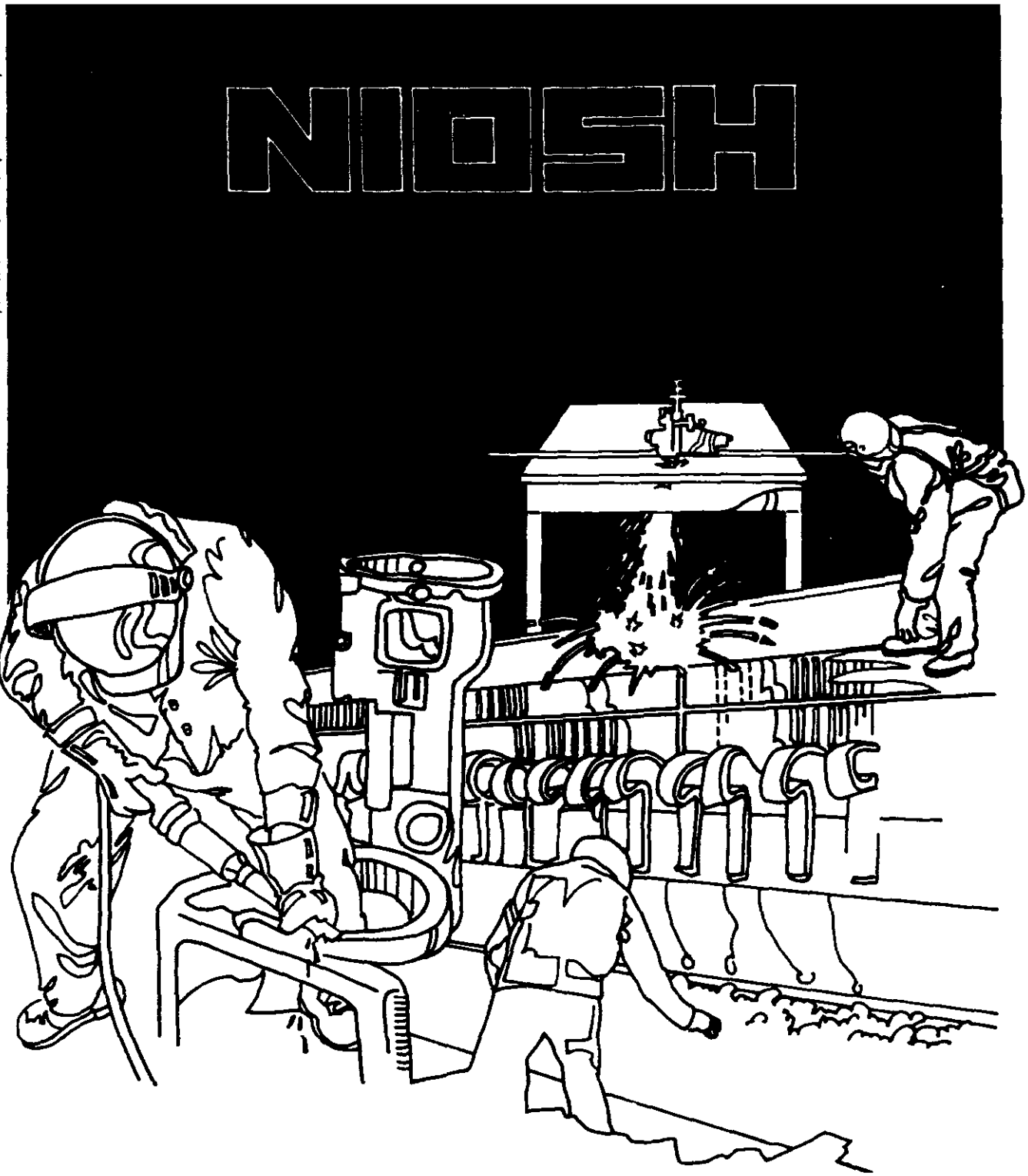
This Health Hazard Evaluation (HHE) report and any recommendations made herein are for the specific facility evaluated and may not be universally applicable. Any recommendations made are not to be considered as final statements of NIOSH policy or of any agency or individual involved.
Additional HHE reports are available at http://www.cdc.gov/niosh/hhe/reports

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



Health Hazard Evaluation Report

HETA 89-307-2009
PERDUE FARMS, INC.
LEWISTON, NORTH CAROLINA
ROBERSONVILLE, NORTH CAROLINA

HETA 89-307
FEBRUARY 1990
PERDUE FARMS, INC.
LEWISTON, NORTH CAROLINA
ROBERSONVILLE, NORTH CAROLINA

NIOSH INVESTIGATORS
Stuart Kiken, M.D., M.P.H.
William Stringer, M.S.
Lawrence Fine, M.D., Dr.P.H.
Thomas Sinks, Ph.D.
Shiro Tanaka, M.D., M.P.H.

I. SUMMARY

In July, 1989, the National Institute for Occupational Safety and Health (NIOSH) received a request from the North Carolina Department of Labor, Division of Occupational Safety and Health, for technical assistance in evaluating cumulative trauma disorders (CTDs) of the neck and upper extremity among employees at two Perdue Farms, Inc. poultry processing plants, located in Lewiston and Robersonville, North Carolina. In response to this request, investigations were conducted at both facilities. The main objective of the investigations was to determine the prevalence of CTDs among employees working in selected departments, which, on the basis of a walk-through evaluation, had been characterized as having jobs with either higher exposure (HE) or lower exposure (LE) to repetitive and forceful motions and/or extreme and awkward postures of the upper extremity.

At Lewiston, 36% of the 174 employees who participated in NIOSH's survey had work-related CTDs in the last year as determined by questionnaire alone, and 20% had current work-related CTDs as determined by questionnaire and physical exam. Most CTDs involved the hand and/or wrist. Employees in HE departments were 4.4 times more likely than employees in LE departments to have CTDs by questionnaire (95% CI 1.48-13.24), and 3.6 times more likely by questionnaire and physical exam (95% CI 0.91-14.28). For hand and wrist injuries, the respective relative rates were 4.7 (95% CI 1.21-18.54) and 3.0 (95% CI 0.76-12.14).

At Robersonville, 20% of the 120 participants had significant work-related CTDs in the last year as determined by questionnaire alone, and 8% had current work-related CTDs as determined by questionnaire and physical exam. Most CTD's here also involved the hand and/or wrist. Employees in HE departments were 10.1 times more likely than employees in LE departments to have CTDs by questionnaire (95% CI 1.42-72.24).

Given the high employee turnover rates at the Lewiston and Robersonville facilities, the relative rates noted above may actually represent an underestimation of the true risks. (Workers with CTDs selectively tend to leave employment, resulting in a "survivor bias.")

On the basis of this investigation, NIOSH investigators concluded that a neck and upper extremity CTD hazard exists at the Lewiston and Robersonville facilities of Perdue Farms, Inc. Recommendations to prevent and manage these CTDs are provided in Section VII.

KEYWORDS: SIC 2016 (poultry processing plant), poultry, chicken, meatpacking, cumulative trauma disorder, carpal tunnel syndrome, tendonitis, epicondylitis, tension neck

II. INTRODUCTION

In July, 1989, the National Institute for Occupational Safety and Health (NIOSH) received a request from the North Carolina Department of Labor, Division of Occupational Safety and Health, for technical assistance in evaluating cumulative trauma disorders (CTDs) of the neck and upper extremity among employees at two Perdue Farms, Inc. poultry processing plants, located in Lewiston and Robersonville, North Carolina. Investigations were conducted (1) on July 10, 1989 at the Lewiston facility, and (2) from July 31, 1989 to August 3, 1989 at both facilities. The main objective of the investigations was to determine the prevalence of CTDs among employees working in selected departments, which, on the basis of a walk-through evaluation, had been characterized as having jobs with higher exposure (HE) or lower exposure (LE) to repetitive and forceful motions and/or extreme and awkward postures of the upper extremity. In addition, investigators assessed the medical management of injured workers and examined the company's CTD prevention program. Preliminary results were reported to the North Carolina Department of Labor, Division of Occupational Safety and Health, on September 11, 1989 and September 18, 1989.

III. BACKGROUND

A. Workforce

Perdue Farms, Inc. produces and packages boneless chicken products, chicken parts, and whole chickens for wholesale distribution. It is the fifth largest poultry processor in the United States, with four plants in North Carolina. The Lewiston facility employs approximately 2600 workers and processes over 420,000 chickens/day. The Robersonville facility employs approximately 550 workers and processes over 120,000 chickens/day. At each plant, there are two production shifts and one sanitation shift per day. The annual employee turnover rate is close to 50% at Lewiston and 70% at Robersonville.

B. Production Process

At the Lewiston facility, chickens are removed from the crates in which they are received and suspended by their feet on an overhead chain conveyor. They are then stunned (and tranquilized) by an electric shock, and their necks cut by machine (to kill and exsanguinate them). Machines and workers stationed along the conveyor (which moves at a pre-determined speed) subsequently defeather the chickens, remove their feet, and eviscerate the birds. The chickens are then graded (to determine which should be sold whole) and cooled in a water bath. Birds that are not sold whole or for parts are deboned and cut. Deboning is done by hand on either a conventional table deboning line or a cone deboning line. (A small percentage are deboned by machine on a newly installed, automated line.) Cutting is done by machine and by hand. The meat is then packed in styrofoam trays, weighed and labeled, and prepared for shipping.

At the Robersonville facility, the process is similar. The main differences are that at Robersonville (1) deboning is only done by hand, and (2) meat is packed in boxes containing ice instead of in styrofoam trays.

IV. METHODS

A. Period Prevalence Rates

Period prevalence rates for the 12 months prior to NIOSH's investigation were calculated from standardized questionnaires administered to current employees at the Lewiston and Robersonville facilities. The questionnaires elicited demographic information, medical and work histories, and data on neck and upper extremity CTDs.

1. Selection Criteria

A walk-through survey was conducted at the Lewiston facility on July 10, 1989 to select departments in which employees had jobs with either higher exposure (HE) or lower exposure (LE) to repetitive and forceful motions and/or extreme and awkward postures of the upper extremity. On the basis of this walk-through, the following departments were determined to contain HE jobs: receiving, evisceration, whole bird grading, cut up, and deboning. LE jobs were determined to be in the maintenance, sanitation, quality assurance, and clerical departments. (These categorizations were substantially corroborated by the North Carolina Department of Labor's analysis of the Lewiston facility's OSHA 200 Log for 1988 and 1989.)

For purposes of determining period prevalence rates, employees were then selected from these HE and LE departments. Analagous departments at the Robersonville facility were similarly categorized. (The LE jobs were selected because their CTD risk levels were expected to be lower than those of HE jobs. If the LE jobs were compared to totally nonrepetitive and nonforceful jobs, however, it is possible that some of them would also have elevated CTD risk levels.)

An attempt was made to select 70-80% of participants from HE departments and 20-30% from LE departments. At Lewiston, participants were randomly chosen from a roster of current employees that had been provided by Perdue Farms, Inc. At Robersonville (which has fewer employees), participants were similarly chosen from HE and LE jobs. For jobs in which there were small numbers of employees, all workers present were asked to participate.

2. Case Definition

An upper extremity CTD was said to exist if:

a. in the past year, the employee had pain, aching,

stiffness, burning, numbness, or tingling in the neck, shoulder, elbow, wrist or hand; and

b. the symptoms began after employment at the plant; and

c. the symptoms were not due to an accident or injury that occurred outside of work; and

d. the symptoms lasted more than 8 hours, and occurred 4 or more times in the last year.

B. Point Prevalence Rates

Physical examinations were performed by NIOSH physicians (certified in internal medicine and/or occupational medicine) on employees who completed questionnaires. The examinations were of the neck and upper extremity, and included inspection, palpation, and the performance of various diagnostic maneuvers.

1. Selection Criteria

See IV. A. 1.

2. Case Definition

For purposes of determining point prevalence, an upper extremity CTD case was said to exist if an employee satisfied (1) the questionnaire case definition (described in IV. A 2.), and (2) the physical examination diagnostic criteria for a neck, shoulder, elbow, wrist or hand injury affecting the same area as the one identified on the questionnaire.

The diagnostic criteria are described below. For those tests requiring an assessment of pain, employees were asked to quantify their pain on a scale of 0 to 8 (with 0 representing no pain and 8 representing the worst pain experienced in one's life).

Tension Neck Syndrome

Tension neck syndrome was defined as pain ≥ 3 on two of the following tests: passive flexion, extension, lateral bending or rotation; resisted flexion, extension, lateral bending or rotation.

Rotator Cuff Tendonitis

Rotator cuff tendonitis was defined as pain ≥ 3 on active and resisted shoulder abduction.

Lateral Epicondylitis

Lateral epicondylitis was defined as pain ≥ 3 at the lateral epicondyle on resisted wrist extension.

Medial Epicondylitis

Medical epicondylitis was defined as pain ≥3 at the medial epicondyle on resisted wrist flexion.

Carpal Tunnel Syndrome

Carpal tunnel syndrome was defined as a positive Tinel's sign (pain, numbness, or tingling in the median nerve distribution resulting from light tapping over the proximal wrist crease) and a positive Phalen's sign (pain, numbness, or tingling in the median nerve distribution resulting from complete flexion of the wrist for 60 seconds).

Tendonitis of the Wrist or Fingers

Tendonitis of the wrist or fingers was defined as pain ≥3 on resisted flexion or extension of the wrist or fingers.

Non-Specific Proximal Interphalangeal (PIP) Joint Dysfunction

Non-specific PIP joint dysfunction was defined as decreased range of motion at the PIP joint.

C. Medical Management and CTD Prevention Program

The medical management of injured workers and the company's CTD prevention program were assessed (1) in the questionnaire and, (2) by reviewing Perdue Farms, Inc. "Repetitive Motion Disorders Action Plan" for Robersonville (dated 11/15/88).

V. RESULTS

A. Lewiston

1. Prevalence Rates

a. Participation

All Participants

One hundred seventy-four (174) employees were interviewed and examined. (Only 3 employees who were asked to participate in the investigation refused.) Of these, 81.7% worked in higher exposure (HE) departments (receiving-9.8%, evisceration-9.8%, cut up-23.0%, and deboning-37.4%), and 18.3% worked in lower exposure (LE) departments (maintenance-4.6%, quality assurance-6.3%, and clerical-7.5% [0.1% rounding error]). Two workers from the (whole bird) packing department and one from the stretch bag department were included in the HE group. (Table 1)

Women Participants

One hundred forty-two (142) employees were women. Of

these, 86.0% worked in HE departments (evisceration-12.0%, cut up-28.2%, and deboning-43.7%), and 14.1% worked in LE departments (quality assurance-5.6% and clerical-8.5%). (0.1% rounding error) Two workers from the (whole bird) packing department and one from the stretch bag department were included in the HE group. (Table 2)

b. Demographics

All Participants

Eighty-one and six-tenths percent (81.6%) of participants were female and 18.4% were male. Eighty-nine and one-tenth percent (89.1%) were black and 10.9% were white. The mean age was 31 years, the mean length of employment 5.5 years, and the mean "time at current job" 47.0 months. The HE group had a greater percentage of women, blacks, and younger people than the LE group. (Table 3)

Women Participants

Ninety and eight-tenths percent (90.8%) of women were black and 9.2% were white. The mean age was 31 years, the mean length of employment 5.4 years, and the mean "time at current job" 44.4 months. The HE group had a greater percentage of blacks and younger people than the LE group. (Table 4)

c. Period Prevalence

All Participants

One hundred thirty-five (77.6%) employees reported symptoms compatible with neck or upper extremity CTDs over the one-year study period and 62 (35.6%) met the period prevalence case definition. Employees in the HE group were 2.3 times more likely to have symptoms (95% CI 1.47-3.63) and 4.4 times more likely to satisfy the period prevalence case definition (95% CI 1.48-13.24) than employees in the LE group. (Table 5)

Women Participants

One hundred nineteen (83.8%) women employees reported symptoms compatible with neck or upper extremity CTDs over the one-year study period and 54 (38.0%) met the period prevalence case definition. Employees in the HE group were 2.6 times more likely to have symptoms (95% CI 1.44-4.78) and 8.7 times more likely to satisfy the period prevalence case definition (95% CI 1.27-59.33)) than employees in the LE group. (Table 6)

d. Point Prevalence

All Participants

Thirty-four (19.5%) employees had current neck or upper extremity CTD's, as determined by questionnaire and physical exam. Most CTDs involved the hand and wrist. Employees in the HE group were 3.6 times more likely to satisfy the point prevalence case definition than employees in the LE group (95% CI 0.91-14.28). (Table 5)

Women Participants

Twenty-nine (20.4%) employees, all in HE departments, had current neck or upper extremity CTDs, as determined by questionnaire and physical exam. Most CTDs involved the hand and wrist. (Table 6)

2. Medical Management

a. Access to the Plant Nurse

Of the 135 employees having any neck or upper extremity symptom, 31 (23.0%) said that at some point during the past year their foreman/supervisor did not let them leave the line to see the plant nurse. Of the 62 employees satisfying the period prevalence case definition, 13 (21.0%) reported the same thing, as did 10 (29.4%) of the 34 employees satisfying the point prevalence case definition.

b. Physician Evaluation

In the last year, physicians to which the company referred employees treated 19 (14.1%) of the employees having any neck or upper extremity symptom, 8 (12.9%) who satisfied the period prevalence case definition, and 6 (17.7%) who satisfied the point prevalence case definition (as reported on questionnaires by employees).

c. Missed and Restricted Days

Of the employees who satisfied the period prevalence case definition, 9 (14.5%) were given work days off to recover from their injuries, and 20 (32.3%) were given light or restricted jobs. Of the workers who satisfied the point prevalence case definition, 4 (11.8%) were given work days off and 12 (35.3%) were given light or restricted jobs.

3. CTD Prevention Program

a. Job Rotation

Forty-two (29.6%) employees in HE departments said that they were involved in a job rotation program. The mean

number of days/week rotated was 2.1, the mean number of hours/day rotated 6, and the mean number of jobs rotated to 2. The jobs most commonly rotated to were in HE departments (such as cut up and deboning). Some employees reported that they were rotated to fill vacancies on the production line, rather than to reduce ergonomic stress.

b. Provision of Sharp Knives and Scissors

Of the employees in HE departments who used knives, 18 (50.0 %) said that they received them once/day, 16 (44.4%) said twice/day, and 2 (5.6%) said more than three times/day. Sixty-six and seven-tenths percent (66.7%) said that they did not receive newly sharpened knives often enough. Many employees reported that when they did receive newly sharpened knives, the tools were, in reality, not very sharp.

Of the employees in HE departments who used scissors, 40 (83.3%) said that they received them once/day, 7 (14.6%) said twice/day, and 1 (2.1%) said three times/day. Sixty-seven and nine-tenths percent (67.9%) said that they did not receive newly sharpened scissors often enough.

c. Training

Nine (6.5%) employees in HE departments were trained to recognize symptoms of carpal tunnel syndrome or tendonitis when they first started working.

Sixty-nine (68.3%) employees in HE departments who cut or sliced meat were trained to do so when they first started working at the plant. Most were trained for 4 weeks, 8 hours/day. Fifty-seven (82.7%) said that this was enough time.

Ten (13.2%) employees in HE departments who used knives were trained to sharpen them when they first started working.

(The statistics cited in this section may not reflect recent changes in the CTD prevention program.)

B. Robersonville

1. Prevalence Rates

a. Participation

All Participants

One hundred twenty (120) employees were interviewed and examined. (None who were asked to participate refused.)

Of these, 69.2% worked in higher exposure (HE) departments (receiving-5.0%, evisceration-18.3%, grading-6.7%, [whole bird] packing-2.5%, cut up-8.3%, table deboning-14.2%, and cone deboning-14.2%) and 30.8% worked in lower exposure (LE) departments (maintenance-6.7%, sanitation-8.3%, quality assurance-7.5%, and clerical-8.3%). (Table 7)

Women Participants

Eighty-four (84) employees were women. Of these, 81.0% worked in HE departments (evisceration-19.0%, grading-7.1%, [whole bird] packing-3.6%, cut up-12.0%, table deboning-19.0%, and cone deboning-20.2% [0.1% rounding error]), and 19.0% worked in LE departments (quality assurance-7.1% and clerical-11.9%). (0.1% rounding error) (Table 8)

b. Demographics

All Participants

Seventy percent (70.0%) of participants were female and 30.0% were male. Eighty-five and eight-tenths percent (85.8%) were black and 14.2% were white. The mean age was 33 years, the mean length of employment 4.1 years, and the mean "time at current job" 39.0 months. The HE group had a greater percentage of women and blacks than the LE group. (Table 9)

Women Participants

Eighty-nine and three-tenths (89.3%) of women were black and 10.7% were white. The mean age was 34 years, the mean length of employment 4.1 years, and the mean "time at current job" 37.7 months. The HE group had a greater percentage of blacks than the LE group. (Table 10)

c. Period Prevalence

All Participants

Eighty-eight (73.3%) employees reported symptoms compatible with neck or upper extremity CTDs over the one-year study period and 24 (20.0%) satisfied the period prevalence case definition. Employees in the HE group were 2.6 times more likely to have symptoms (95% CI 1.65-4.01) and 10.1 times more likely to satisfy the period prevalence case definition 95% CI 1.42-72.24) than employees in the LE group. (Table 11)

Women Participants

Seventy (83.3%) employees reported symptoms compatible with neck or upper extremity CTDs over the one-year study period and 19 (22.6%) met the period prevalence case

definition. Employees in the HE group were 2.5 times more likely to have symptoms (95% CI 1.33-4.74) and 4.2 times more likely to satisfy the period prevalence case definition (95% CI 0.6-29.01) than employees in the LE group. (Table 12)

d. Point Prevalence

All Participants

Nine (7.5%) employees, all in the HE group, had current neck or upper extremity CTDs, as determined by questionnaire and physical exam. Most CTDs involved the hand and wrist. (Table 11)

Women Participants

Seven (8.3%) employees, all in the HE group, had current neck or upper extremity CTDs, as determined by questionnaire and physical exam. Most CTDs involved the hand and wrist. (Table 12)

2. Medical Management

a. Access to the Plant Nurse

Of the 88 employees having any neck or upper extremity symptom, 5 (5.7%) said that at some point during the past year their foreman/supervisor did not let them leave the line to see the plant nurse. Of the 24 employees satisfying the period prevalence case definition, 2 (8.3%) reported the same thing, as did 9 (11.1%) of the employees satisfying the point prevalence case definition.

b. Physician Evaluation

In the last year, physicians to which the company referred employees treated 5 (5.7%) of the employees having any neck or upper extremity symptom, 2 (8.3%) who satisfied the period prevalence case definition, and 2 (22.2%) who satisfied the point prevalence case definition (as reported by employees).

c. Missed and Restricted Days

None of the employees who satisfied the period prevalence case definition and none who satisfied the point prevalence case definition were given workdays off to recover from their injuries. Six (25.0%) employees from the former group and 4 (44.4%) from the latter group were given light or restricted jobs.

3. CTD Prevention Program

a. Job Rotation

Twenty-two (26.8%) employees in HE departments said that they were involved in a job rotation program. The mean number of days/week rotated was 2, the mean number of hours/day rotated 5, and the mean number of jobs rotated to 3. The jobs rotated to were in HE departments (such as evisceration, grading, whole bird packing, cut up, table deboning and cone deboning). Some employees reported that they were rotated to fill vacancies on the production line, rather than to reduce ergonomic stress.

b. Provision of Sharp Knives and Scissors

Of the employees in HE departments who used knives, 3 (15.0%) said that they received them once/day, 13 (65.0%) said twice/day, 1 (5.0%) said three times/day, and 3 (15.0%) said more than three times/day. Forty-four and four-tenths percent (44.4%) said that they did not receive newly sharpened knives often enough. Many employees reported that when they did receive newly sharpened knives, the tools were, in reality, not very sharp.

Of the employees in HE departments who used scissors, 17 (47.2%) said that they received them once/day, 15 (40.5%) said twice/day, and 5 (13.5%) said three times/day. Sixty-seven and six-tenths percent (67.6%) said that they did not receive newly sharpened scissors often enough.

c. Training

Two (2.8%) employees in HE departments were trained to recognized symptoms of carpal tunnel syndrome or tendonitis when they first started working.

Forty-five (86.5%) employees in HE departments who cut or slice meat were trained to do so when they first started working at the plant. Most were trained for 4 weeks, 7-8 hours/day. Thirty-three (75.0%) said that this was enough time.

Thirteen (52.0%) employees in HE departments who used knives were trained to sharpen them when they first started working.

(The statistics cited in this section may not reflect recent changes in the CTD prevention program.)

VI. DISCUSSION

A. Lewiston

1. Prevalence Rates

For all employees who participated in this investigation, the overall period prevalence rate was 36%. The period prevalence rate for hand and wrist CTDs was 25%. The respective point prevalence rates were 20% and 17%. All of

these rates were considerably higher in higher exposure (HE) departments than in lower exposure (LE) departments. As determined by questionnaire, employees in HE departments were 4.4 times more likely to develop CTDs than employees in LE departments. As determined by questionnaire and physical examination, they were 3.6 times more likely to develop CTDs. (When only women were considered, employees in HE departments also had higher prevalence rates than employees in LE departments.) The markedly elevated CTD rates were not due to misclassification of exposure or disease, survivor bias, or confounding factors.

a. Exposure Misclassification

One employee in a LE department who satisfied both the period and point prevalence case definitions said that his CTD began during a previous job, when he was working in a HE department. As a result of this misclassification, (1) period and point prevalence rates may have been slightly underestimated in HE departments and slightly overestimated in LE departments, and (2) relative rates may have been slightly underestimated. (No employees currently in HE departments said that their CTDs started when they were working in LE departments.)

In addition, since a detailed ergonomic analysis was not done on every job, it is possible that some jobs in LE departments may have had significant risk factors for neck and upper extremity CTDs.

b. Disease Misclassification

To minimize disease misclassification, standardized epidemiologic techniques that have been employed in other studies were used.[1]

Random disease misclassification may have occurred in determining point prevalence rates, due to considerable variation among physicians in terms of the frequency with which certain findings were noted on physical examination. However, because the diagnostic criteria used in this investigation were more stringent than those that have been used in similar NIOSH investigations, disease misclassification is unlikely to be responsible for the high point prevalence rates observed. In fact, the stringent criteria may have actually resulted in an underestimation of point prevalence rates in both HE and LE departments.

c. Survivor Bias

There is considerable annual employee turnover, suggesting that survivor bias may be a substantial problem. "Survivors" (i.e. people who are working) are usually healthier (that is, lacking illnesses or injuries that would interfere with work) than those people who

leave employment. The "survivor effect" has been described in studies of other industries and is an inherent bias in the cross-sectional design of this investigation.[2] Survivor bias is nonrandom, affecting HE departments more than LE departments. Since this is likely to decrease the prevalence rates for HE departments, such a bias could have led to an underestimation of relative rates.

d. Potential Confounders

Several factors were considered as potential confounders of the association between the occurrence of CTDs and work in HE departments. These factors included age, race, and gender.

Age

Participants who were 30 years of age or younger were slightly more likely than older workers to be assigned to HE departments (Relative Rate 1.16, 95% CI 1.00 - 1.34). As a result, it was not surprising that workers 30 years of age or younger may have had a slightly increased rate of developing CTDs than older workers (Relative Period Prevalence Rate 1.11, 95% CI 0.74 - 1.66; Relative Point Prevalence Rate 1.40, 95% CI 0.75 - 2.58). However, age did not affect the association between the occurrence of CTDs and work in HE departments. (Participants who were 30 years of age or younger had period prevalence and point prevalence rates similar to those of older workers, when separately comparing HE departments and LE departments.)

Race

Black participants were far more likely to work in HE departments than in LE departments. In fact 99.3% of HE participants were black, compared to 43.8% of LE participants. Because of the high percentage of blacks in HE departments, the association between the occurrence of CTDs and race could not be evaluated. It should be pointed out, however, that an association between race and CTDs has not been well described in the literature. It is unlikely, therefore, that race confounds the association between the occurrence of CTDs and work in HE departments.

Gender

Women participants were 1.37 times (95% CI 1.04 1.81) more likely than men to be assigned to HE departments. Independent of this, women may also have had higher period prevalence (1.52, 95% CI 0.81 2.87) and point prevalence rates (1.31, 95% CI

0.55 - 3.11) than men for CTDs. (Whereas men in HE departments had a period prevalence rate 1.80 times that of other men, women in HE departments had a period prevalence rate 8.69 times that of other women.) For this reason, an analysis stratifying on sex was done and the results for women noted in this report. (The results for men were not noted, as the sample sizes were quite small.)

It is important to note, however, that since (1) all jobs in HE departments probably do not carry equal risk for CTDs, and (2) the number of men and women performing identical jobs is small, it is impossible to definitively determine if women really have higher CTD rates than men.

2. Medical Management and CTD Prevention Program

It is difficult to evaluate the Lewiston facility's management of injured workers and its injury prevention program based on information compiled from the questionnaire that was administered to employees. In order to examine medical management and CTD prevention, more information than was collected in NIOSH's survey is needed. Nevertheless, some findings deserve comment.

One sound ergonomic principle is that the employee is the best judge of the effectiveness of his/her tools. Accordingly, the low percentage of employees who thought that they were receiving adequate numbers of sharp knives and scissors each day is troublesome.

Equally troublesome is the fact that at least some jobs used in the current rotation scheme are inappropriate. Rotation between two HE jobs that both stress the neck and upper extremity is likely to be only modestly effective (or even ineffective) in the prevention and early treatment of CTDs.

Finally, according to questionnaire responses, employees at Lewiston having any neck or upper extremity symptoms were 4.3 times more likely at some point in the past year to have been denied access to the plant nurse by their foreman/supervisor than employees at Robersonville (95% CI 1.71-10.68).

B. Robersonville

1. Prevalence Rates

For all employees who participated in this investigation, the overall period prevalence rate was 20%. The period prevalence rate for hand and wrist CTDs was 16%. The respective point prevalence rates were 8% and 7%. All of these rates were considerably higher in higher exposure (HE) departments than in lower exposure (LE) departments. As determined by questionnaire, employees in HE departments were 10.1 times more likely to develop CTDs than employees in LE

departments. (When only women were considered, employees in HE departments also had higher prevalence rates than employees in LE departments.) The markedly elevated CTD rates were not due to misclassification of exposure or disease, survivor bias, or confounding factors.

a. Exposure Misclassification

One employee in a LE department who satisfied the period prevalence case definition said that her CTD began during a previous job, when she was working in a HE department. As a result of this misclassification, (1) period and point prevalence rates may have been slightly underestimated in HE departments and slightly overestimated in LE departments, and (2) relative rates may have been slightly underestimated. (No employees currently in HE departments said that their CTDs started when they were working in LE departments.)

In addition, since a detailed ergonomic analysis was not done on every job, it is possible that some jobs in LE departments may have had significant risk factors for neck and upper extremity CTDs.

b. Disease Misclassification and Survivor Bias

See VI. A. 1. b.

c. Potential Confounders

Several factors were considered as potential confounders of the association between occurrence of CTD's and work in HE departments. These included age, race, and gender.

Age

There was very little difference in age between participants who worked in HE and LE departments. Therefore, age was not considered to be a confounding factor

Race

Black participants were far more likely to work in HE departments than in LE departments. In fact 100% of HE participants were black, compared to 54.1% of LE participants. Because of the higher percentage of blacks in HE departments, the association between race and the occurrence of CTDs could not be evaluated. It should be pointed out, however, that an association between race and CTDs has not been well described in the literature. It is unlikely, therefore, that race confounds the association between occurrence of CTDs and work in HE departments.

Gender

Women participants were 1.94 times (95% CI 1.30 - 2.90) more likely than men to work in HE departments. Independent of this, women may also have had higher period prevalence (1.54, 95% CI 0.62 - 3.84) and point prevalence rates (1.50, 95% CI 0.33 - 6.87) than men for CTDs. (Whereas men in HE departments had a period prevalence rate 0.90 times that of other men, women in HE departments had a period prevalence rate 5.32 times that of other women. Similar trends were found for point prevalence rates.) For this reason, an analysis stratifying on sex was done and the results for women noted in this report. (The results for men were not noted, as the sample sizes were quite small.)

It is important to note, however, that since (1) all jobs in HE departments probably do not carry equal risk for CTDs, and (2) the number of men and women performing identical jobs is small, it is impossible to definitively determine if women really have higher CTD rates than men.

2. Medical Management

It is difficult to evaluate the Robersonville facility's management of injured employees and its injury prevention program based on information compiled from the questionnaire that was administered to employees. In order to examine medical management and CTD prevention, more information than was collected in NIOSH's survey is needed. Nevertheless, some findings deserve comment.

One sound ergonomic principle is that the employee is the best judge of the effectiveness of his/her tools. Accordingly, the low percentage of employees who thought that they were receiving adequate numbers of sharp knives and scissors each day is troublesome.

Equally troublesome is the fact that at least some jobs used in the current rotation scheme are inappropriate. Rotation between two HE jobs that both stress the neck and upper extremity is likely to be only modestly effective (or even ineffective) in the prevention and early treatment of CTDs.

Finally, certain parts of the Perdue, Inc. "Repetitive Motion Disorders Action Plan" for Robersonville (dated 11-15-88) deserve comment. This document states that "all new hires shall be advised in orientation with Human Resources and during the physical, with the nurses, that the company will recommend them to follow a strict preventative program around-the-clock during the term of their probationary

period." The program includes taking 2 Ibuprofen tablets (400 mgs.) four times per day, 100 mgs. Vitamin B6 daily, 1600 units Vitamin E daily, and 4 grams Vitamin C daily. "Any team member who refuses to follow preventative medical treatment will be first required to furnish Perdue with a note from their personnel physician stating that medications used by the Industrial Nurse can not be taken by the team member for valid medical reasons or the team member may be allowed to sign a waiver refusing the recommended medication after counselling by the Industrial Nurse under which he/she assumes the responsibility of any ROM problems during the [probationary] period."

Although vitamins, anti-inflammation medications, and a variety of exercise programs have been advocated as methods of preventing work-related CTDs of the upper extremity, NIOSH investigators are unaware of any valid, scientific research that establishes the effectiveness of these interventions.[3,4] In addition, these interventions are not adequate substitutes for the effective engineering and administrative control of CTDs. Finally, the regular consumption of therapeutic amounts of ibuprofen is associated with a risk of various adverse health effects, including perinatal complications.[5]

C. Overall Remarks

CTDs are a serious problem in the meat packing and poultry processing industries because of the repetitive and forceful nature of jobs in these sectors. CTDs have been reported in chicken, turkey, pig, and cattle slaughterhouses in the United States and abroad.[2,6-12] The markedly elevated period and point prevalence rates seen in HE departments at the Lewiston and Robersonville facilities is further evidence of this problem.

It is unclear why prevalence rates were lower at the Robersonville facility than at the Lewiston facility. The difference cannot be attributed to the prophylactic use of vitamins and anti-inflammation medications at Robersonville, as only 11 of the 120 employees from this plant who participated in the investigation reported having received such prophylaxis. (Most participants began working before Perdue Farms, Inc. instituted its "Repetitive Motion Disorder Plan.")

VII. RECOMMENDATIONS

The prevention and management of work-related upper extremity CTDs can be divided into 3 areas: engineering, administrative, and medical controls.

A. Engineering Controls

All jobs that (1) are in higher exposure (HE) departments, or (2) have known risk factors for CTDs (i.e. high repetition, forceful exertion, and/or extreme or awkward posture) should be carefully assessed ergonomically to determine the need for job redesign.

After an ergonomic assessment is made, the following recommendations (if appropriate) should be implemented to reduce CTD risk factors.

1. Highly repetitive movements can be reduced in frequency by either slowing down the main conveyor or providing diverging conveyors off the main one so that tasks can be performed at slower rates. Restructuring jobs so that employees' tasks are varied, increasing the number of employees, and automating processes can also reduce repetitiveness. (At Lewiston and Robersonville, work areas are already cramped. Therefore, increasing the numbers of employees without increasing the size of work areas is not recommended, as this could result in an increase in traumatic injuries such as lacerations and amputations.)

2. Excessively forceful exertions can be reduced in intensity by using mechanical devices to aid in deboning and cutting. Maintaining sharp cutting edges on knives and scissors and automating processes can also reduce excessively forceful exertions.

3. Extreme postures can be eliminated by means such as providing work stations that accommodate the height and reach limitations of different size employees.

The design of effective engineering controls is best done with input from employees and supervisors who will be affected by changes.

B. Administrative Controls

Training, job rotation, and rest pauses are recommended as administrative control measures. These methods, however, have not been validated in scientific studies. None of them are as important as engineering controls.

1. Training

New employees should see appropriate demonstrations and be given time to practice proper cutting techniques and knife care. They should also be given the opportunity to condition their muscles and tendons prior to working at full capacity. Conditioning can be accomplished by putting new employees in slower paced lines, varying each employee's tasks, and rotating each employee through different jobs. Training should be done over the course of several weeks.

2. Job Rotation

The aim of job rotation is to alleviate the physical fatigue and stress of particular muscle-tendon-nerve groups by rotating employees among jobs that require the use of different muscles and tendons. Caution, however, must be used in deciding which jobs to rotate employees through.

Although different jobs may appear to require the use of different muscle-tendon-nerve groups, they may actually stress the same area. In addition, rotation schedules should be designed to ensure that the benefits derived by some employees are not compromised by subjecting other employees (who must share the ergonomically hazardous tasks) to excessive musculoskeletal stress.

3. Rest Pauses

Rest pauses are needed to relieve fatigued muscles and tendons.

C. Medical Controls

1. Health Care Providers

Health care providers should be knowledgeable in (1) the prevention, recognition, treatment, and rehabilitation of CTDs, and (2) the basic principles of ergonomics and epidemiology. In addition, they should be familiar with OSHA recordkeeping requirements. At the minimum, an occupational health nurse should be available on each shift.

2. Workplace Walk-Throughs

Health care providers should conduct routine, systematic workplace walk-throughs to understand processes and work practices, identify CTD risk factors, and become aware of any potential light duty jobs. Walk-through surveys should be conducted every month or whenever processes and work practices change significantly.

3. Catalog of Job Descriptions

An ergonomist or other similarly qualified person should ergonomically assess every job and provide health care personnel with the results of this assessment.

4. Active CTD Surveillance

a. Survey of Symptoms and CTDs

The first goal of the surveillance program is to determine (1) the types of symptoms and CTDs that are occurring, and (2) whether the incidence of these problems is increasing, decreasing or remaining the same.

To accomplish this goal, the OSHA 200 Log should be analyzed and a questionnaire administered to all workers. The questionnaire should be administered once a year. They should elicit information regarding (1) the location, frequency, and duration of work-related CTD symptoms, and (2) employees' perceptions about causes of these problems. Employees' names should not be required on questionnaires, as fear of repercussions for reporting

symptoms can lead to the collection of inaccurate data. (A sample questionnaire is provided in Appendix A.)

b. Health Survey

The second goal of the surveillance program is to detect CTDs in order to facilitate early treatment.

To accomplish this goal, a questionnaire (such as the one used at the Lewiston and Robersonville facilities) should be administered to all employees and a brief physical examination performed by a health care provider. This should be done once a year or after an employee changes jobs. It is important to note that this is not a preplacement exam and should not be used to screen out workers.

5. Employee Education.

All employees, including supervisors and other management personnel, should be educated about the prevention, recognition, treatment, and rehabilitation of CTDs. The information should be reinforced by health care providers during workplace walk-throughs and physical examinations. New employees should be educated during orientation. Education programs facilitate the early recognition of CTDs (prior to the development of severe, disabling conditions), and increase the likelihood of compliance with prevention and treatment programs.

6. Prophylactic Use of Vitamins and Anti-Inflammation Medications

Although vitamins, anti-inflammation medications, and a variety of exercise programs have been advocated as effective methods of preventing work-related CTDs of the upper extremity, NIOSH is unaware of any valid, scientific research that establishes the effectiveness of these interventions.[3,4] In addition, these interventions are not adequate substitutes for effective engineering and administrative controls. Finally, the regular consumption of therapeutic amounts of ibuprofen, a commonly used anti-inflammatory agent, is associated with a risk of various adverse health effects, including perinatal complications.[5]

7. Evaluation, Treatment, and Follow-up of CTDs

If CTDs are recognized and treated early in their development, debilitating conditions may be prevented. Symptomatic employees should be guaranteed access to the plant nurse. The nurse, in turn, should take a medical history and perform a limited musculoskeletal physical examination. The examination should include inspection, palpation, an assessment of strength and range of motion (passive, active, and resisted), and the performance of

various diagnostic maneuvers (such as Tinel's test, Phalen's test, and Finkelstein's test). Laboratory tests, X-rays and other diagnostic procedures should not be done routinely at this stage.

Any employee with (1) numbness or crepitus, (2) a positive Tinel's, Phalen's, or Finkelstein's test, or (3) evidence of medial or lateral epicondylitis or a rotator cuff injury should be referred to a physician. If a physician referral is not necessary, the treatment regime outlined in the Upper Extremity Cumulative Trauma Disorder Algorithm (Appendix B) should be followed. This algorithm outlines a conservative approach to treating CTD's, employing the use of the following therapies:

a. Non-Steroidal Anti-Inflammation Medications

These agents are helpful in reducing inflammation and pain.

b. Ice

Ice reduces inflammation and should be used even if no overt signs of inflammation (i.e. redness, warmth, or swelling) are present.

Ice should be applied to affected areas 4 times per day, for 20 minutes each time. Heat treatments should be used only for muscle strains.

c. Exercises

Once CTDs have occurred, in general, passive range of motion exercises should be initiated. (If active exercises are used they should be administered under the supervision of an occupational health nurse, a physician, or a physical therapist. If they are performed improperly, they can aggravate existing conditions.)

d. Light/Restricted Duty

Job reassignment must be done with knowledge of whether new tasks will require use of injured muscles or tendons, or put pressure on injured nerves. Inappropriate reassignment can exacerbate CTDs and result in permanent disability.

e. Splints

Splints are helpful in immobilizing symptomatic muscles, tendons, and nerves. They should not be used during work unless the employee has been transferred from his/her job and it has been determined by the health care provider that the new job does not stress the muscle-tendon-nerve group being splinted.

It is important to note that although the algorithm includes many commonly accepted treatments for CTDs, the effectiveness of these treatments has not been validated in scientific studies. In addition, many of the treatments can have serious side effects: anti-inflammation medications can cause gastrointestinal irritation and bleeding; and active stretching exercises can exacerbate CTD symptoms; THEREFORE, ANY CTD PREVENTION PROGRAM SHOULD PLACE PRIMARY EMPHASIS ON REMOVING CTD RISK FACTORS, RATHER THAN RELYING ON THE MEDICAL TREATMENT OF SYMPTOMATIC EMPLOYEES.

Concerning surgery, (1) "second opinions" should be obtained before surgery is done, and (2) after surgery, appropriate time off work should be provided to allow all injured muscle-tendon-nerve groups and operative sites to heal. The exact number of days off work will vary from employee-to-employee. For carpal tunnel surgery, the following averages have been proposed as guidelines:[13,14]

When returning to a nonrepetitive, non-forceful job (job with cycle time of 5 minutes or more; that never requires lifting objects over 1 pound, using hand tools, or pinching or gripping) - 3 weeks off (minimum 10 days),

When returning to a low-moderately repetitive, low-moderately forceful job (job with cycle time between 30 seconds and 5 minutes; that requires lifting objects less than 2 pounds during most job cycles or occasionally using hand tools) - 6 weeks off (minimum 21 days),

When returning to a highly repetitive, highly forceful job (job with cycle time less than 30 seconds; that requires lifting more than 2 pounds during most job cycles or regularly using hand tools requiring forceful exertions) - 12 weeks off (minimum 42 days),

It must be emphasized that these are averages. Some workers may require more time off or less time off, depending on individual responses to surgery. In addition, these recovery times are the opinions of recognized experts or authors of published articles and do not represent NIOSH policy. These experts and authors emphasize that recovery time is generally a matter of 2-3 months, and not 2-3 weeks.

After an employee has been away from work for medical reasons, he/she should be evaluated by a physician. This evaluation should include an assessment of his/her work capabilities. The physician should either view the employee's job on videotape or, preferably, see it first-hand in the plant.

Every time an employee is seen by a health care provider, the encounter should be documented in the employee's medical records.

D. Other

The CTD prevention and management program should be developed and implemented with input from health care providers, management, and employees. To accomplish this, a committee composed of representatives of these groups should be set up, with members of the committee (1) being educated about the basic ergonomic and medical principles of CTDs, (2) overseeing an ergonomic assessment of the workplace, (3) designing a CTD prevention and management program, and (4) evaluating the effectiveness of the program.

VIII. REFERENCES

1. Silverstein BA, Fine LJ, Armstrong TJ. Hand wrist cumulative trauma disorders in industry. British Journal of Industrial Medicine. 1986; 43:779-784.

2. Viikari-Juntura E. Neck and upper limb disorders among slaughterhouse workers. Scandinavian Journal of Work and Environmental Health. 1983; 9:283-290.

3. Amadio PC. Carpal tunnel syndrome, pyridoxine and workplace. Journal of Hand Surgery. 1987; 2a(part 2):875-879.

4. Silverstein BA, Armstrong JA, Longmate A, Woody D. Can in-plant exercises control musculoskeletal symptoms? Journal of Occupational Medicine. 1988; 38:922-927.

5. Kelley WN, Harris ED, Ruddy S, Sledge, CB. Textbook Of Rheumatology. W.B. Saunders, 1981. page 750.

6. Armstrong TJ, Foulke JA, Joseph BS, Goldstein SA. Investigation of cumulative trauma disorders in a poultry processing plant. American Industrial Hygiene Journal. 1982; 43:103-116.

7. Falck B, Aarnio P. Left-sided carpal tunnel syndrome in butchers. Scandinavian Journal of Work and Environmental Health. 1983; 9:291-297.

8. Finkel ML. The effects of repeated mechanical trauma in the meat industry. American Journal of Industrial Medicine. 1985; 8:375-379.

9. Masear VR, Hayes JM, Hyde AG. An industrial cause of carpal tunnel syndrome. The Journal of Hand Surgery. 1986; 11a:222-227.

10. Muffly-Elsey D, Flinn-Wagner S. Proposed screening tool for the detection of cumulative trauma disorders of the upper extremity. The Journal of Hand Surgery. 1987; 12a:931-935.

11. Hales T, Habes D, Fine L, Hornung R, Boiano J. National Institute of Occupational Safety and Health (NIOSH) Health Hazard Evaluation Report 88-180-1958 (John Morrell and Company). 1989.

12. Hales T, Fine L. National Institute of Occupational Safety and Health (NIOSH) Health Hazard Evaluation Report 89-251-1997 (Cargill) 1989.

13. Sidney Blair. Chairman, Department of Orthopedics and Rehabilitation, Loyola University Medical Center, Chicago, Illinois, personal communication.

14. Dawson DM, Hallett M, Millender L. Entrapment Neuropathies. Little, Brown and Co. 1983. page 59.

XI. AUTHORSHIP AND ACKNOWLEDGEMENTS

Report prepared by: Stuart Kiken, M.D., M.P.H.
William Stringer, M.S.
Lawrence Fine, M.D., Dr.P.H.
Thomas Sinks, Ph.D.
Shiro Tanaka, M.D., M.S.

Originating office: Hazard Evaluations and Technical Assistance Branch
Division of Surveillance, Hazard Evaluations, and Field Studies

The authors would like to acknowledge the following NIOSH personnel: Tom Hales, for designing the protocol and assisting in report preparation; Kathy Watkins, for preparing the questionnaire; B.J. Haussler, for overseeing the administration of questionnaires; Calvin Cook and Chris Hollis, for administering questionnaires; Ray Aldefer and Anthony Suruda, for doing physical examinations; and Don Bates, for supervising data entry.

In addition, the authors would like to thank the following North Carolina Department of Labor personnel: James Oppold, Kevin Hanley, David Lipton, and Mary Carol Lewis, for facilitating the investigations; and Mark Jackson, S.B. White, Jean Williams, and Bion Brewer, for administering questionnaires.

Finally, the investigations would not have possible without the cooperation of the management and employees of Perdue Farms, Inc.

XII. DISTRIBUTION AND AVAILABILITY

Copies of this report are temporarily available upon request from NIOSH, Hazard Evaluations and Technical Assistance Branch, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from the NIOSH Publications Office at the Cincinnati address. Copies of this report have been sent to:

1. The North Carolina Department of Labor, Division of Occupational Safety and Health.
2. Perdue Farms, Inc.

For the purpose of informing affected employees, copies of this report should be posted by Perdue Farms, Inc. in a prominent place that is accessible to employees for a period of 30 calendar days.

TABLE 1

PARTICIPATION
LEWISTON - ALL EMPLOYEES

PERDUE FARMS, INC.
LEWISTON, NORTH CAROLINA
HETA 89-307

Department	Number of Participants	Total Number of Employees*
Receiving	17	43
Evisceration	17	139
Grading	2	25
Stretch Bag	1	27
Cut Up	40	233
Deboning	65	237
Maintenance	8	104
Quality Control	11	16
Clerical	13	NA**
Total	174	

* day shift (except for one employee, all participants were from the day shift)
** not available

TABLE 2

PARTICIPATION
LEWISTON - WOMEN

PERDUE FARMS, INC.
LEWISTON, NORTH CAROLINA
HETA 89-307

Department	Number of Participants
Evisceration	17
Grading	2
Stretch Bag	1
Cut Up	40
Deboning	62
Quality Control	8
Clerical	12
Total	142

TABLE 3

AGE, RACE, GENDER, AND LENGTH OF EMPLOYMENT BY EXPOSURE GROUP
LEWISTON - ALL PARTICIPANTS

PERDUE FARMS, INC.
LEWISTON, NORTH CAROLINA
HETA 89-307

	Overall	HE*	LE**	95% CI
Age (Years)	31.1	30.4	34.4	
Race				
% Black	89.1%	99.3%	43.8%	2.56-116.53
% White	10.9%	0.7%	56.3%	
Gender				
% Male	18.4%	14.1%	37.5%	1.04-1.81
% Female	81.6%	85.9%	62.5%	
Length of Employment (Years)	5.5	5.4	5.8	

* higher exposure
** lower exposure

TABLE 4

AGE, RACE, AND LENGTH OF EMPLOYMENT BY EXPOSURE GROUP
LEWISTON - WOMEN

PERDUE FARMS, INC.
LEWISTON, NORTH CAROLINA
HETA 89-307

	Overall	HE*	LE**	95% CI
Age (Years)	31.4	30.9	34.0	
Race				
% Black	90.8%	99.2%	40.0%	1.85-80.20
% White	9.2%	0.8%	60.0%	
Length of Employment (Years)	5.4	5.4	5.2	

* higher exposure
** lower exposure

TABLE 5

CTD SYMPTOMS, PERIOD PREVALENCE CASES, AND POINT PREVALENCE CASES
LEWISTON - ALL PARTICIPANTS

PERDUE FARMS, INC.
LEWISTON, NORTH CAROLINA

HETA 89-307

	Number	Any Symptoms	Period Prevalence Case	Point Prevalence Case
		# (%)	# (%)	# (%)
Neck				
HE	142	48 (34%)	13 (9%)	6 (4%)
LE	32	5 (16%)	1 (3%)	1 (3%)
Combined	174	53 (31%)	14 (8%)	7 (4%)
RR*		2.2	2.9	1.3
95% CI		0.94-5.00	0.39-21.44	0.17-10.77
Shoulder				
HE	142	65 (46%)	18 (13%)	4 (3%)
LE	32	9 (28%)	1 (3%)	0 (0%)
Combined	174	74 (43%)	19 (11%)	4 (2%)
RR*		1.6	4.0	
95% CI		0.91-2.91	0.56-29.08	
Elbow				
HE	142	32 (23%)	9 (6%)	0 (0%)
LE	32	1 (3%)	0 (0%)	0 (0%)
Combined	174	33 (19%)	9 (5%)	0 (0%)
RR*		7.2		
95% CI		1.02-50.84		
Hand/Wrist				
HE	142	117 (82%)	42 (30%)	27 (19%)
LE	32	6 (19%)	2 (6%)	2 (6%)
Combined	174	123 (71%)	44 (25%)	29 (17%)
RR*		4.4	4.7	3.0
95% CI		2.13-9.08	1.21-18.54	0.76-12.14
Any Area				
HE	142	123 (87%)	59 (42%)	32 (23%)
LE	32	12 (38%)	3 (9%)	2 (6%)
Combined	174	135 (78%)	62 (36%)	34 (20%)
RR*		2.3	4.4	3.6
95% CI		1.47-3.63	1.48-13.24	0.91-14.28

* relative rate

TABLE 6

CTD SYMPTOMS, PERIOD PREVALENCE CASES, AND POINT PREVALENCE CASES
LEWISTON - WOMEN

PERDUE FARMS, INC.
LEWISTON, NORTH CAROLINA

HETA 89-307

	Number	Any Symptoms	Period Prevalence Case	Point Prevalence Case
		# (%)	# (%)	# (%)
Neck				
HE	122	45 (37%)	13 (11%)	6 (5%)
LE	20	3 (15%)	0 (0%)	0 (0%)
Combined	142	48 (34%)	13 (9%)	6 (4%)
RR*		2.5		
95% CI		0.84-7.16		
Shoulder				
HE	122	61 (50%)	17 (14%)	4 (3%)
LE	20	6 (30%)	1 (5%)	0 (0%)
Combined	142	67 (47%)	18 (13%)	4 (3%)
RR*		1.7	2.8	
95% CI		0.83-3.33	0.39-19.64	
Elbow				
HE	122	29 (24%)	8 (7%)	0 (0%)
LE	20	0 (0%)	0 (0%)	0 (0%)
Combined	142	29 (20%)	8 (6%)	0 (0%)
95% CI				
Hand/Wrist				
HE	122	106 (87%)	37 (30%)	24 (20%)
LE	20	2 (10%)	0 (0%)	0 (0%)
Combined	142	108 (76%)	37 (26%)	24 (17%)
RR*		8.7		
95% CI		2.33-32.41		
Any Area				
HE	122	112 (92%)	53 (43%)	29 (24%)
LE	20	7 (35%)	1 (5%)	0 (0%)
Combined	142	119 (84%)	54 (38%)	29 (20%)
RR*		2.6	8.7	
95% CI		1.44-4.78	1.27-59.33	

* relative rate

TABLE 7

PARTICIPATION
ROBERSONVILLE - ALL EMPLOYEES

PERDUE FARMS, INC.
ROBERSONVILLE, NORTH CAROLINA
HETA 89-307

Department	Number of Participants		Total Number of Employees	
	Day	Night	Day	Night
Receiving	5	1	10	10
Evisceration	19	3	39	39
Grading	8		10	10
Packing	3		12	12
Cut Up	10		35	35
Table Deboning	15	2	25	25
Cone Deboning	17		50	0
Maintenance	6	2	18*	
Sanitation	1	9	26*	
Quality Control	6	3	10*	
Clerical	10		NA**	
Total	100	20		

* day and night shift combined
** not available

TABLE 8

PARTICIPATION
ROBERSONVILLE - WOMEN

PERDUE FARMS, INC.
ROBERSONVILLE, NORTH CAROLINA
HETA 89-307

Department	Number of Participants
Evisceration	16
Grading	6
Packing	3
Cut Up	10
Table Deboning	16
Cone Deboning	17
Quality Control	6
Clerical	10
Total	84

TABLE 9

AGE, RACE, GENDER, AND LENGTH OF EMPLOYMENT BY EXPOSURE GROUP
ROBERSONVILLE - ALL PARTICIPANTS

PERDUE FARMS, INC.
ROBERSONVILLE, NORTH CAROLINA
HETA 89-307

	Overall	HE*	LE**	95% CI
Age (Years)	33.1	32.8	33.7	
Race				
% Black	85.8%	100.0%	54.1%	1.30-2.90
% White	14.2%	0 %	46.0%	
Gender				
% Male	30.0%	18.1%	56.8%	
% Female	70.0%	81.9%	43.2%	
Length of Employment (Years)	4.1	4.0	4.4	

* higher exposure
** lower exposure

TABLE 10

AGE, RACE, AND LENGTH OF EMPLOYMENT BY EXPOSURE GROUP
ROBERSONVILLE - WOMEN

PERDUE FARMS, INC.
ROBERSONVILLE, NORTH CAROLINA
HETA 89-307

	Overall	HE*	LE**	95% CI
Age (Years)	33.6	33.7	33.1	
Race				
% Black	89.3%	100.0%	43.8%	1.52-63.98
% White	10.7%	0 %	56.3%	
Length of Employment (Years)	4.1	4.2	4.1	

* higher exposure
** lower exposure

TABLE 11

CTD SYMPTOMS, PERIOD PREVALENCE CASES, AND POINT PREVALENCE CASES
ROBERSONVILLE - ALL PARTICIPANTS

PERDUE FARMS, INC.
ROBERSONVILLE, NORTH CAROLINA

HETA 89-307

	Number	Any Symptoms	Period Prevalence Case	Point Prevalence Case
		# (%)	# (%)	# (%)
Neck				
HE	83	35 (42%)	4 (5%)	1 (1%)
LE	37	4 (11%)	1 (3%)	0 (0%)
Combined	120	39 (33%)	5 (4%)	1 (1%)
RR*		3.9	1.8	
95% CI		1.49-10.18	0.2-15.23	
Shoulder				
HE	83	35 (42%)	6 (7%)	1 (1%)
LE	37	6 (16%)	0 (0%)	0 (0%)
Combined	120	41 (34%)	6 (5%)	1 (1%)
RR*		2.6		
95% CI		1.2-5.64		
Elbow				
HE	83	11 (13%)	0 (0%)	0 (0%)
LE	37	2 (5%)	0 (0%)	0 (0%)
Combined	120	13 (11%)	0 (0%)	0 (0%)
RR*		2.5		
95% CI		0.57-10.52		
Hand/Wrist				
HE	83	69 (83%)	19 (23%)	8 (10%)
LE	37	10 (27%)	0 (0%)	0 (0%)
Combined	120	79 (66%)	19 (16%)	8 (7%)
RR*		3.1		
95% CI		1.8-5.27		
Any Area				
HE	83	75 (90%)	23 (28%)	9 (11%)
LE	37	13 (35%)	1 (3%)	0 (0%)
Combined	120	88 (73%)	24 (20%)	9 (8%)
RR*		2.6	10.1	
95% CI		1.65-4.01	1.42-72.24	

* relative rate

TABLE 12

CTD SYMPTOMS, PERIOD PREVALENCE CASES, AND POINT PREVALENCE CASES
ROBERSONVILLE - WOMEN

PERDUE FARMS, INC.
ROBERSONVILLE, NORTH CAROLINA

HETA 89-307

	Number	Any Symptoms # (%)	Period Prevalence Case # (%)	Point Prevalence Case # (%)
Neck				
HE	68	32 (47%)	4 (4%)	1 (1%)
LE	16	2 (13%)	1 (6%)	0 (0%)
Combined	84	34 (40%)	5 (6%)	1 (1%)
RR*		3.8	0.9	
95% CI		1.00-14.10	0.11-7.75	
Shoulder				
HE	68	32 (47%)	4 (6%)	1 (1%)
LE	16	5 (31%)	0 (0%)	0 (0%)
Combined	84	37 (44%)	4 (5%)	1 (1%)
RR*		1.5		
95% CI		0.70-3.25		
Elbow				
HE	68	10 (15%)	0 (0%)	0 (0%)
LE	16	1 (6%)	0 (0%)	0 (0%)
Combined	84	11 (13%)	0 (0%)	0 (0%)
RR*		2.4		
95% CI		0.32-17.08		
Hand/Wrist				
HE	68	59 (87%)	14 (21%)	6 (9%)
LE	16	5 (31%)	0 (0%)	0 (0%)
Combined	84	64 (76%)	14 (17%)	6 (7%)
RR*		2.8		
95% CI		1.33-5.78		
Any Area				
HE	68	64 (94%)	18 (27%)	7 (10%)
LE	16	6 (38%)	1 (6%)	0 (0%)
Combined	84	70 (83%)	19 (23%)	7 (8%)
RR*		2.5	4.2	
95% CI		1.33-4.74	0.6-29.01	

* relative rate

APPENDIX A

SURVEILLANCE QUESTIONNAIRE

1. Today's Date /___/___/ - /___/___/ - 19/___/___/
   (month) (day) (year)

2. Current Department _____

3. Current Job _____

4. During the past year, have you had pain, aching, stiffness, burning, numbness, or tingling in any of the following areas?

   a. Neck: Yes___1 No___2
   b. Shoulder: Yes___1 No___2
   c. Elbow: Yes___1 No___2
   d. Hand/Wrist Yes___1 No___2

5. If you have had pain, aching, stiffness, burning, numbness, or tingling in the neck:

   a. How often have you had this problem?
      Every 6 months___1 Every 2-3 months___2 Once a month___3
      Once a week ___4 Daily ___5

   b. How long does each episode last?
      1 day or less ___1 1 day to 1 week ___2 1 week to 1 month___3
      1-3 months ___4 3 or more months___5

   c. Was the first time you experienced this problem before or after you started working at this plant? Before___1 After___2

   d. Do you think this problem is caused by work? Yes___1 No___2

      e. If yes, by what in particular? _____
      _____

   f. In the past year have you missed any workdays or been on light/restricted duty because of this problem? Yes___1 No___2

6. If you have had pain, aching, stiffness, burning, numbness, or tingling in the shoulder:

   a. How often have you had this problem?
      Every 6 months___1 Every 2-3 months___2 Once a month___3
      Once a week ___4 Daily ___5

   b. How long does each episode last?
      1 day or less ___1 1 day to 1 week ___2 1 week to 1 month___3
      1-3 months ___4 3 or more months___5

c. Was the first time you experienced this problem before or after you started working at this plant? Before___1 After___2

d. Do you think this problem is caused by work? Yes___1 No___2

e. If yes, by what in particular? _____

_____

f. In the past year have you missed any workdays or been on light/restricted duty because of this problem? Yes___1 No___2

7. If you have had pain, aching, stiffness, burning, numbness, or tingling in the elbow:

a. How often have you had this problem?
Every 6 months___1 Every 2-3 months___2 Once a month___3
Once a week ___4 Daily ___5

b. How long does each episode last?
1 day or less ___1 1 day to 1 week ___2 1 week to 1 month___3
1-3 months ___4 3 or more months___5

c. Was the first time you experienced this problem before or after you started working at this plant? Before___1 After___2

d. Do you think this problem is caused by work? Yes___1 No___2

e. If yes, by what in particular? _____

_____

f. In the past year have you missed any workdays or been on light/restricted duty because of this problem? Yes___1 No___2

8. If you have had pain, aching, stiffness, burning, numbness, or tingling in the hand/wrist:

a. How often have you had this problem?
Every 6 months___1 Every 2-3 months___2 Once a month___3
Once a week ___4 Daily ___5

b. How long does each episode last?
1 day or less ___1 1 day to 1 week ___2 1 week to 1 month___3
1-3 months ___4 3 or more months___5

c. Was the first time you experienced this problem before or after you started working at this plant? Before___1 After___2

d. Do you think this problem is caused by work? Yes___1 No___2

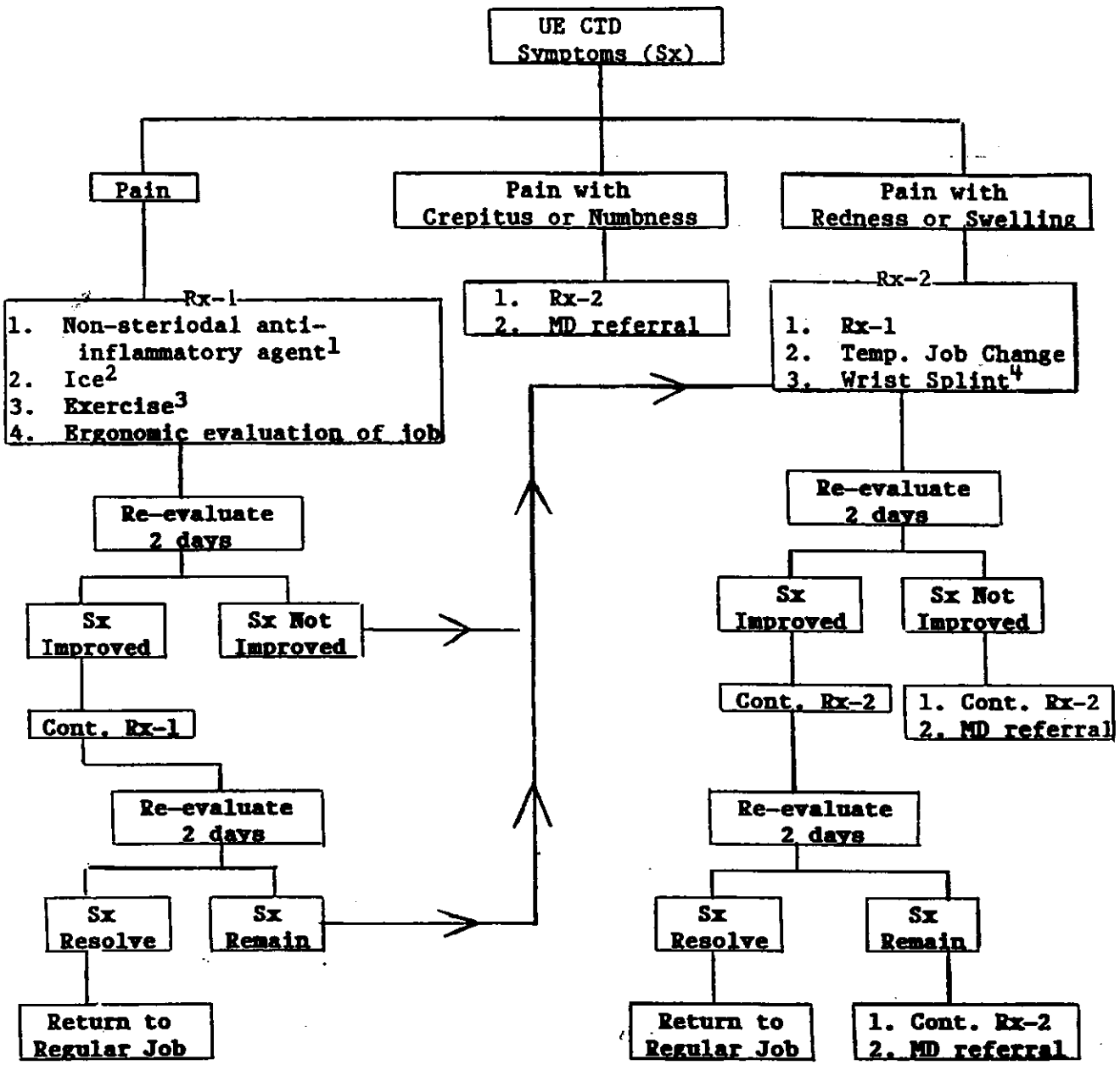
e. If yes, by what in particular? _____

_____

f. In the past year have you missed any workdays or been on light/restricted duty because of this problem? Yes___1 No___2

APPENDIX B

UPPER EXTREMITY (UE) CUMULATIVE TRAUMA DISORDERS (CTD) ALGORITHM



1 – Aspirin 650 mg PO qid or
Ibuprofen 400 mg PO qid.
2 – Ice to area for 20 minutes qid.
3 – Under nursing supervision for first day.
4 – Only if no wrist bending is required.