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Musculoskeletal symptoms among Iowa farmers and farmworkers

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MUSCULOSKELETAL SYMPTOMS AMONG IOWA FARMERS AND FARMWORKERS

by

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CERTIFICATE OF APPROVAL

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PH.D. THESIS

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This is to certify that the Ph.D. thesis of

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To my professors, family, and friends. Thank you.

ABSTRACT

Farmers and farmworkers are at a high risk for development of musculoskeletal symptoms due to the physically demanding nature of their work environment, the repetitive nature of many agricultural tasks, and the time-dependent nature of agricultural work that often requires greater than full-time hours at various times of the year. The purpose of this dissertation was to gain a better understanding of musculoskeletal symptom prevalence in Iowa farmers, examine age-related effects, determine how those symptoms related to safety on the farm, and to determine musculoskeletal symptom prevalence in migrant farmworkers in Iowa on H-2A Visas.

Study data of 438 Iowa farmers was examined retrospectively through a cross-sectional survey that examined musculoskeletal symptoms prevalence, safety scores of the farm environment, and health-seeking behaviors of this population. This study found prevalence rates that varied from 28% (elbow) to 73% (back) with 4.15 (S.D. = 2.75) average painful joints. More farmers in the older age category were in the lower safety category. Significant predictors of seeking healthcare due to musculoskeletal symptoms included arthritis, employee help on the farm, hip pain, or upper back pain.

Migrant farmworkers who were in Iowa on an H-2A Visa for agricultural work were surveyed about their musculoskeletal symptom prevalence at the beginning of their work contract in Iowa. The data from these 180 migrant farmworkers was compared to the National Agricultural Workers Survey. A chart review was completed that provided information about musculoskeletal symptoms throughout the contracted work period and also information about the treatment provided through the non-profit migrant health clinic. Baseline prevalence varied from 1.4% (hip) to 15.9% (neck) with 56 (39.7%)

workers reporting 1 or more painful joints. Throughout the contracted work, 33.6% of visits were attributed to musculoskeletal complaints with farmworkers over 35 being 2.5 times more likely to have musculoskeletal complaints (OR = 2.5; 95% CI: 1.1-5.5).

The information from these studies provides support for the need to develop and test interventions to prevent musculoskeletal symptom development in agricultural worker populations.

PUBLIC ABSTRACT

Farmers and farmworkers are at a high risk for development of musculoskeletal symptoms due to the physically demanding nature of their work environment, the repetitive nature of many agricultural tasks, and the time-dependent nature of agricultural work that often requires greater than full-time hours at various times of the year. The purpose of this dissertation was to gain a better understanding of musculoskeletal symptom prevalence in Iowa farmers, examine age-related effects, determine how those symptoms related to safety on the farm, and to determine musculoskeletal symptom prevalence in migrant farmworkers in Iowa on H-2A Visas.

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CHAPTER I: INTRODUCTION

Background and Significance

There are several sources of information that provide insight into the current state of agricultural workers in the United States. The United States Department of Agriculture is charged with completing a Census of Agriculture every five years with the most recent report completed in 2012 (United States Department of Agriculture, 2014). The current Agricultural Census shows trends for the last 15 years of a decrease in the total number of farms (2,215,876 in 1997 to 2,109,303) and an increase in the average size of farms (431 to 434 acres) (United States Department of Agriculture, 2014). The average age of the principal operator has also continued to rise from 53.3 in 1992 to 58.3 in 2012 (United States Department of Agriculture, 2014). These current trends show that overall farmers are aging but continuing to work while at the same time the farms are continuing to grow in size. Despite these changes, farms are still overwhelmingly owned by families or individuals (1,828,946) and have 1-2 primary operators; however there has been an increase in the number of corporate-owned farms (106,716) (United States Department of Agriculture, 2014). Farming plays a huge role in Iowa economically with Iowa ranking #1 in the U.S. in sale of Grains and Hogs, #1 in the acres farmed for corn and soybeans, and #1 for inventory of Layers, Hogs/Pigs, and Pullets (United States Department of Agriculture, 2015).

In addition to principal operators of farms and their family, many farms also hire additional workers to complete farm tasks, particularly time-dependent tasks such as those during planting or harvest. Within the United States more than 2.7 million workers are employed as hired farm labor (United States Department of Agriculture, 2014). That

hired labor includes local workers, seasonal workers, and migrant workers. In 2012, 22,271 farms utilized 436,570 migrant workers, while within Iowa, 69 farms utilized 341 migrant workers (United States Department of Agriculture, 2014).

National Workplace Injury and Fatality Rates in Agriculture

Workplace injury data is collected by the Bureau of Labor Statistics (BLS) by their Survey of Occupational Injuries and Illness (SOII) and showed the sector of Agriculture, Forestry, Fishing and Hunting has an incidence rate of 5.2 cases per 100 full-time workers (FTW) with the highest subcategory being animal production (6.4 per 100) (Bureau of Labor Statistics, 2012b). Fatality data from the BLS's Census for Fatal Occupational Injury found farmers, ranchers, and other agricultural managers had a fatal work injury rate of 26 per 100,000 full-time equivalence workers (FTE) (Bureau of Labor Statistics United States Department of Labor, 2015). This rate places farmers as ranked 6th in civilian occupational fatality rates in 2014 and first by industry sector of Agriculture, Forestry, Fishing, and Hunting (Bureau of Labor Statistics United States Department of Labor, 2015). Most of the fatalities in this sector are due to being struck by an object or equipment (25%) or roadway incidents (12%) (Bureau of Labor Statistics United States Department of Labor, 2015). For fatal work injuries that involved Hispanic or Latino workers in any occupation, those workers were more likely (68%) to have been born outside the U.S. (Bureau of Labor Statistics, 2012a). Other worker groups with high fatality rates were those workers age 65 and older who had more than 3 times the fatality rate compared to all workers (Bureau of Labor Statistics, 2012a).

There were over 2.1 million principal operators on farms in the United States in 2012, and in addition to those primary operators, there were more than 2.7 million hired farmworkers (United States Department of Agriculture, 2014). There were migrant

workers present on 18,911 farms which amounted to 436,570 migrant workers (United States Department of Agriculture, 2014). The National Agricultural Workers Survey (NAWS) provides a national surveying mechanism of hired crop workers (both migrant and seasonal) and their families. Recent publications from the NAWS data indicate an injury rate of 4.3 per 100 FTE with the subpopulation of shuttle migrants having an injury rate of 7.2 injuries per 100 FTE (Wang, Myers, & Layne, 2011). Injuries to these workers were most often due to contact with objects (32.8%) and body reaction/exertion (31.6%) and the most common type of injury was a strain/sprain (38.8%) or a cut/laceration (21.2%) (Wang et al., 2011).

These trends in larger farm size and older principal operators present challenges to address health and safety needs for farmers, farmworkers, and their families. Farm families are experiencing larger farming operations and may have added stressors such as chronic disease burden of the aging farmer or determining the need for farmworkers if the farm size warrants hiring extra employees. This dissertation research focuses on the populations of older farmers and migrant and seasonal farmworkers. These groups of farmers and farmworkers have exposure to environmental factors such as strenuous work, possible barriers to receiving healthcare due to cultural or financial barriers, and musculoskeletal symptom development that indicates acute and chronic work exposures. Both farmers and farmworkers perform work within an environment where there are time-sensitive tasks that need completed regardless of other external factors.

Purpose of the Study and Specific Aims

The purpose of this study was to gain a better understanding of musculoskeletal symptom prevalence in Iowa farmers, how those symptoms relate to safety on the farm,

and to examine musculoskeletal symptom prevalence in a group of farmworkers in Iowa working through the H-2A Visa program. The following aims were examined as part of this 3-paper option dissertation research:

1. Describe the current research on older farmers in the United States and Canada and critically review the literature regarding aging farmers and how musculoskeletal symptoms affect their ability to perform farm work.
2. Examine health screening data as they relate to musculoskeletal symptoms and farm safety environmental scores for Iowa famers in order to model the factors related to healthcare-seeking behaviors within this population.
3. Examine the musculoskeletal symptom prevalence and past work exposures in newly arrived migrant farmworkers in Iowa certified to work through the H-2A visa process and to compare results to the National Agricultural Workers Survey (NAWS).

This work will build on the current body of research that reports prevalence rates of musculoskeletal symptoms in other farmer and farmworker populations. By understanding the prevalence of musculoskeletal symptoms in Iowa farmers and farmworkers and the factors related to these symptoms, future research will work toward developing interventions to decrease musculoskeletal complaints and improve the function and safety of Iowa farmers and farmworkers.

Barriers

Unfortunately, our current national or governmental surveys in agriculture have limitations that result in lack of comprehensive data related to injuries and safety hazards present on small farms and for migrant farmworkers in the United States on H-2A Visas.

When utilizing the BLS data for injury, illness, or fatality data, the BLS does not track data for farms employing fewer than 11 employees (Bureau of Labor Statistics, 2012b). This data does however give us insight into large, commercial farm injury rates. The BLS collects data using the Occupational Safety and Health Administration's (OSHA) record for injury and illness that employers maintain; however, there is a partial exemption for employers with 10 or fewer employees in a calendar year and family members are not counted as employees for family farms (Occupational Safety & Health Administration, 2013; United States Department of Labor, 2006). This study is utilizing data that was collected from farmers directly due to the limitations of the national data sets.

The survey information from the NAWS survey on hired farm labor provides a basis to establish some key focus areas for health and safety improvements. Limitations of the NAWS sampling and data is that the survey does not collect information from agricultural workers who are in the U.S. on an H-2A Visa (The United States Department of Labor Employment and Training Administration, 2015). The limitations of the survey data available through federal sources such as BLS or NAWS shows that key areas to focus current research on is the implications of the aging workforce within agriculture, causal and preventative factors related to musculoskeletal symptom development, and subpopulations such as older workers or agricultural workers on H-2A Visas. For aim 2 of this dissertation, data was collected directly from H-2A Visa farmworkers in order to obtain data on this subpopulation in agriculture that is not typically studied.

Theoretical Framework

This research is informed by a biopsychosocial (BPS) model of health (Engel, 1977) which provides a holistic view of how biological, psychological, and social factors

interact with each other. The BPS model has been used in chronic pain populations (Gatchel, Peng, Peters, Fuchs, & Turk, 2007). The BPS model was adapted for use in this research and is being used to predict what issues exist in examining factors regarding the pain, function, and safety of farmers or farmworkers experiencing musculoskeletal symptoms (Figure 1.1). Biological factors of importance in farmers or farmworkers with musculoskeletal symptoms include Musculoskeletal Symptoms, Age Related Changes, Comorbid Conditions, Medications, and Physical Ability. Psychological factors of importance in this population include Depression, Stress, Employee Help, and Time Sensitive Work Tasks. Social factors of importance include aspects relating to the Farm Culture and Roles, Environmental Hazards, Farm Tasks, Work Practices, Insurance/Cost Issues, and Family and Community Support.

There are difficulties related to measuring these factors in farmers and farmworkers. When data is examined as a secondary data analysis (aim 2), the variables may be missing from the dataset as they were not measured during the initial study procedures. When tracking the prevalence of musculoskeletal symptoms and these related factors in cohorts of farmer and farmworkers there are barriers related to access and feasibility of measurement. In summary, better understanding the musculoskeletal symptom prevalence of farmers and farmworkers is of importance to researchers, employers, and society as the burden of workplace injuries and illnesses can impact financial, personal, and society factors.

Design Overview

The design for this dissertation is three separate, yet related projects. The approach for aim 1 of this dissertation was to perform a literature search for articles published from 2003-2013 that were about farmers, aging, and prevalence of

musculoskeletal symptoms. These literature results were synthesized according to prevalence data, age-related factors in farming, and suggestions for resources and ergonomics interventions.

The design for aim 2 was to perform a secondary data analysis of data collected during the baseline measurement period of the Certified Safe Farm (CSF) project. The baseline data included health variables from the farmer and also environmental safety scores from the farm. These variables were recoded into variables that indicated levels of safety on the farm, musculoskeletal symptom prevalence, and were then stratified by the age of farmers. A multivariate analysis was performed to determine a model predicting healthcare seeking.

The design from aim 3 was a cross-sectional survey of agricultural workers beginning their seasonal work on crop production tasks. These survey data were then compared to the national dataset of agricultural workers. After baseline data collection, follow-up data were obtained from a medical records audit from a migrant health clinic that serves these farmworkers. Data were extracted and coded for variables that relate to musculoskeletal symptom development and medication usage during these workers' seasonal work experience in Iowa.

Dissertation Outline

Chapters 2, 3, and 4 present a review of the literature and two distinct research projects that all have independent purpose and research focus. These three distinct projects all combine to form a united body of research presented in this dissertation that advances the understanding of musculoskeletal symptoms in agriculture. Chapter 2 focused on an analysis of research literature related to the prevalence of musculoskeletal symptoms in older farmers. Chapter 3 is a database paper that utilized a cross-sectional

method to examine health and safety related factors in Iowa farmers. Chapter 4 utilized a baseline and follow-up health survey to assess musculoskeletal symptoms in migrant farmworkers in Iowa on H2A-Visas. Chapter 5 provides for a summary of all the finding and suggestions for future research directions.

Conceptual Definitions

Clear definitions are needed for important terms related to musculoskeletal symptoms in Iowa farmers and farmworkers. Listed below are key conceptual definitions for this dissertation.

Farm- is a place where ≥ $1,000 of sales were made (or normally would have been made) of agricultural products in a year (United States Department of Agriculture, 2014).

Grain Farms- meet the USDA definition of a *farm* and the agricultural products sold include one or more of the following: corn, soybeans, wheat, alfalfa, hay, sorghum, or other grains grown for sale.

Livestock Farms- meet the USDA definition of a farm and the agricultural products sold include one or more of the following animals: Hogs/Pigs, Beef or Dairy Cattle, Chickens, or other animals raised for sale.

Family Farm- a farm in which ownership is held by people related to each other.

Principal Operator- a person who runs the farm and does the day-to-day management of the farm.

Migrant or Seasonal Farmworker (MSFW)- Seasonal farmworkers perform at least 25 days of agricultural work in a year for different employers near their permanent residence and earn at least half their annual income from farm work. *Migratory farmworkers* are considered seasonal workers who can't return to their permanent

residence each day due to farm work. MSFWs may be residents of the U.S. or may be from other countries.

H-2A Visa- a federal program which allows employers who meet specific criteria to bring foreign workers to the United States to fill temporary agricultural jobs (Department of Homeland Security, 2015).

Farm Safety- Safety on the farm relates to the awareness of hazards and making an effort to reduce risks, improve hazardous situations, and focus on preparing for emergency situations.

Environmental Hazards- Hazards on the farm including, but not limited to the lack of manufacturer safety devices, lack of shielding for moving parts of machinery, tractors without roll-over protective structures (ROPS), elevated work spaces without railings, dust, chemicals, and animals.

Ergonomics- designing the job to fit the worker by considering characteristics of the worker and the job.

Occupational Health and Safety Administration (OSHA)- the federal or state agency responsible for the enforcement of occupational safety and health standards.

Agricultural Exemption- federal funds cannot be used to inspect or enforce OSHA safety regulations on farms employing 10 or fewer workers (Occupational Safety and Health Administration, 2013).

Musculoskeletal Disorders (MSD)- Injuries and disorders of the soft tissues (muscles, tendons, ligaments, joints, and cartilage).

Musculoskeletal Symptoms (MSS)- Symptoms related to musculoskeletal disorders such as pain, stiffness, and difficulty moving.

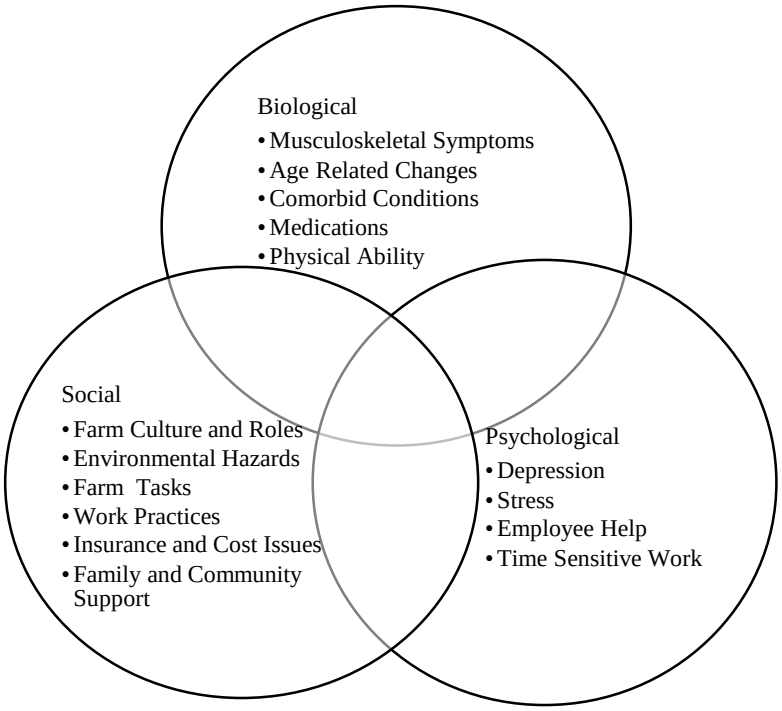

Figure 1.1. Biopsychosocial Model: Farmers and Farmworkers with Musculoskeletal Symptoms

CHAPTER II: WORK-RELATED MUSCULOSKELETAL DISORDERS IN SENIOR FARMERS: SAFETY AND HEALTH CONSIDERATIONS

Introduction

Farming has a rich heritage in the United States; Thomas Jefferson was one of the first to eloquently reflect on the social capital of farmers: "Cultivators of the earth are the most valuable citizens. They are the most vigorous, the most independent, the most virtuous" (McEwan, 2011). Farmers are viewed in the United States as hardy laborers who are essential to providing products to society (Cole, 2010; Rosmann, 2010). Current marketing campaigns use this image to further promote products and support for farmers (Ram Trucks, 2013). Although Jefferson's farms were mostly worked by hired hands and slaves, his appreciation for the occupation of farming in many of his writings was evident (McEwan, 2011). Jefferson's farming innovations were similar to the aging farmers of today; specifically, as he aged, the laborious aspects of his farming operations were delegated to others and he worried about his farming debts.

For aging owner-operators and hired farm workers, their diminished ability to complete farm tasks safely can be devastating psychologically, socially, and financially (Maciuba, Westneat, & Reed, 2013; Reed et al., 2012). The environmental hazards on a farm predispose older farmers to occupational injury and death (Kirkhorn, Earle-Richardson, & Banks, 2010; Lizer & Petrea, 2008; Marcum, Browning, Reed, & Charnigo, 2011; Myers, Layne, & Marsh, 2009). Aging farmers are at particularly high risk for musculoskeletal disorders due to their current and past occupational exposures to heavy lifting, workplace accidents, and other environmental exposures (Osborne et al.,

2012). Age-related changes that increase injury risk include loss of muscle mass and strength, changes in hearing or sight, and problems with balance or cognition (Doria, Buonocore, Focarelli, & Marzatico, 2012). This article describes current research on older farmers in the United States and Canada and critically reviews the literature regarding aging farmers and how musculoskeletal symptoms affect their ability to perform farm work.

Farming in the United States

Farm and farmer demographics have changed dramatically over the past century. The number of small family farms has declined and the number of acres that an individual must farm to economically survive has increased to 500 acres, or $250,000 in annual gross product sales (Banker & MacDonald, 2005). Approximately 2.2 million farms are located in the United States, with the number declining and the acreage per farm increasing (United States Department of Agriculture, 2014) due to modern equipment and more efficient specialized farm practices (MacDonald, Korb, & Hoppe, 2013). Despite these advances, many farmers define their health based on their ability to engage in physical labor (Reed, Rayens, Conley, Westneat, & Adkins, 2012).

The average age of principal operators is currently 58.3 years (United States Department of Agriculture, 2014). The 2012 Census of Agriculture revealed more than 1.8 million farmers are older than 55 years in the United States and 314,829 are older than 75 years (United States Department of Agriculture, 2014). Many farmers continue to work past typical retirement age (Marcum et al., 2011), in part due to younger farmers' inability to afford expensive equipment and land, and increasingly tight profit margins in agriculture (Committee on Agriculture, Nutrition, & Farming, 2011). In addition, farmers

report an emotional attachment to the land and personal satisfaction from farm work (Maciuba et al., 2013). Continuing to work is so important to many farmers that they consider the ability to work part of their definition of "health" (Reed et al., 2012).

Researchers have found that farmers older than 65 years are often working 10- to 12-hour days during planting and harvest times (Lizer & Petrea, 2007). Farmers older than 55 years worked an average of 48 hours per week; farmers older than 75 years, work, on average, 34 hours each week (Voaklander et al., 2010). Older farmers are more likely to have smaller farms and increasingly are supplementing their farm income with off-farm employment (United States Department of Agriculture, 2014).

Farming is Hazardous Work

Due to the labor-intensive nature and hazards of crop and livestock production, the agricultural sector has higher injury and fatality rates than many other occupations, particularly for older farmers (Myers et al., 2009). Over- all, the Agriculture, Forestry, Fishing, and Hunting sector reported 557 fatalities in 2011, with 260 of those fatalities being farmers, ranchers, or other agricultural managers (Bureau of Labor Statistics, 2012b). The fatality rate of 24.2 fatalities per 100,000 full-time workers in this sector is the highest fatality rate in the nation compared to all occupational sectors (Bureau of Labor Statistics, 2012a). This fatality rate does not include youth younger than 16 years, so farm fatality rates are underestimated. Across all measured occupations, older workers have a higher fatality rate (10.8 fatalities per 100,000 full-time workers) than the overall fatality rate for all aged workers (3.5 fatalities per 100,000 workers) (Bureau of Labor Statistics, 2012a). Older farmers have a significantly higher fatality rate (45.8 deaths per 100,000 workers per year) compared to the overall occupational fatality rate (25.4 deaths per 100,000 workers per year) (Myers et al., 2009).

The Agriculture, Forestry, Fishing, and Hunting sec- tor had an overall non-fatal injury rate of 5.2 per 100 full- time workers (Bureau of Labor Statistics, 2012c), with crop production workers at 5.1 per 100 and animal production workers at 6.4 per 100. These rates are likely underestimated because the Bureau of Labor Statistics only collects injury data from larger employers as required by the Occupational Safety and Health Administration (OSHA). Most family farms are not included in these calculations because they employ fewer than 11 workers.

In an independent study of owner-operated farms in Iowa, active surveillance showed that 17% of these farms had an injury in the past year (Donham, Rautiainen, Lange, & Schneiders, 2007) and phone surveillance of all agricultural injuries defined by farmers during a 3-year study found an injury rate of 42 injuries per 100 person-years (Rautiainen, Lange, Hodne, Schneiders, & Donham, 2004). Thus, rates can vary depending on the worker injury definition used, the specific farm population sampled, and the data collection method incorporated. How farmers define "injury" can also impact the interpretation of farm injury research findings (Lizer & Petrea, 2008).

As individuals age, connective tissue of the joints stiffens due to the loss of cartilage and other degenerative osteoarthritic changes; cartilage becomes thinner and more calcified, with resulting impairments in the biomechanical loading and repair of joints (Lotz & Loeser, 2012). The changes in cartilage not only cause pain and joint stiffness but increase the risk of further injury from falls or accidents resulting from slower reaction time. Degeneration of the musculoskeletal system can increase farmers' risk for arthritis, sprains and strains, weakness, pain, and secondary injuries from animal or machine trauma.

Older farmers are also more likely to use older equipment that poses safety hazards or they may remove part of the original safety equipment because finding and in- stalling safety devices for older machinery is difficult and costly (Myers et al., 2009; Rautiainen et al., 2010). Tractor-related fatalities are more common among older farmers and are often related to older tractors without rollover protective structures (Myers et al., 2009). Cost could be a barrier to modifying farm equipment, with costs varying from $50 for a power take off shield cover to more than $700 for a rollover protective structure retrofit (Rautiainen et al., 2010)

Literature Search

The literature searches for this study included articles from PubMed, Web of Science, and CINAHL using the terms "farmer," "aging," "musculoskeletal," "prevalence," and variations of those terms, limiting the results to articles published between 2003 and the present. The search resulted in 226 documents (Figure 2.1.); articles were reviewed by abstract and full-text. They were excluded from this review if they: were duplicates; were from countries other than the United States or Canada; described non-human research; were reviews of the literature; did not include a population of farmers; or were not related to musculoskeletal symptoms or aging.

Musculoskeletal Symptom Prevalence Among Adult Farmers

The primary research studies investigating the prevalence of musculoskeletal symptoms in adult farmers are summarized in Table 2.1. The reported prevalence varied both within and across anatomical joint locations. The lowest prevalence was 5.8% for elbow injuries of Kansas farmers (Rosecrance, Rodgers, & Merlino, 2006), and the highest prevalence was 62% for shoulder injuries for Louisiana crawfish farmers (Nonnenmann et al., 2010). These differences in symptom prevalence are likely related

to differences in exposures for the populations investigated; significant risk factors are listed within Table 2.1.

As farmers age, they likely experience a decrease in re- action time and muscular strength (Yan, Wilber, Wieckowski, & Simmons, 2009). Farmers may operate many types of moving equipment, such as tractors, mowers, or augers that require skill to operate and whose moving parts require a certain level of caution or safety equipment during operation (Penn State Extension, 2010; University of Iowa College of Public Health, 2012). Forty-six percent of older farmer fatalities are due to tractor accidents (Myers et al., 2009). Tractor driving is also a common risk factor for shoulder, neck, lower back, wrist-hand, and knee injuries (Gomez et al., 2003; Nonnenmann, Anton, Gerr, Merlino, & Donham, 2008; Nonnenmann et al., 2010). As part of farm work, farmers may operate equipment, perform manual labor, and climb structures such as buildings or grain bins. Falls or slips are one of the most common injury causes when examining workers' compensation claims for agribusiness employers (Douphrate, Rosecrance, & Wahl, 2006). For example, grain bins can be more than 75 feet tall and a fall from that height could result in significant injury or death (Bureau of Labor Statistics, 2012b; Sukup Manufacturing Co., 2012).

Age-Related Factors and Farming

Primary research articles related to aging and farming were reviewed (Table 2.2.). From those articles, it was clear that although farmers may decrease the number of off-season hours worked on the farm each week, they are still engaged in various strenuous farm tasks in a part-time capacity that increases their risk for injury or death (Amshoff & Reed, 2005; Voaklander et al., 2010). Farmers, age 70 years and older, may reduce their work hours and thus de- crease their exposure to farm hazards and resulting injuries (Heaton, Azuero, Phillips, Pickens, & Reed, 2012; Mariger et al., 2009). However,

comorbidities (e.g., arthritis) in the 70 years and older age group may also increase the risk of injury if these workers continue to lift heavy objects independently (Heaton et al., 2012; Marcum et al., 2011).

In a population of farmers older than 50 years, a diagnosis of arthritis resulted in 1.68 greater odds (95% confidence interval [CI]: 1.32 to 2.14) of occupational injury (Marcum et al., 2011). Recent pain medication use (31 to 90 days prior to injury) of either nonsteroidal anti-inflammatory drugs (odds ratio [OR] = 2.40; 95% CI:1.43 to 4.03) or narcotic analgesics (OR = 9.37; 95% CI:4.95 to 17.72) were also associated with greater adjusted odds of injury among older farmers than among other age groups (Voaklander et al., 2006). Voaklander et al. (2006) hypothesized that this increased injury risk after recently eliminating pain medications may be related to the effect of a prior injury or a lack of focus on farm work due to a competing focus on pain or other injury symptoms.

Discussion

Ergonomic Interventions

Kirkhorn et al. (2010) completed a review of ergonomic interventions in agriculture to determine which interventions significantly improved musculoskeletal symptoms. The ergonomic interventions reviewed were varied and several studies had small sample sizes and lacked random assignment. Additionally, many ergonomic interventions were specific to the type of production agriculture studied. Most of the interventions were researched on farmworkers involved in large-scale fruit and vegetable production; however, some of these interventions could still be applicable to small family animal and crop operations.

Using Kirkhorn et al.'s (2010) proposed ergonomic intervention framework, several

ergonomic interventions could assist older farmers (Table 2.3.). An older worker diagnosed as having osteoarthritis of the hip and knee may struggle with farm tasks such as animal feeding and ladder climbing due to stiffness and pain: modifying steps to grain bins or equipment storage (farm-level intervention), use of an all- terrain vehicle to travel between work locations (individual- level intervention), rest breaks of 5 minutes after every 30 minutes of work (practice-level intervention), or strength training (individual-level intervention) are examples.

Resources for Farmers with Musculoskeletal Disorders

Farmers in the United States may experience disparities in health care access or quality because they live in rural locations and are self-employed (Eberhardt & Pamuk, 2004). Self-employment requires owner-operators to purchase their own health insurance, be eligible for Medicare, or choose to be uninsured. When purchasing health insurance independently, the rates may be higher for the farmer than workers for whom public or private sector employers pay all or a portion of the premium. To save on monthly premiums, farmers may choose plans with high deductibles or catastrophic event coverage only. The lack of coverage for preventive health services could result in higher costs in the future. The Affordable Care Act of 2010 was designed to decrease costs and improve the quality of and access to health care by small business owners (United States Department of Health and Human Services, 2010). Affordable health insurance through the Affordable Care Act marketplace could benefit farmers who are ineligible for Medicare by realizing savings in health insurance premiums.

In examining a population of farmers older than 50 years, risk factors for delaying health care included being older than 65 years, earning a lower family income, reporting

poorer health status and more health-related conditions, and being without health insurance (Reed, Rayens, Winter, & Zhang, 2008). Reed et al. (2008) demonstrated that primary barriers to health care for farmers are lessened once a farmer reaches 65 years of age and becomes eligible for Medicare.

It has been reported that more than 30% of rural families have at least one uninsured member (Ziller, Coburn, Anderson, & Loux, 2008). Although 93% of farmers in Iowa reported having health insurance, many had health insurance with high premiums and high deductibles (Pryor, Lottero, Rukavina, Prottas, & Knudson, 2007). For farm households, 14% overall reported no health insurance during 2007, with 20% of non-elderly primary farming households lacking health insurance (United States Department of Agriculture, 2014). Based on the lack of health insurance in this occupational group, farmers younger than 65 years may be at high risk for inadequate access to health care to meet their health needs.

AgrAbility, funded by the United States Department of Agriculture and other affiliates, assists farmers with disabilities including arthritis or injuries for which farmers require assistive devices if they wish to continue working (AgrAbility, 2013; Hamm, Field, Jones, Wolfe, & Olson, 2012). Research has shown that for disabled farmers in Canada, limited access to health care and rehabilitation was a barrier to continuing or returning to farm work; community and family support were facilitators (Friesen, Krassikouva-Enns, Ringaert, & Isfeld, 2010). At a recent conference focused on farmer disability, presenters suggested that education and work practice modification should be provided for younger farmers (Cook & Field, 2011). Practices to prevent or reduce the impact of arthritis on farm tasks included ergonomic changes

to farm practices, regular exercise, normal weight, and medications to control symptoms. Equipment modification or the use of assistive devices could also reduce strain on affected joints.

The rural nature of farm work can also affect farmers' access to needed care and possibly rehabilitative services during specific times of day or year. Farmers may arrange scheduled procedures such as knee replacement surgery during the winter so that farm work is not impacted. Primary care and public health providers including public health and agricultural health nurses should be aware of the AgrAbility program that serves their area. Additionally, it is imperative that health care providers who serve farmers learn about unique farm environments, possible financial or insurance concerns of farm families, and treatment or rehabilitation options that can assist farmers in continuing to farm safely. The AgriSafe organization works to support health care providers by providing training and networking to better prepare providers to meet the needs of farmers and farm families (AgriSafe, 2013).

Workplace Standards

According to OSHA Directive CPL 02-00-051, federal funds cannot be used to inspect or enforce OSHA safety regulations on farms employing 10 or fewer workers (OSHA, 2013). These farms are more likely to be family owned and operated, and likely to have fewer resources than larger farms. Small farms are currently exempt from OSHA enforcement and owner-operators overwhelmingly do not want OSHA involvement on their farm (Johanns, 2013). However, several states (Washington, Oregon, and California) do not observe the small farm exemption because their state OSHA plan includes small farm regulations; they use state funds for inspection and enforcement of small farms. Fatality rates are significantly higher in states that observe

the exemption than in those that do not (Somervell & Conway, 2011). Despite OSHA's lack of standards for small farms, farmers should be encouraged to create safe farm environments and ensure safe work practices.

For farms employing more than 10 workers, OSHA can inspect the farm and enforce OSHA workplace standards. Applicable standards to agriculture can vary depending on the type and size of operation, including standards for noise, respiratory exposures, confined space, equipment guarding, and rollover protective structure for tractors. For farmers applying pesticides, the Environmental Protection Agency oversees pesticide handling and exposures through the Worker Protection Standard for Agricultural Pesticides (40 CFR part 170) (United States Environmental Protection Agency, 2012).

Recommendations for Future Research

Research addressing the musculoskeletal symptoms of older farmers has provided a basic understanding of musculoskeletal symptom prevalence. Prevalence rates are difficult to interpret due to differences in collecting injury data, recall bias, and the population included in published studies. Adequate surveillance methods to determine the actual rates of agricultural injury should be developed. Without accurate data, identification of at-risk populations and evaluation of program efficacy may be inaccurate.

Agricultural studies originating in other countries such as Canada may be more accurate because of their national surveillance system, Canadian Agricultural Injury Reporting (2013). It is unclear whether specific rates from other countries are comparable to the United States due to differences in work practices and farm commodities. Farm health is more difficult to study in the United States because no

national health registries exist and farmers in the United States often have off- farm jobs or may not have health insurance, which could impact both work and health parameters. More extensive monitoring of agricultural illnesses and injuries by state governments or public health departments could support ongoing research focused on farmer well-being and quality of life. Current research shows high rates of musculoskeletal symptoms among workers in most agriculture operations, but the nature of the operation (e.g., large- scale vs. small-scale farms, crop vs. animal production) should be studied further. The inclusion of both owner-operators and hired farmworkers should be considered in sampling. Despite a high prevalence of musculoskeletal symptoms in older farmers, little has been done to address hazard management that targets either the farm environment or the farm worker. Engineering controls would be most effective in preventing musculoskeletal injuries.

Consideration should also be given to the small farm exempt from OSHA oversight in these investigations. Because arthritis and other musculoskeletal symptoms increase farmers' risk for injury and future disability, interventions should be developed to address environmental hazards across the lifespan. For example, all generations working on a farm are at risk for musculoskeletal injuries and disability. Simple interventions such as the addition of stairs on machinery, identifying hazardous work practices that expose farmers to excessive lifting and bending, and reducing repetitive activities that put farmers at risk for future musculoskeletal disorders are needed. Many farmers are owner-operators and want to continue to farm despite chronic illnesses or injuries. Clinicians must be cautious in treating musculoskeletal pain with nonsteroidal anti-inflammatory drug or narcotic analgesics because both are known to

increase farmers' risks for additional injuries (Voaklander et al., 2006).

Recommendations for Future Practice

Occupational or agricultural health nurses may care for farmers and their families in rural areas (Fleming, 2004). Specialized training in rural and agricultural health through coursework, continuing education, or the AgriSafe Network is needed to best meet the needs of the aging farmer (AgriSafe, 2013; Culp, 2005). Several universities provide semester or summer coursework to educate health care professionals about the unique needs of farm families.

Agricultural health nurses ensure that the materials they use are evidence-based and population-specific to ensure quality health outcomes. Rural clinicians can screen farmers for early signs of musculoskeletal disorders such as pain and stiffness. Programs such as FARM-HAT or Certified Safe Farm provide guidance for farm safety inspections and comprehensive safety and health programs (Penn State Extension, 2010; University of Iowa College of Public Health, 2012). Using farm safety checklists and health information, the agricultural health nurse can identify and reduce ergonomic challenges on the farm. The aging farmer may need assistance in applying for programs such as AgrAbility or case management services to coordinate health care.

Conclusion

Many factors influence the development of musculoskeletal disorders among farmers. Understanding the hazards in the farm environment and the culture of farming can assist health care providers in meeting the needs of farmers and farm families. Future programming and re- search should focus on interventions to reduce the risk of musculoskeletal disorders and improve the safety of the farm environment to reduce

occupational injuries. Older farmers may have unique challenges related to both work exposure and age-related changes that may put them at risk for disability. Occupational health nurses can identify health issues, potential safety hazards in the farm environment, or resources within the community to assist aging farmers.

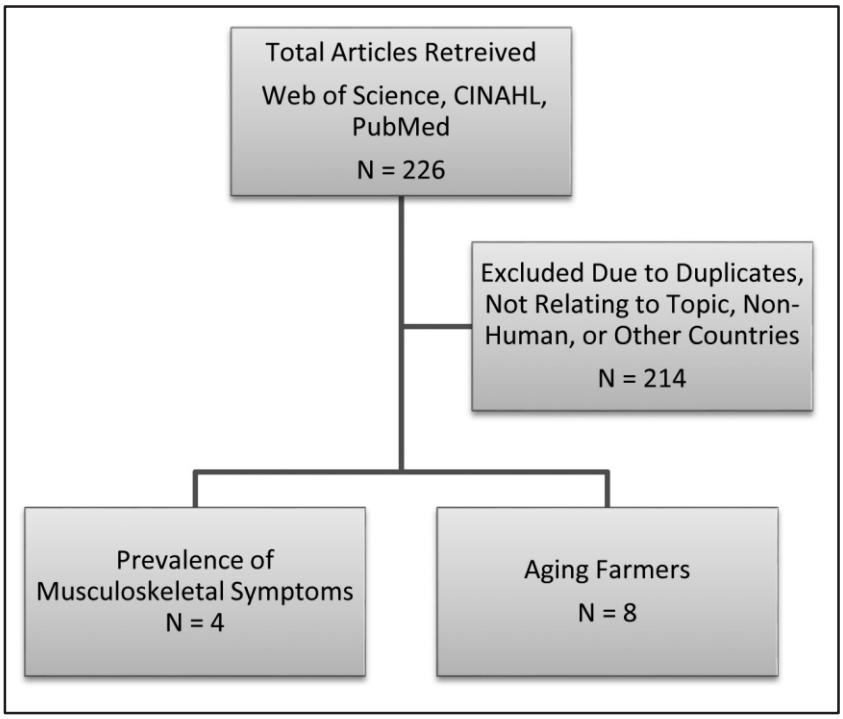

Figure 2.1. Results of Literature Search

Table 2.1. Prevalence of Musculoskeletal Symptoms in Farmers by Joint, Population, and Risk Factors (2003- 2013)

Joint	Prevalence	Population	Significant Risk Factors	Reference
Shoulder	35% (neck & shoulder)	NY Farmers	Female, age, owner/operator, tractor	Gomez et al., 2003
	54%	Iowa Dairy Farmers		Nonnenmann et al., 2008
	62%	Louisiana Crawfish Farmers		Nonnenmann et al., 2010
	25.9%	Kansas Farmers	Animal handling	Rosecrance et al., 2006
Neck	43%	Iowa Dairy Farmers	Manual feeding, tractor driving	Nonnenmann et al., 2008
	48%	Louisiana Crawfish Farmers		Nonnenmann et al., 2010
	22.4%	Kansas Farmers	Lifting materials	Rosecrance et al., 2006
Upper Back	16.7%	Kansas Farmers		Rosecrance et al., 2006
	25%	Louisiana Crawfish Farmers	Years spent farming	Nonnenmann et al., 2010
Elbow	24%	Iowa Dairy Farmers	Hours milking, carrying/lifting	Nonnenmann et al., 2008
	39%	Louisiana Crawfish Farmers		Nonnenmann et al., 2010
	5.8%	Kansas Farmers		Rosecrance et al., 2006
Lower Back	41%	NY Farmers	Female, owner/operator, tractor	Gomez et al., 2003
	61%	Louisiana Crawfish Farmers	Tractor driving	Nonnenmann et al., 2010
	37.5%	Kansas Farmers	Age, heavy lifting, working when injured, working overhead	Rosecrance et al., 2006

Table 2.1. Continued

Wrist & Hand	28%	NY Farmers	Female, age, ambidextrous, tractor	Gomez et al., 2003
	40%	Iowa Dairy Farmers	Manually cleaning stalls	Nonnenmann et al., 2008
	47%	Louisiana Crawfish Farmers	Tractor driving	Nonnenmann et al., 2010
	12%	Kansas Farmers		Rosecrance et al, 2006
Hip	15%	NY Farmers	Female, age, tractor	Gomez et al., 2003
	21% (hip & thigh)	Louisiana Crawfish Farmers		Nonnenmann et al., 2010
	10.4% (hip & thigh)	Kansas Farmers		Rosecrance et al., 2006
Knees	29%	NY Farmers	Age, BMI, milking, tractor	Gomez et al., 2003
	28%	Louisiana Crawfish Farmers		Nonnenmann et al., 2010
	23.6%	Kansas Farmers		Rosecrance et al., 2006
Feet	24%	Louisiana Crawfish Farmers		Nonnenmann, 2010
	15.1%	Kansas Farmers		Rosecrance, 2006

Table 2.2. Primary Research Literature Reviewed, Geographic Location and Population, Type of Study, Outcomes

Primary Research Literature	Geographic Location and Population	Type of Study	Outcomes
Amshoff et al., 2005	725 Farmers in South Carolina and Kentucky over age 50 Mean Age: 67	Baseline data of longitudinal study	• Older farmers are performing varied and strenuous farm tasks that put them at risk for injury. • 43% of farmers reported a diagnosis of arthritis • 25% of farmers reported back problems. • 16% reported musculoskeletal injuries such as strains and sprains in the last 12 months.
Heaton et al., 2012	1,419 Farmers Mean Age (SD): 65.3 (8.43)	Longitudinal	• Over 50% of subjects reported arthritis • Arthritis increased the odds of developing a farm-related injury. • Increased age was predictive of fewer injuries.
Maciuba et al., 2013	156 African-American Farmers Mean Age (SD): 64 (9.1)	Mixed-Methods	• Older African-American farmers scored relatively high in coping ability. • Most of these older farmers were still working part-time on the farm while many were adding off-farm employment as well. • Farmers are attached to the land and gain personal satisfaction from performing farm work.
Marcum et al., 2011	1,394 Kentucky and South Carolina Farmers >50 yrs old Mean Age (SD) at Baseline: 65 (8)	Cohort	• Farmers with a diagnosis of chronic bronchitis, back problems, arthritis, or poor sleep were at a greater risk of injury.

Table 2.2. Continued

Maringer et al., 2009	308 Virginia Farmers Mean Age: 60	Cross-sectional Survey	• 22.8% of farmers have arthritis. • For farmers >64, increasing age was associated with a higher number of medical conditions. • Older workers worked less hours than younger workers, therefore they experienced less exposure to work hazards. • Older workers experienced fewer injuries.
Reed et al., 2012	1,288 Southern Farmers Mean Age (SD): 65.3 (8)	Baseline data of longitudinal study	• Older farmers had on average 1.9 (SD=1.7) health conditions. • Absence of pain was used by 14.3% of older farmers as their definition of health. • Ability to work was rated by 41.9% of older farmers as their definition of health.
Voaklander et al., 2006	282 Male Canadian Farmers with Injury Mean Age (SD): 71.4 (5) and 1410 Controls Mean Age (SD): 71.8 (4.6)	Case-control	• Narcotic and NSAID use increased the odds of injury. • Osteoarthritis as a co-morbidity increased the odds of injury.
Voaklander et al., 2010	1255 Male Canadian Farmers >55 yrs old Mean Age (SD): 65 (8)	Cross-sectional	• Arthritis was reported by over 25% of farmers. • Time spent doing farm work decreased by age. • Farmers over 75 yrs old were working on average 30 hrs/week.

Table 2.3. Dimensions of Ergonomic Intervention Characteristics in Agriculture. Modified from Kirkhorn, Earle-Richardson, & Banks (2010)

	Materials	Practices
Farm Level	Farm-level changes in structures, machines, or common equipment. Example: Modified steps to grain bins and modified ladders on tractors. Most costly, easiest adoption	Farm-level changes, work processes and procedures, equipment. Example: Rest breaks during work such as 5 minutes of rest for every 30 minutes of work. Moderate cost and adoption
Individual Level	Individual level changes, tools and small equipment. Example: Usage of an ATV to allow for easier movement between work locations on the farm. Modest cost, variable adoption	Individual worker behavior. Example: Body mechanics training or individual muscle strength training by physical therapist. Least costly, most difficult adoption

CHAPTER III: PREVALENCE OF MUSCULOSKELETAL SYMPTOMS AND PREDICTORS OF SEEKING HEALTHCARE AMONG FARMERS

Introduction

Farmers have a higher prevalence of musculoskeletal symptoms than other occupations (Holmberg et al., 2002; Thelin et al., 2009; Thelin and Holmberg, 2007; Park et al., 2001), and there are unique factors related to the culture, healthcare insurance coverage, and access to healthcare within the farm community that complicate the prevention of musculoskeletal symptoms and related injuries. Prior research has shown that musculoskeletal symptoms are among the most common health problems for farmers, with prevalence rates as high as 56% to 75% overall (Alterman et al., 2008; Gomez et al., 2003; Nonnenmann et al., 2008; Osborne et al., 2010). The most frequent location for musculoskeletal symptoms varies by type of farming, with consistently high rates for the shoulder (54%) and lower back (37.5% to 41%) for many groups of farmers (Gomez et al. 2003; Nonnenmann et al., 2008; Rosecrance et al., 2006). The arthritis rate among older Kentucky farmers is 50.4% (95% CI: 46.8-53.8) (Browning et al., 1998), with national data showing that 67% of working farmers over age 65 and 75% of working farmers age 75 or older have arthritis (Caban-Martinez et al., 2011). Because musculoskeletal symptoms increase the risk of injury or disability for farmers, examining the safety of the farm environment is of particular importance.

One factor related to the high prevalence of musculoskeletal symptoms is that the average age of farmers in the U.S. is currently 58.3 years (USDA, 2014). Older farmers continue to work past the typical retirement age of other professions, with farmers over age 55 reporting 40 to 60+ hours of work per week (Lizer and Petrea,

2007; Thelin and Holmberg, 2010; Voaklander et al., 2010). Older farmers may also delay seeking healthcare due to the actual or perceived cost (Reed et al., 2008), and older farmers have a higher risk of fatal injury (Myers et al., 2009). Other potential risk factors related to musculoskeletal symptoms in farmers include performing non-farm work (Park et al., 2001), mean hours worked (Osborne et al., 2010), lifting (O'Sullivan et al., 2009), and occupational exposures such as milking cows and large animal handling (Thelin et al., 2004). There is also strong evidence for a connection between heavy lifting and the development of hip osteoarthritis (Jensen, 2008).

Farmers with musculoskeletal symptoms or arthritis have greater odds of injury while working (OR = 1.68-3) (Marcum et al., 2011b; Sprince et al., 2003a, 2003c). Additionally, use of medication for musculoskeletal symptoms and other health disorders has been shown to be associated with increased injuries in farmers as they interact with their work environment (Sprince et al., 2003b; Voaklander et al., 2006, 2009). In Wisconsin, arthritis, back pain, joint injury, and orthopedic injuries account for 48% to 50% of referrals to the AgrAbility program, which assists disabled farmers in continuing to farm (Kirkhorn et al., 2003). While farmers have a high prevalence of musculoskeletal symptoms, this does not affect the number of hours worked per week (Marcum et al., 2011a).

Development and exacerbation of musculoskeletal symptoms can be related to factors within the farm environment. The farm environment can be assessed with a standardized instrument such as the Certified Safe Farm safety checklist (Rautiainen et al., 2010) or the Farm-HAT checklist (PSU, 2010). Prior research in the first Certified Safe Farm studies showed a relationship between safer farms and less costs for

musculoskeletal problems (Donham et al., 2007). Farmers participating in the Certified Safe Farm program found the occupational health history and screening performed by a registered nurse to be the most beneficial component of the program, followed by the farm safety assessment (Kline et al., 2007). Comprehensive health and safety programs assist in increasing the use of personal protective equipment (PPE) by farmers (Donham et al., 2013; Schiller et al., 2010).

In this article, we report health screening data as they relate to musculoskeletal symptoms and farm safety environmental scores. Further, we report on the relationships among these variables for Iowa famers. Additionally, we explore the seasonal aspects of musculoskeletal symptoms and evaluate the factors related to healthcare-seeking behaviors with a logistic regression model.

Methods

This article reports data collected from farmers during a parent study, the Certified Safe Farm (CSF) project (Donham and Thelin, 2006). The original CSF intervention study used a controlled trial design. This sample (n = 438) includes farmers in the intervention group from 38 counties that surround ten AgriSafe clinic sites in Iowa. Occupational health forms with specific agricultural questions were used to collect health information. These forms were developed by the AgriSafe Network, a non-profit focused on the health of farm families, and include an assessment of medications, co-morbidities, and musculoskeletal symptom prevalence (AgriSafe, 2013). We used baseline data from the intervention group (n = 438) and excluded n = 26 because of incomplete records. Inclusion criteria included (1) principal farm operator and/or spouse, (2) residing in the targeted counties, (3) farming at least 20 hours per week on average,

and (4) a minimum agricultural production requirement of $1,000 in sales per year. For this study, clinical data, demo- graphic information, agricultural practices, and environmental surveys were used based on two data collection methods: (1) a clinical wellness and occupational health screening, and (2) an on-farm safety review. Informed consent was obtained from each participant (IRB No. 200608755 and No. 200309064).

Procedures

The health screenings were conducted at a clinic by nurses who had training specific to agricultural health and safety. These nurses had completed a 40-hour certificate course in agricultural medicine (Fisher and Donham, 2011). The nurses performed a clinical exam that consisted of an occupational health history and general wellness parameters (i.e., blood pressure, cholesterol, vision, pulmonary function testing, hearing, etc.). The screening aimed to determine past and current risks to the farmer's health and safety, impairments in functioning, and focus areas for further education and intervention. Specific tests targeted areas such as joint pain, medication usage, diagnosed health concerns, and other health concerns identified by the farmer.

The on-farm safety review took place on the individual farms and was completed by farm reviewers trained in the identification of hazards using a specially designed farm safety checklist. The development of this checklist is described by Rautiainen et al. (2010). The on-site environmental reviewers were trained safety and health personnel or were community members who completed standardized training to complete this assessment. Inter-rater reliability was established as part of the standardized training.

Instruments

An occupational health survey questionnaire was developed for the parent study and included questions on basic demographic information such as age, number of acres farmed, and type of livestock raised. Health and safety data collected included information on general health and wellness indicators, injury and illness history over the past 12 months, and information on musculoskeletal symptoms and arthritis.

The environmental review was conducted by a trained agricultural specialist. An over- all farm safety score was computed based on the environmental assessment and included subscales for the following areas: tractors, combines, gravity-flow augers and wagons, portable augers, skid steers, other self-propelled machines, other non-self-propelled machines, swine and poultry structures, dairy and beef structures, storage structures, machine shop, hand and power tools, chemical storage, and the outdoor working environment. The overall farm safety score was an average of all the subscales that were scored and represented a general indication of the overall safety of the farm. A subscale was not used if the farm did not include that aspect of operation. Each subscale was scored from 0 to 100. Generally, a score of ≤ 95 was considered a low score.

Individual equipment and areas were scored according to the checklist, which gave higher scores for equipment or areas with safer features. The environmental specialist performed a visual inspection of the farming operation and scored it based on the elements present. For example, a tractor received a higher score if it had rollover protection, working lights and markings, a slow-moving vehicle sign, and mirrors. A building with a fire extinguisher, pathways clear of clutter, lighting, and railings for elevated work areas also received a high score. The outdoor environment was assessed

for hazards such as location of roadways, walkways, obstacles and tripping hazards, storage, lighting, fences, power lines, safe play areas for children, location of fuel tanks, and use of cell phones.

Data Analysis

The results were analyzed using SPSS Statistics (IBM, 2012). For each of the areas of analysis the number (*N*) varied due to farmers not completing all aspect of the data col- lection. Missing data were treated as missing and not included in the analysis. Analyses included chi-squared (χ^2) or Fisher's exact test for any data for which the cell size was <5. Forward binary logistic regression was used, including variables that were identified by bivariate analysis in addition to clinical significance.

Results

Demographics and Farm Characteristics

The average age of the population was 56.08 years (SD = 12.37; median = 57) with *N* = 374 (90.8%) male and *N* = 346 (87.8%) married. Demographic and farm characteristics are presented in table 3.1 with comparable demographic and farm information from the most recent Iowa agricultural census to provide a comparison (USDA, 2014). Farm size varied, with *N* = 183 (46%) farming less than 500 acres and *N* = 212 (53.3%) farming 500 or more acres. The top three crops farmed in the last five years included corn (*N* = 361; 94.8%), soybeans (*N* = 333; 89%), and hay (*N* = 243; 67.5%), while animal production consisted of cattle (*N* = 157; 42%), cow/calf (*N* = 121; 32.5%), and swine (*N* = 104; 28.3%). Most farmers had additional family members who helped on the farm, with *N* = 243 (69%) reporting that two or more family members helped farm.

Musculoskeletal Symptoms

The 12-month prevalence of musculoskeletal symptoms varied by joint, with the lowest prevalence of 28% across all ages for the elbow and the highest prevalence of over 73% for the lower back. Other joints assessed included the neck, shoulder, upper back, wrist, hip, knee, and feet, which all had 40% to 56% symptom prevalence. When examining the number of painful joints, the average for all subjects was 4.15 (SD = 2.75) over the last year. This population was split into age categories based on age 55, which is a typical population cut-point in population research, close to the mean age of U.S. farmers overall, and close to the median age of this population. Examining the variables by age category showed significant differences between younger (age 18-54) and older (age 55+) farmers for neck and knee symptoms (Table 3.2.). A significantly higher percentage of younger farmers reported neck symptoms compared to older farmers (58.96% vs. 48.65%; $p = 0.043$), while knee symptoms were reported less by younger farmers than by older farmers (45.61% vs. 60.27%; $p = 0.004$).

When examining whether musculoskeletal conditions prevented work when compared by age, the results were not statistically significant ($\chi^2 = 1.756$; $p = 0.185$) (table 3.3). Overall, relatively few farmers (6.53% overall) reported musculoskeletal conditions that prevented work. Seeking healthcare for musculoskeletal symptoms was reported by a greater percentage of farmers (46.55%), but this variable also did not statistically vary with age category ($\chi^2 = 0.005$; $p = 0.945$), with 20.2% in the younger category and 26.34% in the older category (Table 3.3.). A self-report of doctor-diagnosed arthritis was provided by 31.16% of farmers, and this variable was

statistically different by age, with 6.8% of younger farmers reporting arthritis and 24.36% of older farmers reporting arthritis ($\chi^2 = 30.148$; $p < 0.001$).

When discussing the musculoskeletal variables, the seasonality of the data collection needed to be considered. Examining these variables across winter (December, January, February), spring (March, April, May), summer (June, July, August), and fall (September, October, November) revealed no statistically significant differences in the responses. Musculoskeletal conditions preventing work were reported by 5.9% of farmers overall and did not vary across seasons ($\chi^2 = 0.154$; $p = 0.985$). Musculoskeletal conditions needing a healthcare provider were high overall across seasons at 47% but were not significantly different ($\chi^2 = 1.784$; $p = 0.618$). In winter, 51.7% sought healthcare for musculoskeletal conditions, compared to 43% in fall, but the trend was not significant.

Overall Farm Environment

Overall farm safety scores and outdoor safety scores are presented by age categories in tables 3.4. and 3.5. Farm safety scores of ≤95 were considered low. Overall farm safety scores were significantly different between age categories, with $\chi^2 = 11.562$ ($p = 0.001$). Of farmers in the older category ($N = 223$), 144 (64.6%) were in the low safety category. For the outdoor safety subscale, there was no overall significant difference between age categories ($\chi^2 = 0.396$; $p = 0.397$).

Multivariate Analysis

Logistic regression using SPSS (IBM, 2012) was used to predict which farmers were seeking healthcare for musculoskeletal symptoms. Arthritis history, employee help on the farm, joint pain location, age, and farm size (acres) were analyzed within the

model as predictors. The final model included arthritis, employee help, hip pain, and upper back pain as predictors (Table 3.6.). Age and farm size did not add significant predictive value to the model, so they were not included in the full model. A test of the full model against a constant-only model was statistically significant ($\chi^2 = 53.646$; $p < 0.001$ with $df = 7$). Overall prediction success was 66.1% (57.5% for seeking healthcare and 73.1% for not seeking healthcare). Negelkerke's R^2 was 0.211, indicating a modest relationship of the model predicting the farmers seeking healthcare for musculoskeletal symptoms.

Discussion

Older and younger farmers differed significantly in the prevalence of symptoms re- ported for the neck and knee, indicating that joint location is an important consideration when designing interventions for these groups. The increased prevalence of musculoskeletal symptoms in the knee for older farmers is consistent with research showing that farmers have greater odds than other occupations of undergoing knee (OR = 5.1; 95% CI: 2.1-12.4) or hip (OR = 3.6; 95% CI: 1.3-8.4) replacement due to osteoarthritis (Franklin et al. 2010). The prevalence of symptoms for some joints, such as the lower back and knee, were higher than reported in other studies of musculoskeletal pain in farmers (Tonelli et al., 2014). A possible reason is the difference in the time period used to calculate prevalence. This study asked farmers about pain in the past 12 months, while other studies may have used a shorter time period and thus reported lower prevalence rates. A study of Louisiana crawfish farmers also had a high prevalence of lower back pain (61%) and found that tractor driving was a significant risk factor (Nonnenmann et al., 2010). It is likely that most farmers in our study were

exposed to tractor driving, with 89% reporting growing soybeans and 94% growing corn at the time of the study. This study found similar rates of self-reported doctor-diagnosed arthritis compared to the national adult population, where the overall prevalence rates is 22.7% and ranges from 7.3% for younger populations to 49.7% for older populations (CDC, 2013).

When examining further musculoskeletal factors, it was evident that relatively few farmers (6.53%) take time off work even if they have musculoskeletal symptoms. It might be worth exploring this finding to determine if these farmers perceive barriers to taking time off work or if they are able to adjust their work demands to accommodate their symptoms and healthcare needs. With the independence of self-employment as owner-operators, they may be able to adjust the demands or pace of their work. Nevertheless, interventions could still be considered, such as more frequent breaks, ensuring that tractors and other equipment have adequate seats and mirrors to prevent strain, and possibly medical or pharmaceutical interventions. More farmers sought healthcare for musculoskeletal symptoms and reported missing work during the winter months, but this seasonal relationship was not statistically significant. Hypothesized reasons include the reduction in time-sensitive work demands during the winter months, exacerbation of symptoms due to weather, or an increase in slips, trips, and falls due to ice and snow. Seasonality needs to be explored further to determine if this relationship is clinically significant.

Farm safety scores were overall lower for older farmers. This is significant because the fatality rate is higher for older farmers than for younger farmers (Myers et al., 2009). When examining the safety concerns that led to the lower scores, common

items of concern included tractors, shop areas, and storage areas. The lower score for tractors is of particular concern because tractors are related to 46% of older farmer fatalities (Myers et al., 2009). A farm safety score may help identify safety concerns, encourage the farmer to make changes, and hopefully prevent a future injury or fatality.

When exploring the model that predicted the farmers seeking healthcare for musculoskeletal symptoms, the predictive factor of doctor-diagnosed arthritis was likely due to the chronic nature of the disease process and because the farmer already had an established healthcare provider. When considering arthritis in the model, employee help was also predictive, which suggests that having someone who is able to perform farm work while the farmer is absent may be beneficial to seeking healthcare when needed. The joint pain locations of the hip and upper back may have significance related to the movements that are needed to perform farm work. This is an area where limitations were evident when examining the quality of musculoskeletal risk factors, such as postures, forces, and repetitive tasks. These areas could not be examined in this study due to the lack of measurement of these variables. Measurement of these variables with a sample of this size would have significantly increased the burden and time of the study; however, they are important factors to further explain the specific work tasks that may be related to the development and exacerbation of musculoskeletal symptoms in farmers. Further re- search is needed to determine what influence these variables have, with particular focus on interventions that reduce the risk of arthritis and musculoskeletal symptoms.

Safety Emphasis for Rural Health Practitioners and Safety Specialists

Better understanding of the relationship between age and farm safety allows for interventions that target areas of low safety scores for older farms, such as tractors, shop are- as, and storage areas. The farm safety scores indicate specific areas to target for improving safety on the farm. In particular, the tractors of older farmers should be examined due to the lower safety scores and the increased risk of tractor-related death for older farmers. Targeted interventions toward those at higher risk would allow nurses and other farm safety and health professionals to focus resources on specific groups. Younger farmers may need interventions targeted toward the prevention or treatment of neck pain, while older farmers may benefit more from prevention or treatment of knee pain. By working to keep the farm safe and decrease the prevalence and severity of musculoskeletal symptoms, health and safety professionals can improve the quality of life for farmers.

Conclusion

The prevalence of musculoskeletal symptoms can vary by joint, and the location can be different for young farmers versus older farmers. Standardized health and safety checklists specifically developed for farmers can assist in evaluating specific health needs and safety concerns. In particular, older farmers should have their farm assessed for tractor safety. Improvements to the farm environment and equipment should be encouraged. A better understanding of the impact of musculoskeletal symptoms on work ability is needed, as prevalence is high yet few farmers miss work due to musculoskeletal symptoms. Potential interventions, such as modifications to the work environment, symptom management using medication, and rehabilitative therapy, need to

be further examined to determine their risk or benefit for the health and safety needs of farmers. Due to the unique health and safety needs of this population, specially trained health and safety professionals need to continue to assess farmers and the farm environment. Standardized assessment of farms and farmers can aid in the identification of personal and farm safety and health factors related to musculoskeletal symptoms and injury.

Table 3.1. Demographics and Farm Characteristics

Demographic Characteristic	Mean (S.D.) or N (%)		2012 Iowa Agricultural Census Data
Age	56.08 (12.37)		55.6
Male	374 (90.78)		55,631 (78.40)
Married	346 (87.82)		
Acres Farmed	Number of Acres	N (%)	N (%)
	1-249	81 (20.51)	68,814 (77.64)
	250-449	102 (25.82)	
	500-999	117 (29.62)	11,582 (13.07)
	1000+	95 (24.05)	8,242 (9.30)
Type of Crops Grown in the Last 5 Years	Crop	N (%)	N (%)
	Corn	361 (94.75)	47,477 (53.56)
	Soybeans	333 (89.04)	41,710 (47.06)
	Oats	4 (1.33)	2,594 (2.93)
	Sorghum	138 (40.95)	26 (0.0003)
	Hay	243 (67.50)	26,219 (29.58)
	Organic	14 (4.62)	
Type of Animal Currently Raised	Animal	N (%)	N (%)
	Swine	104 (28.34)	6,266 (7.07)
	Cattle	157 (41.98)	19,677 (22.20)
	Cow/calf	121 (32.53)	21,115 (23.82)
	Dairy	38 (10.73)	1,810 (2.04)
	Chicken, eggs	27 (7.78)	3,821 (4.31)
	Chicken, broiler	15 (4.32)	730 (0.82%)
	Horses	38 (10.73)	9,599 (10.83)
	Sheep	40 (11.30)	2,904 (3.28)
	Other	16 (4.92)	
Number of Family Members Who Help on the Farm	Number	N (%)	
	0-1	109 (30.97)	
	2 or more	243 (69.03)	

Table 3.2. Musculoskeletal Symptom Prevalence by Joint

Joint Location	N (%) Reporting Ache, Pain, or Discomfort in last 12 months**	
	Age 18-54	Age 55+
*Neck	102 (58.96)	108 (48.65)
Shoulder	93 (55.36)	122 (55.45)
Elbow	48 (28.74)	58 (27.36)
Wrist	76 (43.93)	85 (38.64)
Upper Back	76 (44.19)	76 (35.19)
Lower Back	132 (75.43)	160 (71.43)
Hip	62 (36.26)	91 (42.13)
*Knee	78 (45.61)	125 (60.27)
Feet	75 (43.35)	98 (44.95)
Number of Painful Joints (Mean, S.D.)	4.17 (2.72)	4.10 (2.75)

*$p<0.05$ Fisher's Exact Test 2-sided **Total number responding per joint varied

Table 3.3. Musculoskeletal Condition within Age Categories and Overall

Age Category	Musculoskeletal Conditions Prevented Work in last 30 Days N (%)	Sought Medical Care for Musculoskeletal Symptoms N (%)	Doctor-diagnosed Arthritis N (%)
18-54	8 (2.01)	79 (20.2)	24 (6.8)
55+	18 (4.52)	103 (26.34)	86 (24.36)
Overall	26 (6.53)	182 (46.55)	110 (31.16)
χ^2 (p-value)	1.756 (0.185)	0.005 (0.945)	**30.148 (p<.001)

Table 3.4. Overall Farm Safety Score by Age

Age Category	Overall Farm Safety Score N (%)	
	≤ 95	96-100
18-54	77 (19.95)	86 (22.28)
55+	144 (37.31)	79 (20.47)
All Age Categories	221 (57.3)	165 (42.7)

** $\chi^2 = 11.562$; $p=0.001$

Table 3.5. Outdoor Safety Scores by Age

Age Category	Outdoor Farm Safety Score N (%)	
	≤ 95	96-100
18-54	79 (22.32)	74 (20.9)
55+	97 (27.4)	104 (29.38)
All Age Categories	176 (57.3)	178 (42.7)
	$\chi^2 = 0.396$; p=0.397	

Table 3.6. Multivariate Regression: Seeking Healthcare Due to Musculoskeletal Symptoms (N=313)

Variable	Value	B	SE	Wald	p-value	OR (95% CI)
Arthritis	No					1
	Yes	0.555	0.271	4.191	0.041	1.742 (1.024-2.963)
Employee Help	No					1
	Yes	0.771	0.278	7.704	0.006	2.162 (1.254-3.727)
Hip Pain	No					1
	Yes	1.085	0.268	16.413	<0.001	2.959 (1.751-5.001)
Upper Back Pain	No					1
	Yes	0.711	0.268	7.031	0.008	2.036 (1.204-3.443)

CHAPTER IV: MUSCULOSKELETAL DISORDERS IN MIGRANT FARMWORKERS ON H-2A VISAS IN IOWA

Introduction

Migrant and seasonal farmworkers (MSFW) are a population that is often overlooked by the healthcare community, yet due to experiences with arduous farm tasks as well as other unique needs related to healthcare barriers should be examined to determine their prevalence of musculoskeletal disorders (MSD) that included disease/injury symptoms. It is known that many work tasks in agriculture result in high rates of musculoskeletal symptom prevalence in non-migrant farm workers (Alterman, Steege, Li, Petersen, & Muntaner, 2008; Jensen, 2008; Kirkhorn, Greenlee, & Reeser, 2003; Thelin, Vingard, & Holmberg, 2004). Despite the knowledge of high musculoskeletal injury and symptoms prevalence, the MSFW population has not been closely tracked to determine if these exposures are different from other workers in agriculture. For many MSFW populations there is a language and financial barrier to effectively obtaining and advocating for safe work places and healthcare services.

The purpose of this study was to describe the musculoskeletal symptoms prevalence resulting from either aggravated MSD disorders or injuries in newly arrived migrant farmworkers in Iowa certified to work through the H-2A visa process, examine the effects of age, and to compare our results with the NAWS dataset. While data and injury rates have been collected from MSFW populations, there are subpopulations of MSFWs that have little data collected on their health status. The MSFW population of H-2A visa workers is a seldom studied population due to the short-term nature of their work assignments (Arcury, Rodriguez, Kearney, Arcury, & Quandt, 2014). This

population is not permanently within the United States or even one geographic area for long-term healthcare assessment, treatment, and continuity of care.

Unique Health and Safety Concerns for Migrant Workers

Migrant and Seasonal Farmworkers (MSFWs) are a group that is made up of more than one type of agricultural worker. According to the United States Department of Labor (2013), seasonal farmworkers are workers in agriculture who perform at least 25 days of agricultural work in a year for different employers near their permanent residence and earn at least half their annual income from farm work while migratory farmworkers are considered seasonal workers who can't return to their permanent residence each day due to farm work. MSFWs may be residents of the U.S. or may be from other countries. Those from other countries may be permanent residents of the U.S. or may be in the U.S. for temporary work such as through the federal H-2A Visa program which allows employers who meet specific criteria to bring foreign workers to fill temporary agricultural jobs (Department of Homeland Security, 2015).

MSFWs are often utilized to perform short-term, intense work that is time dependent and has higher injury rates (4.3 per 100 FTE) than the national agricultural injury average of 1.1 per 100 FTE (Bureau of Labor Statistics, 2014; Wang, Myers, & Layne, 2011). Occupational fatality statistics show that while agriculture is the 6th highest occupational group, there are disproportionately higher fatality rates in foreign-born Hispanic or Latino workers (Bureau of Labor Statistics United States Department of Labor, 2015). There are unique cultural, financial, and language barriers that may help explain the differences in injury and fatality rates that may delay medical treatment, especially if they continue to work when experiencing a painful MSD (Anthony, Martin,

Avery, & Williams, 2010; Culp & Umbarger, 2004; Thierry & Snipes, 2015; Weigel & Armijos, 2012).

Musculoskeletal symptoms and disorders are a common health condition in many farm worker populations including those who are the principal operators of farms (Osborne et al., 2012; Tonelli, Culp, & Donham, 2014; Tonelli, Culp, & Donham, 2015). Migrant farmworkers experience musculoskeletal symptoms with a prevalence ranging from 11 - 81.9% (Brock, Northcraft-Baxter, Escoffery, & Greene, 2012; Luque et al., 2012; Wang et al., 2011; Weigel & Armijos, 2012). One of the most common body sites of musculoskeletal symptom prevalence in the MSFW population is the back (Brock et al., 2012; Scribani, Wyckoff, Jenkins, Bauer, & Earle-Richardson, 2013; Silver et al., 2014). These studies on MSFWs are similar in findings amongst non-MSFW populations which report overall musculoskeletal symptoms prevalence to vary by joint location from 10 – 75% and the back reported as a common location with high symptom prevalence (Alterman et al., 2008; Nonnenmann, Anton, Gerr, Merlino, & Donham, 2008; Rosecrance, Rodgers, & Merlino, 2006; Tonelli et al., 2015). Across the United States there is an aging of the workforce and that is also evident within the MSFW population where a study of the agricultural workers in the U.S./Mexico border area showed that the migrant workforce is aging and that increased age resulted in greater odds of persistent musculoskeletal injuries (Weigel & Armijos, 2012).

The National Agricultural Workers Study (NAWS) has provided a basis of collecting health and safety data from hired farmworkers in the United States; however NAWS does not include crop workers with H-2A visas (The United States Department of Labor Employment and Training Administration, 2015). Agricultural workers in the

United States on H-2A Visas are only allowed to work for one employer and may feel they can't complain about a MSD or any stressors related to safety and health (Arcury et al., 2015). While there are many health and safety needs of the MSFW population related to environmental exposures, barriers to healthcare access, and work tasks, this research aims to examine these exposures for newly arrived H-2A Visa agricultural workers in Iowa.

Methods

Sample

This study utilized a cross-sectional survey of Migrant and Seasonal Farmworkers (MSFWs) who had just arrived in Iowa at the start of their employment approved through the federal H-2A Visa program. There were 245 newly arrived workers present for orientation on the day of the survey of which 180 participated for a 73.5% response rate. Inclusion criteria included 1) Hispanic or Latino farm worker and 2) Age 18-65. This study was approved by the University of Iowa Institutional Review Board (IRB) (IRB # 201506703).

Setting

This Iowa farm is about 1,000 acres and crop production occurs during the months of June and July (6-8 week active work season). This is arduous work under extreme climate conditions, employees perform tasks such as manual detasseling of seed corn and picking of melons which require a great deal of walking through the field, upper arm movements of pulling, and other musculoskeletal risks such as bending, and lifting. Seed corn is "detassled" to facilitate pollen exchange; the reaching "up" to pull the tassel is strenuous on the upper extremities. Prior to beginning work tasks, the farmworkers

were brought to a training location where they were provided with specific job and safety training by a contracted trainer for their work assignment. A mobile on-site migrant health clinic was available to workers through the Proteus© non-profit organization visited the farm 2-3 times a week and offered primary care service to workers at no cost. These providers were mostly nurse practitioners and physician assistants; not members of the research team. They were able to dispense over-the-counter (OTC) meds and manage minor injuries and illnesses encountered during the work season on this particular farm. Most of these healthcare workers are bilingual or had immediate access to a translator.

Data Sources & Analysis

We used an occupational health survey (described below) to assess the past 12 months of symptom prevalence before crop production tasks began and assessed new-onset symptoms by examining the electronic medical records of a migrant health clinic that provided services at the worksite 8 times through the active work season. Not all workers sought primary care, but N=152 visited the migrant health clinic during the work period, so few barriers existed if participants wanted assessment and treatment for a MSD or any other condition. Our own survey data was then compared to the National Agricultural Worker Survey (NAWS) dataset from 2009-2010 (N=3,691). NAWS data are collected through the United States Department of Labor and include a random sampling of agricultural crop workers, but does not include workers on H-2A Visas (The United States Department of Labor Employment and Training Administration, 2015). The NAWS data utilized for comparison were from 2009-2010 which is the most recent year that the publically available data has variables related to musculoskeletal complaints (Carroll, 2016; United States Department of Labor Employment and Training

Administration, 2013). We computed odds ratios (OR) and 95% confidence intervals (CI) using binary logistic regression and utilized the nonparametric Pearson Chi-Square statistic to compare variable differences between age categories.

Survey Instrument

An occupational health survey (OHS) was developed based on past surveys utilized to study agricultural populations with modifications that focused on MSD injuries (AgriSafe Network, 2013; Kline, Leedom-Larson, Donham, Rautiainen, & Schneiders, 2007). The survey was translated by a native Spanish speaker and checked for accuracy and content validity by two other Spanish speaking individuals. The survey was also targeted for a 6 grade reading level in terms of difficulty. The OHS had a total of 31 total questions of which assessed demographic and health issues, musculoskeletal symptoms during the last 12 months, past work activities, chemical exposures, and exposures related to heat and humidity. The survey was provided in both English and Spanish and after completion subjects returned the survey directly to the research staff, not their employer.

Results

Demographics and Worker Characteristics

The average age of the study population was 37.4 years (SD=9.9; Median=37) with N=178 (98.9%) male and N= 84 (66.7%) married. Demographic and general health characteristics of this group are presented in Table 4.1. This worker population was nearly entirely born in Mexico (N=177; 98.9%) and 72.6% (N=127) spoke only Spanish. Over 50% had completed either some high school (N=59; 40.4%) or college (N=24; 15.1%) and 66.7% (N=84) were married. This group was mostly traveling without

family, but 30.6% (N=49) reported traveling with at least one family member. Unlike other work patterns of migrant worker populations, while in the United States this year this group planned predominately to work only in Iowa and then return home (N=128; 87.1%). There were relatively few chronic health conditions (N=13) reported by this group which is not surprising given the young median age. Also presented in Table 4.1 are comparable demographic and farm data from the 2009-2010 National Agricultural Workers Survey (NAWS) (United States Department of Labor Employment and Training Administration, 2013). In general, we found more Spanish-only workers in the Iowa sample, there were similarities in age, gender and marital status with the NAWS dataset.

Past work exposures reported by these workers were varied. More than half of workers reported experience with hand picking fruits or vegetables (N= 72; 52.9%), lawn mowing or landscaping (N=84; 61.8%), and hand harvesting corn or detasseling (N=87; 64%). Hand-hoeing weeds was reported by nearly 50% of workers (N=66; 48.9%). The least reported exposures were food processing (N=10; 7.4%) and working in a meat processing facility (N=10; 7.4%). Past farm-related production activities are reported in Table 4.2. broken down by age categories. The production activity of “hand hoeing weeds" was the only activity that varied statistically by age with more of the older workers (N=42, 57.5%) having reported this activity compared to the younger workers (N=21, 39.6%; $p<0.05$).

Musculoskeletal Symptoms

Musculoskeletal symptom 12-month prevalence at baseline varied by joint with the lowest prevalence of 1.4% in the hip and highest prevalence of 15.9% in the neck (Table 4.3). Other joints assessed included the neck, shoulder, upper back, wrist, hip, knee, and feet which all had 4.2 - 14.6% symptom prevalence. Of the total workers, 56 (39.7%) reported 1 or more painful joints. The population was split into age categories to determine if there was a difference in musculoskeletal symptoms prevalence between the younger and older subjects in the population. Utilizing a cut-point of age 35 near the median age (37), there were no significant differences in musculoskeletal symptom prevalence between the age categories. Overall, this group of migrant farmworkers did not report high rates of seeking healthcare or missing work due to musculoskeletal symptoms. Only a few (N=3) farmworkers reported musculoskeletal conditions interfering with work in the last 30 days and few sought medical care for musculoskeletal symptoms (N=5). We also compared our MSD prevalence with NAWS and saw higher proportions of shoulder and upper back pain in the Iowa sample compared with the national dataset, possibly due to the specific crop production tasks of detasseling seed corn and lifting melons in our farming operation. Overall, the Iowa sample had a higher prevalence of pain in one joint location (N=56, 39.7%) compared to NAWS (N=585, 15.8%).

Health Record Data

Sixty-two percent (N=152) of the total worker population presented to the migrant health clinic during some point of the contracted work. The mean age of those presenting to the clinic was 40.6 (SD=10.3; Median=41) which is slightly older than the population that completed the baseline survey. The migrant health clinic was held at 8 dates over an

approximately 5 week period of time and was after the work day had been completed. Of the 152 workers seen at the clinic, 51 (33.6%) were experiencing musculoskeletal complaints. The most common pain location was the lower extremity (hip, leg, ankle, foot) with 13.2%, followed by muscle pain (7.2%), upper extremity (5.3%), and neck or back (5.3%). There was no site indicated for 5.9% of subjects. There was a significant difference between age and musculoskeletal symptoms for these workers seen in the clinic. Of those age 18-34, 10 (20.8%) reported musculoskeletal symptoms while 41 (39.4%) of those age 35+ were experiencing symptoms (Pearson χ^2, $p = 0.02$). For those workers in the older age category, they were 2.5 times more likely to have musculoskeletal symptoms (OR=2.5; 95% CI: 1.1-5.5). The number of days worked as indicated by the progression of the work season (clinic visit date) was not a significant predictor of musculoskeletal symptom complaints. Several medical records indicated that the worker was not accustomed to the physical nature of the work due to sedentary or indoor jobs in Mexico.

Nearly all workers presenting to the migrant health clinic with musculoskeletal symptoms were provided with a non-steroidal anti-inflammatory medication (NSAID) such as ibuprofen or naproxen sodium (54.9%) or an analgesic such as acetaminophen (29.4%). These medications or other treatment were provided to the farmworker at no-cost although the clinic uses a voluntary sliding-scale fee system for extended care services. A topical product that contained menthol (Blue Gel) was also provided to many of the workers (39.2%). Occasionally a wrap, brace, or shoe insert was provided to the worker (19.6%). Less common were other interventions such as suggestions for applying ice to the affected area or trying to rest or avoid repetitive motion.

Discussion

Migrant farmworkers in the United States on H-2A visas are a minority population and this is one of the first studies to focus on MSD in seed corn detasseling as a crop production task. We found prevalence rates for musculoskeletal pain that ranged from 1.4 - 15.9% with a prevalence of 39.7% for at least 1 painful joint, which is a higher prevalence rate than reported from farmworkers studied through the National Agricultural Workers Survey (NAWS) (United States Department of Labor Employment and Training Administration, 2013). These farmworkers are different from those in the NAWS study because the Iowa workers are all H-2A Visa workers who arrived from Mexico to perform temporary farm work and they were also performing work tasks of a specific nature (corn detasseling and melon harvest) that may have impacted on specific joints for MSD prevalence. While higher than the prevalence reported in the NAWS study, other studies had much higher prevalence rates that ranged from 11 - 82% (Brock et al., 2012; Luque et al., 2012; United States Department of Labor Employment and Training 2013; Weigel & Armijos, 2012).

These Iowa workers had just arrived primarily from Mexico and most had not yet worked this season, thus the percentage reporting MSD symptoms in the last 12 months was most likely not due to work-related farming tasks and more closely related to past work exposures. The most commonly reported exposures in the past for these workers involved corn detasseling, landscaping or mowing, and hand picking fruit or vegetables. These tasks involve bending, lifting, and vibration if lawn tractors were utilized, thus producing more back and shoulder symptoms for this sample. The high proportion reporting these past work exposures in our sample and the fact that NAWS surveys all

types of farming work and even non-minorities may explain the differences observed here.

This study collected baseline data at the point of time that the workers were participating in orientation for the grower. This may mean that workers were attempting to portray healthy behavior so that the grower would ensure their continued employment or place them in certain key job roles. The workers in this study were predominately young and healthy with a median age of 37, so the paucity of symptoms in the youngest age group may also be due to their stronger stature and lack of exposure to cumulative work-related joint trauma. Workers also may be fearful of reporting work-related symptoms as this jeopardizes their employment in the U.S. (Arcury et al., 2015; Culp & Umbarger, 2004). To examine the new development or exacerbation of musculoskeletal symptoms during this work contract, this study reviewed the clinic medical records for workers seen at a migrant health clinic at the worksite. Nearly 34% of workers expressed some sort of musculoskeletal complaint and many received one or more treatment options such as medications.

This study found that no farmworker self-reported medically-diagnosed arthritis. While this survey was translated by a native Spanish speaker and checked for accuracy, it may be that the terms utilized by the research team were not comprehended by the farmworkers or that there are cultural issues to introduce response bias. These farmworkers may not have access to healthcare providers in Mexico to result in a diagnosis of arthritis. Additionally, this relatively young, health population likely doesn't go to a provider for something common such as aches and pains and many would not have enough cumulative wear to result in an arthritis diagnosis. MSFWs may have a

view that pain and injury are part of the expected consequences of performing hard, manual labor (McCullagh, Sanon, & Foley, 2015). The national adult population in the U.S. has an arthritis prevalence rate of 22.7% overall and a prevalence rate of 7.3% in younger populations (Centers for Disease Control and Prevention (CDC), 2013) while a prior study of Iowa farmers showed an arthritis prevalence rate of 6.8% in a similar age subpopulation of native Caucasian Iowa farmers (Tonelli et al., 2014). These migrant farmworkers had similar rates of work interference compared to a similar age Caucasian Iowa farmer group (1.9% vs 2%); however they sought medical care at a lesser rate (3.3% vs. 20.2%) and did not report any doctor diagnosed arthritis compared to the 8% reported by Caucasian farmers in Iowa (Tonelli et al., 2014).

Limitations

Data were collected from farm workers at one farm location. The grower reported a lengthy relationship with many workers who return to this grower during subsequent seasons. These workers are almost exclusively hired under the H-2A Visa program. This exploratory investigation of MSD symptoms may be one of the first to focus on corn detasseling under the H-2A program which is exclusively composed of minority workers. As previously stated, participants may have been hesitant to complain about their MSD symptoms due to their vulnerable status. These workers are highly motivated to begin work and needed financial compensation. It is possible that the harder the individual worked, they were more valued by this particular owner-operator for continued employment in future growing seasons. There were potential barriers in the educational level for understanding the survey questions. Many workers reported educational levels less than the developed survey level. This may have led to a lack of understanding the

survey questions. Additionally, the timeframe of measurement was brief; we only had a short period to measure and assess workers who were at a time point just prior to the workers beginning field work. This data collected at baseline related more to prior work exposures than to current work tasks. Follow-up data for incident or new-cases of MSD were collected through medical records by a migrant health clinic; however, this data is only available from those workers choosing to utilize the clinic.

Future Research

Monitoring throughout the contracted work season to determine how musculoskeletal symptoms may change with work exposures and duration of work over several types of farming operations would be a significant and essential follow-up to this investigation. Migrant farmworkers vary in their exposures due to their past and current variety of agricultural work tasks and the migratory and seasonal influences on their locations of employment may also be a predictor of MSD symptoms. Nurses can help with meeting the needs of MSFW by focusing on ergonomics education to help with the prevention of musculoskeletal symptoms along with testing of potential ergonomics interventions.

Clinical Implications

Employers should consider contracting with healthcare providers, such as agricultural nurses, during the periods of time where MSFWs are expected to perform time-sensitive, intense agricultural work. It is important that MSFWs have access to healthcare during their contracted work at times that are convenient to the worker and employer. The MSFW population is at a high-risk for development of workplace illness and injury due to workplace exposures, time dependent work, and often lack of

integration into the current healthcare system in the US. When providing primary care there are several factors that need assessed to meet the healthcare needs of these workers. Considerations need to be made to provide care that is sensitive to the need to work long days, pay dependent on work completed, and specific exposures such as chemicals or environmental factors such as heat.

Within Iowa there are health providers through the Proteus© non-profit group and the Migrant Clinicians Network that provide care to migrant farmworkers (Migrant Clinicians Network, 2015a; Proteus, 2015). Proteus© is based out of Iowa and uses grant funding to provide mobile health clinics at job locations convenient to migrant workers (Proteus, 2015). This model of care delivery helps assist MSFWs with the difficulties in accessing healthcare due to the intense time-dependent nature of the temporary work, the fact that the workers are contracted workers, and other barriers such as education and language. Migrant farmworkers have many health and safety needs that are not always met due to the lack of consistent healthcare and other issues such as financial, cultural, and language barriers amongst others (Culp, Tonelli, Ramey, Donham, & Fuortes, 2011; Culp & Umbarger, 2004). Another organization that may be useful to clinicians is the Migrant Clinicians Network; they connect clinicians and provide support and resources to health care providers (Migrant Clinicians Network, 2015b).

Within the population of migrant H-2A farm workers there may be specific needs for subpopulations, such as those who are younger or older than the typical MSFW. There is evidence that less-experienced workers (<1 year U.S. farm work experience) have higher injury rates (Wang et al., 2011), so it may be worth focusing interventions to that group of workers in particular. Older workers may have unique needs due to

chronic health conditions or age-related body changes. There is also evidence that the MSFW population is aging and these age-related changes result in an increased risk for cumulative musculoskeletal injuries impacting on quality of life and functional ability to engage in farm work (Weigel & Armijos, 2012; Weigel, Armijos, & Beltran, 2014).

Summary

There are many unique factors that put migrant farmworkers at a significant risk for current or future development of injury or health conditions. Understanding more of the health history and symptom prevalence will assist nurses and healthcare providers with meeting the needs of migrant farmworkers. Current research in this area should focus on specific ergonomic interventions during work and effective prevention of acute and chronic musculoskeletal symptom development. Occupational health nurses and other professionals must be willing to advocate for services that assist MSFWs in continuing to work and receive healthcare as needed while they are providing the much-needed services of crop maintenance and harvesting.

Table 4.1. Demographics and Personal Health Characteristics of H-2A Visa Workers Compared to Workers in the National Agricultural Workers Survey

Characteristic	Current Study Sample N (%)	National Agricultural Workers Survey (2009-2010)
Age		
18-24	12 (7.1)	650 (17.6)*
25-34	56 (33.3)	1,021 (27.7)
35-44	63 (37.5)	888 (24.0)
45-54	26 (15.5)	682 (18.5)
55+	11 (6.5)	449 (12.2)
Male	178 (98.9)	3,052 (82.7)
Marital Status		
Married	84 (66.7)	2,337 (63.3)
Single	24 (19.0)	1,122 (30.4)
Born in Mexico	178 (98.9)	2,920 (72.0)
Language Spoken		
Spanish Only	127 (79.4)	1,223 (33.1)
Spanish and Some English	26 (16.3)	1,575 (42.7)
Fluent English	7 (4.4)	887 (24.0)
Education		
Elementary (k-6)	37 (25.3)	1,618 (43.8)
Jr. High (7-9)	26 (14.4)	717 (19.4)
High School (10-12)	59 (40.4)	932 (25.3)
Some College or Vocational	22 (15.1)	254 (10)
Health Conditions		
Kidney Disease	1 (0.7)	-
Diabetes	4 (3.2)	108 (2.9)
Heart Disease	2 (1.5)	43 (1.2)
High BP	6 (4.4)	295 (8.0)

*NAWS Sample age 14-24

Table 4.2. Past Farm-Related Production Activities of H-2A Visa Migrant Farmworkers by Age

Prior Work Experience	Age 18-34 n (%)	Age 35+ n (%)	p-value
Food Processing	4 (7.4)	5 (6.8)	0.904
Working in Meat Processing Facility	5 (9.3)	3 (4.1)	0.238
Clear Brush	6 (11.1)	6 (8.2)	0.582
Hand Harvest Sorghum	11 (20.4)	10 (13.7)	0.317
Harvesting Non-Fruit or Vegetable	13 (24)	10 (13.7)	0.133
Picking Melons	11 (20.3)	19 (26)	0.458
Working in a Barn (Hay or Foliage)	12 (22.2)	16 (21.9)	0.967
Harvest Veggies	15 (27.8)	15 (20.5)	0.343
Nursery/Greenhouse Work	16 (29.6)	18 (24.7)	0.532
Working with Live Birds or Animals	18 (33.3)	19 (26)	0.370
Operate Tractors	16 (29.6)	21 (28.8)	0.916
Application of Pesticides	21 (38.9)	18 (24.7)	0.086
Removing Volunteer Corn	21 (38.9)	23 (31.5)	0.387
Cutting Any Plant (Tobacco or Weeds)	21 (38.9)	29 (39.7)	0.924
Tree Planting or Reforestation	26 (48.1)	23 (31.5)	0.057
Lifting Heavy Boxes of Produce	21 (38.9)	29 (39.7)	0.924
Hand Hoeing Weeds	**21 (39.6)**	**42 (57.5)**	**0.047**
Hand Picking any Fruit or Vegetable	25 (46.3)	41 (56.2)	0.271
Lawn Mowing or Other Landscaping	38 (70.3)	41 (56.2)	0.103
Hand Harvesting Corn or Detasseling	35 (64.8)	46 (63)	0.835

Table 4.3. Musculoskeletal Symptom 12-Month Prevalence by Joint Location

Joint Location Experiencing Ache, Pain, or Discomfort	Current Study Sample n (%)	National Agricultural Workers Survey n (%)
Neck	23 (15.9)	*not reported
Shoulder	16 (11.0)	57 (1.5)
Elbow	6 (4.2)	42 (1.1) *elbow/arm
Wrist	12 (8.3)	63 (1.7) *hand
Upper Back	19 (13.1)	247 (6.7)
Lower Back	22 (15.2)	
Hip	2 (1.4)	157 (4.3) *lower extremity
Knee	21 (14.6)	
Feet	11 (7.7)	
At Least One Painful Location	56 (39.7)	585 (15.8)

*Note: The current study and the National Agricultural Workers Study denoted joint locations differently for some locations.

CHAPTER V. DISCUSSIONS, LIMITATIONS, AND RECOMMENDATIONS

Discussion and Conclusions

The purpose of this dissertation research was to review the current literature, measure musculoskeletal symptom prevalence in Iowa farmers, determine what factors relate to seeking healthcare for musculoskeletal symptoms, and to examine musculoskeletal symptom prevalence in a group of farmworkers in Iowa working through the H-2A Visa program. This dissertation research was significant because it was the first to examine specifically the relationship of farm safety scores to the age of farmers and also what factors were significant in explaining healthcare seeking behavior. It was also the first to examine the health characteristics and past work experiences of newly arrived H-2A Visa farmworkers in Iowa.

The literature review and the two separate studies presented in this dissertation provided a background and significance to the problem, examined musculoskeletal symptoms in Iowa farmers, and then examined the problem of musculoskeletal symptoms in a population of H-2A Visa farmworkers who had just arrived in Iowa to work. This chapter will present the synthesis of findings across the distinct, yet related studies, and will discuss the limitations and challenges. Additionally, future directions of research related to musculoskeletal symptoms in agriculture will be presented.

Synthesis of Results

The burden of musculoskeletal symptoms in farmers and farmworkers was revealed in the two original studies presented in this dissertation. Past literature showed that aging farmers are at high risk for musculoskeletal disorders and injury due to occupational exposures and working past the typical retirement age (Tonelli, Culp, &

Donham, 2014). While the development of musculoskeletal symptoms in Iowa farmers may be related to farm work exposures or age, back pain was one of the most common locations for symptoms (Tonelli, Culp, & Donham, 2015). Older farmers also were more likely to have farms that were in the lower safety category using a standardized farm safety checklist (Tonelli et al., 2015). The population of MSFW in Iowa on H-2A Visas had never been examined through research before and this population showed exposure to varied work tasks with musculoskeletal symptoms varying by joint location from 1.4-15.9%. Comparing these rates to other MSFW populations through the NAWS study allowed for some comparisons. This population is at a particularly high risk due to the strong cultural views of hard work and also the financial necessity of earning a wage and providing for family (Culp, Tonelli, Ramey, Donham, & Fuortes, 2011; Donham & Thelin, 2006).

Implications from Chapter 2 are that general prevalence rates provide just a basis for measurement and can vary widely due to the differences in study populations and the time points of the data collection to the time of the symptoms. In general, prevalence varied across specific joints and across different populations (Tonelli et al., 2014). Highest prevalence was found in the shoulder (62%) and the low back (61%) (Nonnenmann et al., 2010). These differences in rates based on the agricultural population show that it is important to understand the study population, past work exposures, and current work environment in order to plan interventions to reduce musculoskeletal symptom prevalence.

In reviewing past research on musculoskeletal symptoms in older agricultural populations, several studies showed musculoskeletal symptoms were related to injury

rates (Heaton, Azuero, Phillips, Pickens, & Reed, 2012; Marcum, Browning, Reed, & Charnigo, 2011; Voaklander et al., 2006). This is of particular importance in understanding this relationship and determining if it is causal or just an associated factor. Prevention becomes even more important as we examine the factors that may be putting aging farmers at a greater risk. Prevention efforts need focused on all ages of agricultural workers as the cumulative trauma of farm work can begin at an early age. As the population of principal operators in farming continues to age, it is likely that this relationship may become even more pronounced and will contribute to an increase among agricultural injuries and fatalities.

Evidence from Chapter 3, as in Chapter 2 showed differences in musculoskeletal symptom prevalence among different joints. The lowest prevalence was in the elbow and highest in the low back (Tonelli et al., 2015). These findings build on the previous studies examined in Chapter 2 that provided prevalence data on this population of farmers in Iowa. When examined for differences by age the knee had higher symptom prevalence for older farmers. This is important when considering higher injury rates for older farmers. This study examined the safety of the farm work environment and was one of few studies to evaluate the surroundings using safety scores developed specifically for use in agriculture (Donham, Rautiainen, Lange, & Schneiders, 2007; Kline, Leedom-Larson, Donham, Rautiainen, & Schneiders, 2007; Rautiainen et al., 2010). The work environment contributes to potential hazards such as trips and falls and injury sources in the work setting such as animals, tractors, and other equipment.

Farmers also have practical and cultural values such as hard work and time-sensitive work demands due to the nature of their self-employment that could potentially

lead to decreased utilization or access to healthcare (Amshoff & Reed, 2005). Despite high prevalence rates of symptoms, very few farmers reported not working due to musculoskeletal symptoms (Tonelli et al., 2015). It is unknown whether this continuation of work is indicative of mild symptoms, lack of others to perform the work, or if the symptoms are something to work through and not prevent work. This potential barrier needs further exploration to determine the extent of the barrier and if these issues could be reduced by changes in the healthcare system infrastructure or if the issue is predominately the mind-set of farmers. The fact that a diagnosis of arthritis, employee help, hip pain, and upper back pain were all predictive of seeking healthcare provides an indication of factors that are related to farmers seeking healthcare for musculoskeletal symptoms.

Chapter 4 provided information that had previously not been researched within this population of H-2A Visa workers in Iowa. By measuring musculoskeletal symptoms within this population, it provided a basis for future studies of prevention and intervention with this group of workers. Past work exposures were varied in this MSFW population and the prevalence of musculoskeletal symptoms relatively low compared to other agricultural populations. Factors related to the healthiness of this population were the relatively young age (median = 37) and the importance of being healthy to start the work contract for the current employer

Limitations and Challenges

There were several limitations and challenges for this research project. The limitations of this dissertation research are that the cross-sectional method utilized in Chapter 3 only allowed for one-time point of data. This time point did not allow for

further tracking of data, such as injury or illness development, which may be of interest in the future. The data utilized for Chapter 3 was a post-secondary data analysis, so some variables of interest were not available because they weren't present in the initial data set. Within Chapter 4 the musculoskeletal symptoms in MSFWs were measured both at baseline and by extracting musculoskeletal symptoms during the work experience from the medical records. This method was not ideal as not all workers were assessed during the work period, however it did allow for more than one-time point of measurement. Periods of measurement are of particular importance to agricultural populations due to the time-sensitive demands and seasonal changes to the work tasks and environment. In the meantime, without a comprehensive surveillance system in agriculture that accurately monitors injury and illness rates of all agricultural populations, there will continue to be problems with accurate and timely reporting of work-related musculoskeletal symptoms in agricultural workers such as those on small farms or those working through temporary visas. Researchers need to determine the most effective way to work around these limitations.

Implications and Future Directions for Nursing Research and Practice

Future research and practice will need to focus on testing interventions to effectively prevent the development of musculoskeletal disorders in agricultural worker populations. To create a reduction of symptom prevalence within either study population, it will be important to determine the most effective way to prevent or decrease musculoskeletal symptoms in farmers and farmworkers. It is likely that due to the differences in work exposures and health considerations that these subpopulations in agriculture need interventions targeted to their unique health and safety needs. With

many musculoskeletal disorders related to chronic exposures, it is important to focus efforts on young populations to prevent the formation of chronic health conditions.

While studying farmers and agricultural workers, it is important to consider the philosophical factors of the occupation of farming. Farming has a distinct history rooted in the honorable profession of growing food for one's family and society. Farming often has family significance and a desire by the farmer to be independent in work and business. There are many books, materials, and media that serve to reinforce many of those views of farming. Thomas Jefferson often wrote about farmers and eloquently stated that "Cultivators of the earth are the most valuable citizens" (McEwan, 2011). In more modern times, there have been commercials such as those from Ram Trucks that utilized a speech from Paul Harvey about how "God made a farmer" that shows farmers as those who are working hard at an honest profession that God and society needs (Franke-Ruta, 2013; Ram Trucks, 2013). These factors set the profession of farming as a strong, independent, God-given calling and strongly influence the development of unique health and safety needs for this population.

Results of this research indicate that there is a need to develop and implement effective interventions that aid in the reduction of musculoskeletal symptom burden in various types of agricultural work settings. Prevention of musculoskeletal symptom injury or illness should be focused at the level of primary prevention. Nurses can work through established health programs and clinics, other organizations such as AgriSafe or Proteus to provide for specific training or care related to agriculture, or other organizations that serve the agricultural or migrant farmworker communities. Nurses have opportunities to provide education to these workers in settings such as the worksite,

clinics, or mobile health offerings. Nurses with specific training in agriculture are able to assess the work location and work tasks and provide education specific to the job tasks to provide for a healthier and safer work environment. In some cases, a referral to an appropriate assistance program may be needed. Nurses can also be in positions to advocate for appropriate healthcare for migrant farmworker populations and provide direct care to those workers in the agricultural setting.

The current research has provided a basis of further understanding of prevalence rates for musculoskeletal symptoms in agricultural workers that had previously not been examined. Future research needs to focus on possible interventions to prevent development of musculoskeletal symptoms and injury. Future research should focus on assisting older farmers and farmers with musculoskeletal symptoms to continue performing agricultural work. The cultural implications of working in agriculture include the importance of this work to family traditions and also the importance of the work to provide for financial means to support the person and family. There needs to be future research that examines the best practices to provide for symptom management for those that have musculoskeletal symptoms. However, due to previous studies finding that medication usage has been related to agricultural injury, this needs extensive examination in order to determine the safest and best suggestions for this population.

Older farmers having worse overall farm safety scores was a finding that may assist in future research to reduce injury or fatality rates in older farmers. In particular, these older farmers may benefit from assistance programs geared towards environmental improvements to their farms. Further exploration of this finding is needed to determine whether interventions targeted to improving safety for this group would be welcome and

whether financial incentives may be needed to make these changes occur. Ergonomics interventions that both prevent development of musculoskeletal symptoms and also that assist those with symptoms to continue to perform work are needed. These interventions may be devices such as handles or steps that allow farmers to more easily access areas of the farm that their symptoms may be making difficult to complete in the same way. Various handles and devices are available through distributors; however, many farmers do not have the exposure to professionals who could provide the expertise to incorporate many of these devices or suggestions into their farm work environment.

Updated Conceptual Framework

The original biopsychosocial framework used to inform this dissertation research and presented in Chapter 1 has been updated to allow for a more directional framework regarding musculoskeletal symptoms. Figure 5.1 shows the relationship between the Biological, Psychological, and Social factors and how these factors are theorized to result in musculoskeletal symptoms in farmers and farmworkers. Further research exploring these factors may eventually assist in the future development of interventions to decrease musculoskeletal symptoms in farmers and farmworkers.

Conclusions

The results of this dissertation demonstrate that musculoskeletal symptoms are a health problem for farmers and farmworkers. Future research needs to move toward effective prevention of musculoskeletal symptoms and methods to reduce symptoms during intense time-sensitive agricultural work. Interventions should focus on the goal of enhancing the ability of the farmer or farmworkers to continue to safely work despite

having musculoskeletal symptoms. The goal is for farmers and farmworkers to continue to perform work that they enjoy in the safest and most comfortable way possible.

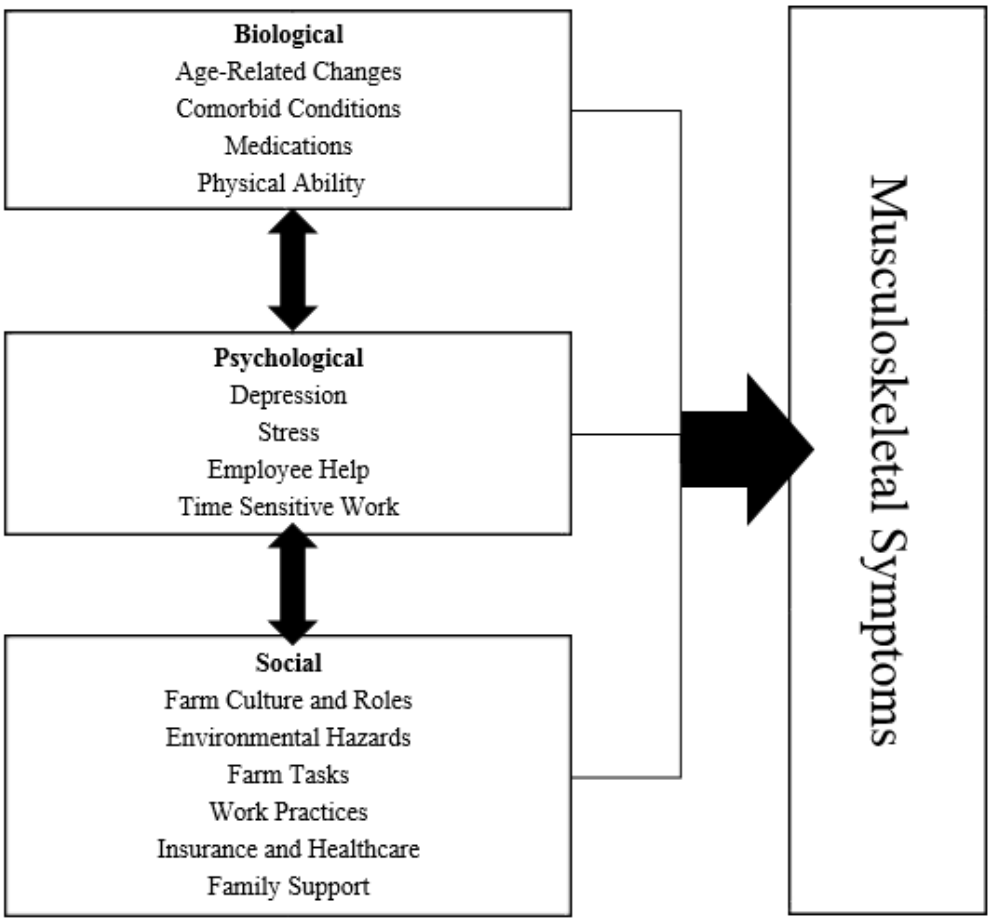

Figure 5.1. Adapted Biopsychosocial Model Influencing Musculoskeletal Symptoms in Farmers and Farmworkers.

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APPENDIX A: IOWA FARMER OCCUPATIONAL HEALTH SURVEY

1. What is your age?

2. What is your gender?

3. What is your marital status?

4. How many acres do you farm (including those owned and rented)?

5. How many family members do you have that help on the farm?

6. How many employees do you have that help on the farm?

7. Did you grow or raise the following in the last 5 years?

Corn	__Yes __ No
Soybeans	__Yes __ No
Oats	__Yes __ No
Sorghum	__Yes __ No
Hay	__Yes __ No
Organic Crops	__Yes __ No
Swine	__Yes __ No
Cattle	__Yes __ No
Cow/Calf	__Yes __ No
Dairy	__Yes __ No
Chickens, eggs	__Yes __ No
Chickens, broilers	__Yes __ No
Turkeys	__Yes __ No
Horses	__Yes __ No
Sheep	__Yes __ No
Other (list)	__Yes __ No

8. During the past 12 months, have you had any aches, pain, or discomfort in your…

Neck	__Yes __ No
Shoulder	__Yes __ No
Upper Back	__Yes __ No
Elbow	__Yes __ No
Lower Back	__Yes __ No
Wrist	__Yes __ No
Hip	__Yes __ No
Knee	__Yes __ No
Feet	__Yes __ No

9. Have any of the aches, pains, or discomforts listed in question 31 prevented you from performing your normal work in the past 30 days?
   __Yes __No

10. Have any musculoskeletal conditions motivated you to see a healthcare provider?

    __Yes __No

11. Has a doctor ever diagnosed you with arthritis?

    __Yes __No

APPENDIX B: MIGRANT FARMWORKER OCCUPATIONAL

HEALTH SURVEY

1. Age ____ years

2. Where were you born?
   ___ U.S. ___Mexico
   ___ Central America ___ South America
   ___ Caribbean ___ Other

3. Where did you live before coming to Iowa?
   _____State (if U.S.) _____ Country

4. How old were you when you started working for income? _____ years

5. What is your present marital status?

   ___Married ___Single ___Widowed
   ___Divorced ___Separated ___Domestic Partner

6. What is the highest grade in school that you completed?
   (check one, but circle the highest level if less than high school)

   __Elementary K 1 2 3 4 5 6
   __Jr. High 7 8 9
   __High School 10 11 12
   __Some college, vocational or technical school
   __College Graduate
   __Some Graduate, Professional School or More

7. Which language best describes you?
   __ Spanish Only
   __ Spanish, but can speak a few words in English
   __ Spanish, but can speak fluently in English

8. Do you use or have you ever used tobacco products?
____ Yes ____ No
If yes:

	Yes	No
cigarettes?	____	_____No
pipe?	____	_____No
chewing tobacco?	____	_____No

9. Did you travel to Iowa with any family members? ___Yes ___No

10. How long have you been a farm worker in the United States?
___ This is my first time EVER.
___ years ___ months

11. Do you plan to be employed in farm work in any other states besides Iowa THIS YEAR?
___Yes ___No

12. Do you have or have you had any of the following illnesses?

Stroke?	___Yes	___ No
Heart failure?	___Yes	___ No
Kidney disease?	___Yes	___ No
Diabetes?	___Yes	___ No
Heart Disease?	___Yes	___ No
High blood pressure?	___Yes	___ No

13. What other types of work experience do you have?

_____

14. Has a doctor or other health professional ever told you that you had arthritis?
___Yes ___No

15. Over the past 12 months have you had aches, pain, or discomfort in the following joints:

Neck	__Yes	__No
Shoulder	__Yes	__No
Upper Back	__Yes	__No
Elbow	__Yes	__No
Lower Back	__Yes	__No
Wrist	__Yes	__No
Hip	__Yes	__No
Knee	__Yes	__No
Feet	__Yes	__No

16. Has a musculoskeletal condition such as arthritis or pain prevented you from working in the last 30 days? __Yes __No

17. Have you sought medical care for musculoskeletal conditions such as arthritis, aches, or pains in the last 12 months? __Yes __ No

The next few questions will be about your work.

18. Have you worked doing any of the following types of farm-related production activities?

Check all that apply

___ hand hoeing weeds
___ hand harvesting corn or detasseling
___ removing volunteer corn
___ application of pesticides
___ lawn mowing or other landscaping work
___ cutting any plant (tobacco or other) or weeds
___ hand harvesting sorghum
___ hand picking any fruit or vegetable
___ operating tractors
___ picking melons
___ harvesting non-fruit/vegetables
___ lifting heavy boxes of produce
___ nursery/greenhouse work
___ harvest vegetables
___ clear brush
___ food (Canning, Freezing, Preserving) processing
___ tree planting or reforestation
___ working with live birds or animals
___ working in a barn around hay or foliage
___ working in a meat processing facility
___ other LIST _____

19. During the past year, have you had an injury as a result of your work (any, not just farm work) for which you received treatment from a doctor?
___Yes ___No (skip to Question 20)

a. What body part was injured?
b. What was this injury caused by specifically?
Note: Some examples are slipping, falling, twisting, lifting something at work.
c. How many months have you had PAIN from this type of injury over the last year?

20. In your work have you had any other chemicals or substances on your hands, face, chest or arms that Irritated your skin?
___Yes ___No

21. During the past year, have you had any other red, inflamed skin rash?
___Yes ___No

22. Have you ever used the short-handled hoe, *el corrito?*
___ Yes ___No

23. In the past year, did your hands or finger often feel clumsy, that is, did you often have difficulty picking up or holding things?
___ Yes ___ No

24. At any time in the last year, did you have lightheadedness or dizziness while working outside in the sun?
___ Yes ___ No

25. At any time in the last year, did you have any nausea or stomach cramps while working outside in the sun?
___Yes ___No

26. At any time in the last year, did you have muscle cramps in your legs or arms while working outside in the sun?
___ Yes ___ No

27. At any time in the last year, did you have muscle cramps in your legs or arms while working outside in the sun?
___ Yes ___ No

28. On a TYPICAL work day, how many times will you drink these types of fluid (on and off work)?

___ Water	___ Sports Drinks	___ Soda
___ Juice	___ Milk	___ Alcoholic Beverages
___ Iced Tea	___ Lemonade	___ Coffee

___ Other _____(LIST)

29. On a TYPICAL work day, are you concerned about drinking fluids because there is no restroom or place for you to empty your bladder?

___ Yes ___ No

30. Do you feel you've had any of these conditions when the day is hot?

A heat rash under the arms, groin or other location?	__Yes __No
An episode of dizziness or lightheadedness?	__Yes __No
An episode of chest pounding?	__Yes __No
An episode of nausea or vomiting?	__Yes __No
An episode of confusion or disorientation?	__Yes __No
An episode of weakness in the legs or arms?	__Yes __No
Extreme thirst or dry mouth?	__Yes __No

31. Put a check mark if you do any of these on a "typical" hot summer day – if you don't do these just leave it blank.

Drink an alcoholic beverage?	____ Only after work ____ At work
Take time to rest?	____ Only after work ____ At work
Take salt tablets?	____ Only after work ____ At work
Wear lighter clothing?	____ Only after work ____ At work
Drink more water?	____ Only after work ____ At work