in the 1989 survey, there was a significant difference in the prevalence of hand/wrist WRMD symptoms based on the speed of keying, the percent of time keying, and workload factors of overtime and number of hours worked.

Buckle[70] investigated an "outbreak" of WRMDs at a major London newspaper using a symptom survey and ergonomic assessment of 356 editorial staff employees. Twenty-six percent reported symptoms, with the majority of painful sites in the hands and wrists. A follow-up study among journalists at this newspaper was undertaken in 1990, with a symptom survey being completed by 224 of 442 potential participants. Fifteen to 20% of participants reported upper extremity symptoms, with sub-editors reporting the highest prevalences. Logistic regression analysis indicated a small but significant association between symptoms and repetitive work and a trend towards a negative association with job variety.[36]

E. Status of Current Knowledge

There has been increasing recognition of the multifactorial nature of WRMDs in the office setting, although a clear and precise reproducible model of factors which contribute to the development of WRMDs, including individual, psychosocial, work organization, and physical ergonomic factors, has not been established. There is considerable research which has found relationships between WRMDs and the following factors:

1. the repetitiveness of a work task;

2. the physical characteristics of the VDT and other aspects of the work environment;

3. the organization of work, which includes psychosocial factors.

This investigation supports the overall conclusion that etiology of WRMDs is likely to be dependent on the interaction of a number of factors. It is also important to note that not all cases of WRMDs are disabling. Fortunately, most of the symptoms reported did not occur daily and have not led to medical treatment. Nevertheless, these conditions can sometimes result in severe impairment and permanent disability. With the current state of the art, until new research findings become available to develop more specific strategies, solutions to the WRMD problem should be directed towards the three categories mentioned in the previous paragraph. An approach to the prevention of WRMDs, which systematically includes all these elements mentioned, has the greatest likelihood in being successful in reducing the magnitude and severity of WRMDs.

VIII. RECOMMENDATIONS

1. We encourage the continuation of the critical components of the existing ergonomics programs at the LA Times. We recommend that top management commitment and employee participation continue to be an important part of the ergonomic program. The joint employee-management Ergonomics Committee, with representation from all affected departments, should be continued, appropriately supported with resources, and convened on a regular basis. The responsibility of the committee should include involvement in decisions on appropriate interventions affecting employees at risk for WRMDs.

   We are encouraged by reports that the LA Times has instituted a computer program into the Editorial Department's computer network system which reminds the staff to "take a Break" at recommended time intervals, using a non-threatening, computer alert system. We understand a trial period has been set to introduce a variety of break-time computer-screen reminders to encourage those in the Editorial Department who may fail to respond to the same repeating message. We laud the efforts of the Times in this endeavor.

   Likewise, we are also encouraged by the reports of the LA Times testing out a computer program in the Editorial Department to document the workload of copy editors in different news-sections. As we understand it, the program will record the number of inches of copy that appears on the computer screen, so that an analysis of overall workload by certain news-sections may be conducted on a regular basis. The intent of the current plan is that the system will not be used to monitor each worker's individual workload (but monitor group data only) and will not be used to electronically monitor individuals (we agree with this intent).

2. The LA Times currently employs an "Ergonomics and Facilities Administrator" in the Editorial Department, who handles equipment, identifies new or existing hazards, helps suggest potential solutions, and provides feedback on the effectiveness of various interventions in the department. Because of the high prevalence of WRMD in the other three Departments studied, there should be an "Ergonomics and Facilities Administrator" or person with similar tasks for each of the three departments.

3. The LA Times should provide specific training for the ergonomics committee in health and ergonomic hazards surveillance, workstation and job evaluation techniques. We would be willing to assist in this training.

4. Consider repeating a symptom survey in one year to estimate the change in prevalence compared to the initial NIOSH survey, and to estimate the incidence of new cases. We would be willing to assist in this effort.

5. Regarding keying workloads at the LA Times, our results suggest that reducing time on the computer may result in a decrease in WRMD symptoms. We suggest that:

   a) Departments evaluate the nature and extent of keyboard work done (e.g. verification of data, data processing, transfer of data between systems, electronic mail or messaging systems) and determine whether there are other acceptable ways of handling this work.

   b) Departments take steps to ensure that adequate keying resources and personnel are available.

   c) Departments provide periods of time away from the VDT, allow more frequent opportunities for employees to get out of their chairs, restructure work to allow for some component of self-pacing, and make efforts to provide job rotation.

6. In those departments where there is continuous keyboard use, departments should examine work/rest cycles, including the types and lengths of work breaks. It may be that encouraging workers to take more frequent, short rest breaks (5 to 10 minutes), would reduce the prevalence of WRMDs.

7. Continue with up-dating and purchasing adjustable workstation equipment for each employee group. Our observations indicated that most of the Orange County Editorial Staff had adjustable furniture to accommodate individual differences and that most renovated workstations were of high ergonomic quality. However, the three other departments lacked this equipment, most notably Circulation and Accounting and Finance. Evaluate how the equipment is being used, and obtain feedback (in a systematic manner) on advantages and disadvantages of equipment. Suggested adjustment ranges for this equipment can be found elsewhere.[63]

8. We have seen the LA Times video that has been used to train employees to use adjustable VDT work-station equipment, and found it to include useful and up-to-date information. Instruction such as this tape, on the use of adjustable workstations, chairs, and equipment to optimum ergonomic advantage, should occur not only upon entry into the LA Times workforce, but be considered on a regular basis, such as yearly, to remind workers the likely benefits of adjusting workstations.

9. NIOSH recommends that VDT workers have visual testing before beginning VDT work and periodically thereafter to ensure that they have adequately corrected vision to handle such work. We are aware of the Vision Testing Program at the LA Times and support the steps made in making VDT eye-wear available to the VDT users.

10. When making changes in the psychosocial work environment, one should consider the following factors:

    a. Doing studies to determine the causes of work pressure and surges in workload, and what interventions might be successful at reducing these demands. Examples would be staggering deadlines, rotating stories or copy-editing among employees, and altering merit or incentive pay structures.

    b. Providing job diversity with increased worker participation and greater decision making opportunities, such as in planning work tasks, arranging the workspace, etc.

    c. Fostering co-worker and supervisor support. Supervisors should be encouraged to attend educational meetings and updates on WRMDs on a regular basis. Education can increase awareness of WRMD issues and provide a starting point for dialogue and understanding of employees with WRMDs.

11. Prompt evaluations of employees with musculoskeletal symptoms by a health care provider should be available without fear of supervisor or employer reprisal. All recommendations for surgery should generally be based on two independent physician recommendations. Guidelines for health care providers to evaluate and treat these disorders have been published elsewhere.

12. Signs should be posted in the LA Times RSI exercise rooms alerting individuals who are currently symptomatic to be evaluated by medical personnel before beginning an exercise program or "working out" in these rooms. Symptomatic individuals may worsen their condition by unsupervised exercise.

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XII. TABLES

Table 1
Physical Examination Criteria for Various Medical Conditions
HETA 90-013
Los Angeles Times

After performing each passive, active, and resisted maneuver, the examinee was asked to quantify the discomfort based on a five-point scale: 1=no pain, 2=mild pain, 3=moderate pain, 4=severe pain, and 5=the worst pain ever experienced. Maneuvers were considered significant if the discomfort score was ≥ 3.

NECK

Tension Neck Syndrome:	Resisted flexion, or extension, or rotation. Trapezius palpation (spasm or trigger points).

SHOULDER

Rotator Cuff Tendinitis:	Active or resisted arm abduction $\geq 90°$ Deltoid Palpation.
Bicipital Tendinitis:	Positive Yergason's maneuver.[71]
Thoracic Outlet Syn:	Positive hyperabduction and Adson's maneuvers.[72-73]

ELBOW

Epicondylitis:	Medial or lateral epicondyle palpation.

HAND-WRIST

Tendinitis:	Pain in the distal 2/3 of the forearm or hand on resisted wrist or finger flexion or extension.
deQuervain's Syn:	Positive Finkelstein's manuever[74]
Carpal Tunnel Syn:	Positive Tinel's and Phalen's maneuvers.[75,76]
Guyon Tunnel Syn:	Positive Guyon Tinel's maneuver.[77]
Ganglion cysts:	Presence of ganglion cysts.
Joint-related:	Decreased MCP, or PIP range of motion (< 100°)
Trigger Finger:	Locking of finger in flexion or palpable tendon sheath ganglion.[78]

Table 2
Phase I: Participation Rate by Department
HETA 90-013, Los Angeles Times

Department	Number of Participants Randomly Selected	Actual Participants	
		Number	Percent
Circulation	200	193	97%
Classified	200	171	86%
Editorial	450	429	95%
Finance	200	180	90%

Table 3
Phase I: Demographics
HETA 90-013, Los Angeles Times

Department	Accounting	Circulation	Classified	Editorial
Mean Age (in years)	39.4	37.4	37.1	40.5
Percent Female	67%	68%	63%	52%
Years working at the LA Times	10.1	6.6	10.8	8.8
Years working at any newspaper	10.4	6.9	11.5	15.4

Table 4
Prevalences of Symptoms of Work-related Musculoskeletal Disorders by Phase I Questionnaire Definition
HETA 90-013, Los Angeles Times

Location	Prevalence Rate*	Percentage of Cases with Daily Pain
any upper extremity	41%(395/973)	---
neck	26% (214/825)	22%
shoulder	17% (153/894)	20%
elbow	10% (98/939)	31%
hand/wrist	22% (199/891)	19%

Denominators vary from total number of participants due to exclusion of persons with acute injuries or symptoms prior to current job or to missing data

Table 5
Phase I: Any Work-Related Musculoskeletal Disorder Prevalence by Department
HETA 90-013, Los Angeles Times

Department	Number of Participants*	Participants with WRMDs	
		Number	Percent
Circulation	193	96	50%
Classified	171	66	39%
Editorial	429	162	38%
Finance	180	66	39%

* Denominators vary from total number of participants due to exclusion of persons with acute injuries or symptoms prior to current job, or to missing data

Table 6
Work-Related Musculoskeletal Disorder Cases
Seen by Health Care Provider or Missing Work Days
HETA 90-013, Los Angeles Times

Location of WRMD	Number of cases	Seen by Health Care Provider (number %)	Missed Work at least one Work day (number %)	Assigned to a Different Job at least 1 Work day (number %)
Neck	214	66 (31%)	31 (15%)	12 (6%)
Shoulder	153	64 (42%)	30 (20%)	12 (8%)
Elbow	98	38 (39%)	9 (9%)	10 (10%)
Hand/Wrist	199	69 (35%)	15 (8%)	18 (9%)

TABLE 7
Prevalence of Physician-Diagnosed Medical Conditions
Phase I
HETA 90-013, Los Angeles Times

Medical Conditions	Number	Prevalence
Thyroid Disorders	47	5%
Rheumatoid Arthritis	29	3%
Disk Disease (Low Back)	24	3%
Diabetes Mellitus	17	2%
Gout	23	2%
Disk Disease (Neck)	13	1%
Alcoholism	9	1%
Kidney Failure	3	0.3%
Lupus	2	0.2%

Table 8
Phase I Work Habit Characteristics
HETA 90-013, Los Angeles Times

Use of Eye Glasses	
Wearing of glasses or contacts when using the VDT	62%
Wearing bi-focals when using the VDT	11%
Wearing tri-focals when using the VDT	2%
Wearing half-lens "granny" glasses when using the VDT	1%
Typing Skill:	
Slow (< 30 words/minute)	28%
Medium (30-60 words/minute)	56%
Fast (> 60 words/minute)	16%
Typing Technique:	
Hunt and Peck	17%
Touch	83%
Typical length of time sitting continuously in chair	
Less than 1/2 hour	24%
1/2 hour to 1 hour	36%
1 hour to 2 hours	23%
Greater than 2 hours	16%

	Mean	Mode	Range
Number of times per hour arising from your chair	5.5*	1*	(0-91)*

Type of Telephone	
Hand/held receiver	53%
Headset	28%
Both	18%
Do not use phone	1%
Mean time spent on the Telephone	**2.9 hours**

* Excludes those who arose "too many times to count"

Table 9
Job Tasks and Work Organization
HETA 90-013, Los Angeles Times

Work on Deadline	Yes	71%
	No	29%

Deadline Hours	0 - 9.9 hours	47%
	10 - 19.9 hours	19%
	20 - 29.9 hours	13%
	30 - 39.9 hours	11%
	40+	10%

		Phase I
Typing Hours	0 - 2 hours	22%
	2+ - 4 hours	22%
	4+ - 6 hours	30%
	6+ - 8 hours	23%
	8+ hours	3%

Own Work-station	Yes	74%
	No	26%
Changes to Work-station in past Year	Yes	56%
	No	44%
Received Training in Posture Technique	Yes	59%
	No	41%

Number of Breaks in morning or afternoon

	Brief Breaks (1/2 min- 10 min)	Longer Breaks (> 10 min)
0	9%	45%
1	20%	34%
2	28%	16%
3	17%	2%
4	8%	1%
5	7%	1%
6+	11%	<1%

Table 10
Phase I: Psychosocial Scales
Statistical Means of Scores by Department
HETA 90-013, Los Angeles Times

Psychosocial Scales* (range)	Accounting and Finance Mean (Std dev**)	Circulation Mean (Std dev)	Classified Mean (Std dev)	Editorial Mean (Std dev)
Job Control (0-35)	18.4 (7.6)	12.9 (8.2)	19.2 (6.3)	19.6 (6.5)
Participation (0-15)	7.5 (4.0)	3.7 (4.1)	6.1 (4.2)	7.5 (3.7)
Workload (4-20)	15 (3.8)	13.3 (3.9)	14.6 (3.1)	15.1 (3.4)
Variance (3-15)	10.1 (2.9)	9.4 (3.3)	10.2 (2.7)	10.1 (2.8)
Future Certainty (4-20)	11.6 (3.7)	10.0 (4.0)	13.5 (3.4)	12.3 (3.8)
Conflict (7-33)	17.0 (5.2)	18.6 (6.0)	16.5 (5.6)	17.0 (6.2)
Ergonomic Importance (4-16)	12.1 (2.6)	10.6 (3.0)	12.5 (2.4)	12.6 (2.4)
Job Pressure (3-18)	10.4 (3.3)	10.5 (3.0)	9.2 (3.0)	10.1 (2.9)

* Higher Scores for these Psychosocial Scales indicate "more of" positive attributes and "less of" negative attributes.

**Std Dev = standard deviation

Table 11
Phase I: Psychosocial Scales
Statistical Means of Scores by Department
HETA 90-013, Los Angeles Times

Psychosocial Scale* (range)	Accounting and Finance Mean (Std dev**)	Circulation Mean (Std dev)	Classified Mean (Std dev)	Editorial Mean (Std dev)
Support from immediate supervisor (4-17)	8.8 (3.4)	9.7 (4.0)	7.5 (3.2)	8.2 (3.5)
Support from co-workers (4-19)	8.3 (2.6)	8.9 (2.9)	8.0 (2.6)	7.8 (2.5)
Support from spouse, friends (4-18)	6.4 (3.0)	6.0 (3.2)	6.9 (3.2)	5.9 (2.6)
Interaction with others (not co-workers) (1-4)	1.8 (1.0)	2.3 (1.3)	1.7 (1.0)	1.8 (1.1)
Interaction with co-workers (1-4)	1.6 (0.8)	2.0 (1.2)	1.8 (1.0)	1.6 (0.7)
Hostility from customers (1-5)	2.9 (1.1)	2.1 (1.2)	2.8 (1.0)	3.2 (1.0)

* Lower scores for these psychosocial scales indicate "more of" positive attributes and "less of" negative attributes

**Std Dev = standard deviation

Table 12
Phase I: Logistic Regression Model Significant Variables
Neck Musculoskeletal Symptoms
HETA 90-013, Los Angeles Times

Variables for Neck WRMD	Odds Ratio (95% CI)*
Female gender	2.1 (1.4-2.4)
Number of hour spent on deadline per week (30-39 hours compared to 0-10 hours)	1.7 (1.4-3.0)
Work variance (e.g., continually changing workload) ("occasionally" compared to "often")	1.5** (1.1-1.8)
Time spent on the telephone (4-6 hours compared to 0-2 hours)	1.4 (1.0-1.8)
Perceived lack of importance for ergonomic issues by management ("disagree" versus "agree")	1.4** (1.2-1.9)

* Confidence intervals derived from the Wald test may be wider than those derived from the likelihood ratio test, and thus may include 1.0

** odds ratios derived from 75-25% interquartile range difference of the responses for each scale

Table 13
Phase I: Logistic Regression Model Significant Variables
Shoulder Musculoskeletal Symptoms
HETA 90-013, Los Angeles Times

Variables for Shoulder Musculoskeletal Symptoms	Odds Ratio* (95% CI)**
Female gender	2.2 (1.5-3.3)
Perceived lack of participation in job decision-making ("very little" compared to a "moderate amount")	1.6*** (1.2-2.1)
Number of years employed at the Los Angeles Times	1.4 (1.2-1.8)
Perceived increased job pressure ("moderately disagree" compared to "moderately agree")	1.4*** (1.0-1.9)

* adjusted for Race (see text)

\- Confidence intervals derived from the Wald test may be wider than those derived from the likelihood ratio test, and thus may include 1.0

\- odds ratios derived from 75-25% interquartile range difference of the responses for each scale

Table 14
Phase I: Logistic Regression Model Significant Variables
Hand/Wrist Musculoskeletal Symptoms
HETA 90-013, Los Angeles Times

Variables for Hand/wrist Musculoskeletal Symptoms	Odds Ratio (95% CI)*
Number of hours spent typing per day (6-8 hours compared to 0-2 hours)	2.5 (1.6-3.9)
Number of hour spent on deadline per week (30-39 hours compared to 0-10 hours)	1.7 (1.2-2.3)
Female gender	1.7 (1.2-2.4)
Perceived lack of support from an immediate supervisor ("very much" compared to "a little")	1.4** (1.1-1.6)

* Confidence intervals derived from the Wald test may be wider than those derived from the likelihood ratio test, and thus may include 1.0

** odds ratios derived from 75-25% interquartile range difference of the responses for each scale

Table 15
Phase II: Demographics
HETA 90-013, Los Angeles Times

	Cases	Controls
Number of Participants	130	40
Age (in years)	38	40
Gender	68% female	47% female
Circulation	31	26
Classified	32	17
Editorial	45	39
Finance	22	17

Table 16
Phase II: Questionnaire
Hand/Wrist WRMD Case Responses
HETA 90-013, Los Angeles Times

Intensity of Hand Pain

No Pain	3%
Mild	29%
Moderate	51%
Severe	16%
Worst in Life	1%

Hand Pain in Last Seven Days

Yes	52%
No	48%

When on Vacation, Do symptoms:

Increase	2%
Decrease	57%
No Change	25%
No Vacation taken in last year	16%

Have Symptoms Improved since First Noticed Them?

Yes	44%
No	56%

Was time taken off due to hand/wrist WRMD problem?

Yes, supervisor informed	9%
Yes, supervisor not informed	2%
No time taken off	89%

Did you Report your Hand/wrist Problem to the Times Medical Department?

Yes	32%
No	68%

Table 17
Phase II: Questionnaire
Responses of Cases: Treatment of WRMD
HETA 90-013, Los Angeles Times

Treatment for WRMD	Better	Worse	No Difference	Did Not Receive
Medical Treatment	24 (63%)	0	14 (37%)	86 (69%)
Surgery	4 (80%)	0	1 (20%)	119 (96%)
Exercise Program	16 (53%)	0	14 (47%)	94 (76%)
Other	13 (72%)	1 (6%)	4 (22%)	106 (86%)

Table 18
Phase II: Questionnaire
Case Responses (n=130)
Effect of New Equipment
HETA 90-013, Los Angeles Times

Has the Equipment made a difference in your hand/wrist symptoms?	Better	Worse	No Difference	Did Not Receive
Adjustable Desk	26 (48%)	2 (2%)	26 (48%)	70 (56%)
Chair	36 (39%)	5 (5%)	52 (56%)	30 (24%)
Wrist Rest	23 (51%)	4 (9%)	18 (40%)	78 (63%)
Foot Rest	23 (44%)	1 (2%)	28 (54%)	71 (58%)
New Keyboard	20 (43%)	0	26 (57%)	77 (63%)
Mouse	2 (13%)	1 (7%)	12 (80%)	106 (84%)
Telephone Headset	27 (38%)	2 (3%)	42 (59%)	52 (42%
Speaker Phone	4 (11%)	0	31 (89%)	88 (71%)
Telephone	2 (3%)	8 (11%)	63 (86%)	50 (40%)

Table 19
Phase II: Case-Control Study
Logistic Regression Model Significant Variables
For Hand/Wrist Musculoskeletal Symptoms
Using the Phase I Questionnaire Data
HETA 90-013, Los Angeles Times

Variables for Hand/wrist Musculoskeletal Symptoms for Cases (58 persons) and Controls (67 persons) (see text for definition)	Odds Ratio (95% CI)*
Female Gender	4.8 (1.9-11.9)
20-40% typing	0.6** (0.2-2.1)
40-60% typing	1.5** (0.5-5.2)
60-80% typing	7.6** (1.8-31.8)
80-100% typing	2.3** (1.0-7.8)

* CI=confidence intervals

** typing referent group: 0-20% time typing

Table 20
Phase II
Logistic Regression Model Significant Variables
for Hand/Wrist Musculoskeletal Symptoms
Using Phase II Questionnaire Data
HETA 90-013, Los Angeles Times

Variables for Hand/wrist Musculoskeletal Symptoms for Cases (58 persons) and Controls (67 persons) (see text for definition)	Odds Ratio (95% CI)*
Change in Hours spent typing from 1/89 to 12/89	9.1 (7.1-11.6)
Change in Overall Workload	3.2 (2.5-4.1)

* CI=confidence intervals

TABLE 21
Phase II
Types of Musculoskeletal Conditions
Identified on the Physical Examination
HETA 90-013, Los Angeles Times

Physical Exam Abnormality	130 Cases		99 Controls	
Tendon-related	60	(46%)	11	(11%)
Rotator Cuff Tendinitis	12	(9%)	5	(5%)
Bicipital Tendinitis	2	(2%)	0	
Epicondylitis	6	(5%)	1	(1%)
Proximal Tendinitis	10	(8%)	1	(1%)
Distal Tendinitis	20	(15%)	2	(2%)
deQuervain's Disease	10	(8%)	2	(2%)
Trigger Finger	0		0	
Nerve Entrapment	25	(19%)	6	(6%)
Thoracic Outlet Syndrome	2	(2%)	0	
Carpal Tunnel Syndrome*	8	(6%)	1	(4%)
positive Phalen's test**	25	(19%)	4	(4%)
positive Tinel's test**	18	(14%)	7	(7%)
Guyon Tunnel Syndrome	15	(12%)	5	(5%)
Ganglion Cyst	6	(5%)	1	(1%)
Joint Related	2	(2%)	1	(1%)

* Requires BOTH positive Phalen's AND Tinel's tests.

- not tallied in summation, included for information purposes only

Table 22
Phase II: Nerve Conduction Results by Case/Control
HETA 90-013, Los Angeles Times

Variable	61 Cases	35 Controls
Mean Age (in years)	39	41
Gender	f=45 (74%)	f=19 (54%)
	m=16 (26%)	m=16 (46%)
Height (cm)	416	430
Finger Circumference (mm)	69	71

Table 23
Phase II
Nerve Conduction Testing
Logistic Regression Model Significant Variables
Median Sensory Latency at the palm to wrist
HETA 90-013, Los Angeles Times

Variable	Odds Ratio	95% Confidence Interval
age (in years)	1.1	0.93-1.24
height (in centimeters)	1.3	1.04-1.52
finger circumference (in centimeters)	1.1	0.93-1.17
case definition*	42.5	1.61-1122
awakened by symptoms	110	1.36-8869

* symptoms in the hand/wrist region lasting longer then 1 week or greater than once per month, no previous injury AND positive physical examination AND being awakened at night by symptoms

Table 24
Phase II
Mean Values of Median Nerve Conduction Results
by Case/Control Status
HETA 90-013, Los Angeles Times

	Prox. Sensory Conduct Vel. (m/sec*)	Motor Distal Latency (msec**)	Sensory Distal Latency (msec)	Motor Conduct Vel. (m/sec)	Prox. Motor Latency (msec)	Latency Diff. median/ ulnar
All 37 Controls	55	3.55	3.06	57.9	7.74	0.42
Controls minus one Outlier (36)	55.2	3.38	3.00	58	7.57	0.52
All 61 Cases	54.6	3.38	2.97	56.68	7.58	0.48
23 Cases with median nerve symptoms	52.7	3.52	3.12	55.9	7.73	0.53
11 Cases with median nerve symptoms and physical findings	54.0	3.63	3.11	54.8	7.60	0.62

* m/sec = meters per second
** msec = milliseconds

Table 25
Phase II
Mean Values of Vibrometry Results by Case/Control Status
HETA 90-013, Los Angeles Times

	2nd Digit Dominant Hand Measurement*	5th Digit Dominant Hand Measurement*	Diff. of the 5th minus 2nd
All 37 Controls	15.3	16.5	-1.23
All 61 Cases	15.4	17.1	-1.73
23 Cases with median nerve symptoms	14.1	16.1	-2.0
11 Cases with median nerve symptoms and physical findings	14.6	17.8	-3.12

* threshold in Hertz at which vibratory sensation was no longer felt.

Table 26
Phase I
Percent Prevalence of
WRMDs by Department
HETA 90-013, Los Angeles Times

Location of WRMD symptoms	Circulation	Classified	Editorial		Finance
			L.A.	Orange County	
neck	35%	26%	25%	13%	27%
shoulder	22%	19%	14%	9%	21%
hand/wrist	25%	19%	25%	20%	19%

Appendix A

Nerve Conduction Measurements

Median and ulnar motor nerve conduction measurements were performed, as well as antidromic median and ulnar sensory nerve conduction measurements. Skin temperature was measured with a digital thermometer and the value recorded. When required, the subject's arm was warmed until the temperature was greater than 30.0 deg. C. using an electric heating pad wrapped about the arm and hand. Calibration procedures as described in the Operation Manual[21] for the electromyograph were performed each morning prior to the testing of subjects.

For all measurements, evoked response amplitudes were measured from baseline to peak. Conduction latencies were measured from stimulation onset to the negative (upward) deflection of the evoked response. Averaging a minimum of three responses was employed for sensory conduction measurements to assure adequate detection of the evoked response. For all evoked responses, the stimulating voltage was increased until a supramaximal stimulation was observed. All evoked potential waveforms were recorded on strip-chart paper for later review.

Median Motor Nerve Evaluation

Disk surface electrodes were used to record the compound motor action potential. The active recording electrode was placed over the abductor pollicis brevis muscle, and the reference electrode was placed over the lateral aspect of the PIP joint of the thumb. Distal nerve stimulation was performed at the wrist. Proximal stimulation was performed at the elbow, medial to the biceps tendon. Distances between the stimulation sites and the active recording electrode were measured to the nearest millimeter. Amplitude, latency and distance were recorded for all evoked responses. The conduction velocity was calculated by the following formula:

$$\text{conduction velocity} = \frac{\text{distance between stimulation sites}}{\text{proximal latency - distal latency}}$$

Ulnar Motor Nerve Evaluation

Disk surface electrodes were used to record the compound motor action potential. The active recording electrode was placed over the abductor digiti V muscle, and the reference electrode over the lateral aspect of the DIP joint of the fifth digit. Distal stimulation was performed at the wrist; proximal stimulation was performed at the ulnar groove at the elbow. Electrophysiologic values were recorded and calculations performed as described above.

Median Sensory Nerve Evaluation: Wrist to Finger

Ring electrodes were used to record the sensory nerve action potentials. The active recording electrode was placed at the PIP joint of the second digit (index finger) and the reference electrode was placed at the DIP of the second digit. Antidromic stimulation was performed at the wrist. Amplitude, latency and distance were recorded for all evoked responses. Conduction velocity was calculated with the formula:

$$\text{conduction velocity} = \frac{\text{distance between stimulating and active recording electrode}}{\text{latency}}$$

Median Sensory Nerve Evaluation: Palm to Finger

Recording electrodes were placed as above. Antidromic stimulation was performed in the palm between the thenar and hypothenar muscle masses. Electrophysiologic values were recorded and calculations performed as described above.

Ulnar Sensory Nerve Evaluation

Only wrist-to-finger measurements were made. Ring electrodes were used to record the sensory nerve action potentials. The active recording electrode was placed at the PIP joint of the fifth digit, and the reference electrode was placed at the DIP of the fifth digit. Antidromic stimulation was performed at the wrist. Electrophysiologic values were recorded and calculations performed as described above.

Criteria for Clinical Evaluation

Results from each subject were reviewed by a neurologist who specializes in electromyography. The normative data of Kimura were used for purposes of establishing clinical abnormality[22]. Based on Kimura's data, and the clinical judgement of the neurologist, findings considered suggestive of incurring median nerve abnormality at the wrist (i.e., suggestive of carpal tunnel syndrome) were:

1. Median nerve distal motor latency > 4.2 msec.
2. Median nerve distal motor latency 1.2 msec. or more greater than ulnar nerve distal motor latency.
3. Median sensory velocity from wrist to finger of < 44 m/s or latency > 3.5 msec. with normal ulnar nerve conduction and latency.
4. Median nerve sensory latency from wrist to finger 0.7 msec. or more greater than ulnar nerve sensory latency from wrist to finger.

Based on the experience of the Mount Sinai Electromyography laboratory, an additional criterion was used to identify of the median nerve abnormality at the wrist. Specifically, a slowing of 10 m/s or greater of median sensory conduction from wrist to finger when compared to either the analogous ulnar sensory value, or the median sensory palm-to-finger value, was considered suggestive of median nerve abnormality at the wrist as well. Subjects with one electrophysiologic value consistent with median nerve abnormality at the wrist were labelled as "Results are equivocal for median nerve abnormality at the wrist." Those with two or more were labelled "Results are consistent with median nerve abnormality at the wrist." Subjects with abnormalities indicating diffuse slowing of the distal segments of the nerves tested were labelled "Electrophysiologic study compatible with generalized distal polyneuropathy." Other modifiers, such as "severe" or "equivocal" were used when indicated by the electrophysiological data.

Individual results of the nerve conduction testing were mailed to participants by NIOSH personnel and were not released to other parties. Mount Sinai personnel involved in clinical evaluation of the nerve conduction results did not have access to individual participant identifiers. Group means (averages) of the testing results were used in the analysis for this report.

Appendix B

Vibrometry Methods

Vibration perception threshold was measured in the 2nd and 4th fingers of the dominant hand of cases and controls using a quantitative, non-invasive instrument, the Vibratron II.[23] A protocol using the method of limits procedure[25] was used. During testing, the subject was asked to touch an easily detectable vibrating rod with a finger. The intensity of the vibration was reduced at a constant rate, and the subject was required to decide when the vibration stops. The setting was recorded, and the subject was asked to lift her/his finger from the stimulator post. The intensity of the stimulation was reduced to well below the threshold of the previous trial, and the subject was asked to place her/his finger back on the stimulator post. The intensity of the stimulus was gradually increased and the subject was asked to indicate when he/she could first feel the vibration in her/his finger. Again, this setting was recorded. Five trials were used on each individual, with the first trial used as an instruction trial. Data from the first trial was not used in the analysis.

Appendix C

Results by Department

Table A
Phase I: Logistic Regression Model Variables
Neck Musculoskeletal Symptoms
Accounting and Finance Department
HETA 90-013, Los Angeles Times

Variables for Musculoskeletal Symptoms	Odds Ratio (95% CI)*	
Deadline hours (30-39 hours compared to 0-10 hours)	2.9	(1.2-6.8)
Work variance (e.g., marked increase in workload concentration) ("often" compared to "occasionally")	2.4**	(1.2-5.0)
Perceived lack of participation in job decision-making ("a moderate amount" compared to "none")	2.4**	(1.3-4.4)

* the confidence intervals (CI) were derived from the Wald test and may be wider than those derived from the likelihood ratio test, and thus may include 1.0

** the odds ratios were derived from 75-25% interquartile range difference of the mean responses for each scale;

Table B
Phase I: Logistic Regression Model Variables
Shoulder Musculoskeletal Symptoms
Accounting and Finance Department
HETA 90-013, Los Angeles Times

Variables for Shoulder Musculoskeletal Symptoms	Odds Ratio (95% CI)*	
Female gender	5.4	(1.6-18.2)
Hostility from clients ("somewhat" compared to "not at all")	2.9**	(1.3-6.1)
Perceived lack of importance for ergonomic issues by management ("agree" compared to "disagree"	1.5**	(1.1-2.1)

* the confidence intervals (CI) were derived from the Wald test and may be wider than those derived from the likelihood ratio test, and thus may include 1.0

** the odds ratios were derived from 75-25% interquartile range difference of the mean responses for each scale;

Table C
Phase I: Logistic Regression Model Variables
Hand/Wrist Musculoskeletal Symptoms
Accounting and Finance Department
HETA 90-013, Los Angeles Times

Variables for Hand/wrist Musculoskeletal Symptoms	Odds Ratio (95% CI)*
Number of hours spent typing per day (6-8 hours compared to 0-2 hours)	6.8 (2.2-20.7)
Number of hour spent on deadline per week (30-39 hours compared to 0 - 10 hours)	2.8 (1.1-6.9)
Hostility from clients ("somewhat" compared to "not at all")	3.3** (1.5-7.4)

* the confidence intervals (CI) were derived from the Wald test and may be wider than those derived from the likelihood ratio test, and thus may include 1.0

** the odds ratios were derived from 75-25% interquartile range difference of the mean responses for each scale;

Table D
Phase I: Logistic Regression Model Variables
Neck WRMD
Circulation Department
HETA 90-013, Los Angeles Times

Variables for Neck Musculoskeletal Symptoms	Odds Ratio (95% CI)*
Number of hours spent typing per day (6-8 hours compared to 0-2 hours)	3.2 (1.1-8.9)
Perceived conflict (group dissention and bickering) ("neither agree nor disagree" compared to "moderately disagree")	2.4** (1.4-4.2)

* the confidence intervals (CI) were derived from the Wald test and may be wider than those derived from the likelihood ratio test, and thus may include 1.0

** the odds ratios were derived from 75-25% interquartile range difference of the mean responses for each scale;

Table E
Phase I: Logistic Regression Model Variables
Shoulder Musculoskeletal Symptoms
Circulation Department
HETA 90-013, Los Angeles Times

Variables for Shoulder CTD	Odds Ratio (95% CI)
Female Gender	4.0* (1.5-10.9)

* Adjusted for race (see text)

Table F
Phase I: Logistic Regression Model Variables
Hand/Wrist Musculoskeletal Symptoms
Circulation Department
HETA 90-013, Los Angeles Times

Variables for Hand/wrist Musculoskeletal Symptoms	Odds Ratio (95% CI)*
Lack of Training in Posture/technique for job tasks	4.1 (1.0-6.9)
Interaction with people (excluding co-workers) through job ("a little" compared to "a very much")	1.8** (1.0-3.0)

* the confidence intervals (CI) were derived from the Wald test and may be wider than those derived from the likelihood ratio test, and thus may include 1.0

** the odds ratios were derived from 75-25% interquartile range difference of the mean responses for each scale;

Table G
Phase I: Logistic Regression Model Variables
Neck Musculoskeletal Symptoms
Classified Department
HETA 90-013, Los Angeles Times

Variables for Neck Musculoskeletal Symptoms	Odds Ratio*	(95% CI)**
Lack of Training in Posture/technique for job tasks	4.1	(1.7-10.1)
Work variance (e.g., marked increase in workload concentration) ("often" compared to "occasionally")	2.4***	(6.1-10.7)
Work closely with co-workers ("very much" compared to "somewhat")	2.0***	(1.3-3.2)

* Adjusted for Deadline work

\- the confidence intervals (CI) were derived from the Wald test and may be wider than those derived from the likelihood ratio test, and thus may include 1.0

\-- the odds ratios were derived from 75-25% interquartile range difference of the mean responses for each scale;

Table H
Phase I: Logistic Regression Model Variables
Shoulder Musculoskeletal Symptoms
Classified Department
HETA 90-013, Los Angeles Times

Variables for Shoulder CTD	Odds Ratio*	(95% CI)
Lack of Training in Posture/technique for job tasks	2.9	(1.2-6.9)

* Adjusted for height

Table I
Phase I: Logistic Regression Model Variables
Hand/Wrist Musculoskeletal Symptoms
Classified Department
HETA 90-013, Los Angeles Times

Variables for Hand/wrist Musculoskeletal Symptoms	Odds Ratio (95% CI)*	
Gender	3.6	(1.2-11.0)
Work closely with co-workers ("very much" compared to "somewhat")	2.9**	(1.9-6.4)

* the confidence intervals (CI) were derived from the Wald test and may be wider than those derived from the likelihood ratio test, and thus may include 1.0

** the odds ratios were derived from 75-25% interquartile range difference of the mean responses for each scale;

Table J
Phase I: Logistic Regression Model Variables
Neck Musculoskeletal Symptoms
Editorial Department
HETA 90-013, Los Angeles Times

Variables for Neck Musculoskeletal Symptoms	Odds Ratio (95% CI)*	
Lack of support of ergonomic issues by management ("disagree" compared to "strongly disagree")	1.8**	(1.2-2.9)
Increased Workload ("often" compared to "sometimes")	1.6**	(1.1-2.5)
Perceived lack of support from spouse, friends, relatives ("a little" compared to not at all")	1.3**	(1.0-1.7)

* the confidence intervals (CI) were derived from the Wald test and may be wider than those derived from the likelihood ratio test, and thus may include 1.0

** the odds ratios were derived from 75-25% interquartile range difference of the mean responses for each scale;

Table K
Phase I: Shoulder Musculoskeletal Symptoms
Editorial Department
HETA 90-013, Los Angeles Times

Variables for Shoulder CTD	Odds Ratio (95% CI)
Number of Hours on Deadline (30 - 39 hours compared to 0-10 hours)	2.1 (1.1-3.9)
Number of years at the LA Times	1.6* (1.2-2.2)

* Odds Ratios obtained from a third order model

Table L
Phase I: Hand/Wrist Musculoskeletal Symptoms
Editorial Department
HETA 90-013, Los Angeles Times

Variables for Hand/wrist Musculoskeletal Symptoms	Odds Ratio (95% CI)
Time spent typing (6 hours compared to 0-2 hours)	3.3 (1.7-6.3)

Table M
Phase I
Important Variables in Final Logistic Models
By Department
HETA 90-013, Los Angeles Times

Variable	Circulation			Classified			Editorial			Accounting		
	neck	shldr	hand	neck	shldr	hand	neck	shldr	hand	neck	shldr	hand
female		*				*					*	
height					*							
non-white		*				-						
LA years								*				
hrs typing	*								*			*
deadline hrs								*		*		*
posture training			*	*	*							
conflict	*											
work variance				*						*		
workload							*					
hostility from clients											*	*
work closely with co-workers				*		*						
importance of ergo							*				*	
lack of particip.										*		
lack of support of spouse, friends, relatives							*					
job interaction with people			*									
deadline work				*								

Table N
Work-related Musculoskeletal Disorder by Gender
by Department
HETA 90-013, Los Angeles Times

	Accounting and Finance		Circulation		Classified		Editorial	
	male	female	male	female	male	female	male	female
Neck WRMD	9 (19%)	30 (31%)	14 (26%)	47 (40%)	9 (19%)	26 (29%)	44 (19%)	35 (26%)
Shoulder WRMD	4 (8%)	30 (31%)	5 (10%)	36 (33%)	4 (10%)	26 (27%)	30 (13%)	18 (14%)
Hand-wrist WRMD	5 (9%)	27 (25%)	9 (16%)	36 (29%)	4 (8%)	26 (24%)	49 (20%)	43 (39%)

Appendix D

Figures

Figure 1
HETA 90-013, Los Angeles Times

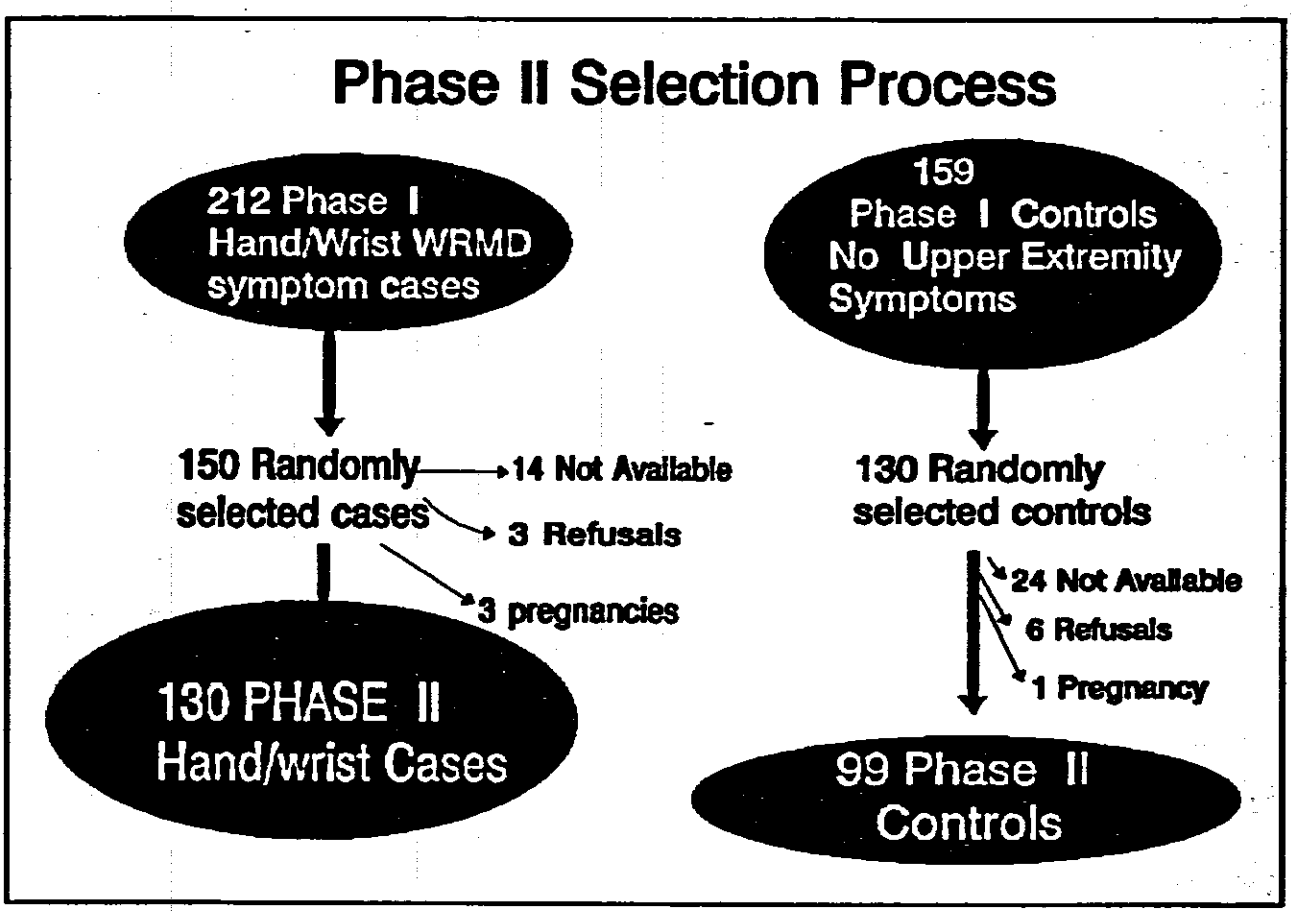
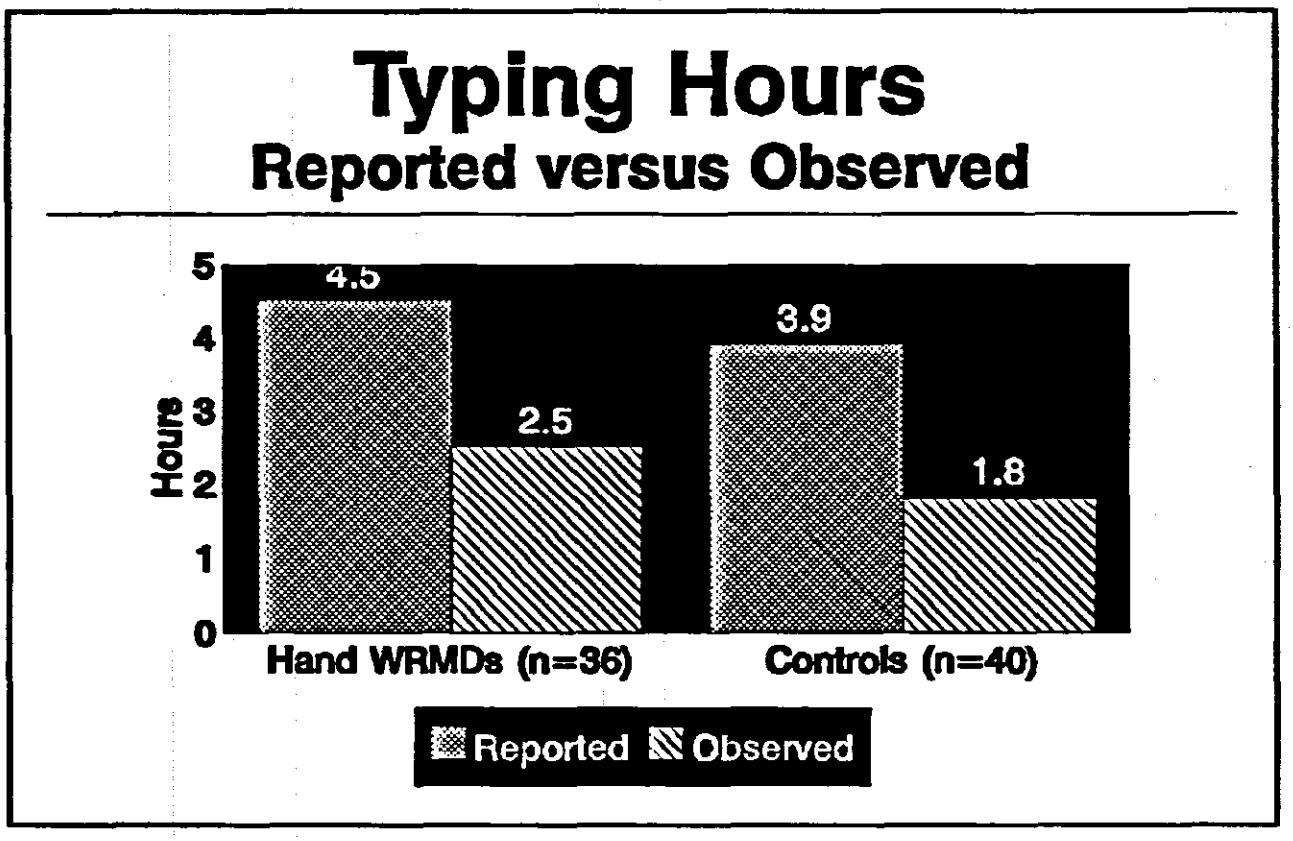


Figure 2
HETA 90-013, Los Angeles Times



Appendix E

Questionnaires and Job Sampling Form

Subject Identification #: |_|_|_|_| (1-4)

National Institute for Occupational Safety and Health
Centers for Disease Control
HETA 90-013
LOS ANGELES TIMES

(For Office Use Only)

Today's Date: |_|_| / |_|_| / 19 |_|_| (5-10)
(month) (day) (year)

Subject Name: |_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_| (11-27)
(last)

|_|_|_|_|_|_|_|_|_|_|_|_| (28-38) |_| (39)
(first) (middle initial)

Subject Address: |_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_| (40-59)
(street)

|_|_|_|_|_|_|_|_|_|_|_|_|_| (60-71)
(city)

|_|_| (72-73) |_|_|_|_|_| (74-78)
(state) (zip code)

CARD |0|1| (79-80)

Home phone number: |_|_|_| - |_|_|_| - |_|_|_|_| (5-14)
(area code)

Work phone number and extension: |_|_|_| - |_|_|_|_| |_|_|_|_| (15-25)
(extension)

Sex: 1___Male 2___Female (26)

Ethnic Background: (Check one) (27)
1___American Indian or Alaskan Native
2___Asian or Pacific Islander
3___Black, not of Hispanic origin
4___Hispanic
5___White, not of Hispanic origin
6___Other

Date of Birth: |_|_| / |_|_| / 19 |_|_| (28-33)
(month) (day) (year)

Height: |_|_| |_|_| (34-36)
(feet) (inches)

1. Considering ALL of your employers, HOW MANY YEARS altogether have you worked in the newspaper business?

|__|__| (# yrs)	|__|__| (# mos)	(37-40)

2. WHEN did you begin working at the L.A. TIMES?

|__|__| (month) / 19	|__|__| (year)	(41-44)

3. IN WHICH L.A. TIMES OFFICE do you now work?

ENTER the NUMBER "1". If you work in more than one office, number them according to the amount of time spent at each.

____Metro, Los Angeles	(45)
____Orange County	(46)
____Other (specify_____)	(47)

4. HOW MANY YEARS have you been at this(these) office(s)?

Metro, Los Angeles	|__|__| (# yrs)	|__|__| (# mos)		(48-51)
Orange County	|__|__| (# yrs)	|__|__| (# mos)		(52-55)
Other	|__|__| (# yrs)	|__|__| (# mos)	(specify_____)	(56-59)

5. Are you: (Check one)

1____Full-time, permanent	3____Temporary	(60)
2____Part-time, permanent	4____On disability (includes Workers' Compensation)	

6. Are you: (Check one)

1____Exempt 2____Non-exempt (61)

7. On average, how many HOURS do you work PER WEEK?

\|__\|__\| (hrs/wk) (62-63)

8. On average, how many DAYS do you work each WEEK?

\|__\|__\| (days/wk) (64-65)

9. Are you hired as a freelance employee for L.A. Times?

1____Yes, full-time 2____Yes, part-time 3____No (66)

10. Please CHECK THE ONE SECTION of the paper in which you work NOW. (If you work in more than one, check the section in which MOST TIME is spent.)

1____Accounting and Finance (67)
2____Administrative Services and Facilities
3____Circulation
4____Classified Advertising
5____Display Advertising
6____Editorial
7____Employee Relations, Medical, Credit Union
8____Information Systems
9____Marketing Research

11. Please CHECK your CURRENT DEPARTMENT and JOB. (If you work in more than one place, check the department and job in which you spend MOST of your time.)

(FOR OFFICE USE) | | | | | | (68-70)

CARD |0|2| (79-80)

1____Accounting and Finance Department

01____Credit
02____Outside Collections
03____General Accounting & Accounts Payable
04____Cashier, Remittance Processing & Payroll
05____Circulation Accounting
06____Advertising Accounting
07____All other Accounting & Finance jobs (specify)
_____

2____Circulation Department

08____Subscriber Accounts
09____Street Sales
10____Subscriber Service
11____Telemarketing
12____Consumer Marketing
13____All other Circulation jobs (specify)
_____

3____Classified Advertising Department

14____Outside Sales
15____Telephone Sales
16____Sales Development
17____Administration
18____Operations
19____All other Classified Advertising jobs (specify)
_____

4____Editorial Department

20____Editorial General
21____Editorial Art
22____Metro Bureau
23____News Desk
24____Sports
25____Financial
26____Transcribers and Messengers
27____Wire Room
28____News Service
29____Editorial Pages
30____View Section
31____Food Section
32____Library & Editorial Services
33____LA Times Magazine
34____Special Sections
35____National Editors & Assistants
36____Foreign Editors
37____Television
38____Art Critics
39____Music Critics
40____Drama Critics
41____Society
42____Fashion News
43____Real Estate
44____Travel
45____Calendar
46____Book Review
47____You Section
48____Graphic
49____Electronic Publishing Services
50____Recruitment and Development
51____Opinion Section
52____Polls and Special Projects
53____All other Editorial jobs (specify)_____

** EDITORIAL STAFF SHOULD ANSWER QUESTIONS 12 & 13; **
** ALL OTHERS SHOULD GO TO QUESTION 14. **

|EDITORIAL ONLY|

12. Please CHECK your CURRENT JOB TITLE.

01____Assignment/Content Editor	06____News Editor	(5-6)
02____Artist	07____Photographer	
03____Copy Editor	08____Reporter	
04____Desk Assistant/Researcher	09____Manager not included above	
05____Librarian/Researcher	10____Clerical	
	11____Other_____	

13. In a typical MONTH how many of the following stories do you work on?

a.	Daily	| | | |	(7-9)
b.	Weekly	| | | |	(10-12)
c.	Short-term special projects (more than 1 week, but less than 1 month)	| | | |	(13-15)
d.	Long-term special projects (1 month or more)	| | | |	(16-18)
e.	Does not apply to my job (Please check)	| |	(19)

(Continue with Question 14.)

|ALL STAFF|

14. Do you work ON DEADLINE?

1____Yes (Go to question 14a) (20)
2____No (Go to question 15, page 5)

a. How many HOURS PER WEEK do you work ON DEADLINE?

\| \| \| (hours per week)
(21-22)

b. How often during the LAST 6 MONTHS were your work deadlines:
(Please CIRCLE ONLY ONE ANSWER for each type of deadline.)

		Never	Rarely	Sometimes	Much of the Time	Almost Always	
(1)	Daily	1	2	3	4	5	(23)
(2)	Weekly	1	2	3	4	5	(24)
(3)	Short-term special projects (more than 1 week, but less than 1 month)	1	2	3	4	5	(25)
(4)	Long-term special projects (1 month or more)	1	2	3	4	5	(26)

15. During an average work week, how many HOURS do you work at your JOB OUTSIDE THE OFFICE (interviewing, photography, etc.)? Please enter "00" if NOT APPLICABLE. |__|__| (hrs/wk) (27-28)

16. Which of the following do you use at work? (Check one)

1____Computer keyboard (29)
2____Typewriter
3____Both
4____Do not use (Go to question 25, page 6)

17. Which KEYBOARD do you CURRENTLY use?

ENTER the NUMBER "1". If you use more than one keyboard regularly, please number them in order of frequency used: 1=most frequently used, 2=second most frequently used, etc.)

____Coyote with NO rubber stops under the keyboard (30)
____Coyote with rubber stops under keyboard (31)
____IBM PC/XT (32)
____IBM PS/2 (33)
____Tandy (34)
____AT&T (35)
____Mac II (36)
____Zentex (37)
____Other (specify_____) (38)

18. How long have you been using your CURRENT PRIMARY KEYBOARD? (Check one)

1____Less than 1 month (39)
2____1 to 6 months
3____7 months to 1 year
4____More than 1 year to 3 years
5____4 to 5 years
6____More than 5 years

19. Have you changed keyboards for your computer?

1____Yes (Go to question 19a) (40)
2____No (Go to question 20)

a. Why did you change? (Check one)

1____Office equipment updated (41)
2____Changed workstations
3____Both 1 and 2
4____Requested change (specify _____)
5____Other reason (specify _____)

|__|__| (42-43)

20. On an average day, how much time do you spend TYPING AT WORK? |__|__| (# hrs) |__|__| (# min) (44-47)

21. Choose the statement that best describes your TYPING SKILL.

1____Touch typing (fingers placed on keyboard as taught in typing class) (48)
2____"Hunt and peck" (fingers placed on keys in no particular pattern)

22. What is your TYPING SPEED?

1____Slow (less than 40 words per minute) (49)
2____Moderately fast (40 to 60 words per minute)
3____Fast (more than 60 words per minute)

23. When TAKING NOTES or messages, how often do you TYPE them instead of writing them down?

1____Never 4____Often (50)
2____Rarely 5____Almost always
3____Sometimes

24. Do you use a KEYBOARD OUTSIDE OF YOUR USUAL JOB (at home, on another job, or for freelance work, for example)?

1____Yes (Go to question 24a) (51)
2____No (Go to question 25)

a. How many HOURS PER WEEK? |__|__| (hrs/wk) (52-53)

25. Were you employed at OTHER JOBS where you used a COMPUTER KEYBOARD (not including the L.A. Times)?

1____Yes (Go to question 25a) (54)
2____No (Go to question 26)

a. How long altogether were you EMPLOYED at these OTHER JOBS? |__|__| (# yrs) |__|__| (# mos) (55-58)

26. Which TELEPHONE do you use at WORK? (Check one)

1____Hand-held receiver (Go to question 26a) (59)
2____Headset (Go to question 26a)
3____Both 1 and 2 (Go to question 26a)
4____Other (Go to question 26a)
5____Do not use phone at work (Go to question 27)

a. On an average WORKDAY, how much time do you spend on the telephone FOR ANY REASON? |__|__| (# hrs) |__|__| (# min) (60-63)

27. How many times PER HOUR do you get up from your chair FOR ANY REASON? |__|__| (# times/hr) (64-65)

28. At work, how long do you usually sit for a CONTINUOUS PERIOD OF TIME?

1____Less than 1/2 hour 3____More than 1 hour to 2 hours (66)
2____1/2 to 1 hour 4____More than 2 hours

CARD |0|3| (79-80)

29. In a typical morning OR afternoon, how many BRIEF BREAKS (1/2 minute to 10 minutes) do you take away from your workstation?

| | | | (# brief breaks) (5-6)

30. How often do you skip or MISS your scheduled work BREAKS (excluding lunch)?

1____Almost always (daily)
2____Frequently (once a week)
3____Sometimes (once a month)
4____Rarely (every 2-3 months)
5____Almost never (every 6 months) (7)

31. In a typical morning OR afternoon, how many LONGER BREAKS (more than 10 minutes, EXCLUDING LUNCH) do you take away from your workstation?

| | | | (# longer breaks) (8-9)

32. Do you take a lunch break?

1____Yes (Go to question 32a)
2____No (Go to question 33) (10)

a. How often do you skip or MISS your scheduled LUNCH BREAK?

1____Almost always (daily)
2____Frequently (once a week)
3____Sometimes (once a month)
4____Rarely (every 2-3 months)
5____Almost never (every 6 months) (11)

33. Do you have your OWN WORKSTATION? (Co-workers on different shifts do not use your desk and chair.)

1____Yes 2____No (12)

34. Have you received CHANGES TO YOUR WORKSTATION during the LAST YEAR?

1____Yes (Go to question 34a)
2____No (Go to question 35, page 10) (13)

a. Which of the following CHANGES did you receive?

(1) ADJUSTABLE DESK (Height can be raised or lowered)

1____Yes (Go to question (a) below)
2____No (Go to question (2) next page) (14)

(a) WHEN did you receive an adjustable desk? | | | / 19 | | | (15-18)
(month) (year)

(b) WHY did you change to an adjustable desk? (Check one)

1____Office equipment updated or changed workstations (19)
2____Requested change (specify_____)
3____Other reason (specify_____)

| | | (20-21)

(2) KEYBOARD DRAWER or "WELL" for COMPUTER KEYBOARD

1____Yes (Go to question (a) below) (22)
2____No (Go to question (3) below)

(a) WHEN did you receive a keyboard drawer? |__|__| / 19 |__|__| (23-26)
(month) (year)

(b) WHY did you change to a keyboard drawer? (Check one)

1____Office equipment updated or changed workstations (27)
2____Requested change (specify_____)
3____Other reason (specify_____)

|__|__| (28-29)

(3) WRIST REST

1____Yes (Go to question (a) below) (30)
2____No (Go to question (4) below)

(a) WHEN did you receive a wrist rest? |__|__| / 19 |__|__| (31-34)
(month) (year)

(b) WHY did you change to a wrist rest? (Check one)

1____Office equipment updated or changed workstations (35)
2____Requested change (specify_____)
3____Other reason (specify_____)

|__|__| (36-37)

(4) TELEPHONE HEADSET

1____Yes (Go to question (a) below) (38)
2____No (Go to question (5) next page)

(a) WHEN did you receive a telephone headset? |__|__| / 19 |__|__| (39-42)
(month) (year)

(b) WHY did you change to a telephone headset? (Check one)

1____Office equipment updated or changed workstations (43)
2____Requested change (specify_____)
3____Other reason (specify_____)

|__|__| (44-45)

(5) ADJUSTABLE CHAIR

1____Yes (Go to question (a) below) (46)
2____No (Go to question (6) below)

(a) WHEN did you receive an adjustable chair? |__|__| / 19 |__|__| (47-50)
(month) (year)

(b) WHY did you change to an adjustable chair? (Check one)

1____Office equipment updated or changed workstations (51)
2____Requested change (specify_____)
3____Other reason (specify_____)

|__|__| (52-53)

(6) FOOT REST

1____Yes (Go to question (a) below) (54)
2____No (Go to question (7) below)

(a) WHEN did you receive a foot rest? |__|__| / 19 |__|__| (55-58)
(month) (year)

(b) WHY did you change to a foot rest? (Check one)

1____Office equipment updated or changed workstations (59)
2____Requested change (specify_____)
3____Other reason (specify_____)

|__|__| (60-61)

(7) OTHER (specify_____)

1____Yes (Go to question (a) below) (62)
2____No (Go to question 35, page 10)

(a) WHEN did you receive this? |__|__| / 19 |__|__| (64-66)
(month) (year)

(b) WHY did you receive this? (Check one)

1____Office equipment updated or changed workstations (67)
2____Requested change (specify_____)
3____Other reason (specify_____)

|__|__| (68-69)

CARD |0|4| (79-80)

35. HOW COMFORTABLE is the chair at your workstation?

1____Reasonably comfortable (Go to question 35a) (5)
2____Somewhat uncomfortable (Go to question 35a)
3____Very uncomfortable (Go to question 35a)
4____Don't have one specific chair (Go to question 36)

a. Have you ADJUSTED any aspect of your CHAIR TODAY?

1____Yes (6)
2____I would, but I don't know how
3____I would, but it is too difficult
4____I would, but it is not adjustable
5____No, it's fine just the way it is

36. Have you ADJUSTED your DESK TODAY?

1____Yes (7)
2____I would, but I don't know how
3____I would, but it is too difficult
4____I would, but it is not adjustable
5____No, it's fine just the way it is

37. Have you ADJUSTED your KEYBOARD TODAY?

1____Yes (8)
2____I would, but I don't know how
3____I would, but it is too difficult
4____I would, but it is not adjustable
5____No, it's fine just the way it is

38. Have you ADJUSTED the height, placement, tilt, etc. of your VDT SCREEN TODAY?

1____Yes (9)
2____I would, but I don't know how
3____I would, but it is too difficult
4____I would, but it is not adjustable
5____No, it's fine just the way it is

39. Have you received TRAINING in the proper POSTURE/TECHNIQUE to perform your job tasks?

1____Yes 2____No (10)

40. Do you wear glasses or contact lenses while working at your VDT?

1____Yes (Go to question 40a) (11)
2____No (Go to question 41)

a. Which of the following do you WEAR AT WORK? (Check all that apply)

1____Contact lenses (12)
2____Bi-focals (13)
3____Tri-focals (14)
4____"Granny" half-lens reading glasses (15)
5____Full-lens reading glasses (16)
6____Glasses specially designed for VDT work (17)
7____Regular single-lens glasses (18)
8____Other (specify_____) (19)

SYMPTOMS

The next part of the questionnaire asks questions about the following upper extremity joint areas: neck, shoulder, elbow, hand, wrist and back.

41. Have you ever been told by a physician that you had tendonitis, tenosynovitis, carpal tunnel syndrome, thoracic outlet syndrome or bursitis in any of the areas shown above?

1____Yes (Go to question 41a) (20)
2____No (Go to question 42)

a. In which areas do the above-mentioned conditions occur?

(1)	Neck	1____Left	2____Right	3____Middle		(21)
(2)	Shoulder	1____Left	2____Right	3____Both		(22)
(3)	Elbow	1____Left	2____Right	3____Both		(23)
(4)	Hand/wrist	1____Left	2____Right	3____Both		(24)
(5)	Back	1____Left	2____Right	3____Middle		(25)

42. Have you ever been told by a physician that you had any of the following?

a.	Diabetes	1____Yes	2____No	(26)
b.	Gout	1____Yes	2____No	(27)
c.	Thyroid problems	1____Yes	2____No	(28)
d.	Lupus	1____Yes	2____No	(29)
e.	Ruptured disc in the neck	1____Yes	2____No	(30)
f.	Ruptured disc in the back	1____Yes	2____No	(31)
g.	Rheumatoid arthritis	1____Yes	2____No	(32)
h.	Alcoholism	1____Yes	2____No	(33)
i.	Kidney failure	1____Yes	2____No	(34)

43. Are you currently:

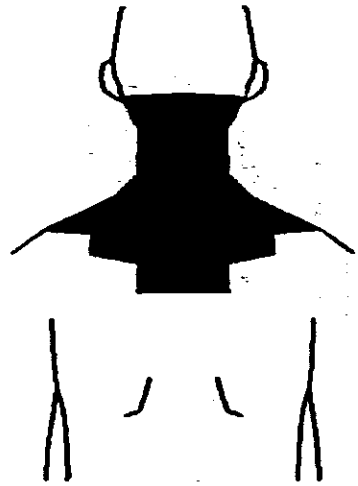
a.	Pregnant	1____Yes	2____No	3____Does not apply	(35)
b.	Using birth control pills	1____Yes	2____No	3____Does not apply	(36)

44. Are you "naturally":

1____Right handed 2____Left handed 3____Use both hands equally (37)

45. Which <u>HAND</u> do you use <u>MOST</u> at work (for everything--typing, filing, phone, etc.)? 1____Right 2____Left 3____Both (38)

NECK



46. In the PAST YEAR, have you had pain, aching, stiffness, burning, numbness, or tingling in the area shown on this diagram?

1____Yes (Go to question 46a) (39)
2____No (Go to question 47, page 13)

a. How often have you had this NECK problem in the PAST YEAR?

1____Almost always (daily) (40)
2____Frequently (once/week)
3____Sometimes (once/month)
4____Rarely (every 2-3 mos)
5____Almost never (every 6 mos)

b. How long does this NECK problem usually last?

1____Less than 1 hour
2____1 to 24 hours
3____25 hours to 1 week
4____More than 1 week to 2 weeks
5____More than 2 weeks to 1 month
6____More than 1 month to 3 months
7____More than 3 months
(41)

c. On average, describe the INTENSITY of your NECK problem. Use the scale below and CIRCLE the best answer.

1	2	3	4	5	(42)
No pain	Mild	Moderate	Severe	Worst pain ever in life	

d. Have you ever had an accident or sudden injury to your NECK that is not work-related (such as a whiplash, sports injury, fracture, or sudden slipped disc)? 1____Yes 2____No (43)

e. When was the FIRST TIME you experienced this NECK problem?

1____Before this job 2____After starting this job (44)

f. What job were you doing when you first noticed this NECK problem?

1____Current job 2____Other job (specify_____) (45)

g. Do activities at work make this NECK problem:

1____Better 2____Worse 3____No change (46)

h. Have you had this NECK problem in the PAST 7 DAYS? 1____Yes 2____No (47)

i. Which side bothers you most? 1____Right 2____Left 3____Middle (48)

j. In the PAST YEAR, has this NECK problem resulted in your:

(1) Seeing a health care provider?

1____Yes, 1 to 5 times 2____Yes, more than 5 times 3____No (49)

(2) Missing work?

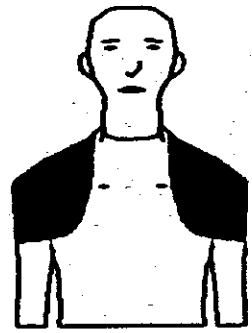
1____Yes, 1 to 5 times 2____Yes, more than 5 times 3____No (50)

(3) Assigned to a different job or restriction of job duties?

1____Yes, 1 to 5 times 2____Yes, more than 5 times 3____No (51)

SHOULDER

47. In the PAST YEAR, have you had pain, aching, stiffness, burning, numbness, or tingling in the area shown on this diagram?

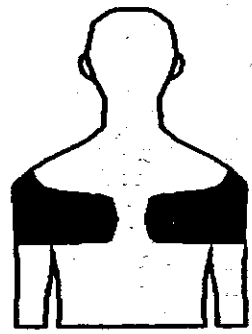


1____Yes (Go to question 47a) (52)
2____No (Go to question 48, page 14)

a. How often have you had this SHOULDER problem in the PAST YEAR?

1____Almost always (daily) (53)
2____Frequently (once/week)
3____Sometimes (once/month)
4____Rarely (every 2-3 mos)
5____Almost never (every 6 mos)

b. How long does this SHOULDER problem usually last?



1____Less than 1 hour
2____1 to 24 hours
3____25 hours to 1 week
4____More than 1 wk to 2 wks
5____More than 2 wks to 1 mon
6____More than 1 mon to 3 mos
7____More than 3 months (54)

c. On average, describe the INTENSITY of your SHOULDER problem. Use the scale below and CIRCLE the best answer.

1	2	3	4	5
No pain	Mild	Moderate	Severe	Worst pain ever in life

(55)

d. Have you ever had an accident or sudden injury to your SHOULDER that is not work-related (such as a dislocation, sports injury, fracture or tendon tear)?

1____Yes (56)
2____No

e. When was the FIRST TIME you experienced this SHOULDER problem?

1____Before this job 2____After starting this job (57)

f. What job were you doing when you first noticed this SHOULDER problem?

1____Current job 2____Other job (specify_____) (58)

g. Do activities at work make this SHOULDER problem:

1____Better 2____Worse 3____No change (59)

h. Have you had this SHOULDER problem in the PAST 7 DAYS? 1____Yes 2____No (60)

i. Which side bothers you most? 1____Right 2____Left 3____Both (61)

j. In the PAST YEAR, has this SHOULDER problem resulted in your:

(1) Seeing a health care provider?

1____Yes, 1 to 5 times 2____Yes, more than 5 times 3____No (62)

(2) Missing work?

1____Yes, 1 to 5 times 2____Yes, more than 5 times 3____No (63)

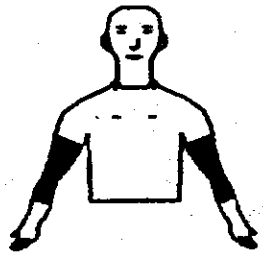
(3) Assigned to a different job or restriction of job duties?

1____Yes, 1 to 5 times 2____Yes, more than 5 times 3____No (64)

|0|5| (79-80)

ELBOW/FOREARM

48. In the PAST YEAR, have you had pain, aching, stiffness, burning, numbness, or tingling in the area shown on this diagram?



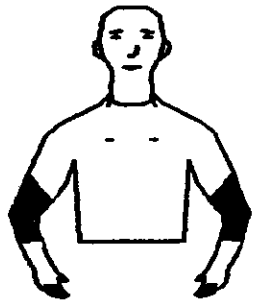
1____Yes (Go to question 48a) (5)
2____No (Go to question 49, page 15)

a. How often have you had this problem in the PAST YEAR?

1____Almost always (daily) (6)
2____Frequently (once/week)
3____Sometimes (once/month)
4____Rarely (every 2-3 mos)
5____Almost never (every 6 mos)

b. How long does this ELBOW problem usually last?

1____Less than 1 hour
2____1 to 24 hours
3____25 hours to 1 week
4____More than 1 week to 2 weeks
5____More than 2 weeks to 1 month
6____More than 1 month to 3 months
7____More than 3 months (7)



c. On average, describe the INTENSITY of your ELBOW problem. Use the scale below and CIRCLE the best answer.

1	2	3	4	5
No pain	Mild	Moderate	Severe	Worst pain ever in life

(8)

d. Have you ever had an accident or sudden injury to your ELBOW that is not work-related (such as a dislocation, sports injury,fracture or tendon tear)?
1____Yes
2____No (9)

e. When was the FIRST TIME you experienced this ELBOW problem?

1____Before this job 2____After starting this job (10)

f. What job were you doing when you first noticed this ELBOW problem?

1____Current job 2____Other job (specify_____) (11)

g. Do activities at work make this ELBOW problem:

1____Better 2____Worse 3____No change (12)

h. Have you had this ELBOW problem in the PAST 7 DAYS? 1____Yes 2____No (13)

i. Which side bothers you most? 1____Right 2____Left 3____Both (14)

j. In the PAST YEAR, has this ELBOW problem resulted in your:

(1) Seeing a health care provider?

1____Yes, 1 to 5 times 2____Yes, more than 5 times 3____No (15)

(2) Missing work?

1____Yes, 1 to 5 times 2____Yes, more than 5 times 3____No (16)

(3) Assigned to a different job or restriction of job duties?

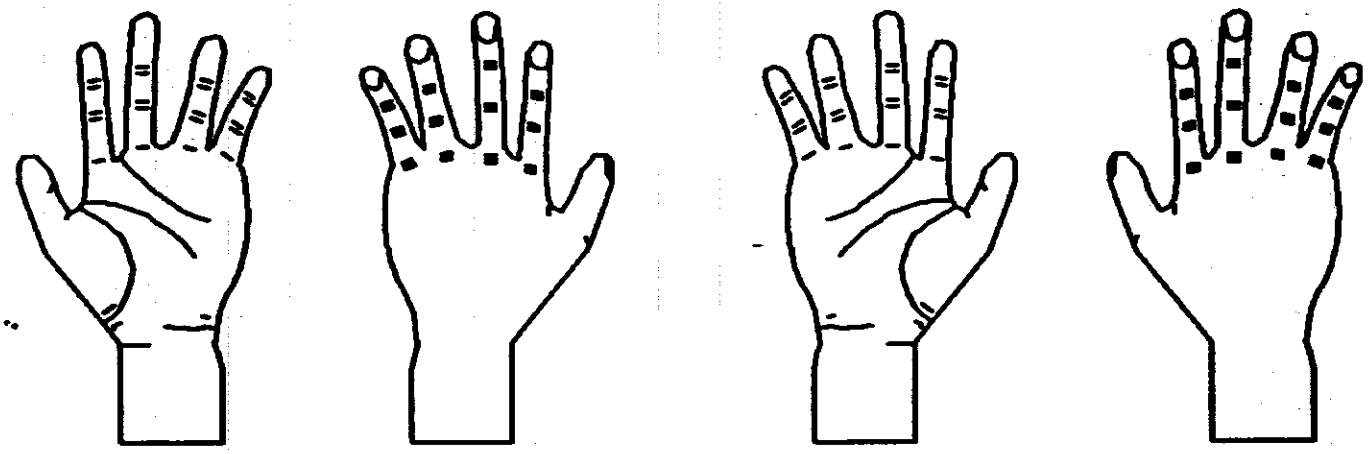
1____Yes, 1 to 5 times 2____Yes, more than 5 times 3____No (17)

HAND/WRIST

49. In the PAST YEAR, have you had pain, aching, stiffness, burning, numbness, or tingling in the area shown on this diagram?

1____Yes (Go to question 49a) (18)
2____No (Go to question 50, page 17)

a. In the diagram below, SHADE IN THE AREAS where you have problems.



b. Select the symptom(s) that BEST DESCRIBE(S) the areas you have just shaded.

____Pain ____Aching ____Stiffness ____Burning ____Numbness ____Tingling

c. How often have you had this HAND/WRIST problem in the PAST YEAR?

1____Almost always (daily) (19)
2____Frequently (once/week)
3____Sometimes (once/month)
4____Rarely (every 2-3 mos)
5____Almost never (every 6 mos)

d. How long does this HAND/WRIST problem usually last?

1____Less than 1 hour
2____1 to 24 hours
3____25 hours to 1 week
4____More than 1 week to 2 weeks (20)
5____More than 2 weeks to 1 month
6____More than 1 month to 3 months
7____More than 3 months

e. On average, describe the INTENSITY of your HAND/WRIST problem. Use the scale below and CIRCLE the best answer.

1 2 3 4 5 (21)
No pain Mild Moderate Severe Worst pain ever in life

f. Have you ever had an accident or sudden injury to your HAND/WRIST that is not work-related (such as a dislocation, sports injury, fracture or tendon tear)? 1____Yes (22)
2____No

g. When was the FIRST TIME you experienced this HAND/WRIST problem?

1____Before this job 2____After starting this job (23)

h. What job were you doing when you first noticed this HAND/WRIST problem?

1____Current job 2____Other job (specify_____) (24)

i. Do activities at work make this HAND/WRIST problem:

1____Better 2____Worse 3____No change (25)

j. Does this HAND/WRIST problem usually WAKE you from sleep?

1____Yes 2____No (26)

k. Have you had this HAND/WRIST problem in the PAST 7 DAYS?

1____Yes 2____No (27)

l. Which side bothers you most? 1____Right 2____Left 3____Both (28)

m. In the PAST YEAR, has this HAND/WRIST problem resulted in your:

(1) Seeing a health care provider?

1____Yes, 1 to 5 times 2____Yes, more than 5 times 3____No (29)

(2) Missing work?

1____Yes, 1 to 5 times 2____Yes, more than 5 times 3____No (30)

(3) Assigned to a different job or restriction of job duties?

1____Yes, 1 to 5 times 2____Yes, more than 5 times 3____No (31)

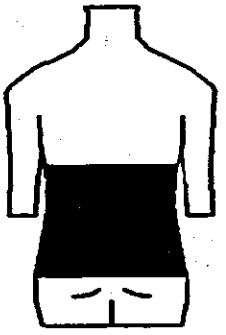
n. Do you do any sporting activities, have any hobbies, play a musical instrument, or do art work AT LEAST 3 HOURS every week? 1____Yes (Go to #(1) below) (32) 2____No (Go to #50, p. 17)

(1) Please LIST these activities and the number of hours per week:

	Activities		Hours per Week	
(a)	_____	|__| (33)	|__|__|	(34-35)
(b)	_____	|__| (36)	|__|__|	(37-38)
(c)	_____	|__| (39)	|__|__|	(40-41)
(d)	_____	|__| (42)	|__|__|	(43-44)
(e)	_____	|__| (45)	|__|__|	(46-47)

BACK

50. In the PAST YEAR, have you had pain, aching, stiffness, burning, numbness, or tingling in the area shown on this diagram?



1____Yes (Go to question 50a) (48)
2____No (Go to question 51, page 18)

a. How often have you had this BACK problem in the PAST YEAR?

1____Almost always (daily) (49)
2____Frequently (once/week)
3____Sometimes (once/month)
4____Rarely (every 2-3 mos)
5____Almost never (every 6 mos)

b. How long does this BACK problem usually last?

1____Less than 1 hour
2____1 to 24 hours
3____25 hours to 1 week
4____More than 1 week to 2 weeks
5____More than 2 weeks to 1 month
6____More than 1 month to 3 months
7____More than 3 months (50)

c. On average, describe the INTENSITY of your BACK problem. Use the scale below and CIRCLE the best answer.

1 No pain 2 Mild 3 Moderate 4 Severe 5 Worst pain ever in life (51)

d. Have you ever had an accident or sudden injury to your BACK that is not work-related (such as a whiplash, sports injury, fracture, or sudden slipped disc)? 1____Yes 2____No (52)

e. When was the FIRST TIME you experienced this BACK problem?

1____Before this job 2____After starting this job (53)

f. What job were you doing when you first noticed this BACK problem?

1____Current job 2____Other job (specify_____) (54)

g. Do activities at work make this BACK problem:

1____Better 2____Worse 3____No change (55)

h. Have you had this BACK problem in the PAST 7 DAYS? 1____Yes 2____No (56)

i. Which side bothers you most? 1____Right 2____Left 3____Middle (57)

j. In the PAST YEAR, has this BACK problem resulted in your:

(1) Seeing a health care provider?

1____Yes, 1 to 5 times 2____Yes, more than 5 times 3____No (58)

(2) Missing work?

1____Yes, 1 to 5 times 2____Yes, more than 5 times 3____No (59)

(3) Assigned to a different job or restriction of job duties?

1____Yes, 1 to 5 times 2____Yes, more than 5 times 3____No (60)

CARD 1016 (79-80)

51. If you reported on the previous pages having PROBLEMS in your neck, shoulder, elbow, hand/wrist or back, please answer the next set of questions for the FIRST time your problem/problems occurred.

		Date of 1st occurrence	When did you report this problem to your supervisor? (Enter date or check line)	Did you seek initial medical assessment? (Check one)
a.	NECK	__/__/19__ (5-8)	__/__/19__ -or- 0000____Did not report (9-12)	1____Yes, co. medical 2____Yes, other 3____No (13)
b.	SHOULDER	__/__/19__ (14-17)	__/__/19__ -or- 0000____Did not report (18-21)	1____Yes, co. medical 2____Yes, other 3____No (22)
c.	ELBOW/ FOREARM	__/__/19__ (23-26)	__/__/19__ -or- 0000____Did not report (27-30)	1____Yes, co. medical 2____Yes, other 3____No (31)
d.	HAND/ WRIST	__/__/19__ (32-35)	__/__/19__ -or- 0000____Did not report (36-39)	1____Yes, co. medical 2____Yes, other 3____No (40)
e.	BACK	__/__/19__ (41-44)	__/__/19__ -or- 0000____Did not report (45-48)	1____Yes, co. medical 2____Yes, other 3____No (49)

52. The next series of questions asks HOW MUCH INFLUENCE you now have in each of several areas at work. By influence we mean the degree to which YOU CONTROL what is done by others and have freedom to determine what you do yourself. Select your answers from the following scale and enter the appropriate number on the lines provided.

SCALE: None.....0 A moderate amount...3
Very little...1 Much.....4
A little.....2 Very much.....5

a. How much influence do you have over the AMOUNT OF WORK you do? _____ (50)

b. How much influence do you have over the AVAILABILITY OF MATERIALS you need to do your work? _____ (51)

c. How much do you influence the POLICIES AND PROCEDURES in your work group? _____ (52)

d. How much influence do you have over the ARRANGEMENT OF FURNITURE AND OTHER WORK EQUIPMENT at your workstation? _____ (53)

e. If you are required to meet a SPECIFIC PRODUCTIVITY STANDARD (e.g. average work time or units of output) how much influence did you have in DETERMINING THE STANDARD? _____ (54)

f. How much influence do you have over THE PACE OF YOUR WORK, that is how FAST or SLOW you work? _____ (55)

g. How much influence do you have over THE QUALITY OF THE WORK that you do? _____ (56)

h. How much influence do you have over THE HOURS OR SCHEDULE that you work? _____ (57)

53. The following items deal with DIFFERENT ASPECTS OF WORK. Indicate how much of EACH ASPECT you have on your job by selecting answers from the following scale and entering the appropriate number on the lines provided.

SCALE: None.....0 A moderate amount...3
Very little...1 Much.....4
A little.....2 Very much.....5

a. How much do you take part WITH OTHERS in MAKING DECISIONS that affect you? _____ (58)

b. How much do you participate WITH OTHERS in PLANNING the way things are done on your job? _____ (59)

c. How much do you decide WITH OTHERS what PART OF A TASK you will do? _____ (60)

54. The NEXT series of questions asks HOW OFTEN certain things happen at your job. Select your answers from the following scale and enter the appropriate number on the lines provided.

SCALE: Rarely.....1 Often.....4
Occasionally...2 Very often...5
Sometimes.....3

a. How often does your job require you to work VERY FAST. _____ (61)

b. How often does your job require you to work VERY HARD? _____ (62)

c. How often does your job leave you with LITTLE TIME to get things done? _____ (63)

d. How often is there a GREAT DEAL to get done? _____ (64)

e. How often is there a marked increase in your WORKLOAD? _____ (65)

f. How often is there a marked increase in the AMOUNT OF CONCENTRATION required on your job? _____ (66)

g. How often is there a marked increase in how FAST YOU HAVE TO THINK? _____ (67)

h. How often are you PHYSICALLY exhausted at the end of the work day? _____ (68)

i. How often are you MENTALLY exhausted at the end of the work day? _____ (69)

55. In your job, are you required to meet A SPECIFIC PRODUCTIVITY STANDARD, (e.g., process a certain number of ads or calls within a given period of time)?

1___Yes (Go to question 55a) (70)
2___No (Go to question 56)

a. What is the PRODUCTIVITY STANDARD you are required to meet?

_____

_____

b. Is the productivity standard: (Check one)

1___Difficult to meet? (71)
2___Somewhat difficult to meet?
3___Not difficult to meet?

CARD 0171 (79-80)

56. IN THE FUTURE, some jobs will be changing while others will be staying the same. Here are some questions which deal with this topic. Select your answers from the following scale and enter the appropriate number on the lines provided.

SCALE:	Uncertain.....1	Somewhat certain...3
	A little uncertain...2	Fairly certain.....4
		Very certain.....5

a. How certain are you about what your FUTURE CAREER PICTURE looks like? _____ (5)

b. How certain are you of the OPPORTUNITIES FOR PROMOTION AND ADVANCEMENT which will exist in the next few years? _____ (6)

c. How certain are you about whether your JOB SKILLS will be of use and value FIVE YEARS FROM NOW? _____ (7)

d. How certain are you about what your RESPONSIBILITIES will be SIX MONTHS FROM NOW? _____ (8)

e. If you lost your job, how certain are you that you could SUPPORT YOURSELF? _____ (9)

57. This section asks you to describe your job in terms of SPECIFIC QUALITIES. In order to gain a better understanding of your work environment, we would like to know HOW YOU FEEL about your job situation.

We would like you to think about the TYPE OF WORK you do in your job. (Check one box for each statement.)

a. All in all, HOW SATISFIED are you with your job?

1____Very satisfied (10)
2____Somewhat satisfied
3____Not too satisfied
4____Not at all satisfied

b. If you had to decide again whether or not TO TAKE THE JOB YOU NOW HAVE, what would you decide?

1____Decide without hesitation to take the same job (11)
2____Have some second thoughts
3____Decide definitely not to take the same job

c. If you were free to go into ANY TYPE OF JOB you wanted, what would your choice be?

1____Take the same job (12)
2____Take a different job
3____Not want to work

d. If a friend of yours told you he/she was interested IN A JOB LIKE YOURS, what would you tell him/her? Would you:

1____Strongly recommend it (13)
2____Have doubts about recommending it
3____Advise against it

58. The next set of questions asks about PEOPLE with whom you may come into contact. Select your answers from the following scale and enter the appropriate number on the lines provided.

SCALE: Very much...1 Somewhat....2 A little....3 Not at all.....4 No such person...5

a. How often does your job offer the opportunity to interact with people (excluding co-workers)? _____ (14)

b. How often does your job require you to work closely with co-workers? _____ (15)

c. How often do you face hostility or abuse from customers or clients? _____ (16)

PLEASE SELECT A CODE FROM THE ABOVE SCALE FOR EACH OPTION IN QUESTIONS d-g.

d. How much do each of the following people go out of his/her way to make your WORK LIFE EASIER?

(1) Your immediate supervisor _____ (17)
(2) Other people at work _____ (18)
(3) Your spouse, friends, relatives _____ (19)

e. How easy is it to TALK with each of the following people?

(1) Your immediate supervisor _____ (20)
(2) Other people at work _____ (21)
(3) Your spouse, friends, relatives _____ (22)

f. How much can each of the following people be RELIED ON when things get tough at work?

(1) Your immediate supervisor _____ (23)
(2) Other people at work _____ (24)
(3) Your spouse, friends, relatives _____ (25)

g. How much is each of the following people WILLING TO LISTEN to your personal problems?

(1) Your immediate supervisor _____ (26)
(2) Other people at work _____ (27)
(3) Your spouse, friends, relatives _____ (28)

59. The following questions are about your WORK SITUATION. Select your answers from the following scale and enter the appropriate number on the lines provided.

SCALE: Disagree strongly.....1 Moderately disagree.....2 Neither agree nor disagree...3 Moderately agree...4 Strongly agree.....5

a. There is HARMONY within my group. _____ (29)
b. In my group, we have lots of BICKERING over who should do what job. _____ (30)
c. In my group, people CANNOT afford to RELAX. _____ (31)
d. There is DISSENSION in my group. _____ (32)
e. The members of my group are SUPPORTIVE of each other's ideas. _____ (33)
f. In our group, there is constant PRESSURE to keep working. _____ (34)
g. There are CLASHES between subgroups within my group. _____ (35)
h. There is FRIENDLINESS among members of my group. _____ (36)
i. There is a "WE" FEELING among members of my group. _____ (37)
j. In my group there is a sense of URGENCY about everything. _____ (38)

60. Please indicate the degree to which you agree or disagree with the following statements about the LOS ANGELES TIMES MANAGEMENT. Select your answers from the following scale and enter them on the lines provided.

SCALE: Strongly disagree...1 Disagree.....2 Agree.....3 Strongly agree...4

a. Do you feel that your IMMEDIATE SUPERVISOR is generally supportive of the L.A. Times ergonomics program? _____ (39)

b. Do you feel that the L.A. TIMES MANAGEMENT is generally supportive of the L.A. Times ergonomics program? _____ (40)

c. Do you feel HEALTH AND SAFETY is considered an IMPORTANT ISSUE by your IMMEDIATE SUPERVISOR? _____ (41)

d. Do you feel HEALTH AND SAFETY is considered an IMPORTANT ISSUE by the L.A. TIMES MANAGEMENT? _____ (42)

61. Below is a list of words that describe FEELINGS people have. Select your answers from the scale below which best describe HOW YOU HAVE BEEN FEELING during the PAST WEEK INCLUDING TODAY. Enter the appropriate number on the lines provided.

SCALE: Not at all...1 A little.....2 Moderately...3 Quite a bit...4 Extremely.....5

a.	Tense	_____	(43)	m.	Nervous	_____	(55)
b.	Worn out	_____	(44)	n.	Cheerful	_____	(56)
c.	Lively	_____	(45)	o.	Exhausted	_____	(57)
d.	Shakey	_____	(46)	p.	Anxious	_____	(58)
e.	Listless	_____	(47)	q.	Sluggish	_____	(59)
f.	Active	_____	(48)	r.	Weary	_____	(60)
g.	On edge	_____	(49)	s.	Alert	_____	(61)
h.	Energetic	_____	(50)	t.	Full of pep	_____	(62)
i.	Panicky	_____	(51)	u.	Carefree	_____	(63)
j.	Relaxed	_____	(52)	v.	Vigorous	_____	(64)
k.	Uneasy	_____	(53)	w.	Bushed	_____	(65)
l.	Fatigued	_____	(54)				

CARD 1|8| (79-80)

Is there anything else you would like to add about your job at the Los Angeles Times?

_____

_____

THANK YOU FOR TAKING THE TIME TO COMPLETE THIS QUESTIONNAIRE!

LOS ANGELES TIMES
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
HETA 90-013

Subject Identification *(1-4)*

(For office use only)

Today's Date: |__|__| / |__|__| / 19 |__|__| *(5-10)*
(month) (day) (year)

Subject Name: |_____| *(11-27)*
(last)

|_____| *(28-38)* |__| *(39)*
(first) *(middle in)*

Street: |_____| *(40-58)*

City: |_____| *(59-71)*

State: |__|__| *(72-73)* **Zip code:** |_____| *(74-78)*

Card |0|1| *(79-80)*

Home Phone Number: |__|__|__| - |__|__|__| - |__|__|__|__| *(5-14)*
(area code)

Work Phone Number: |__|__|__| - |__|__|__| - |__|__|__|__| *(15-24)*
(area code)

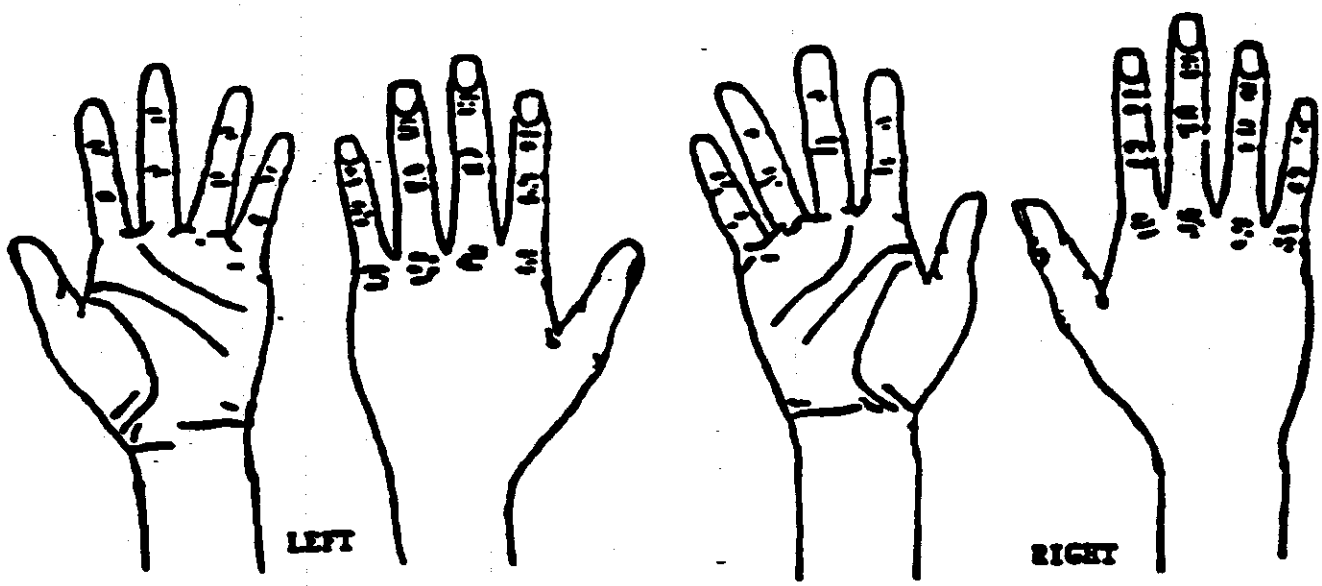
Extension: 7-|__|__|__|__| *(25-28)*

Sex: 1___male 2___female *(29)*

Date of birth: |__|__| - |__|__| - 19 |__|__| *(30-35)*
(month) (day) (year)

1. In the **PAST YEAR**, have you had pain, aching, stiffness, burning, numbness, or tingling in the area shown on this diagram?

1____yes 2____no *(36)*



2. Do you do sporting activities, have any hobbies, play a musical instrument, or do art work <u>AT LEAST 3 HOURS</u> every week away from work?

1____yes *(go to question 2a)* *(37)*
2____no *(go to question 3)*

a. Please list these activities and the number of hours/week:

	Activities	Hours/Week *(at least 3 hrs/wk)*	
(1)	_____	___	*(38-39)*
(2)	_____	___	*(40-41)*
(3)	_____	___	*(42-43)*
(4)	_____	___	*(44-45)*
(5)	_____	___	*(46-47)*

****

The next questions will be asked for 1-year intervals for the past 3 years (1988-1990).

"TYPING" refers to using a computer keyboard, typewriter, or ten-key.

****

PAST YEAR ***(January 1990 to December 1990)***

****

In this section, we are comparing your work situation during the past year to conditions in 1989.

****

3. **Were you employed at the L.A. Times anytime during 1989?**

1____yes *(go to question 4)* *(48)*
2____no *(go to question 30, page 7)*

4. **Has your TYPING SPEED changed in the PAST YEAR compared to what it was in 1989?**

1____yes, I type faster *(go to question 4a)* *(49)*
2____yes, I type slower *(go to question 4a)*
3____no change *(go to question 4a)*
4____I do NOT type *(go to question 5)*

a. **Have the number of HOURS you spend TYPING in a day changed in the PAST YEAR compared to what it was in 1989?**

1____yes, I type MORE hours 3____no change *(50)*
2____yes, I type LESS hours

5. **Has there been a change in the WAY YOU HAVE BEEN SUPERVISED in the PAST YEAR?**

1____improved 4____it has changed, but *(51)*
2____become worse neither has improved
3____no change nor become worse

6. **Has SATISFACTION with your JOB changed in the PAST YEAR?**

1____more satisfied 2____less satisfied 3____no change *(52)*

7. **Has your ability to TALK WITH YOUR SUPERVISOR changed in the PAST YEAR?**

1____improved 2____become worse 3____no change *(53)*

8. Has the overall **WORK LOAD**, which you have been assigned, changed in the **PAST YEAR**?

1____heavier 2____lighter 3____no change *(54)*

9. Has your overall **WORK PACE** changed in the **PAST YEAR**?

1____increased 2____decreased 3____no change *(55)*

10. In the **PAST YEAR**, what was the **maximum** number of **HOURS** you worked in **ONE DAY** at the **TIMES**?

|__|__| hours *(56-57)*

11. In the **PAST YEAR**, how many **DAYS PER MONTH** did you work longer than **7.5 HOURS**?

|__|__| days/month *(58-59)*

LAST YEAR *(January 1989 to December 1989)*

****
In this section, we are comparing your work situation during the last year (1989) to conditions in 1988.
****

12. Were you employed at the L.A. Times anytime during 1988?

1____yes *(go to question 13)* *(60)*
2____no *(go to question 30, page 7)*

13. Did your **TYPING SPEED** change in the period from **JANUARY 1989 TO DECEMBER 1989** compared to what it was in 1988?

1____yes, I began to type faster *(go to question 13a)* *(61)*
2____yes, I began to type slower *(go to question 13a)*
3____no change *(go to question 13a)*
4____I did **NOT** type *(go to question 14)*

a. Did the number of **HOURS** you spent **TYPING** in a day change in the period from **JANUARY 1989 TO DECEMBER 1989** compared to what it was in 1988?

1____yes, I typed **MORE** hours 3____no change *(62)*
2____yes, I typed **LESS** hours

14. Was there a change in the **WAY YOU WERE SUPERVISED** in the period from **JANUARY 1989 TO DECEMBER 1989**?

1____improved 2____became worse 3____no change *(63)*

15. Did **SATISFACTION** with your **JOB** change in the period from **JANUARY 1989 to DECEMBER 1989?**

1____more satisfied 2____less satisfied 3____no change *(64)*

16. Did your ability to **TALK WITH YOUR SUPERVISOR** change in the period from **JANUARY 1989 TO DECEMBER 1989?**

1____improved 2____became worse 3____no change *(65)*

17. Has the overall **WORK LOAD**, which you have been assigned, changed in the **PAST YEAR?**

1____heavier 2____lighter 3____no change *(66)*

18. Did your overall **WORK PACE** change in the period from **JANUARY 1989 TO DECEMBER 1989?**

1____increased 2____decreased 3____no change *(67)*

19. During the period from **JANUARY 1989 TO DECEMBER 1989**, what was the maximum number of **HOURS** you worked in **ONE DAY** at the **TIMES?**

|__|__| hours *(68-69)*

20. During the period from **JANUARY 1989 TO DECEMBER 1989**, how many **DAYS PER MONTH** did you work longer than 7.5 **HOURS?**

|__|__| days/month *(70-71)*

CARD |0|2| *(79-80)*

TWO YEARS AGO *(January 1988 to December 1988)*

****
In this section, we are comparing your work situation two years ago (1988) to conditions in 1987.
****

21. Were you employed at the L.A. Times anytime during 1987?

1____yes *(go to question 22)* *(5)*
2____no *(go to question 30, page 7)*

22. Did your **TYPING SPEED** change in the period from **JANUARY 1988 TO DECEMBER 1988** compared to what it was in 1987?

1___yes, I began to type faster *(go to question 22a)* *(6)*
2___yes, I began to type slower *(go to question 22a)*
3___no change *(go to question 22a)*
4___I did **NOT** type *(go to question 23)*

a. Did the number of **HOURS** you spent **TYPING** in a day change in the period from **JANUARY 1988 TO DECEMBER 1988** compared to what it was in 1987?

1___yes, I typed **MORE** hours 3___no change *(7)*
2___yes, I typed **LESS** hours

23. Was there a change in the **WAY YOU WERE SUPERVISED** in the period from **JANUARY 1988 TO DECEMBER 1988?**

1___improved 2___became worse 3___no change *(8)*

24. Did **SATISFACTION** with your **JOB** change in the period from **JANUARY 1988 TO DECEMBER 1988?**

1___more satisfied 2___less satisfied 3___no change *(9)*

25. Did your ability to **TALK WITH YOUR SUPERVISOR** change in the period from **JANUARY 1988 TO DECEMBER 1988?**

1___improved 2___became worse 3___no change *(10)*

26. Has the overall **WORK LOAD**, which you have been assigned, changed in the period from **JANUARY 1988 TO DECEMBER 1988?**

1___heavier 2___lighter 3___no change *(11)*

27. Did your **WORK PACE** change in the period from **JANUARY 1988 TO DECEMBER 1988?**

1___increased 2___decreased 3___no change *(12)*

28. During the period from **JANUARY 1988 TO DECEMBER 1988**, what was the maximum number of **HOURS** you worked in **ONE DAY** at the **TIMES?**

|__|__| hours *(13-14)*

29. During the period from **JANUARY 1988 TO DECEMBER 1988**, how many **DAYS PER MONTH** did you work longer than **7.5 HOURS?**

|__|__| days/month *(15-16)*

****

Questions 30 & 31 deal with the past 6 months.

****

30. Have you used a computer keyboard in the PAST SIX MONTHS?

1____yes *(go to question 30a)* *(17)*
2____no *(go to question 31)*

a. What type of computer keyboard(s) did you use in the PAST SIX MONTHS?

Check all that apply:

Editorial:

01____Coyote keyboard *(18-19)*
02____light-touch Coyote keyboard *(IBM clone)* with Coyote function keys *(20-21)*
03____light-touch Coyote keyboard *(IBM clone)* with function keys in different arrangement than old Coyote keyboard *(22-23)*
04____IBM keyboard *(24-25)*
05____Mac II *(26-27)*
06____other *(specify below)* *(28-29)*
_____ |__|__| *(30-31)*

Classified:

07____older brown Zentex *(32-33)*
08____newer white Zentex *(34-35)*
09____other *(specify below)* *(36-37)*
_____ |__|__| *(38-39)*

Circulation:

10____Memorex *(40-41)*
11____IBM *(42-43)*
12____other *(specify below)* *(44-45)*
_____ |__|__| *(46-47)*

Accounting:

13____IBM *(48-49)*
14____ten-key *(50-51)*
15____other *(specify below)* *(52-53)*
_____ |__|__| *(54-55)*

31. **Have you used a typewriter in the PAST SIX MONTHS?**

1____yes *(go to question 31a)* *(56)*
2____no *(go to question 32)*

a. **On average, how much time do you spend using it per day?**

|__|__| |__|__| *(57-60)*
(hours) *(minutes)*

****
If you have had HAND/WRIST PROBLEMS,
continue with the next questions;
OTHERWISE, skip to question 41 on page 12.
****

32. **Describe the INTENSITY when your HAND/WRIST problem occurs/ occurred. Use the scale below and <u>circle</u> the best answer.**

1	2	3	4	5	*(61)*
no pain	mild	moderate	severe	worst pain in life	

33. **Have you had this HAND/WRIST problem in the LAST SEVEN DAYS?**

1____yes 2____no *(62)*

34. **When on VACATION for more than ONE WEEK do your symptoms:**

1____increase 3____not change *(63)*
2____decrease 4____have not been on vacation

35. **Have your symptoms IMPROVED since you first noticed them?**

1____yes 2____no *(64)*

CARD |0|3| *(79-80)*

36. Has the following **EQUIPMENT** made a difference in your **HAND/WRIST** symptoms?

a. Adjustable desk	1___better	3___no difference	*(5)*
	2___worse	4___did not receive	
b. Chair	1___better	3___no difference	*(6)*
	2___worse	4___did not receive	
c. Wrist rest	1___better	3___no difference	*(7)*
	2___worse	4___did not receive	
d. Foot rest	1___better	3___no difference	*(8)*
	2___worse	4___did not receive	
e. New keyboard	1___better	3___no difference	*(9)*
	2___worse	4___did not receive	
f. Computer mouse	1___better	3___no difference	*(10)*
	2___worse	4___did not receive	
g. Telephone headset	1___better	3___no difference	*(11)*
	2___worse	4___did not receive	
h. Speaker phone	1___better	3___no difference	*(12)*
	2___worse	4___did not receive	
i. Telephone	1___better	3___no difference	*(13)*
	2___worse	4___did not receive	
j. Document holder	1___better	3___no difference	*(14)*
	2___worse	4___did not receive	

37. Have the following **TREATMENTS** made a difference in your **HAND/WRIST** problem?

a. Medical treatment *(specify*_____*)*
(drugs, physical therapy, etc.)
1___better 3___no difference *(15)*
2___worse 4___did not have

b. Surgery *(specify*_____*)*
1___better 3___no difference *(16)*
2___worse 4___did not have

c. Exercise program
1___better 3___no difference *(17)*
2___worse 4___did not have

d. Other *(specify*_____*)*
1___better 3___no difference *(18)*
2___worse 4___did not have

38. Have you taken **TIME OFF WORK** due to your **HAND/WRIST** problem?

1____yes, supervisor/medical dept. was informed of the reason *(go to question 38a)* *(19)*
2____yes, supervisor/medical dept. was NOT informed of the reason *(go to question 38a)*
3____no time was taken off due to hand/wrist problem *(go to question 39)*

a. How many days? *(If < 1 day, enter "01")* |__|__| days *(20-21)*

39. Did you **REPORT** your **HAND/WRIST** problem to the Times Medical Department?

1____yes *(go to question 39a)* *(22)*
2____no *(go to question 40)*

a. Was your work station **EVALUATED** after you reported your injury?

1____yes *(go to #1 below)* *(23)*
2____no *(go to question 40)*

(1) **HOW SOON** after you reported your injury did someone from the Times evaluate your work station?

1____a few days *(24)*
2____about a week
3____more than 1 week to 2 weeks
4____more than 2 weeks to a month
5____more than one month to three months
6____more than three months

(2) If your work station was evaluated, how soon did you **RECEIVE THE EQUIPMENT** that was recommended?

1____a few days *(25)*
2____about a week
3____more than 1 week to 2 weeks
4____more than 2 weeks to a month
5____more than one month to three months
6____more than three months
7____did not receive the equipment

WORKERS' COMPENSATION

40. Did you **APPLY** for Workers' Compensation because of your **HAND/WRIST** problem?

1____yes *(go to question 40a)* *(26)*
2____no *(go to question 41)*

a. Is your **CASE:** 1____open 2____closed *(27)*

b. Have you had **DIFFICULTY** with the Workers' Compensation system at the Times?

1____yes 2____no *(28)*

c. Did you **RECEIVE** information about how the Workers' Compensation system works?

1____yes, it explained the system well *(go to quest. 41)* *(29)*
2____yes, but it was not satisfactory *(go to #1 below)*
3____no *(go to #1 below)*

(1) What particular **PROBLEM** did you have with the Workers' Compensation system? *(Please specify below).*

_____

_____

_____

_____

EQUIPMENT

41. How often do you carry **HEAVY EQUIPMENT** *(such as camera equipment, boxes of files)* for your job?

1____almost daily	*(go to question 41a)*	*(30)*
2____frequently *(once/week)*	*(go to question 41a)*	
3____sometimes *(once/month)*	*(go to question 41a)*	
4____rarely *(every 2-3 months)*	*(go to question 41a)*	
5____never *(every 6 months/ not at all)*	*(go to question 42)*	

a. How do you **CARRY** the equipment? *(Check all that apply).*

1____in the left hand only	*(31)*
2____in the right hand only	*(32)*
3____in both hands *(or arms)*	*(33)*
4____suspended from one shoulder	*(34)*
5____suspended from both shoulders *(backpack)*	*(35)*
6____around the neck *(camera)*	*(36)*
7____around the waist *(in a belt)*	*(37)*
8____pull it in a cart or other	*(38)*

CARD |0|4| *(79-80)*

42. Do you have anything to add to this questionnaire?

_____

_____

_____

_____

JOB SAMPLING FORM

Name _____ JOB _____

Tasks	Time:							
1. Keying from:								
a. phone (head-neck)								
b. phone (headset)								
c. external documents								
d. no external document								
e. OTHER								
2. Using Mouse								
3. Manual Writing from:								
a. phone (head-neck)								
b. interview								
c. other documents								
d. no external document								
4. Driving Self								
5. Phone								
head-neck								
headset								
6. Discussions/meetings								
7. Absent _____								
8. Other _____								
9. Posture:								
Constrained								
Standing								
Sitting								
Reclined								
10. Keyboard								
Below elbow height								
At elbow height +/- 1"								
Above elbow height								
11. Work:								
At screen level								
On desk top								
12. Body Support								
Floor								
Foot rest								
Seat pan								
Seat back								
Desk top (S=sharp edge)								
Keyboard								
OTHER								
13. Physical work Pace: low[1]								
medium[2]								
heavy[3]								

[See back of page for coding numbers]

Posture:

Constrained - Body position must be maintained to complete task in this manner, holding phone handset between shoulder and ear or hands on keyboard.

Work pace: low[1] - waiting for information, occasionally typing or writing.

medium[2] - steady work, leisure pace, no apparent difficulty in keeping up.

heavy[3] - steady work, maximum pace unable to stop due to deadline or anxiety.