WORK RELATED MUSCULOSKELETAL DISORDERS AND THE CRAB PROCESSING INDUSTRY: AN ANALYSIS OF GENDER DIFFERENCES

ANDREA BARRON

Work related Musculoskeletal Disorders and The Crab Processing Industry: An analysis of Gender Differences

by

© Andrea Barron

A thesis submitted to the

School of Graduate Studies

in partial fulfillment of the

requirements for the degree of

Master of Nursing

School of Nursing

Memorial University of Newfoundland

April 2007

St. John's Newfoundland and Labrador

Your file Votre référence
ISBN: 978-0-494-31233-9
Our file Notre référence
ISBN: 978-0-494-31233-9

Abstract

This study, part of a larger project, examined the prevalence, type, and symptoms of work-related musculoskeletal disorders (WMSDs) and resulting disability in a sample of 107 crab plant workers in Newfoundland. The overall purposes of the thesis were two-fold. First and foremost, the purpose of this thesis was to examine the types of work related injuries that men and women experience as a result of crab processing, the symptoms of these injuries, level of disability, and if there were any gender differences. An analysis comparing the survey responses of women (n=74) and men (n=33) revealed few differences in the prevalence, type or symptoms of WMSDs and resulting disabilities by gender. Some of these differences included that female workers were more likely to experience a neck injury than males and that males were more likely to have injuries to their arms than females. Pain was the predominant symptom experienced. Disability scores were high for men and women, but no significant differences. The second purpose was to assess what role physical risk factors plays in the presence of WMSDs. Overall, the results suggest that jobs in which employees engage in repetitive motion, work at high speeds and use precise movements of the hands and finger are associated with increased evidence of WMSDs. However, no significant relationship was found for gender differences on these physical risk factors. The findings from the study have a number of important education and practice implications for occupational health nurses, others working in occupational health and safety, as well as for workers and employers.

Acknowledgments

First, a sincere thank you to my thesis committee, Drs. Shirley Solberg and Sandra LeFort, for their support and advice throughout this process.

Second, a thank you to the Canadian Institutes of Health Research and the Community Alliance for Health research program for a graduate fellowship that enabled me to pursue work in occupational health and safety. I would like to thank the co-principal investigators for the project, Project 2b: Cumulative trauma Disorders in Crab Processing Workers, Drs. John Molgaard, Shirley Solberg, and Nicole Vezina for the ability to work on this project and for the use of the data collected as part of their survey on cumulative trauma or work related musculoskeletal disorders. As well I thank SafetyNet: A Community Alliance on Health and Safety in Coastal Work Environments for the support throughout the project.

Third, a thank you to the plant management, Health and Safety Committee, and the employees who agreed to participate in this study.

Fourth, a thank you to my family. To my husband, Travor, I thank you for encouraging me to "keep going." To my children, Davin, Alexandrea and Maddison, I'm finally finished!

Finally, I dedicate this thesis in the memory of my father John Barron, who always believed in me and taught me the importance of education. I think he would be proud!

Table of Contents

List of Tables

List of Figures

Chapter 1

Introduction

Over the past several decades work-related musculoskeletal disorders (WMSDs) have become one of the most frequently reported health problems in many occupations and industries among both women and men (Clauw & Williams, 2002; Derebery, 1998; Hess, 1997; Pransky, Benjamin, Hill-Fotouhi, Flecther, & Himmelstein, 2002; Stock, 1991; Weigert, Rodriquez, Radwin, & Sherman, 1999; Zakaria, Robertson, MacDermid, Hartford, & Koval, 2002). While there has been a considerable amount of research into WMSDs, particularly associated with workplace and psychosocial factors, limited research was found on these disorders among crab processing workers.

This thesis is part of a larger more detailed study that explored the ergonomics, biomechanics, work organization, and psychosocial factors associated with WMSDs, as well as the prevalence and effects of the disorder on workers in a single crab processing plant. The overall purpose of this thesis was to explore gender differences in WMSDs among the study participants. Gender differences were examined for the types of WMSDs that women and men experienced as a result of crab processing and the symptoms of these injuries. Selected physical/ergonomic factors were examined to determine if: (a) they have a role in the presence of WMSDs in the affected workers and (b) if women and men in the plant in question have differing exposure to these physical/ergonomic risk factors. In addition, the level of disabilities experienced by the affected employees along gender lines was also examined.

This chapter presents background information concerning WMSDs, a discussion of the rationale for the thesis, the specific research questions, a description of the conceptual model, a summary of the key definitions related to this thesis, as well as an overview of the thesis chapters.

Background

It has been estimated that WMSDs cost organizations millions, if not billions, of dollars each year in terms of employee absenteeism, treatment, and workers' compensation costs (Amell & Kumar, 2001; Barthel, Miller, Deardorff, & Portenier, 1998; Evanoff et al., 2002; Ostendorf, Rogers, & Bertsche, 2000). In 2003 Health Canada reported that one out of every ten Canadian adults had a WMSD, 10.3% of women and 9.9% of men (Repetitive strain injuries, 2003). In addition, these injuries were so severe that they interfered with the affected individual's ability to carry out normal activities. That same year in Newfoundland and Labrador alone there was the equivalent of 5213 injury years lost as a result of WMSDs (i.e., absenteeism) (WHSCC, 2003). Moreover, 59% of all short-term workplace disability claims in Newfoundland and Labrador in 2003 were related to some form of WMSD (WHSCC). These claims were not broken down by gender.

Unfortunately being injured in the pursuit of one's livelihood is not a new or recent phenomenon. Throughout history working women and men have sustained injuries to their hands, arms, backs, and other parts of their bodies as a direct result of their paid employment (Armstrong et al., 1993; Melhorn, 1998; Morse, Punnett, Warren, Dillon, & Warren, 2003; Ostendorf et al., 2000; Tyrer, 1999). However certain occupations appear to place employees at greater risk for the development of WMSDs. These include such diverse occupations as assembly line workers, computer programmers, cashiers, fish-plant workers, and musicians. Any occupation that requires the worker to have frequent repetitive movements, awkward positions, or work in areas with significant levels of vibration can result in a WMSD (Crumpton-Young, Killough, Parker, & Brandon, 2000; Melhorn; Strasser, Lusk, Franzblau, & Armstrong, 1999). In fact all employees in all occupations and industries are at some risk for the development of a WMSD.

Disabilities resulting from WMSDs can range from minimal to severe and can have a negative impact on both the work and home life of the affected employee (Hildebrandt, Bongers, Dul, van Dijk, & Kemper, 2000). The level of disability that an injured employee has to contend with can be influenced by treatment for the WMSD and any modifications in the work environment to reduce the impact on the part of the body injured. However there are occasions where the level of disability, as a result of a WMSD, is so severe that the affected employee can no longer function in her/his job, regardless of the treatment or modifications (Pransky et al., 2000). As a result the employee may have to leave the workforce for a period of time to heal his/her injury.

There have been many different names used to identify these work-related injuries, for example repetitive strain injuries, cumulative trauma disorders, cumulative trauma disorders of the upper extremities, and WMSDs are just some of these names. There are also many different parts of the body that can be affected by a WMSD, such as, the back, fingers, arms, legs, and feet. For the purposes of this research study, work-related musculoskeletal disorders (WMSDs) will be the name used to refer to these disorders and the focus will be on injuries to the upper body, including the fingers, hands, wrists, arms, shoulders, and neck. The reason for this focus on the upper extremities is that this is the region of the body that is used most in crab processing. Therefore these regions of the body would appear to be at the greatest risk for the development of these WMSDs in those employed in crab processing.

Rationale

This study was conducted for three reasons: (a) to add to the research in the area of occupational health and safety (OHS) nursing; (b) to determine if there are gender differences in terms of the types of injuries and symptoms the workers experience in relation to WMSDs in the crab industry; and (c) to add to the literature on WMSDs in crab processing, as there have not been any studies located that were conducted on this industry and WMSDs. Occupational asthma and to a lesser extent dermatological disorders have been the main focus of occupational health research among crab processors (Cartier et al., 2004; Howse et al., 2006; Jeebhay, Robins, Lehrer, & Lopata, 2001; Jong, Neis, Cartier, Horth-Susin, & Howse, 2006).

The role of the OHS nurse is to work in organizations and industries and with workers and workers groups, and employers to make the work environments safer and healthier for all employees, and to help enable all employees to work to their best abilities and remain healthy (American Association of Occupational Health Nursing (AAOHN), 2006; Canadian Occupational Health Nurses Association, 2006; Ontario Occupational Health Nurse Association (OOHNA), 2006). This is often achieved through the identification of actual and potential workplace hazards, as well as the development and implementation of strategies to make the workplace safer and healthier for all employees. The outcomes of this study could potentially help nurses and other health and safety officials working in the crab processing and fishing industry identify factors that may increase employees' risks for the development of WMSDs. With this information those with a responsibility for health and safety could then help to develop strategies, in consultation with the plant management and union representatives, to help decrease employee exposure to identified risk factors. This could be achieved through educational sessions with all employees, as early identification of employees at risk can help improve the employee's ability to remain productive and avoid injury and pain. The results of this study could also be used by OHS nurses to help those employees who have a WMSD determine ways that they can be appropriately managed and accommodated in the workplace to facilitate their continued ability to work and be productive within their level of ability.

Despite the long history of work-related injuries, much of the research to date has focused on the prevalence and psychosocial, work organization, or ergonomic factors associated with these disorders. Until recently there has been limited examination of gender and gender differences or any focus on women's occupational health (Messing & Mager Stellman, 2006). Several authors indicated that women tend to be at higher risk for the development of WMSDs than their male counterparts (Chiang et al., 1993; Messing, 1998; Morse et al., 2005; Nordander et al., 1999; Treaster & Burr, 2004; Vroman & MacRae, 2001). However, there is less research regarding how women and men differ in terms of the types of injuries they experience, their symptoms, or level of disability in relation to WMSDs (Dahlberg, Karlqvist, Bildt, & Nykvist, 2004; de Zwart, Frings-Dresen, & Kilbom, 2001; Neis & Williams, 1993; Nordander et al.; Strazdins & Bammer, 2004).

The broader literature search revealed a few studies relating to the fishing industry and processing, but none that examined the crab processing industry and

WMSDs. However given the nature of the work performed by the employees in the crab processing plant, they are exposed to known occupational risk factors (e.g., highly repetitive work, a short intensive work season, and the stressful nature of the industry in general). Thus, this population would appear to be at high risk for the development of WMSDs.

Within the limited literature on the fish processing industry two studies focused solely on women and WMSDs (Ohlsson et al., 1994; Olafsdottir & Rafnsson, 2000), while four other studies compared the frequency of WMSDs in women and men (Chiang et al., 1993; Neis & Williams, 1993; Nordander et al., 1999; Palsson, Stromberg, Ohlsson, & Skerfving, 1998). Only one study was conducted in Canada and that was in Newfoundland and Labrador (Neis & Williams). As the focus of the present study is crab-processing workers in Newfoundland and Labrador, the findings from international and fishing industry studies may, or may not, apply to the plant workers under consideration. Other factors that may limit the generalizability of these studies' findings to the present situation are that these studies examined fish filleting, which is somewhat different from crab processing, and that the research was almost all conducted outside of Canada, therefore in different social and work environments (Chiang et al.; Nordander et al.; Ohlsson et al.; Olafsdottir & Rafnsson; Palsson et al.).

As a result of these gaps in the literature, this study is important to the crab processing industry by identifying the degree to which crab plant-processing workers are at risk of developing WMSDs. Moreover, the study investigated the impact of gender in relation to these disorders. More specifically, this thesis examined if WMSD prevalence, injury area, symptomology, and level of resulting disability differed by gender within this particular industry. This analysis is especially important given that the number of workers is increasing in this industry and female workers are increasingly being employed (www.shellfishohs.ca/shellfishing_processing.html).

The findings of this thesis may also help identify environmental and ergonomic conditions that could be altered in the plant, potentially decreasing the workers' risk of developing WMSDs. Thus, the results of this particular study could aid the plant to create a safer and healthier working environment for workers, which could lead to fewer injured workers, reduced costs associated with worker's compensation premiums, and increased productivity as well.

Due to the short crab season, which usually runs from April to October, many of the employees work injured, therefore, need to be accommodated in the work environment so that they can continue to work. This can cause stress and tension in the work environment, as employers and other workers have to accommodate the injured employees while they continue to get the product finished in a timely manner. The results of this thesis may help indicate ways to reduce the stress and tension through a better understanding and insight into some of the factors associated with WMSDs and the effects on workers' lives. Examining gender differences could lead to gender-specific modifications in the work environment which could help decrease the number of WMSDs experienced by the crab processing workforce. Given the uncertainty of the crab industry in general, any measures that can improve the quality of work for the employees while decreasing their chances of getting injured at work and any cost savings may help with the long-term viability of the plant.

Research Questions

The overall purpose of this thesis was to explore gender differences in the crab processing industry. The research questions for this study were:

1. Do women and men who work at the selected crab processing plant differ in terms of the types of upper body WMSDs they experience and the occurrence of such WMSDs?
2. Do those women and men with these WMSDs differ in the symptoms they experience?
3. Are there physical/ergonomic risk factors that are associated with the presence of these WMSDs and what are the gender differences?
4. What is the level of disability in the affected employee and does it differ by gender?

Conceptual Framework/Model

The more recent investigations on WMSDs have discussed a multifactorial cause for the development of WMSDs (Amell & Kumar, 2001; Haufler, Feuerstein, & Huang, 2000; Pransky, Robertson, & Moon, 2002). Individual, physical, psychosocial, and work organizational factors have been recognized as contributing to WMSDs (Bernard, 1997). For the purpose of this study, I have chosen an adaptation of the Dose-Response model for WMSD, developed by Armstrong et al., (1993), as the conceptual model to guide the research. This model was chosen because it is specific to the neck and upper extremities and recognizes that there are multiple factors that may have an effect on an employee developing a WMSD (Armstrong et al.; Huang, Feuerstein, & Sauter, 2002). The model has four components including: exposure, dose, response, and capacity. A summary of this model follows and a visual depiction is presented in Figure 1.

1. *Exposure*. This aspect of the model refers to any work requirements that can have an impact on the body. This can include the ergonomic make up of the work environment, as well as any forces (e.g., vibration, repetition, weight of tools) that the actual job exerts on the body. The model states that with any exposure, the worker's body will respond (i.e., muscles and tendons will contract and stretch). However, with repeated exposure to a work requirement, the internal body response and subsequent change (i.e., contraction and stretching of muscles and tendons) may have a permanent effect and lead to WMSDs (Armstrong et al., 1993; Huang et al., 2002).
2. *Dose.* This aspect of the model examines the individual and his/her internal state. This portion of the model takes into consideration mechanical, physiological, and psychological factors. Mechanical changes can occur internally to muscles and tendons from the work that the individual does. Physiological changes can result from the byproducts of bodily function (i.e., metabolites). Psychological factors incorporate stress and support that the worker perceives in the work environment and at home (Armstrong et al.; Huang et al.).
3. *Response*. Here, the model takes into consideration the changes that occur within the individual as a result of the exposure and the dose. This portion of the model can be infinite. In WMSDs this portion of the model takes into consideration the repetitive nature as causation for this disorder. With each exposure and dose reaction the body of the worker will respond and change. The body's response to

the exposure and dose can be mutlifactorial. Some workers will adapt and not become injured; whereas, other workers cannot adapt and a WMSD results (Armstrong et al.; Huang et al.).

4. *Capacity.* This final aspect of the model specifically considers the individual and how he/she reacts to the internal changes that occur in the dose aspect of this model. For example, how does the individual cope with stress? Is there a supportive home environment? What activities are the individuals involved in to help reduce stress? How have they coped and reacted in the past to similar situations? (Armstrong et al.; Huang et al.).

As the main focus of this thesis was to explore gender as it relates to the presence or absence of upper body WMSDs, two constructs from the Dose-Response model were selected; exposure and response. Exposure was operationalized in terms of selected physical/ergonomic factors observed in the particular plant and the effects of these factors on WMSDs (i.e., repetitive movements, vibrations, awkward hand positions, etc). Response was examined in terms of the presence or absence of a WMSD and symptoms related to these disorders (i.e., pain, tingling, numbness, loss of use, etc.). These two constructs link to the research questions set for the study, as these questions explore whether the employees at the plant have different types of WMSDs, different symptoms, and if the physical/ergonomic factors are factors in the development of WMSDs. As such the adapted Dose-Response model for this thesis is presented in figure 2. Dose and capacity were not explored in this study.

Figure 1: The Dose-Response model (Armstrong et al., 1993)

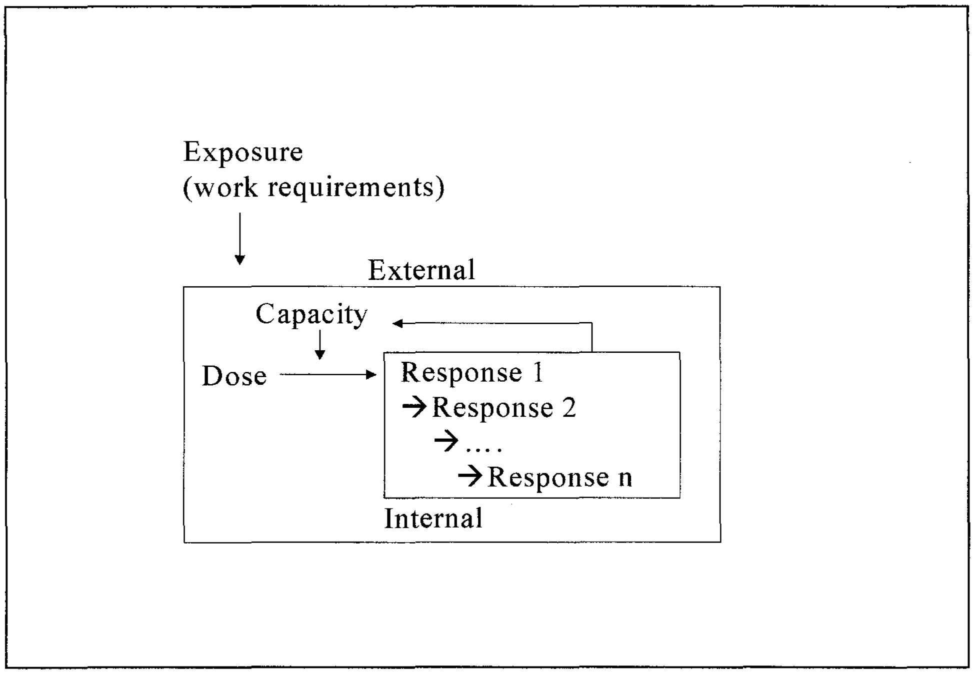
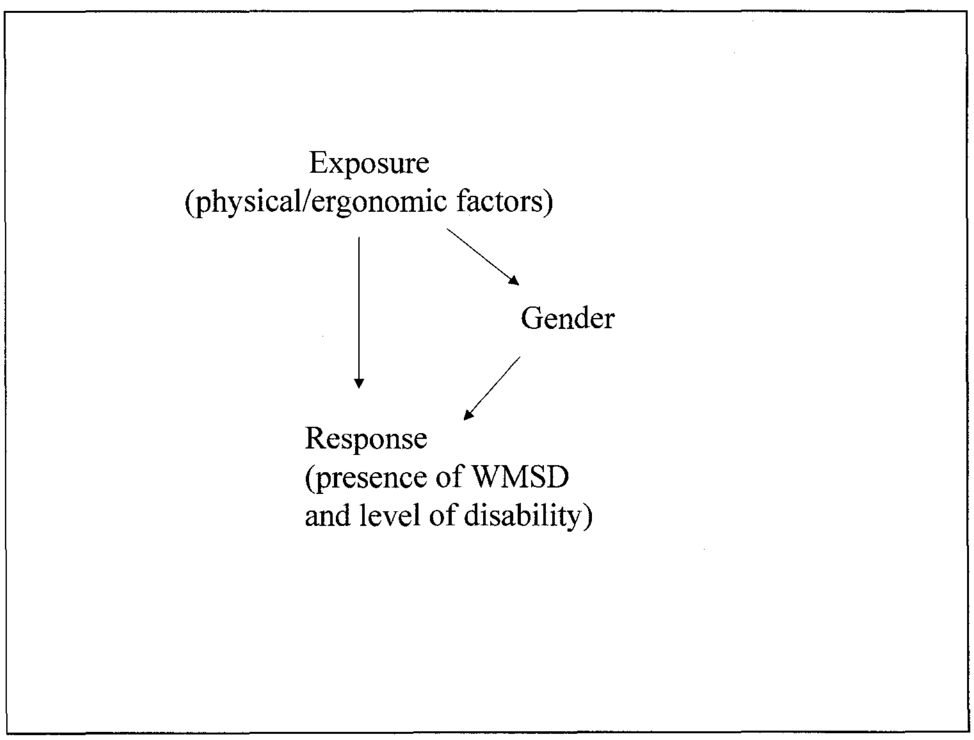


Figure 2: Adapted Dose-Response Model: Gender and WMSDs



Definitions

Several definitions have been provided to help enhance the understanding of the condition under investigation in this thesis. Specifically, these include a broad definition of work-related musculoskeletal disorders, an operational definition of these injuries as they relate to this study, a definition of the physical/ergonomic factors, a definition of disability and, finally, a conceptualization and an operational definition of gender.

Broad definition of WMSDs. The literature presents many different definitions for WMSDs. These definitions include, but are not limited to the following general criteria: (1) disorders resulting from a job-related task that are not associated with a workplace accident; (2) disorders that develop over time and can affect any aspect of the workers' body (e.g., fingers, hands, arms, shoulders, or neck); and (3) disorders that can cause the affected worker to experience a variety of symptoms including pain, discomfort, tingling, numbness, burning, loss of sensation, and loss of function of the affected body part (Abbas et al., 2001; Beaton et al., 2000; Katz et al., 2000).

Operational definition of WMDSs. For the purpose of this thesis, WMDSs will refer to any condition of the *upper extremities* that meet the preceding general criteria. These conditions will include both diagnosed conditions (e.g., carpel tunnel syndrome) and self-reported conditions meeting the above criteria of symptoms that may, or may not, have been medically diagnosed.

Physical/Ergonomic factors. Physical/ergonomic factors are those ergonomic work-related risk factors that have been linked to WMSDs (Bernard, 1997). These include long periods of standing, repetitive motion, lifting, high speed, awkward positions, precise hand movements, forceful exertions, vibration, and continuous watching. It also includes exposure to environmental factors such as loud noise, and exposure to cold, and chemicals and fumes. These particular factors were selected because these were observed by the research team to be present in the plant and were confirmed as important by the Health and Safety Committee of the plant.

Disabilities. For the purposes of this thesis, disabilities will refer to the level of impaired function reported by affected workers, as measured on the Disabilities of the Arm, Shoulder and Hands (DASH) outcome measurement tool (Solway, Beaton, McConnell, & Bombardier, 2002). This involves their self-reported ability to perform day-to-day tasks such as dressing, cooking etc.

Gender. Gender (i.e., what is feminine or masculine) is a cultural and social construct that is acquired through the person's development in different roles in a particular society (Gamble, 1999). While gender is not a simple or clear construct and not determined by biology, it is generally related to sex (i.e., being female or male) as growing up in a particular society women and men fulfill different roles and positions. This is noted in selected occupations and work processes where "women's and men's work" is differentiated. For the purposes of this thesis, gender is operationalized by whether an employee is female or male.

Overview of the Thesis

The layout of the remaining chapters of this thesis is as follows. First, in chapter two, I review the relevant literature related to the present study. In chapter three, I present the methodology as it relates to the thesis and the broader research program in which this study is contained. Chapter four presents the findings from the study. Chapter five is a discussion of the findings while chapter six contains limitations of the study and presents an overview of the implications of this study for nursing practice and future research.

Chapter 2

Literature Review

The following chapter contains a review of relevant literature on gender and WMSDs and in particular how these disorders relate to workers in the fishing industry. First, there will be a brief discussion of the library search process used to identify relevant literature. Second, a brief summary of work-related factors and WMSDs will be presented. Third, gender differences and WMSD injuries will be discussed. This section of the literature review will include research that examines the injury types that women and men experience, symptoms that women and men report, physical/ergonomic factors that potentially increase a woman or man's risk of developing a WMSD and how they are affected by this disorder. Finally, as one of the foci of the current study is to examine injuries of the upper extremities of employees in a crab processing plant in Newfoundland, there will be a discussion of the literature on WMSDs and the fishing industry, as there was no research found that specifically examined the crab processing industry and WMSDs.

However as was indicated in the introductory chapter, allergic reactions such as crab asthma and dermatological disorders have received some attention. Fishing and fish processing industries were included in the review, as they would have similar risks for the development of WMSDs as that of the crab processing industry. Both these industries have common physical and environmental risk factors (i.e., jobs that require repetitive motions, awkward hand positions, vibrations, and cold environments) (Gorsche et al., 2002; Nordander et al., 1999).

Literature Search

In searching the various article indexes (e.g., CINAHL, PubMed, Medline, Web SPIRS) available on the Memorial University of Newfoundland library system, a vast amount of literature on gender and WMSDs was found. In order to retrieve the relevant literature on the subject, several key word searches were conducted. Key words used in these searches included gender, sex factors, repetitive strain injuries, cumulative trauma disorders, and work-related musculoskeletal disorders. Each word was then searched in multiple search engines in order to capture the relevant literature. Next, searches were conducted using crab processing and/or fishing as the key words. This search was then linked with the searches on WMSDs, with the aim of performing as extensive a literature search as possible on this subject matter. This use of key word searches and linking back to the larger search continued until the retrieved literature became repetitious and no additional relevant articles were found.

The initial search was not limited in any manner. However, subsequent searches were limited by: (1) studies written in, or translated into, English; (2) year in order to capture the more recent research (the year was limited to 2000 and greater); and (3) injuries affecting the upper extremities only (neck, shoulders, arms, elbows, wrists, hands, and fingers). In addition, Internet searches were conducted, using the same key words, and information pertaining to the subject area was obtained from a variety of sites (i.e., Health Canada, Workplace Health, Safety and Compensation Commission, and general work-related health sites).

Physical Work-related Factors and WMSDs

In the vast amount of literature on WMSDs, many physical work- related factors have been identified as potentially increasing an employee's risk for the development of WMSDs. Some of these work-related factors include, but are not limited to:

- repetitive movements of the fingers, hand, wrist, and arm/shoulders (e.g., filleting fish, scanning items, typing, assembling items, cutting, and other upper arm activities) (Brouwer, Mazzoni, & Pearce, 2001; Dahlberg et al., 2004; Feely, Seaton, Arfken, Edwards, & Young, 1995; Martin, Irvine, Fluharty, & Gatty, 2003; Nordander, et al., 1999; Ohlsson et al., 1994; Ostendorf et al., 2000);
- awkward hand/arm position (Crumpton-Young et al., 2000; de Zwart, et al., 2001; Dortch & Trombly, 1990; Kramer, Potter, Harburn, Speechley, & Rollman, 2001; Ostendorf et al., 2000);
- vibration (Amell & Kumar, 2001; de Zwart, et al., 2001; Ostendorf et al., 2000; Stock, 1991; Stock, Cole, Tugwell, & Streiner, 1996; Strasser et al., 1999);
- work station configuration (Aribisala, 1993; Ostendorf et al., 2000);
- low/cold temperatures (Amell & Kumar, 2001; Chiang et al., 1993; Ostendorf et al., 2000; Strasser et al., 1999);
- insufficient rest time. For example, employees who lack adequate breaks or time off between work, especially in jobs with repetitive movements, are more likely to develop WMSDs relative to those employees with sufficient breaks (Amell & Kumar, 2001; Clauw & Williams, 2002; Feely et al., 1995; Haufler et al., 2000; Ratzon, Jarus, Baranes, Gilutz, & Erez, 1998; Stock, 1991).

Epidemiological studies support the argument that the more work-related physical/ergonomic factors that an employee is exposed to on a continuous basis, the greater the risk of that employee for the development of a WMSD (Bernard, 1997). The conceptual framework selected for this study supports the multifactorial nature of the causes of WMSDs (Armstrong et al., 1993).

The above factors are not exclusive of those that have been implicated in the development of WMSDs (Bernard, 1997). Work organizational factors and the interface between activities at home and work, as well as individual factors, are also important. These have not been included as they are beyond the scope of this thesis.

Gender Differences and WMSDs

There is a large amount of literature that examines gender and WMSDs. Research in this area has been conducted in many countries including Canada (Neis & Williams, 1993), China (Chiang et al., 1993), Denmark (Hviid et al., 2002), France (Cassou, Derriennic, Monfort, Norton, & Touranchet, 2002), the Netherlands (de Zwart, Broersen, Frings-Dresen, & van Dijk, 1997; de Zwart et al., 2001), and Sweden (Fredriksson et al., 2002; Nordander et al., 1999 Ostergren et al., 2005; Palsson et al., 1998). Overall, the literature reviewed suggested that female workers over a wide range of occupations are, generally speaking, at a higher risk of developing WMSDs at some point during their work life as compared to their male counterparts (Cassou et al.; de Zwart, Broersen, et al.; de Zwart et al.; Fredriksson et al.; Hviid, et al.; Melhorn, 1998; Nordander et al.; Ostergren et al.; Strazdins & Bammer, 2004; Treaster &Burr, 2004).

Women and the Development of WMSDs

While women are more prone to developing WMSDs than their male counterparts, the reason why this is so is not clear. However, the literature presented several potential explanations for why women have an increased likelihood for developing WMSDs than men. First, the type and length of time spent in occupations that women have traditionally pursued are factors (Messing et al., 2003). Many female- dominated occupations have been identified as having high levels of WMSDs as they require the employee to perform repetitive tasks in short time frames, in awkward positions, and often these employees feel that they have little control over their work environment. These occupations have included, but are not limited to, sales clerks, cashiers, assembly line workers, computer programmers, and fish processors (Cassou et al., 2002; Fredriksson et al., 2002; Lundberg, 2002; Melhorn, 1998; Rosenstock & Jackson, 2000). In many of these occupations women perceived that they had little control, support, or decision making ability; these factors have been identified as increasing an employee's risk for the development of WMSDs (Messing, 2004). Women also tended to stay in these occupations longer than their male counterparts and, thus, faced longer exposure to work factors that could cause WMSDs. In contrast, a male employee has been more likely to advance into different roles or change jobs (de Zwart et al., 2001; Messing et al.).

A second explanation relates to differences in the physical characteristics between men and women (Gender, Health and Work, 2004; Messing, 2000). For example, men generally have been shown to have greater upper body strength than women; therefore, they may be less affected by factors that have been shown to increase WMSDs (Hart, Archambault, Kydd, Carol, & Herzog, 1998; Messing et al., 2003; Strazdins & Bammer, 2004).

Third, many women have had additional responsibilities outside of work compared to men (Premji, 2005; Ratzon et al., 1998). Outside work responsibilities such as caring for family, ill relatives, and household tasks continue repetitive actions that women often performed in their paid employment and limited rest time between exposure to factors at their workplace (Feely et al., 1995; Keogh, Nuwayhid, Gordon, & Gucer, 2000; Lundberg, 2002; Ostendorf et al., 2000; Premji; Ratzon et al.; Strazdins & Bammer, 2004; The Canadian Women's Health Network, 2005; Vroman & MacRae, 2001).

In addition, the literature documented that women tended to be more affected by higher levels of job stress, lower job satisfaction, and less social support (Bongers, Kremer, & ter Laak, 2002; Boudreau & Reitav, 2001; Clauw & Williams, 2002; Haufler et al., 2000; Hess, 1997; Leclerc, Chastang, Niedhammer, Landre, & Roquelaure, 2004; Lundberg, 2002; Stephens & Smith, 1996; Strasser et al., 1999). These psychosocial and work organization factors have been identified as potentially increasing the female employee's risk of developing a WMSD. Studies by Dahlberg et al. (2004) and Nordander et al. (1999) further identified that psychosocial factors could potentially increase the female employee's risk of development of WMSDs (i.e., outside work responsibilities and stress).

Similar findings concerning gender differences were also reported by Strazdins and Bammer (2004). They compared data gathered from women and men who were public service employees and examined several risk factors believed to potentially increase an employee's risk of developing WMSDs (i.e., repetitive work, ergonomic set up, job control, ability to relax and engage in exercise, and meet family demands). The results of this study revealed that women were at a much greater risk for the development of WMSDs than men. They also found that differences in the jobs performed were significant in the likelihood of the worker reporting a WMSD.

A fourth explanation is that even when women and men engage in the same work processes or tasks, women may approach these tasks differently than men (Dahlberg et al., 2004; Messing, 2004). This may be due to workstation design, but other explanatory factors need to be considered (Messing & Mager Stellman, 2006). Traditionally, many workstations have been designed based on male employees' needs. The female employee may have had to adapt the workstation so she can complete the required work or alternately work in awkward positions (Hoozemans, van der Beek, Frings- Dresen, van Dijk, & van der Woude, 1998; Messing, 2000; Rosenstock & Jackson, 2000; The Canadian Women's Health Network, 2005; Treaster & Burr, 2004).

A fifth explanation that has been identified in the literature is aging. Both women and men have been shown to have more WMSDs with increasing age (Cassou et al., 2002; de Zwart et al., 1997). However, women tend to be at a greater risk as they age. Potential reasons for this difference have included physiological changes that occur with aging, both physical and hormonal, number of years working in the same occupation (i.e., length of exposure to potential causes), and that many of the initial WMSDs have become chronic as a result of repeated exposure (Cassou et al.; de Zwart et al.).

Finally, it has been suggested that women are have been more likely to report and seek medical treatment for perceived health problems (de Zwart et al., 2001). As a result the female employee is more likely than her male counterpart to report a WMSD or get this diagnosis. This could be one possible explanation as to the higher number of women with WMSD in the workforce (Messing, 2004).

Types of WMSD Injuries

The literature documents that there are differences in the types of injuries (i.e., body region/area) reported by men and women with WMSDs. A study by de Zwart et al. (2001) found gender differences in the types of upper extremity injuries reported by the participants in their study across a wide variety of occupations. Women in the study reported more disorders of the neck, shoulder, elbow, and wrist than men. The study also found that female employees suffered more upper extremity injuries than male employees, regardless of their occupation. Similarly, an earlier study by de Zwart et al., (1997) documented that women and men reported different types of WMSDs. In that study they also found that women had more neck and upper extremity complaints than men.

Ostergren et al. (2005) examined women and men who were employed in a variety of vocational occupations. They found that women had more neck and shoulder problems than men. This was especially true in occupations where women felt that they had little control, support, or opportunity for movement. Hviid et al. (2002) also found that neck and shoulder pain was the greatest for women in their study of workers in a variety of occupations in Denmark.

Dahlberg et al. (2004) examined men and women performing the same types of jobs to determine if a gender difference existed in the types of injuries reported. Their study revealed that women and men did differ in the type and prevalence of upper extremity disorders. They found that women reported more disorders of the neck, shoulders, wrists, and hands; whereas, men reported more problems with their elbows. They also found that women reported more injuries than men when performing similar job tasks. In addition, the study explored other activities that the employees performed which could increase their risk of developing an upper extremity injury. Specifically, they found that the women in the study performed more household duties with their hands than men and had a longer workday. They argued that these additional factors could potentially increase women's risk for the development of upper extremity injuries. An article by Messing (2000), in which she reviewed existing literature and ergonomic information, supports the argument that women and men performing the same job can experience very different outcomes. Messing argued that this finding could be attributed to the previously discussed explanations as to why women are at an increased likelihood of experiencing a WMSD in the first place (i.e., type of occupation, outside work responsibilities, etc.).

A study by Leijon, Bernmark, Karlqvist, and Harenstam (2005) found that in occupations dominated by women, women stood more often and performed more awkward arm positions. These women also perceived themselves to have low status and little control over their work environment. These factors have been documented to increase an employee's risk for the development of WMSDs. These results were less significant for male-dominated occupations and for those occupations that were considered to be gender equal. There were no associations found between factors that could potentially increase an employee's risk for the development of a WMSD. For example, a study by McDiarmid, Oliver, Ruser, and Gucer (2000) examined carpal tunnel syndrome (CTS) and rate differences between women and men. They explored six high-risk occupations for CTS that employed both women and men. They found that in occupations (e.g., data entry) that had equal numbers of women and men, the risk for the development of CTS was equal. However, they also found that women tended to be employed in more high risk occupations for the development of CTS than men, therefore they had a higher incidence of CTS.

Several studies that related to the fish processing industry only examined female fish processing workers. They were compared to women in other occupations. The results of these studies found that women in the fish processing industry were at greater risk of developing WMSDs of the upper extremity than women in different occupations, such as office workers (Ohlsson et al., 1994; Olafsdottir & Rafnsson, 2000).

There was limited discussion in the literature on the symptoms associated with WMSDs, regardless of gender. Pain intensity was the symptom most often studied in women and men with WMSDs and this pain ranged from mild to very severe (Dahlberg et al., 2004; de Zwart et al., 2001; Neis & Williams, 1993; Nordander et al., 1999; Ohlsson et al., 1994; Strazdins & Bammer, 2004). The pain experienced by employees with WMSDs has been documented to affect their ability to function normally and perform daily tasks (Dale et al., 2003; Keogh et al., 2000; Ratzon et al., 1998).

WMSDs and Seafood and Fishing Industries

There were no studies located in the databases that were searched on the topic of crab or seafood processing industries and WMSDs. As a result the search was expanded to include literature related to fishing and the fish processing industry. This decision was based on the knowledge that the work performed is somewhat similar while the physical environment of this industry is very similar to that of the crab industry. As such, the research on this industry was believed to provide information relevant to the crab industry. Even with this expanded search, there was limited research found concerning WMSDs in the fishing and the fish processing industries.

Of the few studies found that examined those employed in fish processing and WMSDs (Chiang et al., 1993; Neis & Williams, 1993; Nordander et al., 1999; Ohlsson et al., 1994; Olafsdottir & Rafnsson, 2000; Palsson et al., 1998), only one was Canadian-based (Neis & Williams). The Canadian based research was a pilot study in the area of WMSDs and fish processing in Newfoundland and Labrador. The remaining studies were conducted in Iceland, Sweden, and Taiwan, three countries with high proportions of the population employed in the fishing industry. A study by Kim, Kim, Son, and Yen (2004) used both fish and meat processing employees in their sample; however, the two groups were not compared to determine if one occupation put the workers at greater risk for the development of WMSDs. Rather they were compared to employees in clerical occupations to determine which group was at higher risk for the development of CTS only. The results found that there was an increase in CTS for those in the fish processing industry. A common finding across all of these studies was that the work performed in the processing of fish places the employees at great risk for the development of WMSDs.

Four studies were found that examined men and women in the fish processing industry (Chiang et al., 1993; Neis & Williams, 1993; Nordander et al., 1999; Palsson et al., 1998). Chiang and colleagues found that both men and women working in the fish processing plants in Taiwan had WMSDs. The women in that study were more likely than the men to experience carpal tunnel syndrome and epicondylitis, but both women and men reported shoulder girdle pain. Within the study sample highly repetitive and forceful movements were shown to be associated with WMSDs. Nordander et al. found differences in the types of injuries (i.e., body location) reported by women and men in fish plants in Sweden. Men experienced more back injuries whereas women had more injuries of the upper extremities. The study reported that in that particular plant, the roles of the female workers were different from men. Thus, it was argued that job function (i.e., a female worker was more likely to work on a fish processing line than a male worker) could potentially explain gender differences found in the prevalence of WMSDs. In addition, psychosocial issues were identified (e.g., stress, lack of social support, increased external and family responsibilities) as playing a role in the development of WMSDs. Similarly, the Newfoundland and Labrador study by Neis and Williams, found that the men and women differed in injuries and symptoms reported.

The study by Palsson et al. (1998) examined the amount of sick leave taken by male and female fish processing workers in Sweden and compared this to workers who were employed in municipal jobs. They found that women and men in the fish processing industry used more sick time than men and women in the comparison group. Female employees in the fish processing industry used more sick time for musculoskeletal complaints than did male employees. Sick time increased for both men and women the longer they were employed in fish processing and low back pain was the chief complaint across both sexes. A study by Leijon, Hensing, and Alexanderson (1998) also examined the amount of sick time that was taken by employees in Sweden. They found that women with WMSDs used more sick time than men. For example for neck and shoulder injuries, the women had twice the number of sick days than the men in the study.

In addition to the fish processing industries, several other studies conducted in the United States were found that explored fishing as it occurs on the water from a boat, and not related to the actual processing of the fish once it has been bought to shore. Even though the setting in these studies differs from that of the plant floor, the findings indicated that such employees were at risk for the development of WMSDs (Lipscomb et al., 2004; Mirka, Shin, Kucera, & Loomis, 2005). These studies revealed that job-related factors such as repetitive motions, harsh environment, vibrations, and awkward hand positioning were all factors that increased the risk of a fisherman developing a WMSD.

In terms of specific types of WMSDs, Lipscomb et al. (2004), found that lower back disorders were the most common self-reported WMSD injuries, followed by disorders of the upper extremities. Similar findings were also shown in the study conducted by Mirka et al. (2005), namely that lower back disorders were the most common reported disorder of commercial fisherman.

Table 1 provides a brief review of the research studies concerning WMSDs in the fishing and the fish processing industry. The table summarizes these studies in terms of study, study design, instruments, participants, industry, and key findings. Most of the studies presented in table 1 used the Nordic questionnaire, as the instrument for data collection on the WMSDs. The Nordic questionnaire has questions that measure general health, as well as specific questions asking about musculoskeletal symptoms (Kuorinka et al., 1987). A limitation of the Nordic questionnaire is that this questionnaire is not industry specific.

Table 1: Summary of WMSD Literature in the Fish Processing Industry

Authors	Study design	Instruments	Participants	Industry	Key Findings
Chiang et al., 1993	Cross sectional	Pre-structured interview, medical checkups, and job analysis	207 fish factory employees: 140 women and 67 men	8 fish factories in Taiwan	- Highly repetitive and forceful movements within one's job found to be associated with musculoskeletal disorders of the upper extremities. - Both men and women experienced upper limb injuries from their work in fish processing. - Women were more likely to have a Cumulative trauma disorders (CTD) than the men
Kim et al., 2004	Cross sectional	Questionnaire, physical examination with Tinel's sign and Phalen's test conducted.	69 meat and fish processing workers and 28 employees who worked in other non-processing jobs.	5 meat and food processing plants in Korea.	- Employees who worked in the fish and meat processing jobs had a much higher prevalence of CTDs than those who worked in other clerical type jobs in the plants. - No differences were found based on gender. - Concluded that the fish and meat processing industries are high risk occupations that place employees at high risk for the development of CTDs

Authors	Study design	Instruments	Participants	Industry	Key Findings
Lipscomb et al., 2004	Repeated measures. Participants were assessed at 6-month intervals for 18 months.	Nordic questionnaire administered at the initial interview. A modified version of the initial questionnaire was used at the follow up interviews (Validity of modified questionnaire was not discussed).	215 commercial fishermen.	Commercial fishing in North Carolina.	- Men (and a few women working in this industry) were at high risk for having a WMSD. - 179 of the study participants revealed that they had a musculoskeletal injury that they developed as a result of the work they performed. - Reported injuries related to the back and lower extremities. - Injuries were sufficiently severe to interfere with work and leisure activities.
Mirka et al., 2005	Quantification of biomechanical stress that is placed on the back during the work performed by crab pot fishermen.	Video of the crews performing crab pot fishing. Continuous Assessment of Back Stress (CABS) was used to determine the distribution of back stress within this group.	Two and three man crab pot fishing crews.	Commercial crab fishermen in North Carolina.	- Both two person and three person crews demonstrated the same amount of biomechanical stress to the lower back as a result of the work that they performed. - CABS is a valid way to measure biomechanical stress on the back.

Authors	Study design	Instruments	Participants	Industry	Key Findings
Neis & Williams, 1993	Retrospective	Questionnaire, interviews and self-reports.	16 men and women.	Ground fish processing plant in Newfoundland.	- Pilot study. - Both men and women reported repetitive strain injuries of the upper extremities. - These injuries were attributed to the work that the employees performed.
Nordander et al., 1999.	Cross sectional	Nordic questionnaire, ergonomic work place analysis, National Institute of Occupational Safety and Health (NOISH) guidelines for lifting, videotape recordings and physical examinations.	116 men and 206 women working in fish processing, 196 male and 322 females formerly employed in the fish processing and a comparison group of 129 men and 208 women.	13 fish processing plants in Sweden.	- Both men and women working in the fish processing industry had more WMSDs than men and women in the comparison group. - Within the group that no longer worked in the fish processing industry, women were more likely to have left the industry as a result of neck and upper limb problems.

Authors	Study design	Instruments	Participants	Industry	Key Findings
Ohlsson et al., 1994	Cross sectional	Nordic questionnaire, ergonomic workplace analysis, NOISH guidelines for lifting, physical examination.	206 women working in fish processing plants, 322 women who had left fish processing work, and a comparison group of 208 women.	13 fish processing plants in Sweden.	- Disorders of the neck and shoulders were greater for people currently employed in the fish processing plants than those in the comparison group. - Younger women were found to be at greater risk. - Stress and worry had an effect on muscle tension in women employed in the fish processing industry. This result was not found in the women in the comparison group.
Olafsdottir & Rafnsson, 2000	Cross sectional	Nordic questionnaire.	254 women currently working in the fish processing industry and 28 women who used to work in the fish processing industry.	Fish processing in plants in Iceland.	- Former workers of the plant had higher rates of musculoskeletal problems than did women currently working at the plant. - Noted that changes made at the plant to increase efficiency may have led to an increase in musculoskeletal disorders. - Reasons for leaving the fish plant not identified. - "Healthy-worker effect" (i.e. those who continue to be employed are the healthiest, hence, may be less likely to suffer from musculoskeletal disorders).

Authors	Study design	Instruments	Participants	Industry	Key Findings
Palsson et al., 1998	Historical cohort design	File information on sick leave and occupational diseases/accidents	515 women and 304 men working in fish processing factories and a comparison group of 178 women and 117 men who were employed in other occupations.	13 fish processing factories in Sweden	- The fish processing employees (both men and women) had more sick leave then those in the comparison group. - Within the fish processing employees women had more sick time then men.

Summary

WMSDs are a very complex group of disorders that have far reaching effects on the worker across a number of different industries. The literature reviewed in this chapter provides information on several different areas that are important to our understanding of WMSDs. First, physical work-related factors were identified that potentially increase an employee's risk for developing a WMSD. These risk factors included: repetitive movements of the fingers, hand, wrist, arm, and shoulder, awkward hand/arm position, vibration, low/cold temperatures, and insufficient rest time. Second, the notion that women are at greater risk of developing WMSDs than men was explored, with several suggested propositions for a potential gender effect (i.e., type of job, ergonomic factors, outside work responsibilities, help-seeking behaviour, etc.). Third, the literature examining gender differences was reviewed with the overall finding that women and men differed in the types of WMSDs that they reported. Women tend to have a greater number of neck and shoulder injuries, while for men it was elbows, wrists, and back-related injuries. Fourth, the findings concerning symptoms was reviewed, with the evidence suggesting that limited symptoms have been examined in the literature. To date, pain is almost exclusively the sole symptom examined in the WMSD literature, with no differences being reported between women and men.

Some of the research on physical/ergonomic risk factors also indicated that work organizational and sociocultural, e.g., women's roles in the home, may be important factors in the etiology of WMSDs. However, that literature was not systematically reviewed, as it was not the focus of the current study.

The final area that was reviewed pertained to WMSDs in the crab, fish processing and fish industries. The studies often compared fish processing employees to other (i.e., non-fish processing) employees to determine which group suffered from more WMSDs. A clear finding of these studies was that people employed in the fish processing industry were found to have more WMSDs than those employed in other industries.

The research conducted to date has limitations. Much of the literature reviewed did not include the conceptual framework used to guide the studies. In addition, much of the literature in the area of WMSDs was found to be descriptive in nature. In some cases the samples were also small and lacked sufficient numbers of women and men to examine gender effects. In addition sampling and selection of participants varied among studies, with some just examining women, while others included men and comparison groups of employees outside of the fish processing industry.

Through the course of the literature review, several important gaps were noted. First, the literature did not include any studies specifically examining the crab processing industry. Rather, much of the literature reviewed was based in the fishing and fish processing industries. While these industries may be similar to crab processing, there could be differences that may affect the ability to generalize the results of the reviewed literature to crab processing. Therefore, it is important to conduct research within the crab processing industry to determine if the employees in this industry are at risk for the development of WMSDs. A second gap identified was that only one of the reviewed studies was based in Canada, namely Newfoundland and Labrador. The majority of the studies were conducted in Europe. As the employees and the working conditions may differ in other countries, generalizing the results of European studies to Newfoundland

and Labrador may be difficult. A third gap concerns the limited amount of information concerning the types of symptoms reported by workers with WMSDs. A final gap is the limited number of studies that have examined gender differences in the fish processing industries. These gaps in the literature provide additional support for both the timeliness and relevance of this thesis for both OHN and nursing research.

Chapter 3

Methodology

This chapter describes the methodology used for this study. It will start with a brief overview of the broader research program and how the present thesis fits into this program. Included is a brief description of the plant in order to provide a context to the study. This will be followed by a discussion of the study design, instruments used, recruitment and sample, data collection, data analysis, and ethical considerations related to this study.

Broader Research Program

This study is part of a larger integrated case study on WMSDs in the crab processing industry involving a biomechanical engineer, ergonomist, and nurse sociologist as the principal investigators. It is part of a larger funded research program on occupational health and safety in marine and coastal environments (http://www.safetynet.mun.ca). The research is funded under the Community Alliance for Health Research Program by the Canadian Institutes for Health Research. The larger study employed principles of participatory ergonomics. Participatory ergonomics is an intervention used in workplaces to actively engage workers in the process so they can decrease risks associated with physical work (Laing et al., 2005). The research consisted of three interrelated research foci, which are concerned with the overall prevalence, contributing factors to the development of, and prevention of WMSDs in crab plant processing workers. First, the ergonomic part of the study focused on two main work processes (i.e., butchering and packing) as anecdotally these two areas were identified by the Health and Safety Committee as having the highest rate of WMSDs at the plant where the study was conducted. This part of the study consisted of a detailed observation of work processes and task analysis associated with the job of packing and a detailed observation of the butchering process. With their consent, packers were videotaped. The tapes were digitalized and analyzed in detail. The videos and the findings of the video analysis were shown to the worker and in depth interviews were conducted. Second, in the biomechanical section, the researchers examined how force during butchering affects particular muscles in the upper body. The workers who participated in this part of the study were also interviewed about their work techniques and any WMSDs they had. Third, was a survey employed to document the prevalence of WMSDs among the workers, symptoms they experienced, some of the health, workplace, i.e., work organization and physical layout of the plant, and psychosocial factors associated with these disorders, and some of the effects these disorders have had on the workers. The survey was designed in part to obtain information on some of the physical, psychosocial, work, and individual factors that might put an employee at risk for WMSDs.

Description of Plant

The plant where the study was conducted is located in the central part of the island of Newfoundland and Labrador. It is a large modern plant that is well kept. Crab processing is the main work that occurs at the plant but there is also a small groundfish operation. Most of the processing consists of preparing crab-sections to be shipped to Asian countries for secondary processing. However, a small amount of crabmeat is produced. All processing work at the plant is seasonal, usually running from April until September or October depending on supply and demand and legislation governing quotas of crab and opening and closure of the various fishing zones. The workforce is generally stable with very few new workers coming into the plant each season. This has resulted in an older workforce at the plant. The workers generally know each other as they have worked together for a long period of time and come from the same geographical area.

There is a very active Health and Safety Committee at the plant consisting of workers, union representatives, and management who meet at regular intervals, keep minutes, review these minutes to document that appropriate actions have been taken of any health or safety concern. Thus there is overall good tripartite involvement in health and safety and working relationships have been characterized as "good" by all three groups. The management of the plant was open and cooperative about the research into WMSDs. They facilitated and supported the research in any way requested. No restrictions were placed on the research activities, in fact the plant contributed in kind to the research by allowing videotaping, filming, and interviewing at work.

During the crab season the work is uncertain and intense because poor weather and unpredictable catches can affect the timing and amount of crab delivered to the plant. The crab needs to be processed as quickly as they are delivered to the plant to ensure that they are in optimal condition. This can mean some very busy work periods at high production times in the season. The workers are then subjected to long hours and many times these are irregular hours, although the plant tries to maintain a day and an evening shift. There are many factors related to supply of crab that the workers cannot control, such as poor weather and size of catch. Workers in crab processing are subjected to cold and wet conditions because of the nature of the product they work with and our plant is no exception. It can be warm on hot days in the summer but every effort is made to ensure good ventilation. Likewise ventilation is used to minimize the exposure to steam from cooking the crab for processing to decrease the exposure to crab allergens. Processing work is done at workstations in assembly line fashion. Floors are concrete and sloped to allow for good cleaning and drainage, however, this makes the floor uneven in places. Mats are provided to workers who need extra height to reach the crab on assembly lines or if standing on concrete is a problem for the worker. Much of the plant is automated with conveyor belts delivering the crab to the workers. However many of the work processes required to prepare the final product require repetitive movements, forceful actions, twisting, and heavy lifting. Workers are required to stand at the conveyor belts working for long periods of time in a cold and wet environment. The management of the plant make continual changes to workstation design to improve both efficiency and to assist the workers. While efforts have been instituted to help the worker, they are still exposed to a number of risk factors for the development of WMSDs.

Study Design and Instruments

The broader research study is an integrated case study on WMSDs in the crab processing industry that used a participatory ergonomics approach. The worker survey, a subset of this case study, and which provided the data for the present study consisted of three research instruments.

Survey Research Study Instruments

A survey was used to collect data for the third focus of the broader study (i.e. to document the prevalence of WMSDs among crab processing workers symptoms they experienced, some of the health, workplace and work organization, and psychosocial factors associated with these disorders, and the effect these disorders have on the workers). This survey consisted of three instruments: the Cumulative Trauma Disorder

(CTD) survey, The SF-12v2™, and The DASH Outcome Measure Questionnaire. A copy of the survey used in the survey can be found in Appendix A. The CTD survey was designed by the principal investigators of the larger study and included input from graduate students and members of the Health and Safety Committee working on the project. The questions were derived mainly from observations of workers and the work processes they employed at the plant in the study, as well as detailed interviews with individual workers and groups of workers in various areas of the plant, over time. Some questions were modified with permission from existing surveys or were based on the literature. Once the questions were developed, they were reviewed by the Health and Safety Committee members at the plant to ensure face and content validity. The Health and Safety Committee consisted of 10 employees from the plant, and included representatives from management, union, and plant workers. The CTD survey also included any questions the Health and Safety Committee members felt were important to be explored. Wording of items were carefully designed and chosen and based on terminology that was understandable to plant workers.

The second part of the survey was the SF-12v2™. This questionnaire is a general health survey that is widely used. It consists of 12 items that measure general physical and mental health. This instrument has been demonstrated to have reliability and validity (Ware, Kosinski, Turner-Bowker, & Gandek, 2004). In addition, norms have been established by age group and gender and for different medical conditions.

The third and final part of the survey was the Disabilities of the Arm, Shoulder and Hand (DASH) outcome measure (Solway et al., 2002). This was used to measure the level of disabilities that employees reported as a result of their injuries. The DASH is a measurement tool, developed by orthopedic surgeons and the Institute for Work and Health to measure the level of disability in individuals with upper extremity WMSDs (Hudak, Amadio, & Bombardier, 1996). The DASH was developed in 1993 and has been used in many studies investigating upper extremity disorders. As a result of its frequent use in different settings, it has been shown to be a valid and reliable tool. In terms of reliability, the DASH has test-retest reliability and internal consistency. Face, content, criterion and construct validity have also been established for the DASH (Beaton, Davis, Hudak, & McConnell, 2001; Solway et al.). The DASH consists of 30 questions, which measure the level of disability on every day common activities (i.e., dressing, making bed, etc). These questions are measured on a likert type scale from 1 to 5 (1= no difficulty, 5=unable). There are also two optional sections on the DASH, which measure disability on additional activities such as music and sport.

The Health and Safety Committee members at the plant reviewed and approved all measurement instruments and support was given for the study to proceed. The committee requested that the questionnaire be administrated in person by trained research assistants from outside the local area, as they were aware of the sensitivity of the data and a need for confidentiality. Permission was obtained from the committee to use a second research assistant, a health professional from the area, as this person was considered to be already privy to confidential information concerning the employees at the plant.

Thesis Research Items and Instrument

The research for this thesis is largely exploratory, descriptive, and correlational in design. More specifically, I conducted an analysis of selected data collected from the survey part of the larger research study. The data used in this thesis research study include items from the CTD questionnaire (see Appendix A) and the complete DASH outcome measurement tool. The specific questions used from the CTD questionnaire include:

- CTD A6. *What job did you get last season?* The participant was asked to state his/her most recent and frequent role within the plant. The roles within the plant were then coded and the coding was then collapsed to represent the main job categories of respondents, such as butcher, packer, crabmeat processor, lifting pans, and a miscellaneous category (miscellaneous category was made up of all other job categories at the plant that had limited number of workers).
- CTD B6. *Did your job require you to: stand for periods of time, etc.?* There are 13 different job requirement statements, which measured the frequency that employees had to perform certain requirements. A 5 point scale (1= never, 5 = all the time) was used to rate the frequency that an employee had to perform specific job requirements and exposure to specific physical/ergonomic factors. An additional part to this question was specific to those employees who answered 3 to 4 of the statements. They were asked to describe if they were experiencing any difficulties as a result of the job requirements that they indicated that they had to perform.
- CTD C4. *While working in the plant during the past year and not related to any accident or single incident, have you experienced any pain,*

tingling, numbness, aching, stiffness, aching, stiffness, burning, swelling or loss of movement to any part of your body? The employee had to indicate yes or no. This question was used to capture those injuries that the participants felt were a result of their work and not caused by another factor such as a previous injury or accident. If yes, the participant was directed to answer C5.

- CTD C5. *If yes, describe and use the body chart to locate the area: (number each problem; if more than one, use that number to indicate the area on the body chart*). This question allowed the participants to describe their symptoms and identify the specific site on the body that was injured as recorded on a body chart (part B). For each area of the body affected the injury was explored in detail.
- CTD C11. *Have you ever had to take time off work for any of these problems?* Used to determine the amount of time lost by the workers for WMSDs.
- CTD E1. *Sex of participant.* This question was used to determine the number of women and men participating in the study. This category was used in many of the statistical tests that were conducted to determine if any gender differences were present in the study population.
- CTD E2, E3, E4, E7. These additional questions were used to gather demographic data on the study participants.

Recruitment and Sample

In order to recruit employees to take part in the CTD survey, a letter from the researchers was distributed to all employees working in the processing area at the plant. Management, office staff, and processing supervisors, was not included in the recruitment or sample. The letters were either given directly to these employees with their pay cheques or sent out to the employees via mail. The letter stated the purpose of the study and what the employees would have to do in order to participate (Appendix B, Letter of purpose). Most of the workers would have been familiar with aspects of the study as the primary investigators had spent a number of days at the plant familiarizing themselves with the work organization and work processes. Some workers had volunteered for other parts of the study.

After a period of time (i.e., a few days) from when the employee would have received their letter of invitation to take part in the study an office employee designated as the primary contact person called each employee to see if they were willing to be interviewed. Participation in the study was voluntary. Those employees who agreed to participate in the study were asked if their name and home phone numbers could be given to the research assistant coordinating the study. Once permission was obtained, the employee contact information was given to the research assistant. The research assistant then phoned those who agreed to participate in the research in order to set up a convenient time and place to conduct the interview.

The primary contact person phoned a total of 316 employees and each was invited to participate in the study. Out of the 316 employees she attempted to contact by phone, 8 could not be reached because they were no longer in the province, 21 were left messages that they did not return, and 174 declined participation in the study. Therefore 203 employees did not participate in the survey. The remaining 113 employees contacted agreed to participate in the survey, however, the research assistant was unable to reach 6 of these employees despite multiple attempts to call them. In total, 107 crab processing workers completed the survey.

The time of year, relative to the work year, was a factor in determining whether an employee was willing to participate in the survey. When the primary contact person called employees shortly after they were laid off for the season, the employees were generally more willing to participate. If the employees had been laid off for a longer period of time, they were less likely to agree to participate in the study when contacted. A possible reason for this lack of participation could be the fact that the crab-processing season starts in the spring and does not finish until fall. During this time the employees are very busy with work-related activities and once the season finishes, they try to complete activities and tasks that were delayed due to the busy work season. Also, some of the employees move from the area and others do not want to participate in anything that is considered work- related. The final number of employees who agreed to participate in the study and set up an interview session with the research assistant was 107, giving an overall response rate of 34%.

Data Collection

Two research assistants were trained for data collection but because of the low response rate, all but 15 interviews were conducted by the primary research assistant. This research assistant ensured that the recording of information by the second research assistant was done systematically. The survey data were collected using face-to-face interviews. Advantages of surveys collected using face-to-face interviews include that participants can ask questions if they misunderstand questions and questions are not missed or skipped (Saks, 2000). The first face-to-face survey was conducted on October 15, 2004; the last took place on December 1, 2004, approximately 6.5 weeks later. The interviews were conducted during the week, unless another time was more convenient to the participant. Due to the geographical area where the crab plant is located, and the fact that employees lived in 17 different communities in this area, the research assistant spent a considerable amount of time driving to interview sites.

Data Analysis

Once collected, the data were coded and entered into SPSS (Statistical Program for Social Sciences) for analysis. Data were then checked for any errors. Given the nature of the research and many of the items contained in the survey that was used for the data collection, the statistical analyses were largely descriptive in nature. Analyses consisted mainly of frequencies, means, standard deviations, cross tabulations, and correlations. In the case of correlation, the non- parametric statistic, Kendall's tau-b, was used, given the nature of the data, in that a key variable (gender) was dichotomous (Weinberg & Abramowitz, 2002). T-tests were conducted on the data collected by the DASH measurement tool. The final test performed was a binary logistic regression in order to determine the likelihood the different factors contributed to the development of a WMSD.

Ethical Considerations

The entire research was carried out in accordance with the *Tri-Council Statement: Ethical Conduct of Research Involving Humans* (TCPS, 1998). As required, the study received ethical approval from the Human Investigation Committee (HIC) at Memorial

University of Newfoundland. Participation by employees in the study was voluntary and each employee was assured confidentiality in that no individual data would be published or released. Prior to beginning the interview, each participant was asked to sign a consent form (see Appendix C. participant consent form). This consent form provided each participant with information as to what he or she was agreeing to participate in and ensured each participant that the information given would be kept confidential and that no individual data would be released or published. Each participant was also given contact information for the principal investigators and HIC. As a researcher, I worked with a denomalized data file. In addition, I signed an oath of confidentiality (see Appendix D, Confidentiality form).

Chapter 4

Findings

In this chapter, the findings of this study will be presented. First, a general description of the sample is presented. Second, the findings of the data related to type of upper body WMSD, symptoms, and gender differences are presented. Third, the findings examining physical/ergonomic factors (e.g., hand movements, standing, repetitive motion) and their potential role in the development, or risk of development of these WMSDs are presented. Fourth, the findings of the DASH are examined. Finally, the findings of a binary logistic regression, which was used to examine factors that may increase the likelihood of an upper body WMSD are reviewed.

Participants

The total number of employee participants was 107 (74 women and 33 men). The mean age of all participants was 48 years (*SD* = 6.4). A breakdown of age by gender revealed that the mean age for women was 48 years (*SD*= 6.21) and the mean age for men was 47(*SD* =6.92). Most of the participants were married or living with a partner (97% women; 91% men) and most had between one and two children (60% women; 58% men). The educational level of the participants was similar, 45% women and 30% men reported that they had not completed high school, 43% women and 53% men reported high school as their highest level of education and 12% women and 15% men reported that they had completed a program at a vocational and/or technology institute. Table 2 provides a description of the participants based on gender. Given the importance of gender in this study, cross tabulations were conducted to determine if men and women differed on the demographic variables. As the demographic variables reported in table 2 were nominal or ordinal (i.e., all demographic variables were recorded as categorical versus continuous measures), crosstabs were deemed appropriate as recommended by SPSS (SPSS, 2001). Note that age χ^2 (5, n =107)= 6.86, p>.05, martial status χ^2 (2, n= 107)= 2.25, p>.05, number of children χ^2 (3, n = 107) = .72, p>.05 and educational levels χ^2 (2, n = 107) = 1.90, p>.05 did not differ between men and women.

Table 2: Characteristics of Participants by Gender

Characteristics	Women (n=74)	Men (n=33)
Age groups in years		
35-44	21 (28%)	14 (42%)
45-44	39 (53%)	14 (42%)
55-59	14 (19%)	4 (12%)
60 or more	0 (0%)	1 (.03%)
Martial Status		
Single	1 (.01%)	1 (.03%)
Married/Common Law	72 (97%)	30 (91%)
Widowed/Divorced	1 (.01%)	2 (.06%)
Education		
< High school	33 (45%)	10 (30%)
High school	32 (43%)	18 (53%)
Voc/tech	9 (12%)	5 (15%)
Number of Children		
0	2 (3%)	2 (6%)
1-2	44 (60%)	19 (58%)
3	21 (28%)	9 (27%)
4 or more	7 (9%)	3 (9%)

The main occupations or the primary occupations of the participants during the past season included butcher, packer, crabmeat processor, lifting of pans, and a general miscellaneous category (all other roles). Of the 107 employees, 21 were employed as primarily butchers (9 men and 12 women), 37 were packers (all women), 15 were employed as crab meat processors (4 men and11 women), 14 employees lifted/carried pans (9 men and 5 women) and 23 employees had a variety of occupations within the plant (13 men and 10 women). Table 3 presents a summary of the main jobs that were performed within the plant by gender. An examination of this table suggests that the type of jobs performed by women and men differed. For example, 27% of the men were employed to lift or carry pans while 100% of packers were women. No men work as packers in the plant as this is one of the work processes that employ all women. In the original dataset, the main job performed last year was a single measure.

To test whether each type of job performed at the plant differed by gender a series of dichotomous variables were created, one for each job type (i.e., butcher, packer, crab processor, pan lifter, and misc.). Following the advice of Weinberg and Abramowitz (2002), cross-tabulations were then conducted, as the occupational variables in question were nominal, more specifically dichotomous. The findings revealed that the number of people employed as packers χ^2 (1, n = 107) = 25.22, p = .000 and pan lifters χ^2= (1, n=107) = 8.44, p = .006 did differ by gender. No other job differences were found by gender.

Table 3: Primary Occupation Within the Plant by Gender

Occupation	Male (n=33)	Female (n=74)	Total (n=107)	Pearson Chi-Squared
Butcher	9 (16%)	12 (27%)	21 (20%)	1.77
Packer	0	37 (50%)	37 (35%)	25.22***
Crab meat processor	5 (10%)	7 (15%)	12 (11%)	.74
Lifting pans	9 (27%)	5 (7%)	14 (13%)	8.44**
Miscellaneous	13 (18%)	10 (15%)	23 (17%)	2.19

Note:
* = significant at p<. 05
** = significant at p<. 01
*** = significant at p<. 001

Type and Occurrence of Upper Body WMSD

To examine whether each injury type differed by gender, six dichotomous variables were created, with one for each injury type (e.g., neck, shoulder, arms, wrist, hands, and elbow). Consistent with Weinberg and Abramowitz (2002), cross-tabulations were used, as the variables in question were dichotomous (see Tables 4 and 5). As such, parametric statistics, which assume normal distribution and interval or ratio data, could not be used.

As shown in Table 4, while both men and women had very high levels of WMSDs of the upper body, there was no difference in the occurrence of these WMSDs in men versus women χ^2 = 1, n=107) = 1.32, *p.* =.25.

Table 4:Cross-tabulations: Upper Body WMSD Occurrence by Gender

Injury Status	Male (n=33)	Female (n=74)
Presence of injury	24 (73%)	61 (82%)
Absence of Injury	9 (27%)	13 (18%)

However, Table 5, which presents a summary of upper body WMSD by injury location and gender, did reveal a few significant differences. Pearson chi-square analyses revealed that female workers were more likely to report a neck injury χ^2 (1, n = 107) = 5.43, p = .02 than male workers. In contrast, male workers were more likely to have an injury to their arms χ^2 = (1, n = 107) = 5.14, p = .02) relative to their female counterparts. No other significant differences were found (see Table 5).

Table 5:Cross-tabulations: Upper Body WMSD Location by Gender

Injury Location	Female (n=62)	Male (n=24)	Pearson Chi-Squared
Neck	22 (30%)	3 (9%)	4.58*
Shoulder	39 (53%)	12 (34%)	2.44
Arms	9 (12%)	10 (30%)	5.14*
Wrist	11 (15%)	4 (12%)	.14
Hands	32 (43%)	15 (45%)	.04
Elbow	10 (13%)	5 (15%)	.05

Note:
* = significant at p<. 05

Cross-tabulations were then conducted to determine if there was any association between the type of work performed and whether the employee performing that work had a WMSD of the upper body. Again, cross-tabulations were conducted as the presence of injury is a dichotomous variable and each occupation was examined separately. The findings are presented in Table 6. A review of the frequencies suggests that the level of injuries across jobs is relatively high with 86 (80%) employees self-reporting an upper body injury. A closer examination of the frequencies and percentages revealed that packers (87%) had the highest rate of injury followed by those lifting and carrying pans

(86%). Cross-tabulations failed to detect differences in the presence of an upper body WMSD among the different occupations.

Table 6: Presence of Upper Body WMSD by Primary Occupation

Occupation	Injury	No Injury	Pearson Chi-Squared
Butcher (n=21)	15 (72%)	6 (28%)	1.03
Packer (n=37)	32 (87%)	5 (13%)	1.72
Crab meat processor (n=12)	9 (75%)	3 (25%)	.16
Lifting pans (n=14)	12 (86%)	2 (14%)	.39
Miscellaneous (n=23)	17(74%)	6 (26%)	.55

Note:
* = significant at p<. 05
** = significant at p<. 01

Symptoms

The second research question was whether women and men with upper body WMSDs who worked at the crab processing plant differed in the symptoms they reported. In an attempt to answer this question, cross tabulations were used. Again, this decision was made consistent with the recommendations of Weinberg and Abramowitz (2002), as the variables involved, namely gender and symptoms, were nominal and dichotomous in nature. Table 7 summarizes the number of men and women who reported six, specific symptoms as well as the Pearsons chi-square statistics. A review of the findings indicates that there was one significant difference in the types of symptoms reported by the women and men. Women were more like to report pain χ^2 $(1, n = 107) = 62.13, p = .013$ than were the men.

In addition a review of the findings revealed a high level of symptoms reported with 207 different symptoms across the 107 employees. The findings further revealed that the top three symptoms for women were: pain (50%), burning (30%), tingling (28%)

and numbness (22%). The top symptoms for men were slightly different with numbness and tingling (36%) equally most frequently reported followed by aching (30%) and pain (24%). Men and women experienced high levels of multiple symptoms 62% of women had 2 or more symptoms compared with 60% of the men. The difference was not statistically different.

Table 7: Cross-tabulations: Symptoms by Gender

Symptoms	Female (n=66)	Male (n=27)	Pearson Chi Squared
Pain	37 (50%)	8 (24%)	6.21*
Aching	15 (20%)	10 (30%)	1.28
Tingling	21 (28%)	12 (36%)	.68
Numbness	16 (22%)	12 (36%)	2.57
Swelling	10 (14%)	6 (18%)	.39
Burning	22 (30%)	4 (12%)	3.85
Pain	15 (22.7%)	4 (14.8%)	.39

* = significant at $p < .05$
** = significant at $p < .01$
*** = significant at $p < .001$

Physical/Ergonomic Risk Factors

The third research question in this study set out to identify selected physical/ergonomic risk factors in the work environment and the correlation between these risk factors and the presence of WMSDs. As previously noted in chapter 2, the literature has indicated that various physical factors can increase an employee's risk for the development of a WMSD.

In an attempt to determine whether there was a relationship between physical/ergonomic risk factors and WMSDs, participants were asked to assess how often they were required to perform certain activities or motions during their work. For these questions, frequency was assessed on a four point scale (*1=never* and *4=all the time).*

Table 8 presents a summary of the self-reported physical demands of work by gender. For the purposes of presentation in Table 8, the scale was collapsed to never/from time to time (former points 1 and 2) and fairly often/all the time (former scale points 3 and 4). Categories were collapsed because there were categories that did not contain any data. Also note that the "other" category captures such activities as reaching and stretching for objects, twisting and gripping, and pulling.

As seen in Table 8, the majority of participants reported multiple physical demands. Ninety seven percent (97%) of women who participated in the study reported that their positions required standing for long periods of time, ninety five percent (95%) engaged in repetitive motions, eighty one percent (81%) were exposed to loud noises and seventy percent (70%) used precise hand movements. The men in the study reported being exposed to similar risk factors as the women, but with different weighting. For men, eighty five percent (85%) engaged in repetitive motions, seventy three percent (73%) stood for long periods of time, sixty percent (60%) were exposed to loud noises and fifty four percent (54%) used precise hand movements.

Table 8: Physical Demands of the Job by Frequency and Gender

Demand	Women	Men	Demand	Women	Men
Long Periods of Standing			*Cold Environments*		
Never/From time to time	2 (3%)	9 (27%)	Never/From time to time	64(87%)	28(44%)
Fairly often/ All the time	72(97%)	24(73%)	Fairly often/ All the time	10(13%)	5(15%)
Repetitive Motion			*Loud Noises*		
Never/From time to time	4(5%)	5(15%)	Never/From time to time	14(27%)	13(39%)
Fairly often/ All the time	70(95%)	28(85%)	Fairly often/ All the time	60(81%)	20(60%)
Heavy Lifting			*Fumes/Chemicals*		
Never/From time to time	61(83%)	20(63%)	Never/From time to time	24(34%)	20(60%)
Fairly often/ All the time	13(18%)	12(36%)	Fairly often/ All the time	50(67%)	13(39%)
High Speed			*Vibrations*		
Never/From time to time	27(36%)	18(54%)	Never/From time to time	60(81%)	21(64%)
Fairly often/ All the time	47(63%)	15(45%)	Fairly often/ All the time	14(19%)	12(36%)
Awkward Positions			*Forceful Exertions*		
Never/From time to time	49(66%)	24(72%)	Never/From time to time	45(61%)	23(69%)
Fairly often/ All the time	25(34%)	9(27%)	Fairly often/ All the time	29(40%)	10(30%)
Precise Hand Movements			*Continuous Watching*		
Never/From time to time	22(30%)	15(45%)	Never/From time to time	31(44%)	26(79%)
Fairly often/ All the time	52(70%)	18(54%)	Fairly often/ All the time	43(58%)	7(21%)
Other					
Never/From time to time	50(68%)	24(73%)			
Fairly often/ All the time	10(14%)	4(12%)			

After examining the descriptive statistics (namely, the frequencies) of the physical/ergonomic risk factors, relationships between these factors and the occurrence of upper body WMSDs were examined. Given that each environmental factor was assessed on an ordinal scale, and the presence of a these WMSDs was measured dichotomously, two-tailed non-parametric correlations were conducted following the recommendations of Weinberg and Abramowitz (2002). This was done in an attempt to answer research question three, namely: are there physical/ergonomic risk factors in the work environment that are associated with the presence of WMSDs? Table 9 (pgs. 55 & 56) reports the frequency of each risk factor as well as the inter-correlations (using Kendall's tau-b) between risk factors and presence of an upper body WMSDs. As shown in Table 9, jobs that require~~,~~ repetitive motion ($r = .21, p < .05$), working at high speeds ($r = .26, p < .01$), and using precise movements of the hands and finger ($r = .23, p < .5$) are associated with the presence of WMSDs. In addition, jobs with loud noises ($r = .17, p < .05$), displayed a correlation that approached significance, indicating that there may be a relationship between this physical/ergonomic risk factor and the presence of a WMSDs.

Other physical/ergonomic risks, such as continuous standing, heavy lifting, cold environments, exposure to fumes/chemical, vibrations, awkward positions, forceful exertion, and continually watching (i.e., sustained concentration) did not demonstrate any statistical significance. While there were no statistically significant findings based on gender, it was previously found that a higher proportion of women reported more exposure to the three physical/ergonomic risk factors that correlated with the presence of an injury relative to men (namely, repetitive motion, use of precise hand movements, and working at high speed). A closer examination of the correlation matrix revealed that many of these factors were intercorrelated. For example high speeds correlated significantly with nine other risk factors. Overall, these findings suggest that some employees are exposed to several risk factors. This multiple exposure to risk factors is known to increase the likelihood of an employee developing a WMSD (Bernard, 1997).

Table 9: Correlation between the Presence of an Upper Body WMSD and Exposure to Selected Physical/ergonomic Factors

Variable	Count N=107	1	2	3	4	5	6
Presence of WMSD	85 (79%)						
Standing	104 (97%)	.17					
Repetitive motion	105 (98%)	.21*	.44***				
Lifting	76 (71%)	-.02	.11	-.11			
Cold environment	63 (59%)	.02	.09	.08	.19*		
Loud noises	100 (93%)	.18	.26**	.23**	.04	.08	
Chemicals/Fumes	95 (89%)	.13	.23**	.14	.05	.02	.39**
High speeds	88 (82%)	23**	.17*	.24**	.17+	.17+	.23**
Exposure to vibrations	49 (46%)	.10	.06	.01	.07	.2*	.22*
Awkward positions	74 (69%)	.14	.01	.03	.14	.07	.26**
Forceful exertion	76 (71%)	.09	.18*	.09	.25**	.15	.13
Precise movements of hands and fingers	87 (81%)	.23*	.26**	.20*	-.01	.02	.3**
Continually watching an object	72 (67%)	.11	.27**	.25**	-.15	.17	.31**
Other	17 (16%)	.09	.12	.27**	-.18*	.14	-.14

Note:
* = significant at p < .05
** = significant at p < .01
*** = significant at p < .001

Table 9: Correlation between the Presence of an Upper Body WMSD and Exposure to Selected Physical/ergonomic Factors

Variable	Count N=107	7	8	9	10	11	12	13
Presence of WMSD	93(87%)							
Standing	104 (97%)							
Repetitive motion	105 (98%)							
Lifting	76(71%)							
Cold environment	63(58.9)							
Loud noises	100 (93%)							
Fumes	95 (89%)							
High speeds	88 (82%)	.25**						
Exposure to vibrations	49 (46%)	.12	.14					
Awkward positions	74 (69%)	.07	.14	.28**				
Forceful exertion	76 (71%)	.09	.32**	.21*	.28**			
Precise movements of hands and fingers	87 (81%)	.17*	.29**	.21*	.21*	.17*		
Continually watching	72 (67%)	.27**	.35**	.24**	.07	.31**	.49**	
Other	17 (16%)	-.03	.03	-.03	-.26**	.01	-.03	16

Note:
* = significant at p < .05
** = significant at p < .01
*** = significant at p < .001

Given the significant correlations between many of these physical/ergonomic risk factors and the presence of an upper body WMSD, an analysis was conducted to see if male and female employees differed in terms of their exposure to such environmental physical/ergonomic risk factors. As the physical/ergonomic risk factors were measured on an ordinal scale, non-parametric Mann-Whitney U tests were conducted following the guidance of Weinberg and Abramowitz (2002). The mean rank, by gender, and Mann-Whitney U statistics are presented in Table 10. The findings revealed that females were more likely to report that their job required long periods of standing (Mann-Whitney U = 822.00, p<. 001), exposed them to loud noises (Mann-Whiney U = 765.50, p<. 001) and chemicals/fumes (Mann-Whitney U = 815.50, p<. 01), required them to use precise hand and finger movements (Mann-Whitney U = 865.50, p<. 01) as well as continually watch objects (Mann-Whitney U = 680.00, p<. 001) relative to men. Moreover, female workers exposure to high speed work approached significance (Mann-Whitney U = 951.50, p<. 06). Note that many of these risk factors more frequently reported by women were also found to correlate significantly with the presence of upper body injury in Table 9.

Table 10: Physical/Ergonomic Factors by Gender

Environmental Factor	Mean Rank Female (n=66)	Mean Rank Male (n=27)	Mann-Whitney U
Standing	59.39	41.91	822.00***
Repetitive motion	56.45	48.50	1039.50
Lifting	50.60	60.20	969.50
Cold environment	54.11	53.76	1213
Loud noises	60.16	40.20	765.50***
Fumes	59.48	41.71	815.50**
High speeds	57.64	45.83	951.50+
Exposure to vibrations	52.43	57.53	1104.50
Awkward positions	56.37	48.68	1045.50
Forceful exertion	56.26	48.92	1053.50
Precise movements of hands and fingers	58.80	43.23	865.50**
Continually watching	61.31	37.31	680.00***
Other	55.32	51.03	1123.00

Note:
+ = significant at p< .10
* = significant at p < .05
** = significant at p < .01
*** = significant at p < .001

The last research question concerned the level of disability in the affected employee as measured by the DASH outcome measure tool. More specifically, it examined whether

WMSDs affected normal functioning, as assessed by DASH, and the extent to which DASH scores differed by gender. As the DASH is a continuous variable, and gender is dicotomous, two-tailed t-tests were conducted following the recommendations of Weinberg and Abramowitz (2002). The two-tailed t-test was used because it was not certain how the WMSDs would affect gender on the particular items measured in the DASH. Specifically, these t-tests examined whether overall DASH, the sports DASH and the work DASH differed by gender. The means and standard deviations of these DASH scores, by gender, are presented in Table 11. While the findings suggest that women have higher DASH scores than men across all three DASH measures, and thus higher levels of dysfunction, no significant differences were found by gender.

Table 11: DASH Findings by Gender

	Female (n=74)	Male (n=33)	T-Statistic
DASH-Total	16.43 (16.81)	12.59 (18.56)	1.06
DASH-Work	64.20 (27.49)	58.27 (31.79)	1.52
DASH-Sports	15.37 (19.82)	10.23 (17.24)	1.29

Notes: Means with standard deviations in parentheses
+ = significant at p< .10
* = significant at p < .05
** = significant at p < .01
*** = significant at p < .001

The final analysis consisted of a binary logistic regression in an attempt to examine factors that may increase the likelihood of an upper body WMSD when examining multiple variables at once. This form of regression was chosen, consistent with the guidance provided by SPSS (2001), as it is the appropriate form of regression when the dependent variable is dichotomous. In this case, the dependent variable was the occurrence of an upper body WMSD (yes/no) and the independent variables were age, number of weeks worked during the season, and four dichotomous job measures (i.e., butcher, packer, crab meat processor, and lifting pans). Note that consistent with this form of regression, one job category (i.e., miscellaneous) was excluded as it represented the reference category for the regression. The miscellaneous category was excluded as it captured multiple roles while the remaining four job codes were specific to a single job within the plant. Overall, the binary regression revealed that none of the independent variables were significant predictors of a person having an upper body WMSD. Thus none of these variables increased the likelihood of a person reporting such a WMSD. The findings of this regression are presented in Table 12.

Table 12: Binary Regression – Predictors of Occurrence of an Upper Body WMSD

Variable	B	S.E.	Wald	Exp (B)
Gender (male)	.38	.58	.45	1.47
Weeks worked	.09	.10	.79	1.10
Age	.01	.04	.12	1.01
Crab meat processor (miscellaneous)	.20	.83	.06	1.23
Packer (miscellaneous)	1.02	.80	1.62	2.78
Butcher (miscellaneous)	.08	.71	.01	1.09
Lifting pans (miscellaneous)	.91	.93	.96	2.49
Constant	-1.38	2.73	.26	.25

Note: Model Chi-square 4.93, -2 Log Likelihood 98.796
+ = significant at $p < .10$
* = significant at $p < .05$
** = significant at $p < .01$
*** = significant at $p < .001$

Summary

The findings show that the employees at the plant have a high incidence of upper body WMSDs, 82% of women and 73% of men. While there was no statistical difference found between the number of WMSDs between women and men, there were differences in the types of injuries reported. Women reported more neck injuries than men, while men reported more injuries to their arms. The results also revealed that those employed as crabmeat packers had the highest number of injuries, followed by those involved with lifting/carrying pans. However, no differences were found by gender.

Pain was the most frequently reported symptom, followed by tingling and numbness. Both women and men also reported that they suffered from multiple symptoms, but there were no statistically significant gender differences found. Several physical/ergonomic work factors at the plant were found to have associations with the presence of upper body WMSDs (i.e., working at high speeds, precise movements of the hands and fingers, repetitive motions, etc.). Women were found to have multiple exposures to several physical/ergonomic factors that could explain a possible reason for the women having slightly more WMSDs than men.

The level of disability found in the affected employees, was high as per the DASH outcome measure. Women had higher DASH scores but again there was no statistically significant gender difference found.

Chapter 5

Discussion

The general focus of this thesis was to explore upper body WMSDs within a sample of crab processing employees. Factors that potentially increase employees' risk factors to develop these conditions were identified, as was the level of disability that the affected crab processing employees had as a result of the problem. More specifically, the main purpose of this study was to explore if there were any gender differences in the employees at the crab processing plant related to these types of WMSDs. These gender differences were explored using four research questions: (1) if there were any differences in the types and occurrence of WMSDs reported by women and men; (2) if women and men differed in the symptoms caused by WMDSs; (3) if physical/ergonomic factors played a role in the presence of WMSDs, and (4) if the level of disability of the affected employees differed by gender.

This chapter provides a discussion of the findings and is structured as follows. The first section contains a general discussion of the upper body WMSDs found among the crab processing workers. In the second section, gender differences that were found in the study participants are discussed. Within this section on gender, there are several subsections related to the types and frequencies of WMSDs, symptoms reported by those affected, physical/ergonomic risk factors and level of disability. In the third section, I present the contributions of this specific thesis to the literature.

Crab Processing and WMSDs

The nature of the work involved in the processing of crab results in many employees being exposed to work –related factors that have been acknowledged in the literature to increase an employee's risk for the development of WMSDs. Repetitive movements of the fingers, hands, wrists, arms, and shoulders are some of the main work-related risk factors for the development of WMSDs (Brouwer et al., 2001; Dahlberg et al., 2004; Feely et al., 1995; Martin et al., 2003; Nordander et al., 1999; Ohlsson et al., 1994; Ostendorf et al., 2000). These work-related risk factors were prevalent in those employees who worked as butchers, packers, and crabmeat processors in the plant in this study. These employees had to perform many repetitive movements of their upper extremities in order to perform their assigned jobs. The findings of this thesis suggest that repetitive movements of fingers, hands, wrists, arms, and shoulders are significant factors related to the presence of upper body WMSDs among employees of the crab processing plant.

A second work-related risk factor identified in the literature is awkward hand/arm position (Crumpton-Young et al., 2000; de Zwart et al., 2001; Dortch & Trombly, 1990; Kramer, et al., 2001; Ostendorf et al., 2000). While examined in this thesis, it was not found to have a relationship with the development of WMSDs. While the employees often were required to have awkward hand/arm positions when carrying out their jobs there was no relationship (i.e., correlation) between this risk factor and presence of WMSDs in the present sample. A worker is often not aware of awkward postures and positions and exposure to this risk factor may have been underreported. In debriefing following videotaping of women on the packing line, they often said they were unaware of how much their hands and wrists or shoulders deviated from normal alignment (S. Solberg, personal communication, January 4, 2007).

Additional physical work-related risk factors that have been identified in the literature included: (1) vibration (Amell & Kumar, 2001); (2) low/cold temperatures (Strasser et al., 1999), (3) workstation configuration (Aribisala, 1993; Ostendorf et al., 2000) and (4) insufficient rest time (Amell & Kumar, 2001; Clauw & Williams, 2002; Feely et al., 1995; Haufler et al., 2000; Ratzon et al., 1998; Stock, 1991). Vibration and low/cold temperatures were not found to be significant for the participants of this study. Workstation configuration was beyond the scope of this thesis. Much of that data was collected via videotaping of the workers who agreed to participate in that part of the study. These were mainly women who worked as packers.

Insufficient rest time, while not part of this thesis, is an area that should not be overlooked. In essence, insufficient rest time plays out in two ways in this study. First, crab is processed quickly in an assembly line fashion resulting in frequent repetitive movements of the fingers, hands, wrists, arms, and shoulders. When the plant is in production, the employees work long shifts and perform multiple cycles of repetitive movements, with little rest time between cycles. In addition, the pace of the assembly line is out of the control of employees, who continue to perform their jobs even when feeling pain. They were required to ensure that the crab was processed in a timely and uniform manner to prevent spoilage and have a good product.

Second, crab processing is seasonal in nature. The season can vary in length as a result of the amount of crab available, the quota available to the plant, the market demand for crab, and the market price (News Release, 2005). As a result of this short and variable work season, the women and men employed at the crab processing plant work long shifts with little time for rest between shifts. Therefore they have little time to rest injured upper extremities before having to return to the same work environment, performing the same job tasks that may have caused the initial injury. In addition the employees at the plant may be less likely to take time off during the crab-processing season, as they will lose wages and benefits that will cover them financially when the plant is not in operation. The reluctance to take time off during the season is consistent with findings from other seasonal industries including fishing, farming, and forestry (Jeebhay, Robins, & Lopata, 2004; NIOSH, 2006).

An unexpected finding was the large number of employees who reported having an upper extremity WMSD. Of the 107 study participants, 85 employees (79%) reported having an upper extremity WMSD. This percentage appears to be on the higher end of comparable studies conducted within the fishing industry, where the percentage of employees with WMSDs ranged from 35% to 93% (Nordander et al., 1999; Ohlsson et al., 1994; Olafsdottir & Rafnsson, 2000). One of the reasons for the variation in prevalence of WMSDs has to do with how this outcome measure is collected. Some studies rely on clinical findings by a medical practitioner and others on self-reported symptoms. There is no standard approach. In the present study we went with self-reported WMSDs in that it fit within the definition for a WMSD that is generally accepted (Abbas et al., 2001; Beaton et al., 2000; Katz et al., 2000). The literature suggested that self-reporting is an appropriate approach (Schierhout & Myers, 1996) and many workers do not seek medical help with the problem. In addition workers often have symptoms (e.g., pain and numbness), with no physical clinical signs.

While the literature included discussion on the relationship between WMSDs and absenteeism (Friedman, 1997; Islam, Velilla, Doyle & Ducatman, 2001; Leijon et al., 1998; Palsson et al., 1998), this was not an issue at the plant. This group of employees worked injured, perhaps for reasons discussed earlier concerning the seasonal nature of their work and the importance of getting enough work weeks to get their employment insurance benefits. This could potentially make the injury much worse and interfere with their ability to function and heal.

A second explanation for the high number of WMSDs at the plant is that the workers have been working in the industry for a number of years and we are seeing cumulative effects. Although there has been automation introduced into the plant through the years, many of the workers can remember having to do much of the work manually. Some of the workers described how they "shook" crabmeat from crab legs on a metal plate before leg rollers were introduced. Job tenure and types of work done in the past are no doubt important factors.

Given the number of employees affected with upper body WMSDs, the processing of crab appears to place employees at high risk for the development of WMSDs. The crab processing industry, and the occupations presented in this study (e.g., butcher, packer, processors, lifter), can be added to the existing list of industries and occupations where employees are at high risk for the development of WMSDs.

In addition to the various risk factors previously discussed, the level of disability is also important to the discussion of the impact of WMSDs on affected employees. To aid this analysis, the DASH was used to measure the level of disability. The findings of the DASH indicate that the affected employees had a significant level of disability based on the high scores obtained across all three DASH measures. This appears to be the first time that the DASH has been used in the crab-processing sector to examine the level of disability in the crab processing employees. However, the DASH has been used to evaluate and document the level of disability in many different populations suffering from upper extremity disorders where it has been found to be a valid and reliable instrument (Atroshi, Gummesson, Andersson, Dahlgren & Johansson, 2000; De Smet, 2004; Gummesson, Atroshi, Ekdahl, 2003; Stiller & Uhl, 2005).

Gender Differences

The main purpose of this thesis was to explore gender differences in crab processing employees in relation to WMSDs of the upper body. This was done through a review of the following by gender: types and frequencies of WMSDs, the symptoms reported, an examination of physical/ergonomic risk factors present in the plant, and the level of disability of the affected employees.

Types and Frequencies

There were several differences in the types of injuries reported by men and women in this study. Women reported more WMSDs related to the neck. In contrast, men had more WMSDs that involved the arms. This finding is consistent with the literature reviewed in chapter two, where men and women were found to differ in the types of injuries they experienced in other work settings (Dahlberg et al., 2004; de Zwart et al., 2001; Neis & Williams, 1993; Norlander et al., 1999; Strazdins & Bammer, 2004). A possible reason for this could be the variation in jobs that men and women perform at the plant in question, which could lead to the different types of injuries that they report. The physical demands of these different jobs vary; women and men did have different jobs at the plant. For example, all the packers at the plant were women. In contrast to some of the other jobs at the plant, there are no men on the packing line; it is totally a female job. Several other reasons for these differences could be related to such factors as external responsibilities that the employees have in their personal lives, or a lack of rest that they have as a result of the short crab season (Amell & Kumar, 2001; Clauw & Williams, 2002; Feely et al., 1995; Haufler et al., 2000; Messing, 2000; Messing, 2004; Ratzon et al., 1998; Stock, 1991).

There were some other and significant differences in the types of injuries reported by men versus women. In fact, the findings revealed that men experienced injuries to the arms, more frequently than women in the present sample; they were more than twice as likely to have these injuries than their female counterparts. Given the small number of men (n=33) in the total study, this is a significant finding. A potential explanation for this finding may also be the jobs that the men perform in the plant. In addition to the neck injuries, women reported more shoulder injuries than men. This could be explained by the fact that most of the women who participated in the study were employed as packers, which would be expected given the nature of the work that they perform (i.e., reaching to take the crab off the line and packing it into containers; these are work processes that use the shoulders and hands to carry out the work).

Symptoms

The women and men who participated in the study did not differed slightly in terms of the types of symptoms that they experienced related to their WMSDs. Women reported pain to be their main symptom while for the men it was tingling and numbness. This is consistent with the literature, where pain clearly represents the predominant symptom of WMSDs (Feuerstein, Shaw, Lincoln, Miller, & Wood, 2003; Haufler et al., 2000; Ohlsson et al., 1994). While not statistically significant, the differences in the frequencies of various symptoms, (e.g., aching, burning, and numbness), reported by women and men suggest that symptoms may indeed differ by gender. As such, these trends are important to explore in future research in this field. Other symptoms, such as numbness, tingling, have been less extensively explored in the academic literature. In the present study and in contrast to frequency of symptoms, no differences were found in the type of symptoms reported by women and men. Future research is now needed to determine if men and women actually exhibit different symptoms. Perhaps future studies involving larger samples will confirm whether there are truly significant differences in the symptoms experienced by men and women.

Physical/Ergonomic Factors

Physical/ergonomic factors in the work environment were examined in this thesis and several were found to have a relationship with the presence of the upper body WMSDs reported by the affected employees. Specifically, physical/ergonomic factors such as, working at high speeds, and work processes that required precise movements of the hands and fingers and repetitive motions were all associated with an increased presence of WMSDs in this sample of crab processing plant employees. As such, these findings reaffirm past studies (e.g., Brouwer et al., 2001; Crumpton-Young et al., 2000) showing that repetitive motion can increase the likelihood of WMSDs. Moreover, it generalizes these findings to an industry not previously examined, namely that of crab processing. It is also important to note that a number of participants were working in environments that exposed them to multiple work-related risk factors. As such these employees may be at an even higher risk for the development of a WMSD.

A relationship between physical/ergonomic factors and gender was found in this study. Specifically, women were more likely to be exposed to several physical/ergonomic risk factors (i.e., repetitive motions, working at high speeds, and precise hand/finger movements) that were highly correlated with the presence of WMSDs. Moreover, approximately half of the women in the survey were employed as packers. This job requires women to stand for long periods of time, continuously watch the surveyor belt for crab sections, as well as use their upper extremities to reach for the crab sections and remove these sections from the belt (with their arms constantly above their shoulder level). Packers are also required to flex their wrists in order to place the sections in the pans in the desired alignments. Thus, while no significant difference was found between presence of WMSD and gender, the gender differences found in terms of physical/ergonomic risk factors would suggest that women might be at greater risk of developing an upper body WMSD than men within this industry.

Level of Disability

As already identified, the level of disability was measured using the DASH. There were no statistically significant differences between the DASH scores of men and women; however, an examination of the means suggests that women, on average, had higher DASH scores than men. However, all the DASH scores are on the higher end suggesting that women with WMSDs have more difficulty performing daily activities, (i.e., making beds, household chores). Gummesson et al. (2003) found that the participants in their study who were awaiting surgical intervention for their injury reported an average DASH score of 35. This result is higher than that in the crab processing group, but the population in the study may have had more disability given the fact that they were waiting to have corrective surgery.

In reviewing the variety of literature available on the DASH outcome measurement tool, none was found that identified specific occupations as the study population. Much of the research identified various groups of patients who had diagnosed upper extremity injuries that were to be repaired through surgical intervention. Both women and men were participants in these studies, however differences in scores between women and men were not identified (Atroshi et al., 2000; De Smet, 2004; Gummesson et al., 2003; Tashjian, Henn, Kang, & Green, 2006).

Given the small sample size of this study, additional research should be conducted to see if significant gender differences do indeed exist on the DASH. If women have higher rates of WMSDs you would expect to see this translated into higher levels of disability. Based on the literature reviewed earlier, and some of the gender differences found in this study, it might be that this difference would become statistically significant with a larger sample, as women also usually have more responsibility in the home and, therefore, may not have time to rest and heal from their injuries.

Contributions

As no other studies were found that examined WMSDs and crab processing workers, and there was a need to describe what was happening in this industry with regards to this common disorder, the research and this thesis should be considered exploratory in nature. This thesis presented mostly correlational and descriptive statistics concerning these disorders in the crab processing sector. Several risk factors were identified that potentially increased an employees' risk for the development of an upper body WMSD.

In addition to contributing to the literature through the analysis of the four research questions, this thesis makes two contributions to the overall literature in the WMSD subject area. First, the study demonstrates that employees in a previously unexplored industry (i.e., crab processing) are at a high risk of developing WMSDs affecting the upper body. As a result of the information obtained in this exploratory study, the management in cooperation with the health and safety committee of the plant has begun to examine processes within the production line that could be changed in order to potentially decrease the number of injuries reported by employees. One change already instituted is to lower the conveyor belt carrying the crab sections to the packing line. Moreover, the findings of the study could lead to new occupational health and safety practices that could lead to earlier intervention and treatment of those employees who are affected with WMSDs.

Second, this study further adds to the literature in the use of the Dose Response model (Armstrong et al., 1993). The Dose Response model was chosen as the conceptual model for this study because of the multifactorial components; it takes into consideration many factors that could increase an employee's risk for the development of upper body WMSDs. The findings of this study demonstrated that the employee has a response over time (presence/absence of a WMSD and the symptoms related) to an external exposure (some factor in the physical work environment). The study provides support for this model and the multifactorial way that it presents the development of WMSD. The dose and capacity portions of the model were not tested in this study, (was part of overall study) but based on the literature; both physiological and psychosocial factors (i.e., job stress, lack of support, family responsibilities) have been shown to increase an employee's risk for the development of a WMSD (Nordander et al., 1999; Feely et al.,1995). This demonstrated the importance of these portions of the model when examining WMSDs.

Chapter 6

Limitations, Nursing Implications, and Conclusion

The final chapter of this thesis contains three main sections. The first section addresses some of the methodological and conceptual limitations of the research. The second study will be a discussion of some of the nursing and occupational health and safety implications that come from the research. The final section is the conclusion.

Limitations

Working in a seasonal occupation and in a rural area presents challenges for participatory research. In addition because of the exploratory nature of the work this thesis has some methodological and conceptual limitations.

Methodological

Five methodological limitations of this thesis are evident. First is the sample size. The sample was relatively small with a total of 107 participants. Thus, type II error may have resulted and the large number of null and insignificant findings of this study may be a direct result of this sample size. Simply put, the small sample may have caused a lack of statistical power to detect key relationships or significant differences based on gender.

Second, and closely related to the first, is that only 30% of the sample were male resulting in a very small number of men in the study. The majority of the participants in the research were women, which is typical of this industry in general and the plant studies in particular. Thus, there may have been too few men to find statistically significant gender effects that may have indeed been present. This again may explain the number of null findings for gender in this study. However, the percentage breakdown of 70% women and 30% men is representative to the breakdown of the plant workforce.

Third, there was a low response rate, with only 107 (34%) of the 316 employees working at the plant agreeing to participate in the survey. While this could be considered a low response rate, and therefore not representive of the larger population, other factors could have influenced the response rate (Kelley, Clark, Brown, & Sitzia, 2003). As discussed in chapter 3, one possible reason for the low response rate is the fact that the employees were asked to participate after the crab season had finished for the season. Some had already moved away from the communities and others did not want to participate in activities that could have been considered work related. Future studies should be conducted while the plant is in production with the hopes of increasing the participation rate. The literature has reported an overall decrease in response rates to surveys in general; this could also be another potential reason for the low response rate (Tourangeau, 2004)

Fourth, as a first exploratory study in this area, some of the survey questions were created explicitly for this research program. While these questions were based on an extensive literature review, extensive observation and indepth interviewing, there is no way to assess the validity of these questions at this time. As additional research is conducted in the field, it may be helpful to validate and refine these questions. As outlined in the methodology chapter, only certain questions were selected that allowed me to explore the questions developed for this thesis. Some of the information was gathered through the use of open-ended questions. In future studies, these questions should be asked again to determine if similar answers would be provided.

Fifth, the data used in this study were collected after the crab-processing season was completed. This may have influenced the participants' responses as well as their willingness to participate in the survey. Moreover, issues related to WMSDs may have been less salient for workers once the crab season has ended, as they may have no longer been performing tasks that aggravated their disorders.

Conceptual

One of the challenges of research with WMSDs is an appropriate conceptual framework with which to view the problem. Part of the reason for this is a lack of agreement among researchers and the medical profession in how to view the problem (Huang et al., 2002). The Dose-Response model selected for this study has four constructs. The nature of this study allowed for the usage of two of the four components, namely, exposure and response. This model appears to be consistent with the current research on WMSD as it represents a multifactorial causation for these disorders. But given the nature of the present study, the full model could not be fully examined. Dose and capacity were not explored as part of this study, however, these constructs are just as important as the two constructs used. If used in future research, this model should be utilized fully to truly capture the multifactorial nature of WMSDs.

Nursing Implications

As a result of this initial exploration of upper body WMSDs in the crab processing industry, the implications for nursing, especially OHS nurses, are grouped into three themes: education, practice, and research. It is important to highlight also that these implications could apply to other health and safety officers as not all workplaces have an OHS nurse. The plant in the study did not have such a nursing position. In some communities the community health nurse works with these types of workplaces to help with health promoting activities.

Education

In terms of educational implication for nurses, two areas can be examined. First, the results of this study can be used to educate OHS nurses about a new group of employees that have now been identified as a group at risk for the development of WMSDs, namely, crab plant processing workers. This finding adds to the literature that shows that a growing number of employees are at risk of developing WMSDs. Therefore, OHS nurses involved in this industry need to recognize potential symptoms and risk factors that could increase the likelihood of employees developing WMSDs. As part of both of the educational implications, nurses will have an increased awareness that women may be more affected by these disorders within the crab processing industry, and other industries in general, than men. This suggests that nurses may need to conduct more targeted educational sessions for, and concerning, female employees. In so doing, nurses can help women learn and identify factors that could decrease their potential of sustaining such an injury.

Secondly, as WMSDs have become a very serious workplace issue, affecting millions of employees across many, if not all, occupations, all nurses need to have at least a basic understanding of what these disorders are, as well as, the symptoms, treatments, and the impact that they can have on those affected. This education could occur in a number of settings: in the undergraduate basic program, during orientation programs, as continuing education courses, or in masters level programs. All nurses need to be aware of these disorders to assist their clients and to protect themselves.

Employers and supervisors in the workplace need education about these disorders, how to respond to workers who have an upper body WMSD, and how to recognize and decrease physical risk factors. At the current plant management and supervisors have been approached and have attended workshops to deal with some of these issues.

Practice

One of the roles of the OHS nurse is to conduct health assessments on employees. In this role, it is important that the OHS nurse assesses the employees on a regular basis for WMSDs. Within this assessment, both the physical and psychosocial aspects of the employee need to be reviewed. This is a result of the recommendations of recent literature, suggesting that WMSDs are multi-factorial in nature (e.g., Amell & Kumar, 2001; Haufler et al., 2000; Pransky et al., 2002). Thus, a multi-facet assessment could help employees who are suffering with WMSDs receive treatment and support that could potentially lead to a decrease in the frequency of WMSDs and their symptoms. Along with these assessments of the employee, the OHS nurse would also conduct assessments on the physical environments in which the employee works and work with health and safety and ergonomic committees in the review. These reviews could potentially lead to changes in the physical work environment that should decrease the environmental risks to employees. For example, the OHS nurse could review the workstation configuration to ensure that it is appropriate for both the male and female employees. In addition, the nurse could assess whether changes can be made to minimize exposure to high-risk environmental factors known to increase risk of WMSDs (i.e., standing, working at high speeds, and precise hand/finger movements).

Second, the information from this study, complemented with the current literature, can be used by OHS nurses and other health and safety officers employed within the crab processing industry to create awareness and prevention programs for their workplace. These programs could be used to inform employees concerning WMSDs, defining what constitutes a WMSD, as well as presenting potential risk factors for the development of such an injury. Implementing such WMSD awareness and prevention programs could also help facilitate the reporting rate of WMSDs, therefore, leading to more affected employees being diagnosed and treated appropriately.

Research

A significant nursing implication of this study, in general, is the need for further research in this area. As identified throughout this thesis, there are many voids in the WMSD literature at a time when these disorders represent significant personal and financial costs to injured workers, their employers, and the overall healthcare system. Nurses can develop and conduct new studies that can add to the literature. In so doing, they can hopefully find ways to decrease the risk of WMSDs for employees in all industries as well as help those who are currently suffering from these disorders.

As an exploratory study, this research suggests several additional avenues for future investigation. In addition to doing more research with larger sample sizes using the same questions, other research could be conducted to determine possible reasons why female employees are more likely to work in positions that potentially increase their risk for the development of a WMSD. One potential area that could be examined is job segregation, where women perform certain jobs (usually clerical and low paid) that differ from men, which is known to be a common occurrence in the workplace (New Brunswick Advisory Council on the Status of Women, n.d.).

Second, as suggested by past research (Messing et al., 2005; Premji, 2005), workstations in most organizations are designed for male employees. Given the physical differences between men and women, future research should examine whether the current ergonomic setup is appropriate for the mainly female employee base within this particular plant. If changes are deemed necessary, this study could be replicated using a non-experimental design. Specifically, the present results could be used as pre-measures to determine if both the prevalence and symptomology of WMSD differ post-ergonomic changes.

Third, the Dose-Response model could be used in future research as the conceptual model. In future research this model could be utilized to fully explore the multifactorial nature of WMSDs. Factors such as work organization and family/home responsibilities could be worked into the model to determine the role that these factors play in the development of upper body WMSDs.

Conclusion

In this thesis, I set out to conduct a gender analysis of crab processing and upper bodyWMSDs. I was particularly interested in exploring any differences in the types and occurrences of WMSDs between women and men, if women and men differed in the types of symptoms reported, if physical/ergonomic factors played a role in the presence of WMSDs and if the level of disability of the affected employees differed by gender. The results indicated that within the present sample, women and men differed in the types and occurrences of WMSDs, and that women reported more injuries to the neck and shoulders, while men reported more injuries to the arms. In addition, physical/ergonomic factors were found to play a role in the presence of WMSDs and these factors differed by gender -- women were more likely to be exposed to physical/ergonomic factors that could potentially increase their risk for the development of WMSDs. However, there were no significant differences in the level of disability reported by women versus men.

In addition to differences between men and women, there were two findings of interest that cut across both sexes. First, the finding that 85 of the 107 employees who participated in the survey reported having a WMSD to their upper body suggests that employees who work in the crab processing industry are at a high risk for the development of these types of WMSDs. Second, for women, pain was the most frequently reported symptom that they experienced, while for men it was tingling and numbness.

Taken together, these findings suggest that more research concerning WMSDs in the crab-processing industry and the role gender may play in these disorders.

References

Abbas, M., Faris, R., Harber, P., Mishriky, A., El-Shahaly, H., Waheeb, Y., et al. (2001). Worksite and personal factors associated with carpal tunnel syndrome in an Egyptian electronics assembly factory. *International Journal of Occupational Environmental Health, 7,* 31-36.

Amell, T., & Kumar, S. (2001). Work-related musculoskeletal disorders: Design as a prevention strategy: A review. *Journal of Occupational Rehabilitation, 11,* 255-265.

American Association of Occupational Health Nursing (AAOHN)(2006). Retrieved June 4, 2006, from http:// www.aaohn.org.

Aribisala, E. (1993). Cumulative trauma disorder: Occupational hazard of the ' 90s. *The Radiation Therapist, 2*(1), 27-29.

Armstrong, T., Buckle, P., Fine, L., Hagberg, M., Jonsson, B., Kilbom, A. et al. (1993). A conceptual model for work-related neck and upper limb musculoskeletal disorders. *Scandinavian Journal of Work, Environment and Health, 19,* 73-84.

Atroshi, I., Gummesson, C., Andersson, B., Dahlgren, E., & Johansson, A. (2000). The disabilities of the arm, shoulder, and hand (DASH) outcome questionnaire: Reliability and validity of the Swedish version evaluated in 176 patients [Electronic version]. *Acta, Orthopaedica Scandinavia, 71,* 613-618.

Barthel, R., Miller, L., Deardorff, W., & Portenier, R. (1998). Presentation and response of patients with upper extremity repetitive use syndrome to a multidisciplinary rehabilitation program: A retrospective review of 24 cases. *Journal of Hand Therapy,* July- September, 191-199.

Beaton, D., Cole, D., Manno, M., Bombardier, C., Hogg-Johnson, S., & Shannon, H. (2000). Describing the burden of upper-extremity musculoskeletal disorders in newspaper workers: What difference do case definitions make? *Journal of Occupational Rehabilitation, 10*(1), 39-53.

Beaton, D., Davis, A., Hudak, P., & McConnell, S. (2001). The DASH (Disabilities of the arm, shoulder, and hand) outcome measure: What do we know about it now? *British Journal of Hand Therapy, 6,* 109-118.

Bernard, B.P. (Ed.). (1997). *Musculoskeletal disorders and workplace factors: A critical review of epidemiological evidence for work-related musculoskeletal disorders of the neck, upper extremity, and low back.* Cincinnati, OH: Department of Health and Human Services, National Institute for Occupational Health and Safety. DHHS (NIOSH) Publication No. 97B141.

Bongers, P., Kremer, A., & ter Laak, J. (2002). Are psychosocial factors, risk factors for symptoms and signs of the shoulder, elbow or hand/wrist? A review of the epidemiological literature. *American Journal of Industrial Medicine, 41*, 315-342.

Boudreau, L., & Reitav, J. (2001). Psychosocial and physical factors in work transition. *Journal of the Neuromusculoskeletal System, 9*, 129-134.

Brouwer, B., Mazzoni, C., & Pearce, G. (2001). Tracking ability in subjects symptomatic of cumulative trauma disorders: Does it relate to disability. *Ergonomics, 44*, 443-456.

Canadian Occupational Health Nurses Association (COHNA), (2007). Retrieved April 4, 2007, from http://www.cohna-aciist.ca/english/.

Cartier, A., Lehrer, S., Horth-Susin, L., Swanson, M., Neis, B., Howse, D. et al. (2004). Prevalence of crab asthma in crab plant workers in Newfoundland and Labrador. *International Journal of Circumpolar Health, 63*, 233-236.

Cassou, B., Derriennic, F., Monfort, C., Norton, J., & Touranchet, A. (2002). Chronic neck and shoulder pain, age and working conditions: Longitudinal results from a large random sample in France. *Occupational and Environmental Medicine, 59*, 537-544.

Chiang, H., Ko, Y., Chen, S., Yu, H., Wu, T., & Chang, P. (1993). Prevalence of shoulder and upper-limb disorders among workers in the fish processing industry. *Scandinavian Journal of Work Environment and Health, 19*, 126-131.

Clauw, D., & Williams, D. (2002). Relationship between stress and pain in work-related upper extremity disorders: The hidden role of chronic multi-symptom illness. *American Journal of Industrial Medicine, 41*, 370-382.

Crumpton-Young, L.L., Killough, K., Parker, P., & Brandon, K. (2000). Quantitative analysis of cumulative trauma risk factors & risk factor interactions. *Journal of Occupational & Environmental Medicine, 42*,1013-1020.

Dahlberg, R., Karlqvist, L., Bildt, C., & Nykvist, K. (2004). Do work technique and musculoskeletal symptoms differ between men and women performing the same type of work tasks? *Applied Ergonomics, 35,* 521-529.

Dale, L., Barkley, A., Bayless, S., Coleman, S., McDonald, B., Myszkowski, J., et al. (2003). Experience of cumulative trauma disorders on life roles of worker and family member: A case study of a married couple. *Work, 20,* 245-255.

Derebery, J. (1998). Determining the case of upper extremity complaints in the workplace. *Physical Medicine and Rehabilitation, 12*, 177-190.

De Smet, L. (2004). Responsiveness of the DASH score in surgically treated basal joint arthritis of the thumb: Preliminary results. *Clinical Rheumatology*, *23,* 222-224.

de Zwart, B., Broersen, J., Frings-Dresen, M., & van Dijk, F. (1997). Musculoskeletal complaint in the Netherlands in relation to age, gender and physically demanding work. *International Archives of Occupational and Environmental Health*, 70, 352-360.

de Zwart, B., Frings-Dresen, M., & Kilbom, S. (2001). Gender differences in upper extremity musculoskeletal complaints in the working population. *International Archives of Occupational and Environmental Health, 74*, 21-30.

Dortch, H., & Trombly, C. (1990). The effects of education on hand use with industrial workers in repetitive jobs. *The American Journal of Occupational Therapy, 44*, 777-782.

Evanoff, B., Abedin, S., Grayson, D., Dale, A.M., Wolf, L., & Bohr, P. (2002). Is disability underreported following work injury. *Journal of Occupational Rehabilitation, 12*, 139-150.

Feely, C., Seaton, M., Arfken, C., Edwards, D., & Young, V. (1995). Effects of work and rest on upper extremity signs and symptoms of workers performing repetitive tasks. *Journal of Occupational Rehabilitation, 5*, 145-156.

Feuerstein, M., Shaw, W., Lincoln, A., Miller, V., & Wood, P. (2003). Clinical and workplace factors associated with a return to modified duty in work- related upper extremity disorders. *Pain, 102*, 51-61.

Fredriksson, K., Alfredsson, L., Ahlberg, G., Josephson, M., Kilbom, A., Hjelm, E., et al. (2002). Work environment and neck and shoulder pain: The influence of exposure time. Results from a population based case control study. *Occupational and Environmental Medicine, 59,* 182-188.

Friedman, P. (1997). Predictors of work disability in work related upper extremity. *Journal of Occupational an Environmental Medicine, 39*, 339-343.

Gamble, S. (Ed.). (1999). *The Routledge critical dictionary of feminism and postfeminism.* New York: Routledge.

Gender, Health and Work (2004, September). Geneva, Switzerland: WHO, Department of Gender, Women and Health. Retrieved November 20, 2006, http://www. who.int/gender/documents/en.

Gorsche. R., Wiley, J., Brant, R., Renger, R., Sasyniuk, T., & Burke, N. (2002). Comparison of outcomes of untreated carpal tunnel syndrome and asymptomatic controls in meat packers. *Occupational Medicine, 52*, 491-496.

Gummesson, C., Atroshi, I., & Ekdahl, C. (2003). The disabilities of the arm, shoulder and hand (DASH) outcome questionnaire: Longitudinal construct validity and measuring self-rated health change after surgery [Eletronic version]. *BMC Musculoskeletal Disorders, 4*, 11.

Hatch, M., & Moline, J. (1997). Women, work and health. *American Journal of Industrial Medicine, 32,* 303-308.

Hart, D., Archambault, J., Kydd, A., Carol, F., & Herzog, W. (1998). Gender and neurogenic variables in tendon biology and repetitive disorders. *Clinical Orthopaedics and Related Research, 351,* 44-56.

Haufler, A., Feuerstein, M., & Huang, G. (2000). Job stress, upper extremity pain and functional limitations in symptomatic computer users. *American Journal* of Industrial Medicine, 38, 507-515.

Hess, D. (1997). Employee perceived stress. *The American Association of Occupational Health Nurses Journal, 45*, 115-123.

Hildebrandt, V.H., Bongers, P.M., Dul, J., van Dijk, F.J., & Kemper, H.C. (2000) The relationship between leisure time, physical activities and musculoskeletal symptoms and disability in worker populations. *International Archives of Occupational and Environmental Health, 73*, 507-518.

Hoozemans, M., van der Beek, A., Frings-Dresen, M., van Dijk, F., and van der Woude, L. (1998). Pushing and pulling in relation to musculoskeletal disorders: A review of risk factors. *Ergonomic, 41*, 757-781.

Howse, D., Gautrin, D., Neis, B., Cartier, A., Horth-Susin, L., Jong, M. et al. (2006). Gender and snow crab occupational asthma in Newfoundland and Labrador, Canada. *Envrionmental Research, 101(2),* 163-174

Huang, G., Feuerstein, M., & Sauter, S. (2002). Occupational stress and work-related upper extremity disorders: Concepts and models. *American Journal of Industrial Medicine, 41,* 298-314.

Hudak, P., Amadio, P., & Bombardier, C. (1996). Development of an upper extremity outcome measure: The DASH (disabilities of the arm, shoulder and hand). *American Journal of Industrial Medicine, 29,* 602-608.

Hviid, J., Kaergaard, A., Frost, P., Frolund, J., Bonde, J., Fallentin, N., et al., (2002). Physical, psychosocial and individual risk factors for neck/shoulder pain with pressure tenderness in the muscles among workers performing monotonous, repetitive work. *Spine, 27,*660-667.

Islam, S., Velilla, A., Doyle, E., & Ducatman, A. (2001). Gender differences in work-related injury/illness: Analysis of workers compensation claims. *American Journal of Industrial Medicine, 39*, 84-91.

Jeebhay, M., Robins, T., & Lopata, A. (2004). World at work: Fish processing workers. *Occupational and Environmental Medicine, 61*, 471-474.

Jeebhay, M.F., Robins, T.G., Lehrer, S.B., & Lopata, A.L. (2001). Occupational Seafood Allergy – A Review. *Occupational and Environmental Medicine*, *58 (9)*, 553-562.

Jong, M., Neis, B., Cartier, A., Horth-Susin, L., & Howse, D. (2004). Knowledge, attitudes and beliefs regarding crab asthma in four communities of Newfoundland and Labrador. *International Journal of Circumpolar Health, 63*, 337-342

Katz, J., Stock, S., Evanoff, B., Rempel, D., Moore, S., Franzblau, A., et al. (2000). Classification criteria and severity assessment in work-associated upper extremity disorders: Methods matter. *American Journal of Industrial Medicine, 38,* 369-372.

Kelley, K., Clark, B., Brown, V., & Sitzia, J. (2003). Good practice in the conduct and reporting of survey research. *International Journal for Quality in Health Care, 15*, 261-266.

Keogh, J., Nuwayhid, I., Gordon, J., & Gucer, P. (2000). The impact of occupational injury on injured worker and family: Outcomes of upper extremity cumulative trauma disorders in Maryland workers. *American Journal of Industrial Medicine, 38,* 498-506.

Kim, J., Kim, J., Son, J., & Yun, S. (2004). Prevalence of carpal tunnel syndrome in meat and fish processing plants. *Journal of Occupational Health, 46,* 230-234.

Kramer, J., Potter, P., Harburn, K., Speechley, M., & Rollman, G. (2001). An upper body musculoskeletal assessment instrument for patients with work-related musculoskeletal disorders: A pilot study. *Journal of Hand Therapy*, April-June, 115-121.

Kuorinka, I., Jonsson, B., Vinterberg, H., Biering-Seresen, F., Andersson, B., & Jorqensen, K. (1987). Standardized Nordic questionnaires for the analysis of musculoskeletal symptoms. *Applied Ergonomics*, 233-237.

Laing, A., Frazer, M., Cole, D., Kerr, M., Wells, R., & Norman, R. (2005). Study of the effectiveness of a participatory ergonomics intervention in reducing worker pain severity through physical exposure pathways. *Ergonomics, 48,* 150-17.

Leclerc, A., Chastang, J.F., Niedhammer, I., Landre, M.F., & Roquelaure, Y. (2004). Incidence of shoulder pain in repetitive work. *Occupational and Environmental Medicine, 61*, 39-44.

Leijon, M., Hensing, G., & Alexanderson, K. (1998). Gender trends in sick-listing with musculoskeletal symptoms in a Swedish country during a rapid increase in sickness absence. *Scandinavian Journal of Social Medicine, 26,* 204-211.

Leijon, O., Bernmark, E., Karlqvist, L., & Harenstam, A. (2005). Awkward work postures: Association with occupational gender segregation. *American Journal of Industrial Medicine, 47,* 381-393.

Lipscomb, H., Loomis, D., McDonald, M., Kucera, K., Marshall, S., & Li, L. (2004). Musculoskeletal symptoms among commercial fishers in North Carolina. *Applied Ergonomics, 25,* 417-426.

Lundberg, U. (2002). Psychophysiology of work: stress gender, endocrine response and work-related upper extremity disorders. *American Journal of Industrial Medicine, 41*, 383-392.

Martin, S., Irvine, J., Fluharty, K., & Gatty, C. (2003). A comprehensive work injury prevention program with clerical and office workers: Phase 1. *Work, 21*, 185-196.

McDiarmid, M., Oliver, M., Ruser, J., & Gucer, P. (2000). Male and female rate differences in carpal tunnel syndrome injuries: Personal attributes or job tasks? *Environmental Research, 83,* 23-32.

Melhorn, M. (1998). Cumulative trauma disorders and repetitive strain injuries. *Clinical Orthopedics and Related Research, 351*, 107-126.

Messing, K. (1998). *One-eyed science: Occupational health and women workers.* Philadelphia, PA: Temple University.

Messing, K. (2000). Ergonomic studies provide information about occupational exposure differences between women and men. *Journal of the American Medical Women's Association, 55*(2), 72-76.

Messing, K. (2004). Physical exposures in work commonly done by women. *Canadian Journal of Applied Physiology, 29*, 639-656.

Messing, K., Punnett, L., Bond, M., Alexanderson, K., Pyle, J., Zahm, S., et al. (2003). Be the fairest to them all: Challenges and recommendations for the treatment of gender in occupational health research. *American Journal of Industrial Medicine 43,* 618-629.

Messing, K., & Mager Stellman, J. (2006). *One-eyed science: Occupational health and women workers*. Temple University Press.

Mirka, G., Shin, G., Kucera, K., & Loomis, D. (2005). Use of CABS methodology to assess biomechanical stress in commercial crab fishermen. *Applied Ergonomics, 36,* 61-70.

Morse, T., Dillon, C., Kenta-Bibi, E., Weber, J., Diva, U., Warren, N., & Grey, M. (2005). Trends in work-related musculoskeletal disorder reports by year, type and industrial sector: A capture recapture analysis. *American Journal of Industrial Medicine, 48,* 40-49.

Morse, T., Punnett, L., Warren, N., Dillon, C., & Warren, A. (2003). The relationship of unions to prevalence and claim filing for work- related upper extremity musculoskeletal disorders. *American Journal of Industrial Medicine, 44,* 83-93.

New Brunswick Advisory Council on the Status of Women (n.d.). *The pay gap: Why such a gap between women's and men's salaries?* Retrieved on December 6, 2005 from http://www.acswcccf.nb.ca/english/documents/factsheeteng.pdf

Neis, B., & Williams, S. (1993). Occupational stress and repetitive strain injuries: Research review and pilot study. *Institute of Social and Economic Research, 8.* 1-89.

NIOSH (2006). NIOSH program portfolio. Retrieved on November 4, 2006 from http://www.cdc.gov/niosh/programs/agff/economics.html

Nordander, C., Ohlsson, K., Balogh, I., Rylander, L., Palsson, B., & Skerfving, S. (1999). Fish processing work: The impact of two sex dependent exposure profiles on musculoskeletal health. *Occupational and Environmental Medicine, 56*, 256-264.

Ohlsson, K., Hansson, G., Balogh, I., Stromberg, U., Palsson, B., Nordander, C., et al. (1994). Disorders of the neck and upper limbs in women in the fish processing industry. *Occupational and Environmental Medicine, 51,* 826-832.

Olafsdottir, H., & Rafnsson, V. (2000). Musculoskeletal symptoms among women currently and formerly working in fish-filleting plants. *International Journal of Occupational Environmental Health, 6*, 44-49.

Ontario Occupational Health Nurse Association (OOHNA)(2006). Retrieved on June 5, 2006, from http://www.oohna.on.ca.

Ostendorf, J., Rogers, B., & Bertsche, P. (2000). CTD management evaluation tool. *The American Association of Occupational Health Nurses Journal,* 48(1), 17-24.

Ostergren, P., Hanson, B., Balogh, I., Ektor-Andersen, J., Isacsson, A., Orbaek, P., et al., (2005). Incidence of shoulder and neck pain in working population: Effect modification between mechanical and psychosocial exposures at work? Results from a one year follow up of the Malmo shoulder and neck study cohort. *Journal of Epidemiology and Community Health, 59*, 721-728.

Palsson, B., Stromberg, U., Ohlsson, K., & Skerfving, S. (1998). Absence attributed to incapacity and occupational disease/accidents among female and male workers in the fish-processing industry. *Occupational Medicine, 48*, 289-295.

Pransky, G., Benjamin, K., Hill- Fotouhi, C., Flecther, K., & Himmelstein, J. (2002). Occupational upper extremity conditions: A detailed analysis of work-related outcomes. *Journal of Occupational Rehabilitation, 12*, 131-138.

Pransky, G., Benjamin, K., Hill-Fotouhi, C., Himmelstein, J., Fletcher, K.E., Katz, J.N., & Johnson, W.G. (2000). Outcomes in work-related upper extremity and low back injuries: A retrospective study. *American Journal of Industrial Medicine, 37*, 400-409.

Pransky, G., Robertson, M., & Moon, S. (2002). Stress and work-related upper extremity disorders: Implications for prevention and management. *American Journal of Industrial Medicine, 41*, 443-455.

Premji, S. (2005). A call to action: Women's health at work & musculoskeletal disorders. *The Canadian Women's Health Network.* Retrieved July 29, 2005, from http://www.cwhn.ca/resources/workplace/msd.html .

Ratzon, N., Jarus, T., Baranes, G. Gilutz, Y., & Erez, A. (1998). Reported level of pain of upper extremity related to multi-factorial workloads among office workers during and after work hours. *Work, 11*, 353-369.

Repetitive strain injury. (2003, August 12). *The Daily*. Retrieved July 26, 2005, from http://www.statcan.ca/Daily/English/030812/d030812b.htm.

Rosenstock, L., & Jackson, L. (2000). Caution: Women at work. *Journal of the American Medical Women's Association, 55*(2), 67-68.

Saks, A.M. (2000). *Research, measurement, and evaluation of human resources.* Nelson: Scarborough.

Schierbout, G., & Myers,J. (1996). Is self – reported pain an appropriate outcome measure in ergonomic- epidemiological studies of work related musculoskeletal disorders? *American Journal of Industrial Medicine, 30,* 93-98.

Solway, S., Beaton, D., McConnell, S., & Bombardier, C. (2002). *The DASH outcome measure user's manual.* Institute for Work & Health: Toronto.

SPSS (2001). *SPSS version 11.1 On-line documentation.* Chicago: SPSS Inc.

Stephens, C., & Smith, M. (1996). Occupational overuse syndrome and the effects of psychosocial stressors on keyboard users in the newspaper industry. *Work & Stress, 10*, 141-153.

Stiller, J., & Uhl, T. (2005). Outcome measurement of the upper extremity function. *Athletic Therapy Today, 10 (3),* 24-26.

Stock, S. (1991). Workplace ergonomic factors and the development of musculoskeletal disorders of the neck and upper limbs: A meta analysis. *American Journal of Industrial Medicine, 19*, 87-107.

Stock, S., Cole, D., Tugwell, P., & Streiner, D. (1996). Review of applicability of existing functional status measures to the study of workers with musculoskeletal disorders of the neck and upper limb. *American Journal of Industrial Medicine, 29,* 679-688.

Strasser, P., Lusk, S., Franzblau, A., & Armstrong, T. (1999). Perceived psychological stress and upper extremity cumulative trauma disorders. *The American Association of Occupational Health Nurses Journal, 47*(1), 22-30.

Strazdins, L., & Bammer, G. (2004). Women, work and musculoskeletal health. *Social Science and Medicine, 58*, 997-1005.

Tashjian, R., Henn, R., Kang, L., & Green, A. (2006). Effect of medical comorbidity on self assessed pain, function, and general health status after rotator cuff repair [Electronic version]. *The Journal of Bone and Joint Surgery, 88*, 536-540.

The Canadian Women's Health Network. A call to action: Women's health: Occupational considerations. (2005). Retrieved July, 26, 2005, from http://www.cwhn.ca/resources/workplace/occupational.html

Tourangeau, R. (2004). Survey research and societal change. *Annual review of Psychology, 55*, 775-801.

Treaster, D. & Burr, D. (2004). Gender differences in prevalence of upper extremity muscloskeletal disorders. *Ergonomics, 47*,495-526.

Tri-Council Policy Statement. (1998). *Ethical conduct for research involving humans.* Canada: Author.

Tyrer, S. (1999). Repetitive strain injury. *Pain Reviews, 6*, 155-166.

Vroman, K., & MacRae, N. (2001). Non-work factors associated with musculoskeletal extremity disorders in women: Beyond the work environment. *Work, 17*,3-9.

Ware, J.E., Kosinski, M., Turner-Bowker, D.M., & Gandek, B. (2004). How to score version 2 of the SF-12 Health Survey. Lincoln, Rhode Island & Boston, MA: Quality Metric Incorporated & Health Assessment Lab.

Weigert, B., Rodriquez, A., Radwin, R., & Sherman, J. (1999). Neuromuscular and psychological characteristics in subjects with work-related forearm pain. *American Journal of Physical Medicine and Rehabilitation, 78*, 545-551.

Weinberg, S.L, & Abramowitz, S.K. (2002). *Data analysis for the behavioral sciences using SPSS.* Cambridge, UK: Cambridge University Press.

Workplace Health and Safety Compensation Committee (2003). *Annual Report.* WHSCC.

Zakaria, D., Robertson, J., MacDermid, J., Hartford, K., & Koval, J. (2002). Work-related cumulative trauma disorders of the upper extremity: Navigating the epidemiologic literature. *American Journal of Industrial Medicine, 42,* 258-269.

Appendix A
Cumulative Trauma Disorder Survey

SafetyNet

A Community Research Alliance on Health & Safety in Marine & Coastal Work

MEMORIAL UNIVERSITY OF NEWFOUNDLAND
CUMULATIVE TRAUMA DISORDER SURVEY

To be filled out by the Research Assistant

Initial Introduction:

Thank you for agreeing to take part in the Cumulative Trauma Disorder (CTD) survey that is part of the *SafetyNetProject*. In this interview I would like to ask you questions about your work and your health. Although some of the questions may seem like they are not related to CTDs, they have been found in other research to relate to this condition. Remember you only are asked to answer those questions you feel comfortable answering. All your answers will be completely confidential. Survey results will be combined for statistical purposes and presented in community and professional conferences, and professional journals. No individuals will be identified in publications or presentations, nor will results be presented in such a way that any person could be identified.

Section A: I will start by asking you some questions about your work.

A-1. How many years have you been working in this crab plant?
(Record seasons or years _______) or since _______

A-2. How many years seniority do you have at this plant? __________

A-3. How many years have you been working in total?
(Record all years of work ______) or working since _______

A-4. What kind(s) of work did you do before you began working at this crab plant?
Job 1______________________**# of years**________________________________

____

Job 2________________________# of years_______________

Job 3________________________# of years________

A-5. What job did you apply for last season? _________________

(Record the job the person reports)

A-6. What job did you get last season? _____________________________________
(Record the job the person reports)

A-7. How many weeks in total did you work at the plant last season?
___________**weeks**

A-8. What area of the plant did you work most often last season? Rank each of the following by how much time was spent there, i.e., 1. Where they spent the greatest amount of time; 2. Where they spent the next second greatest amount of time etc. (Please indicate the job you did most in that area).

- **a. Brine area** ______________**job**_________________
- **b. Claw area** ________________**job**_________________
- **c. Section sorting/packing** __________________**job**_______________
- **d. Butchering area** ______________**job**__________________
- **e. Groundfish** _____________**job**______________________
- **f. Other**_________________**job**______________________

A-9. Did you mainly work? (Read responses to participants)

- **a. All day shifts** _______________
- **b. All night shifts** _______________
- **c. Both day and night shifts** ____________

A-10. Did you have frequent overtime? ***Yes***_____________*No*____________

A-11. Did your work involve job rotation?

- **a. Yes ______(if yes, go to A-13)**
- **b. No _____________ (if no, go to A-12)**

A-12. Would you like to do job rotation?

a. Yes________

b. No_________

A-13. Was this job rotation:
a. Some of the time____________

b. All of the time____________

A-14. Do you like job rotation?

a. Yes ________

b. No _________

A-15. Why do you like/not like job rotation?______________________________

____

____

SECTION B: Next I would like to ask some questions about your workplace

B-1. In order of importance (and beginning with the most important) what are the two things you like <u>most</u> about working in the crab plant? (Participants do not have to identify two but get as many of these as they can list)

1. ____

2. ____

B-2. In order of importance (and beginning with the most important what are the two things you like <u>least</u> about working in the crab plant? (Participants do not have to identify two but get as many of these as they can list)

1. ____

2. ____

B-3. The following statements may or may not apply. Thinking about the job you did most often last season (refer to question A-8) and using a 5-point scale, (with 1 being "Strongly Disagree", 2 being "Disagree", 3 being "Undecided", 4

being "Agree" and 5 being "Strongly Agree"), please indicate your level of agreement with the following statements: (Refer to page 2 of the respondent's booklet)

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Don't Know	No Response
a. I frequently make work easier for my co-worker.	1	2	3	4	5	8	9
b. My co-workers frequently make my work easier.	1	2	3	4	5	8	9
c. I just do my own job and do not worry about others.	1	2	3	4	5	8	9
d. I have the freedom to do my job in a way that suits me.	1	2	3	4	5	8	9
e. I feel satisfied with the quality of my work.	1	2	3	4	5	8	9
f. I have control over when I take a break	1	2	3	4	5	8	9
g. I received enough training to do my job	1	2	3	4	5	8	9

B-4. How would you rate the physical surroundings of your workplace? (Refer to pg. 3 of respondent's booklet)

Extremely pleasant	1
Pleasant	2
Neutral	3
Unpleasant	4
Extremely unpleasant	5

B-5. How would you rate the working conditions in your workplace? (Refer to pg. 4 of respondent's booklet)

Excellent	1
Good	2
Neutral	3
Bad	4
Very bad	5

B-6. Did your job require you to: (Indicate all that apply) (Refer to pg. 5 of respondent's booklet) needs to critique this in the thesis

	Never	From time to time	Fairly often	All the time
Stand for long periods of time	1	2	3	4
Engage in repetitive motion	1	2	3	4
Lift heavy boxes or equipment	1	2	3	4
Spend long periods in a cold environment	1	2	3	4
Be exposed to loud noises	1	2	3	4
Be exposed to chemicals or fumes	1	2	3	4
Work at high speed	1	2	3	4
Be exposed to vibrations	1	2	3	4
Work in awkward positions	1	2	3	4
Use forceful exertion	1	2	3	4
Use precise movements of hands and fingers	1	2	3	4
Continually watch an object (example: conveyor belt)	1	2	3	4
Other ____________	1	2	3	4

If you answered 3 or 4 to any of the above, did this present any difficulty for you? (Describe)

____

____

____

B-7. The following statements are about your workstation where you spend most of your time (referring to question A-80. Using a 5-point scale, (with 1 being "Strongly Disagree", 2 being "Disagree", 3 being "Undecided", 4 being "Agree" and 5 being "Strongly Agree"), please indicate your level of agreement with the following statements: (Refer to pg. 2 of respondent's booklet)

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Don't Know	No Response
a. My workstation is designed to be comfortable.	1	2	3	4	5	8	9
b. I have plenty of space to do my work.	1	2	3	4	5	8	9
c. I can change the way I do my work.	1	2	3	4	5	8	9
d. I have to stretch to reach for things.	1	2	3	4	5	8	9
e. I have to bend to pick up things.	1	2	3	4	5	8	9
f. I can talk to my co-worker.	1	2	3	4	5	8	9

g. I control the pace of work at the workstation.	1	2	3	4	5	8	9
h. I have difficulties keeping my attention on my work.	1	2	3	4	5	8	9
i. I have control over where I stand at my workstation (i.e., particular side, position).	1	2	3	4	5	8	9

B-8. The pace of my work is controlled by (Check all that apply):

a. Machine? ___________
b The work of others? _________
c. My supervisor? _____________
d. Myself? ________________
e. Other factors? ______________
Explain ____

____

____

B-9. If you were able to improve your work or workstation, what two or three changes would you recommend?

1. ____

2. ____

3. ____

SECTION C: Next I would like to ask you some questions about any injuries or strains at work.

C-1. <u>While working</u> during the past year have you ever experienced any of the following? (Indicate all that apply)

	Yes	No
Sprain/strain to any part of the body resulting from an accident? If yes, please indicate where? ________________________	1	2
Cut to any part of the body resulting from an accident? If yes, please indicate where?	1	2

Any other type of injury related to an accident? Describe briefly? ___________________________________	1	2

C-2. Did any of these injuries result in a loss of time from work?

Yes	No
1	2

C-3. If yes, length of time away from work? Days________

C-4. While working in the plant during the past year and <u>not related</u> to any accident or single incident, have you experienced any pain, tingling, numbness, aching, stiffness, burning, swelling or loss of movement to any part of your body?

Yes___________ (Go to C-5) No____________(Go to C-13)

C-5. If yes, describe fully and use body chart to locate the area: (Number each problem if more than one and use that number to indicate the area on the body chart) (Use the other side of the page if needed)

1.____

____

2.____

____

3.____

____

C-6. Do your symptoms go away when you stop working?

Yes	No
1	2

If yes, how long does it take for the symptoms to go away? (right away, an hour, overnight, after the season etc.)____

____

____

C-7. When did these symptoms first start? ______________________________

____

C-8. What work were you doing when the symptoms started?

____

____

C-9. Have you sought treatment for any of these problems (Examples are doctor, nurse, physiotherapist, etc)?

Yes	No
1	2

If yes, whom did you see? ____

For what symptom(s)? ____

Location of symptoms ____

Treatment prescribed (including any medication)

____

____

C-10. Have you ever taken any medication or other treatments not prescribed by a doctor or a nurse for any of these problem?

Yes	No
1	2

If yes, describe:

Medication/treatment taken____

Type of symptoms____

Location of symptoms____

C-11. Have you ever had to take time off work for any of these problems?

Yes	No
1	2

If yes, describe:

Type of symptoms ____

Location of symptoms ____

Length of time off work: days ____________ **(or weeks**____________**)**

C-12. Have you ever had to get transferred to another job at work because of these problems?

Yes	No
1	2

If yes describe:

When ____

Type of symptoms____

Location of symptoms_______________________________________

Job transferred from____

Job transferred to____

C-13. Did you experience any of these symptoms in the previous work season?

No _________ **Yes**___________

If yes (previous to last season) how have the symptoms changed over time?

C-14. **Has anyone in your family been diagnosed with a CTD (or RSI)?**

Yes	No
1	2

If yes who, and what was their job ______________________________

C-15. Have you ever been involved in a motor vehicle accident?

Yes_______(Go to C-16) No_______(Go to section D)

C-16. When did it occur?______________________________

C-17. What kind of injuries did have?______________________________

SECTION D: Next I would like to ask you some questions about your health in general and what may affect your health.

D-1 The following statements are about how satisfied you are with aspects of your life. Using a 5-point scale, with 1 being "Very Satisfied", 2 being "Satisfied", 3 being "Neither Satisfied nor Dissatisfied", 4 being "Dissatisfied" and 5 being "Very Dissatisfied", please indicate your level of agreement with the following statements:
(Refer to pg. 6 of respondent's booklet)

	Very Satisfied	Satisfied	Neither Satisfied or Dissatisfied	Dissatisfied	Very Dissatisfi ed	Don't Know	No Response
a. Your life in general.	1	2	3	4	5	8	9
b. Your health,	1	2	3	4	5	8	9
c. Your job.	1	2	3	4	5	8	9
d. Your co-workers.	1	2	3	4	5	8	9
e. Your employer.	1	2	3	4	5	8	9
f. Your union.	1	2	3	4	5	8	9
g. Your community.	1	2	3	4	5	8	9
h. Your education.	1	2	3	4	5	8	9

D-2 Have you been told you have any of the following conditions (check all that apply)

	Yes	No
Arthritis or rheumatism	1	2
Asthma	1	2
Emphysema or chronic bronchitis	1	2
Hay fever	1	2
Allergies (other than hay fever)	1	2
Stomach ulcer	1	2
Other digestive problems	1	2
High blood pressure	1	2
High blood cholesterol	1	2
Diabetes	1	2
Migraine headaches	1	2
Tension headaches	1	2
Overweight	1	2
Depression	1	2
Thyroid condition	1	2
Other conditions ____________________	1	2

D-3. If you answered yes to any of the above, how long have you had the condition?

1. Condition ____________________ **Months** _____ **Years** _______
2. Condition ____________________ **Months** _____ **Years** _______
3. Condition ____________________ **Months** _____ **Years** _______
4. Condition ____________________ **Months** _____ **Years** _______

D-4. Would you describe your life at the present time as (indicate one) (Refer to pg. 7 of respondent's booklet)

Not at all stressful	1
Not very stressful	2
Somewhat stressful	3
Very stressful	4

D-5. Compared with three years ago would you say your life is (indicate one) (Refer to pg. 8 of respondent's booklet)

Much less stressful	1
Somewhat less stressful	2
About the same	3
Somewhat more stressful	4
Much more stressful	5

D-6. Have you ever smoked?

Yes _____ No _______ (If no, go to D-9)

D-7. Have you quit smoking?

Yes _____ No _______

<u>If yes:</u>

How old were you when you stopped smoking? __________

<u>If no:</u>

D-8. On average, how much do you currently smoke?
cigarette(s) per day __________________
cigarillo(s) per day __________________
pipe(s) per day ____________________

(In the next question, when we use the word <u>drink</u> it means:
- one bottle or can of beer or a glass of draft,
- one glass of wine or a wine cooler, or
- one straight or mixed drink with one and a half ounces of hard liquor)

D-9. During the past 12 months, how often did you drink alcoholic beverages? (Refer to pg. 9 of respondent's booklet)

1. Never
2. Less than once a month
3. Once a month
4. 2-3 times a month
5. Once a week
6. 2-3 times a week
7. 4-6 times a week
8. Every day

88. Don't know
99. No response

D-10. On average over the last month, how many times a week did you exercise for more than 15 minutes DURING YOUR LEISURE TIME? (Refer to pg. 10 of respondent's booklet)

1. Not at all
2. Once per week
3. 2-3 times per week
4. 4-6 times per week
5. Every day
6. More than once every day

8. Don't know
9. No response

D-11. What do you usually do between the crab seasons? ________________

____

____

SECTION E: We would like the following information in order to complete this survey and look at factors associated with CTDs

E-1. Sex of the participant (Do not need to ask)

Female	1
Male	2

E-2. How many children do you have?

0	1
1-2	2
3	3
4 and over	4

How many of these children are under 19 years? ______________________

E-3. How old are you? Age in years? ____________________

E-4. What is your current marital status?

Now married	1
Living with a partner	2
Single (never married)	3
Widowed	4
Separated	5
Divorced	6

E-5. Approximately how much do you weigh? __________________

E-6. Approximately how tall are you? __________________________

E-7. What was the highest level of education completed? (Refer to pg. 11 of respondent's booklet)

NO SCHOOLING	1
ELEMENTARY SCHOOL	
- Incomplete	2
-Complete	3
JUNIOR HIGH SCHOOL	
-Incomplete	4
-Complete	5
HIGH SCHOOL	
-Incomplete	6
-Complete	7
NON-UNIVERSITY (voc/tech)	8
-Incomplete	9
-Complete	10
UNIVERSITY	
-Incomplete	11
-Diploma/certificate	12
-Bachelor's degree	13
-Professional degree	14
-Master's degree	15
-Doctorate	16

Now I would like to complete two other short questionnaires with you. These will allow me to compare your health with those of others.

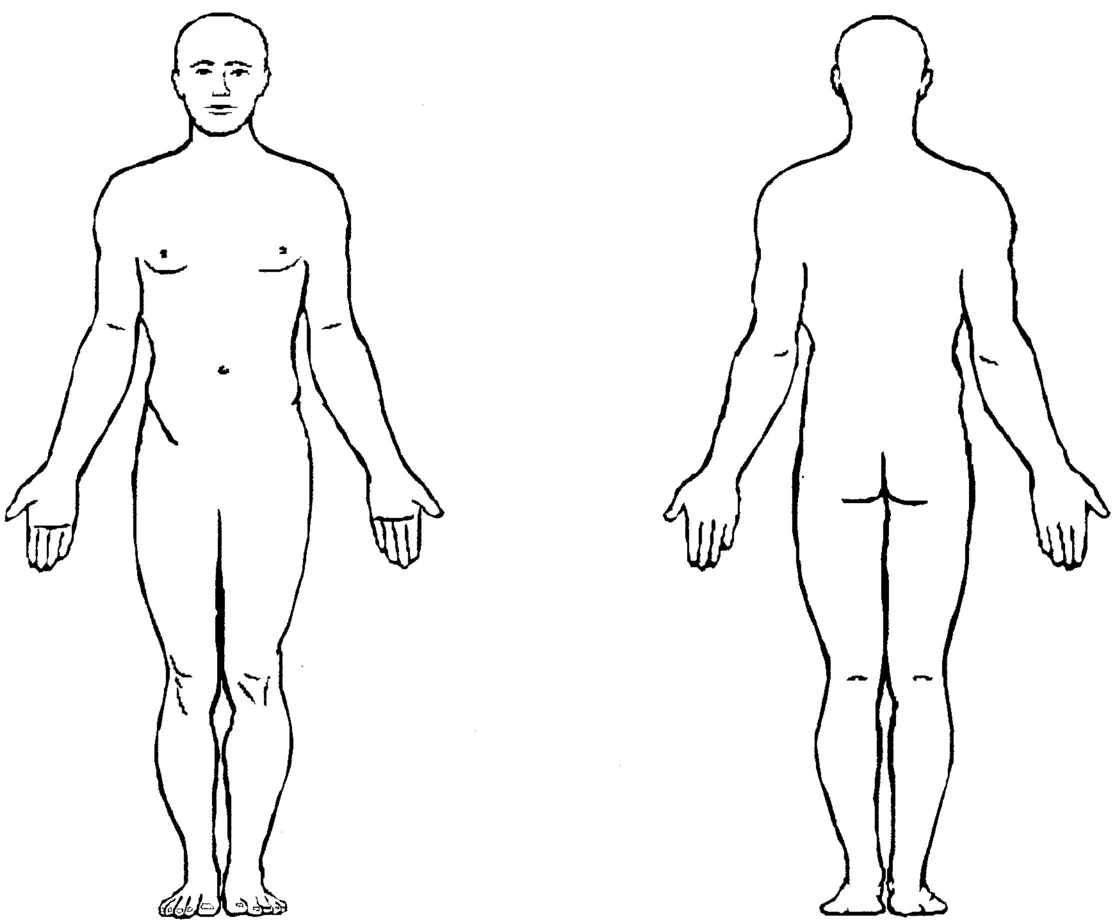
Researcher Administer: 1. The SF-12v2 – Health Survey
2. The DASH

Thank you for your time.

SYMPTOMS EXPERIENCED

While working in the plant during the past year and not related to any accident or single incident, have you experienced any pain, tingling, numbness, aching, stiffness, burning, swelling or loss of movement to any part of your body? ☐ Yes ☐ No

If yes, please number each problem on the body chart.



Your Health and Well-Being

This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. ***Thank you for completing this survey!***

For each of the following questions, please mark an ☒ in the one box that best describes your answer.

1. In general, would you say your health is:

Excellent	Very good	Good	Fair	Poor
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

2. The following questions are about activities you might do during a typical day. Does <u>your health now limit you</u> in these activities? If so, how much?

	Yes, limited a lot	Yes, limited a little	No, not limited at all
a <u>Moderate activities</u>, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	☐ 1	☐ 2	☐ 3
b Climbing <u>several</u> flights of stairs	☐ 1	☐ 2	☐ 3

3. During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a Accomplished less than you would like	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b Were limited in the kind of work or other activities	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

4. During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a Accomplished less than you would like	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b Did work or other activities less carefully than usual	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

5. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

Not at all	A little bit	Moderately	Quite a bit	Extremely
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

These questions are about how you feel and how things have been with you <u>during the past 4 weeks</u>. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the <u>past 4 weeks</u>...

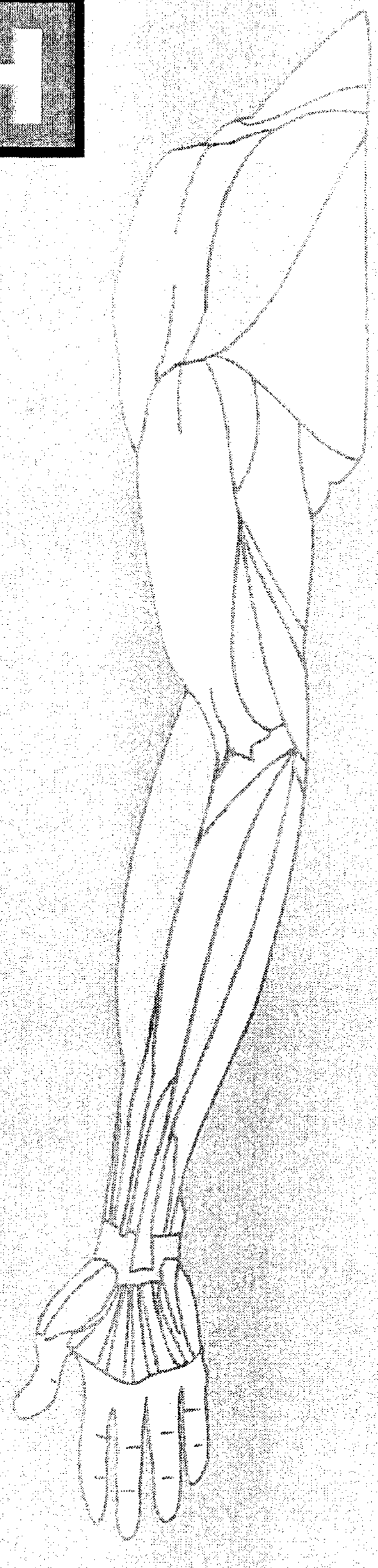
	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a Have you felt calm and peaceful?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b Did you have a lot of energy?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
c Have you felt downhearted and depressed?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

6. During the <u>past 4 weeks</u>, how much of the time has your <u>physical health or emotional problems</u> interfered with your social activities (like visiting friends, relatives, etc.)?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Thank you for completing these questions!

THE DASH



INSTRUCTIONS

This questionnaire asks about your symptoms as well as your ability to perform certain activities.

Please answer *every question*, based on your condition in the last week, by circling the appropriate number.

If you did not have the opportunity to perform an activity in the past week, please make your *best estimate* on which response would be the most accurate.

It doesn't matter which hand or arm you use to perform the activity; please answer based on your ability regardless of how you perform the task.

DISABILITIES OF THE ARM, SHOULDER AND HAND

Please rate your ability to do the following activities in the last week by circling the number below the appropriate response.

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. Open a tight or new jar.	1	2	3	4	5
2. Write.	1	2	3	4	5
3. Turn a key.	1	2	3	4	5
4. Prepare a meal.	1	2	3	4	5
5. Push open a heavy door.	1	2	3	4	5
6. Place an object on a shelf above your head.	1	2	3	4	5
7. Do heavy household chores (e.g., wash walls, wash floors).	1	2	3	4	5
8. Garden or do yard work.	1	2	3	4	5
9. Make a bed.	1	2	3	4	5
10. Carry a shopping bag or briefcase.	1	2	3	4	5
11. Carry a heavy object (over 10 lbs).	1	2	3	4	5
12. Change a lightbulb overhead.	1	2	3	4	5
13. Wash or blow dry your hair.	1	2	3	4	5
14. Wash your back.	1	2	3	4	5
15. Put on a pullover sweater.	1	2	3	4	5
16. Use a knife to cut food.	1	2	3	4	5
17. Recreational activities which require little effort (e.g., cardplaying, knitting, etc.).	1	2	3	4	5
18. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.).	1	2	3	4	5
19. Recreational activities in which you move your arm freely (e.g., playing frisbee, badminton, etc.).	1	2	3	4	5
20. Manage transportation needs (getting from one place to another).	1	2	3	4	5
21. Sexual activities.	1	2	3	4	5

DISABILITIES OF THE ARM, SHOULDER AND HAND

	NOT AT ALL	SLIGHTLY	MODERATELY	QUITE A BIT	EXTREMELY
22. During the past week, *to what extent* has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups? *(circle number)*	1	2	3	4	5

	NOT LIMITED AT ALL	SLIGHTLY LIMITED	MODERATELY LIMITED	VERY LIMITED	UNABLE
23. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem? *(circle number)*	1	2	3	4	5

Please rate the severity of the following symptoms in the last week. *(circle number)*

	NONE	MILD	MODERATE	SEVERE	EXTREME
24. Arm, shoulder or hand pain.	1	2	3	4	5
25. Arm, shoulder or hand pain when you performed any specific activity.	1	2	3	4	5
26. Tingling (pins and needles) in your arm, shoulder or hand.	1	2	3	4	5
27. Weakness in your arm, shoulder or hand.	1	2	3	4	5
28. Stiffness in your arm, shoulder or hand.	1	2	3	4	5

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	SO MUCH DIFFICULTY THAT I CAN'T SLEEP
29. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand? *(circle number)*	1	2	3	4	5

	STRONGLY DISAGREE	DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE
30. I feel less capable, less confident or less useful because of my arm, shoulder or hand problem. *(circle number)*	1	2	3	4	5

DASH DISABILITY/SYMPTOM SCORE = $\left[\left(\frac{\text{sum of n responses}}{n}\right) - 1\right] \times 25$, where n is equal to the number of completed responses.

A DASH score may not be calculated if there are greater than 3 missing items.

DISABILITIES OF THE ARM, SHOULDER AND HAND

WORK MODULE (OPTIONAL)

The following questions ask about the impact of your arm, shoulder or hand problem on your ability to work (including homemaking if that is your main work role).

Please indicate what your job/work is:______________________________

❏ I do not work. (You may skip this section.)

Please circle the number that best describes your physical ability in the past week. Did you have any difficulty:

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. using your usual technique for your work?	1	2	3	4	5
2. doing your usual work because of arm, shoulder or hand pain?	1	2	3	4	5
3. doing your work as well as you would like?	1	2	3	4	5
4. spending your usual amount of time doing your work?	1	2	3	4	5

SPORTS/PERFORMING ARTS MODULE (OPTIONAL)

The following questions relate to the impact of your arm, shoulder or hand problem on playing *your musical instrument or sport or both*.
If you play more than one sport or instrument (or play both), please answer with respect to that activity which is most important to you.

Please indicate the sport or instrument which is most important to you:______________________________

❏ I do not play a sport or an instrument. (You may skip this section.)

Please circle the number that best describes your physical ability in the past week. Did you have any difficulty:

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. using your usual technique for playing your instrument or sport?	1	2	3	4	5
2. playing your musical instrument or sport because of arm, shoulder or hand pain?	1	2	3	4	5
3. playing your musical instrument or sport as well as you would like?	1	2	3	4	5
4. spending your usual amount of time practising or playing your instrument or sport?	1	2	3	4	5

SCORING THE OPTIONAL MODULES: Add up assigned values for each response; divide by 4 (number of items); subtract 1; multiply by 25.
An optional module score may not be calculated if there are any missing items.

Appendix B
Letter of Purpose

October 6, 2004

Dear Plant Worker:

The purpose of this letter is to introduce you to part of our study on Cumulative Trauma Disorders (CTDs). CTDs, also sometimes called repetitive strain injuries (RSIs) are injuries to muscles and tendons that occur with repeated activity. They are common in many industries and mainly affect the neck, back, and upper arms. The proposed study is a survey of crab processing workers at [name of company]. The survey which consists of a number of questions focuses on understanding these disorders better, how often they occur, what factors are associated with their development, and how to prevent them from happening. We are interested in interviewing you whether or not you have these conditions.

The study is part of the SafetyNet program, a community research alliance on health and safety in marine and coastal work. The program is administered by the Centre for Applied Health Research at Memorial University of Newfoundland. Funding for the program is through the Canadian Institutes of Health Research (CIHR). CIHR is a federally funded research agency that funds health research.

If you agree to be interviewed for this part of the study all information you give the interviewer will be treated completely confidentially. Neither the researchers nor your employer will be able to connect any information with your name. Neither your name nor your employer's name will appear in any report or publication. In addition you may withdraw from the study at any time without your employment being in any way affected.

The study has been reviewed and given approval by the Human Investigation Committee of the Faculty of Medicine, Memorial University of Newfoundland and approved by union and management officials through the Safety Committee at [name of company]. Confidential feedback, without identifying any individual participants, on the findings from the study will be given to participants and the plant. While we hope that the findings will help us better understand the problem of CTDs and under what conditions they occur there is no guarantee that you will benefit directly from participating in this study.

The project leaders for the research on CTDs are Dr. John Molgaard (Engineering), Dr. Shirley Solberg (Nursing), Memorial University of Newfoundland, and Dr. Nicole Vezina, (Ergonomics), University of Quebec at Montreal, Quebec.

____

Shirley Solberg, PhD, RN

Appendix C
Consent form

Revised 2002/11

Faculty of Medicine, School of Pharmacy, School of Nursing of Memorial University of Newfoundland; Newfoundland Cancer Treatment and Research Foundation; Health Care Corporation, St. John's

Consent to Take Part in Health Research

TITLE: Cumulative Trauma Disorders Among Crab Processing Workers

INVESTIGATOR(S): Drs. Shirley Solberg, Memorial University of Newfoundland School of Nursing, (709) 777-8311, John Molgaard, Faculty of Engineering, Memorial University of Newfoundland , Nicole Vezina, University of Quebec at Montreal and Ms. Andrea Barron, Master of Nursing Student at Memorial University of Newfoundland

SPONSOR: SafetyNet: Community Alliance for Health Research funded through the Canadian Institute for Health Research.

You have been asked to take part in a research study. It is up to you to decide whether to be in the study or not. Before you decide, you need to understand what the study is for, what risks you might take and what benefits you might receive. This consent form explains the study.

The researchers will:

- **discuss the study with you**
- **answer your questions**
- **keep confidential any information which could identify you personally**

1. Introduction/Background:

Cumulative trauma disorders (CTDs) are problems in the workplace. They cause a great deal of pain and disability to workers. It is only by understanding these problems better and the factors related to them that changes to work may be designed that may prevent them. This research will help provide a better understanding.

2. Purpose of study:

Signature Page

Study title: Cumulative Trauma Disorders Among Crab Processing Workers

Name of principal investigator: Dr. Shirley M. Solberg
To be filled out and signed by the participant:

Please check as appropriate

have read the consent Yes { }
No { }
I have had the opportunity to ask questions/to discuss this study. Yes { }
No { }
I have received satisfactory answers to all of my questions. Yes { }
No { }

I have received enough information about the study.
Yes { } No { }

I understand that I am free to withdraw from the study Yes { }
No { }

- at any time
- without having to give a reason
- without affecting my future employment

I understand that it is my choice to be in the study and that I may not benefit. Yes { }
No { }

______________________________ ______________________
Signature of participant Date

______________________________ ______________________
Signature of witness Date

To be signed by the investigator:

I have explained this study to the best of my ability. I invited questions and gave answers. I believe that the participant fully understands what is involved in being in the study, any potential risks of the study and that he or she has freely chosen to be in the study.

______________________________ ______________________
Signature of investigator Date

Telephone number: ______________________

Appendix D
Confidentiality form

Human Investigation Committee
Undertaking of Confidentiality

I understand that as an investigator or member of a research team, I must maintain strict confidentiality of information obtained from participants in research studies and/or their health and study records.

I understand that not all members of a research team will require confidential information about research participants and that the principal investigator will limit the number of persons on the team who require such information to as few as possible.

As an investigator I agree not to disclose or discuss any confidential information to which I have access except with the appropriate members of the research team.

As a staff member of the research team I agree not to disclose or discuss such information unless specifically authorized to do so by the investigator to whom I am responsible.

I understand that a failure to abide by this requirement could cause individual participants embarrassment. Breach of confidentiality could have serious personal, social and legal consequences for the participant and for the participant's family, friends and associates. I appreciate that an unauthorized disclosure could have consequences for the participant in his or her employment.

I also acknowledge that as part of my employment relationships, if I should make an unauthorized disclosure of information about a participant in a research study, I may be dismissed from my position or suffer formal reprimand. I appreciate that I shall be legally responsible for my actions and, in the event of litigation for my unauthorized disclosure of information, I agree to indemnify my employer for any damages incurred by him.

Printed name of research team member:

Position on the research study:

- [ ] Investigator
- [ ] Staff member

Signature of research team member:

Witness name:
Witness signature:
Date: