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# Health of migrant and seasonal farmworkers in Iowa

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# HEALTH OF MIGRANT AND SEASONAL FARMWORKERS IN IOWA

by

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A thesis submitted in partial fulfillment
of the requirements for the Master of Science
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CERTIFICATE OF APPROVAL

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MASTER'S THESIS

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This is to certify that the Master's thesis of

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the thesis requirement for the Master of Science degree
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This thesis is dedicated to:

Laurie and John McCuen, my parents who have supported me through all my college endeavors in every theoretical and financial way; I will never be able to show you enough gratitude for all that you have done;

Diane Rohlman, Brandi Janssen, and other professors in the Occupational and Environmental Health department for your guidance and trust in me that pushed me towards my goals and beyond; I now have opportunities that I never knew would exist;

My other family and friends, I have greatly appreciated your understanding of my limited communication and interaction during these chaotic years, but I will always return the same support and love to you;

Last, but not least, to you as a reader for your time to learn about migrant and seasonal farmworkers and the agricultural industry.

*Salud y felicidad.*

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## ABSTRACT

There are three to five million migrant and seasonal farmworkers in the United States that work in one of the most hazardous industries. They are exposed to numerous occupational and non-occupational injuries and illnesses daily, including but not limited to, pesticide and chemical-related health conditions, heat-related health conditions, muscle and joint pain, eye injuries, diabetes, high blood pressure, obesity, and depression. Furthermore, these farmworkers also experience multiple vulnerabilities including cultural and language barriers and low socioeconomic status.

A survey was administered in an interview setting to characterize farmworkers' occupational and non-occupational health conditions, their healthcare-seeking behavior, and their use of preventive measures and health education. Muscle and joint pain and eye injuries were the most commonly reported occupational health outcomes, and diabetes and high blood pressure were the most commonly reported non-occupational health outcomes. Farmworker participants requested more information covering prevention, management, and treatment for these health outcomes. There were low reports of receiving health education regarding common occupational and non-occupational health conditions. Future research efforts and next steps should focus on creating networks between healthcare providers, employers, and other organizations that serve farmworkers as well as continue to host programs that directly involve farmworkers to understand their perceptions of their health and access to healthcare.

## PUBLIC ABSTRACT

Migrant and seasonal farmworkers are a transient and vulnerable population that works in the agricultural industry throughout the United States. They suffer from multiple occupational and non-occupational health outcomes, including pesticide and chemical-related health conditions, heat-related health conditions, muscle and joint pain, eye injuries, diabetes, high blood pressure, obesity, and depression. However, this population has limited access to healthcare and health education due to their cultural and language barriers and low socioeconomic status. The purpose of this research was to identify farmworkers' health status, healthcare-seeking behavior, and knowledge and interest of health education. Findings show that muscle and joint pain, eye injuries, diabetes, and high blood pressure are the most common health conditions. Farmworker participants reported that they would like more information about all those health conditions.

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## PREFACE

This dissertation is original, independent work by the author, A. Johannes, with guidance and support by those listed in the acknowledgement and more.

# CHAPTER I: INTRODUCTION

## FARMWORKERS IN THE UNITED STATES

Agriculture is one of the most hazardous industries in the United States. It accounts for the highest rates of nonfatal injuries and illnesses [1-3], and ranks in the top three for fatal injury rates [4, 5]. In 2014, the nonfatal injury and illness rate for agriculture was 5.5 per 100,000 full-time employees compared to the overall workforce rate of 3.4 [6]. In 2008, the fatality rate among all workers in agriculture was approximately 28.4 per 100,000 full-time employees [7] compared to the overall workforce rate of 3.7 [6]; migrant and seasonal farmworkers had a fatality rate of 20.0 [7]. The focus of this thesis will be on migrant and seasonal farmworkers, and for brevity they will be referred to as farmworkers.

On an annual basis, three to five million farmworkers are employed in agriculture in the United States [3, 8-15], which in 2012 consisted of 2.1 million farms [16]. By definition, the migrant farmworker population relocates from their permanent location of residence to another state or country to obtain employment in agriculture. The seasonal farmworker population works in agriculture on a seasonal basis, but works within their community instead of migrating away from their residence [11, 12]. These workers are employed in both crop and animal production (Figure 1-2) [17].

**Figure 1 – Estimates of crop production farmworkers, United States, 2012-14***

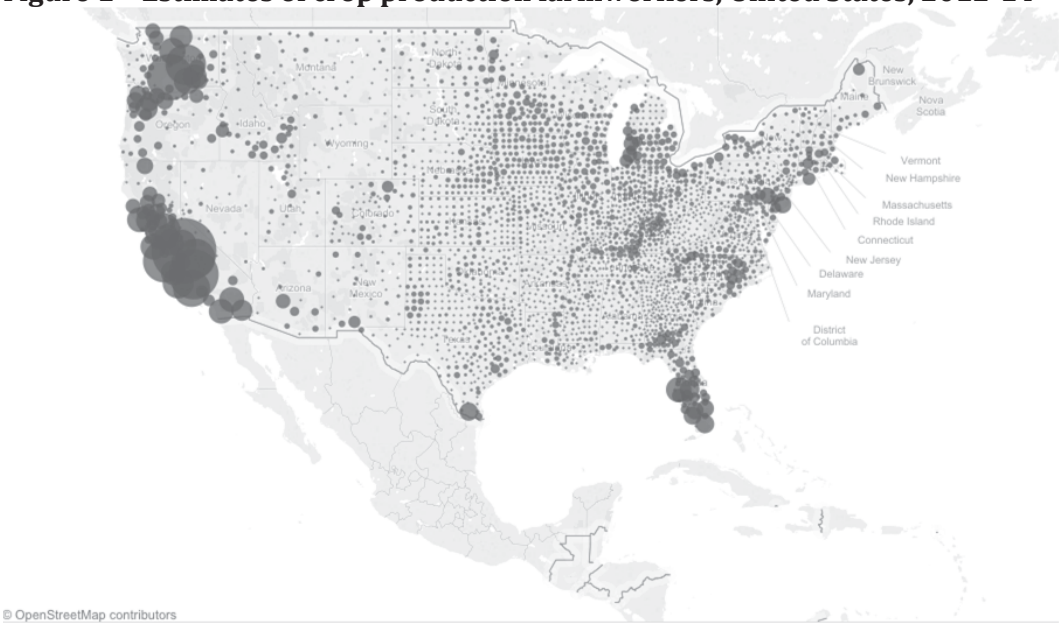


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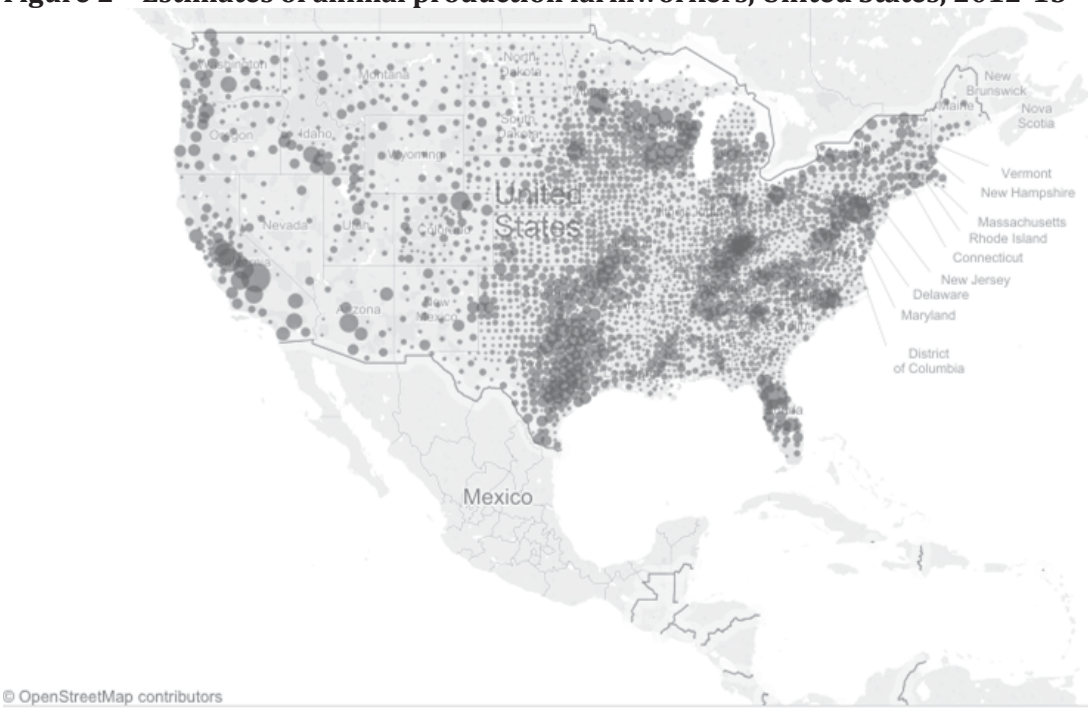
**Figure 2 – Estimates of animal production farmworkers, United States, 2012-15***

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Farmworkers are a vulnerable population because of their ethnicity, cultural and language barriers, and low socioeconomic status and, as a result, suffer from

mortality and morbidity rates greater than most of the American population [11, 12, 15, 18-20]. The majority of farmworkers are male, Hispanic, born in Mexico, and unauthorized citizens in the United States [12, 21]. In 1999, almost half of the farmworker population consisted of migrant workers, as opposed to seasonal workers. By 2010, less than one-third of the farmworker population were migrant farmworkers [21]. In recent years, a large portion of the population has been living in the United States for 5-9 years compared to previous years when half of the population had only been in the United States from 0-4 years. However, the range in years since the farmworkers have first arrived to the United States is between one to thirty years [21]. The farmworker population is becoming more settled, but still face some of the same barriers and hardships as they did over a decade ago.

The average annual income of farmworkers has been increasing since early 2000's when it was less than $7,500 per year [11, 12, 21, 22]. However, a large portion of the population has an income level of less than $15,000 per year, which places them around the single-family poverty income of $12,000 per year [23]. Over half of the farmworker population reads at the sixth grade level or lower, does not continue education beyond primary education (grade levels of first through sixth), and speaks little or no English. These characteristics have remained the same over the past two decades [12, 15, 21, 22]. Similar to farm owners and operators, the age of the farmworker population is increasing, with the average age around 40 years old [14, 21, 22]. This is consistent with the increase in the average number of years of doing farm work in the United States [21].

Despite increasing stability and income over the past decades, housing is typically expensive yet substandard with farmworkers often having to find housing on their own (i.e. non-employer provided housing), even if they are migrating. This frequently results in alternative options including tents or vans. Employer-provided housing is often overcrowded with inadequate amenities, and located near the pesticide-sprayed fields [11, 15]. These lifestyle characteristics and situations often

result in high risk of injuries and illnesses within the farmworker population.

Occupational Injuries and Illnesses Experienced by Farmworkers

There are many occupational exposures in agriculture that may result in acute and chronic health conditions. Pesticides and chemicals, heat and sun, and repetitive motions and awkward positions are some common exposures in agriculture. These exposures may lead to injuries and illnesses including pesticide or chemical-related health conditions, heat-related health conditions, contact dermatitis, musculoskeletal pain, and eye injuries.

Farmworkers are frequently exposed to pesticides during preparation and application, or while working with the crop or livestock post-application as well as exposures to chemicals that are naturally part of plants, fertilizers, or other synthetic mixtures. Many pesticides are toxic, persistent, and cause illnesses to those exposed, especially when personal protective equipment is not worn. Pesticides and chemicals can also be an eye and skin irritant and can harm several organs in the body, including brain, kidney, and liver. Chemical and pesticide poisonings are experienced by farmworkers at higher rates than any other United States working population [2, 3, 11, 13, 21, 24-26]. Furthermore, there is underreporting of pesticide-related injuries and illnesses by farmworkers and healthcare providers due to lack of symptom recognition. Heat stress and other heat-related illnesses are also common among farmworkers, since they are working outdoors for long hours [2, 11, 26, 27]. Health conditions related to heat often occur from fear of taking breaks or cultural context, such as not showing signs of weakness.

Contact dermatitis is the most frequently reported occupational health condition by farmworkers, which can arise from various occupational and environmental exposures, including pesticides and sun exposure, or a synergistic effect between the two [3, 11, 25]. Approaches for the prevention of pesticide and heat-related

health conditions are discussed with farmworkers more often than other occupational health conditions, since it is required for pesticide training to be provided to all farmworkers and heat-related conditions are highly fatal.

Health conditions that perhaps receive less recognition by healthcare providers and other professions serving farmworkers include musculoskeletal disorders and eye injury. Farmworkers are constantly twisting, kneeling, bending, lifting and carrying heavy loads, and reaching at awkward angles for long hours. Due to this strenuous work, farmworkers suffer high rates of musculoskeletal injuries and illnesses [14, 25, 28] that lead to low chronic back pain, musculoskeletal disorders, and other chronic disabilities. Muscle and joint pain are one of the most frequently reported occupational conditions for which farmworkers seek healthcare [13, 14]. Eye injuries are often reported by farmworkers, which arise from physical sources such as tools and machinery or branches and vines, and biological sources including chemical and pesticide exposures, dust and other airborne particles, and UV light and heat from the sun [2, 3, 25].

Other adverse health outcomes among farmworkers include respiratory illnesses, such as asthma, allergies, and hypersensitivity pneumonitis [11, 21, 25], injuries related to crushing, trampling, kicking, and biting from livestock [29], and equipment-related injuries, including cuts, falls, slips, and trips, and being crushed or pinned by the equipment [25]. All of these health conditions can result in lost work time from either seeking treatment or needing rest days to recover.

There is inconsistent research regarding employer-provided healthcare insurance or payment for healthcare expenses that arise from occupational injuries or illnesses. Some claim that almost three-fourths of the population receives coverage [21]. However, others state that farmworkers rarely receive such benefits [3, 30]. However, it is known that majority of the farmworkers do not receive compensation during recovery time which can lead to a “domino effect”; time away from work to

seek healthcare, or treat their current health conditions will not be compensated, leading to continuous injury and illness patterns [21, 30].

Non-occupational Injuries and Illnesses Experienced by Farmworkers

Farmworkers also experience high rates of non-occupational health conditions. Diabetes is a prevalent condition among farmworkers who have a two times greater risk than non-Hispanic Caucasians [18, 28, 31, 32]. Other common chronic conditions among farmworkers include obesity, hypertension, and high cholesterol (or metabolic syndrome, having at least three of the following risk factors abdominal obesity, high triglyceride levels, high cholesterol, high blood pressure, and high glucose levels) [3, 24, 28, 33].

Farmworkers are under constant pressure of sustaining an income, avoiding deportation, and living in overcrowded housing, which can contribute to events of domestic abuse or violence along with symptoms of depression and stress [3, 5, 11, 24]. Also, due to living in close proximity, infectious diseases are common. The likelihood of contracting tuberculosis is six times greater for farmworkers than the general population [3, 11, 25], and HIV and other sexually transmitted infections are not uncommon [3, 11, 24].

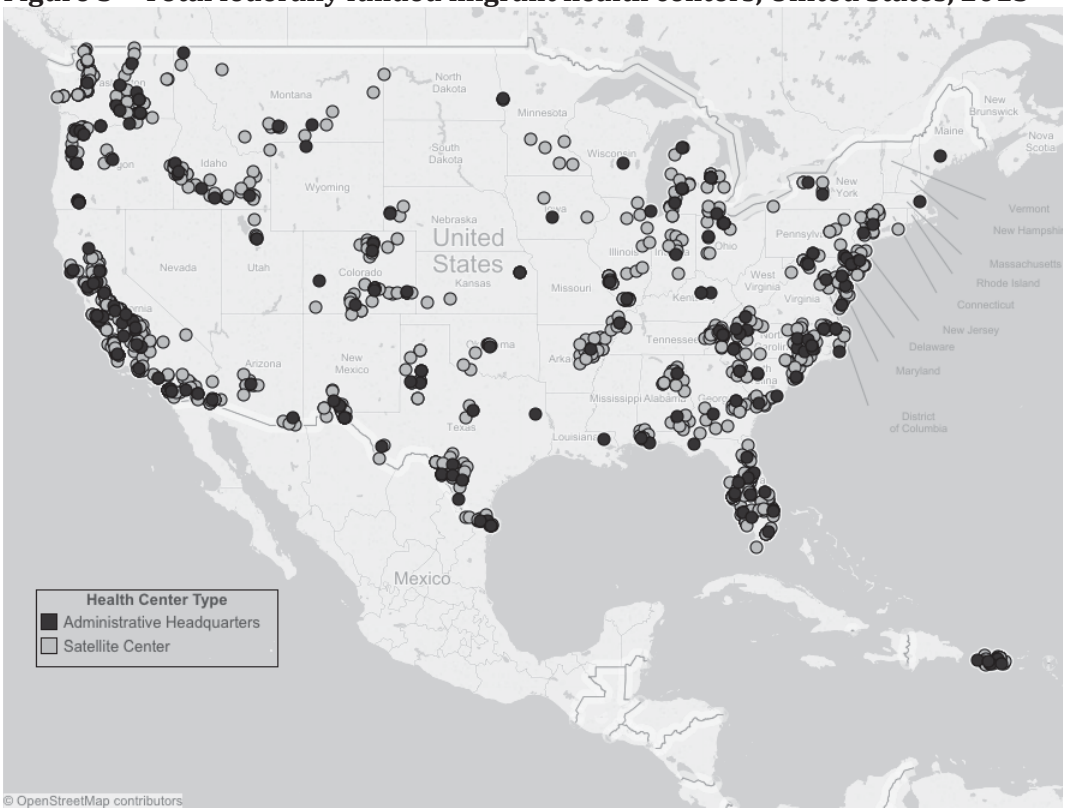
Farmworkers are a transient population that is often hard to reach, since they live in rural areas, at least half of the farmworkers are unauthorized citizens, and may lack access to transportation. Due to their high risk of multiple occupational and non-occupational health conditions, prevention approach may be especially important to mitigate and reduce injuries and illnesses among this population. There are three stages of prevention: primary, secondary, and tertiary. Primary prevention focuses on reducing risk of injuries and illnesses among healthy persons [34]. Health education about primary prevention may be most beneficial to farmworkers who rarely seek healthcare resources. Secondary prevention aims to identify early (i.e., preclinical) illnesses to control progression. Since farmworkers are known to be at

high risk for many health conditions, but have low healthcare-seeking behavior, employing health screenings frequently with farmworkers could potentially capture health outcomes before they become severe reducing their rates of morbidities. Tertiary prevention involves treating known illnesses and supporting continuity of care [34]. With continuity of care often being nonexistent for this population, primary and secondary prevention may be more important to focus on when trying to decrease the rates of injuries and illnesses. Lastly, non-occupational injuries and illnesses are commonly addressed by healthcare providers or farmworkers themselves; however, with the large number of occupational hazards in agriculture, attention needs to be raised concerning occupational injuries and illnesses as well.

## NATIONAL HEALTHCARE SERVICES FOR FARMWORKERS

As of 2013, there were more than 169 federally funded migrant health centers nationwide [12, 22]. These centers have provided care annually to almost one million farmworkers and their families [12, 22, 33]. There are very few states that do not have a migrant health center, headquarters or satellite site, and the states with a large farmworker population tend to have multiple migrant health centers (Figure 3) [17]. Nonetheless, the limited number of facilities in each state still creates barriers for healthcare accessibility, since farmworkers are spread across the entire state.

**Figure 3 – Total federally funded migrant health centers, United States, 2015***

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Although healthcare continues to expand, farmworkers continue to be underserved [20]. Almost half of the farmworker population did not use healthcare services in the United States during 2008-10 [21]. Private medical clinics or doctors' offices are most commonly used by those who do seek healthcare, while fewer farmworkers seek care at community health centers or migrant health clinics [21, 30]. Among those who do utilize healthcare services, almost half pay for the expenses out of pocket (i.e. no insurance or health plan). The high cost is the primary reason why farmworkers do not seek healthcare services [21, 35, 36]. Other significant reasons farmworkers are not seeking treatment for injuries or illnesses include lack of availability and accessibility [11, 13, 20-22, 28, 35-37]. Farmworkers do not want to be absent from work, often lacking paid time off from their employer.

Transportation is another barrier; many farmworkers arrive to the farm site at the beginning of the employment season in large buses or vans provided by their

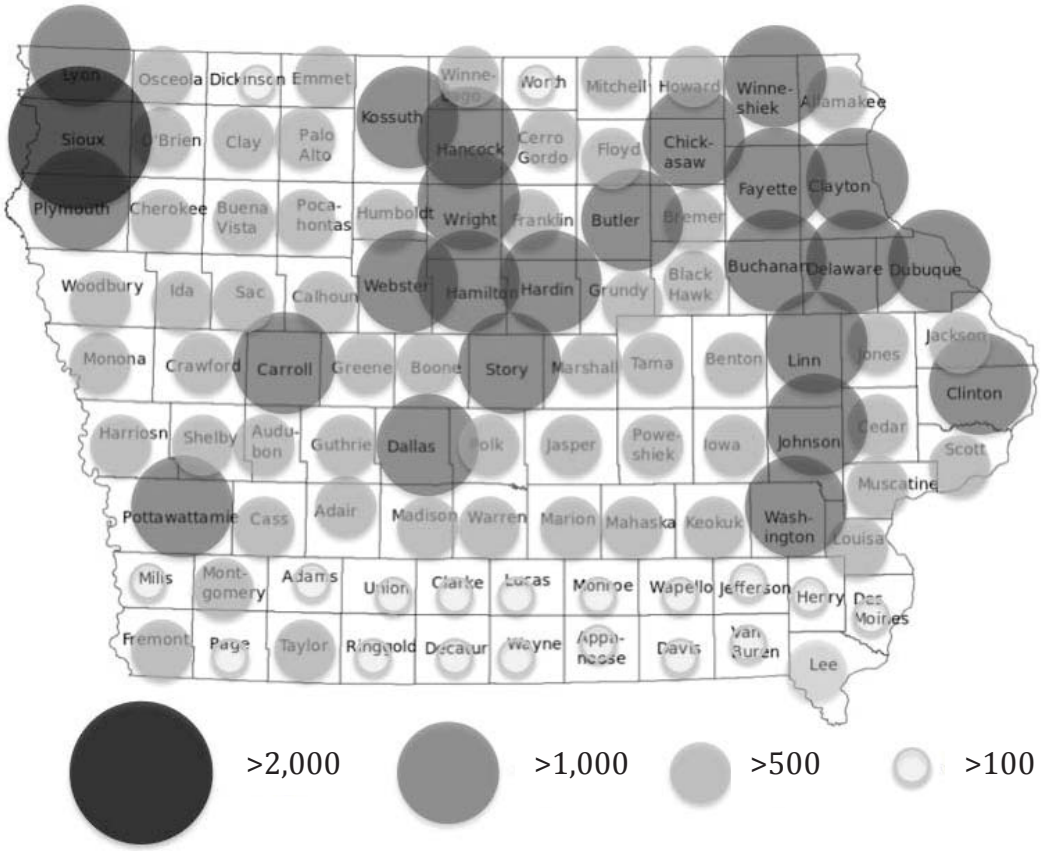
employer leaving them with no means of transportation throughout their stay. Time is also a major constraint, as healthcare services are typically unavailable during evening and night hours when farmworkers are available. Lastly, farmworkers are frequently relocating to new areas. They are not familiar with the services available in the area, and since their stay is usually not permanent, they may not have the time or desire to locate healthcare clinics or other services. These factors make it difficult for migrant health centers to adequately accommodate these needs of farmworkers. Health centers often have limited resources, including hours of operation, financial support, and healthcare providers, and they have limited facilities to be able to provide services to farmworkers across the state.

**AGRICULTURE AND FARMWORKERS IN IOWA**

Agricultural land makes up over 90% of Iowa, which has some of the richest and most productive soils worldwide [38]. Iowa is known for being the largest producer of corn and soybeans in the nation; however, there are various types of farms with some having a many crops and other farms having one or two mass-produced crops. Some of the smaller farms grow various types of greens, peppers, squash, potatoes, tomatoes, apple orchards, vineyards, and other vegetables and fruits. There are also several types of livestock raised in Iowa. Dominant livestock in Iowa includes hogs, chickens, and cows; however, turkey, goats, sheep, fish, and other animals are not uncommon. Pork production in Iowa is the largest in the nation with an estimate of 21 million hogs making up one-third of the nation's hogs. Iowa also leads the nation in egg production [38].

There were 88,500 farms in Iowa as of 2013; a decrease since 2007 when there were close to 100,000 farms, and the number continues to decline [16]. As of 2016, there were over 80,000 farmworkers employed in Iowa [22]; a greater than 10 percent increase since 2007 [39].

**Figure 4 – Number of hired farmworkers by county, Iowa, 2012**




*Data retrieved from Census of Agriculture, USDA, 2012 [40]

Approximately two-thirds of Iowa farmworkers worked in crop production (51,201) with the remaining employed in animal production (29,521) [22]. Farmworkers engage in several corn-related tasks, including harvesting, detasseling, weeding, and processing. They also engage in similar activities for the production of soybeans, cucumbers, potatoes, melons, and apples. As the popularity of greenhouses and bee and honey production increases, more farmworkers are employed in these areas of farming. With the large number of hogs and laying hens in Iowa, several farmworkers are employed in these production facilities, particularly large hog confinements [26, 41]. There are high risks of injuries and illnesses associated with conducting these tasks. The nonfatal and fatal injury and illness rates of agriculture in Iowa were 5.9 and 33.4 per 100,000 full-time employees. Both these rates are larger than the overall worker statewide rates of 4.4 and 6.0 [6].

## LOCAL HEALTHCARE SERVICES FOR FARMWORKERS IN IOWA

Among the roughly 200 migrant health centers nationwide, there is only one located in Iowa, Proteus, Inc., which consists of a main office in Des Moines and two satellite sites in Fort Dodge and Iowa City. They have been providing primary care to farmworkers and their families through their Migrant Health Program since 1991 through mobile healthcare clinics. Farmworkers are eligible to use this healthcare service if they have performed agricultural work, including workers in crop and livestock production as well as food processing plants, within the previous two years or if they are a spouse or dependent of an eligible farmworker [26]. While food processing plants are not typically considered part of the agricultural industry, the federal support for Proteus' services includes workers employed in these plants [22, 26]. Proteus optimizes their access to farmworkers by providing evening hours for clinics, traveling to farmworkers' housing and work sites, and providing transportation to farmworkers to seek healthcare services that Proteus cannot provide (e.g. dental, woman health). However, similar to other migrant health centers, Proteus has limited resources that challenge their ability to provide care to a large portion of the farmworkers.

### Proteus' Needs Assessment 2012

Proteus completes a needs assessment every five years to measure the quality of their services they provide to farmworkers and identify the gap areas. The most recent needs assessment and written report completed was in 2012. During this needs assessment, Proteus collected information from their electronic health records system, and focus groups and interviews with farmworkers.

#### *Electronic health records of farmworkers*

According to Proteus' electronic health records, a computerized system of patients' health charts, they have provided primary care for 1,000 to 2,000 Iowan farmworkers annually [26]. These records indicate that overall diabetes, overweight/obesity, and cardiovascular disease are the most common diagnoses of

patients seen at Proteus. Although, in 2012, the most common diagnosis was hypertension (15%) followed by diabetes (11%). The most common occupational health condition was contact dermatitis (3%) followed by hearing problems and asthma [26]. While it appears that farmworkers are not experiencing occupational health conditions as often as non-occupational health conditions, one possibility may be that providers are unfamiliar with occupational injuries and illnesses and may not be asking about these health concerns [3, 13, 24, 35].

***Focus groups and interviews with farmworkers***

Focus groups and interviews were conducted with farmworkers to obtain information about their own perspectives on their health. Findings from both the focus groups and interviews indicate that many of the health conditions they are experiencing are, in fact, occupational. The most common occupational health condition reported was allergies from not being acclimatized to the new environments. Other occupational conditions the farmworkers reported were musculoskeletal injuries and illnesses, injury resulting from slips and trips, heat-related health issues, and pesticide or chemical-related health issues.

Non-occupational conditions reported during the focus groups included diabetes, cancer, cardiovascular disease, and vision problems. The farmworkers believe their diet is the cause of these diseases, since they have better access to American food, which, in their belief system, is less healthy than their native food. These findings are consistent with phone interviews held with farmworkers [26]. Even though farmworkers reported high rates of occupational injuries and illnesses, they expressed concerns for information regarding non-occupational health conditions.

During the focus groups and interviews with farmworkers, they specified interest in information about nutrition, physical activity, and how to seek dental care at lower costs and in close proximity to their homes. While Proteus does have health education materials for their patients, they are insufficiently utilized due to time and

other limitations. Also, farmworkers reported they try to self-treat their injuries and illnesses before seeking care from a medical clinic due to multiple barriers including lack of health insurance and other financial means, time, transportation, and awareness of healthcare clinic. Farmworkers concluded that they only sought healthcare if their injury or illness reaches the point of being severely painful or unbearable. The exception is farmworkers who have Medicaid do tend to seek healthcare services more often. All farmworkers typically sought Proteus clinics for immunizations or health check-ups [26].

**ADDRESSING THE GAP IN RESEARCH**

There is still a need for further research regarding the occupational and non-occupational health experiences of farmworkers, since they are a transient and vulnerable population. Study findings indicate that a large portion of the population is not seeking healthcare treatment for injuries and illnesses, even though agriculture is one of the most hazardous industries and this is a high-risk population [13, 21, 26, 37]. While non-occupational health conditions are addressed at migrant health centers, it is unknown whether occupational health concerns receive any attention and how often information regarding prevention, management, and treatment of occupational and non-occupational health conditions is provided to farmworkers.

Many studies have characterized farmworkers' health conditions, especially non-occupational illnesses, the quality of housing and diet, and barriers to healthcare services; although fewer studies have investigated farmworkers' healthcare-seeking behavior for occupational injuries and illnesses, and the best methods for educating this population inside and outside the healthcare system about prevention and care [3, 24, 30]. Therefore, the goal of this project was to characterize farmworkers' occupational and non-occupational health conditions, their healthcare-seeking behavior, and their use of preventive measures. This study has three Aims:

Aim 1: Enumerate farmworkers' self-report of occupational and non-occupational injuries and illnesses.

Aim 2: Characterize healthcare-seeking behaviors in relation to occupational and non-occupational injuries and illnesses.

Aim 3: Identify barriers and opportunities for receiving information about prevention, management, and treatment for health conditions, and use of preventive measures.

## CHAPTER II: METHODOLOGY

### INTRODUCTION

Agriculture is one of the most hazardous industries in the United States in which three to five million farmworkers are employed annually [3, 8-13, 22]. Even though Iowa farmworkers only make up 3% of the nationwide population, Iowa is one of the leading agricultural states with various types and sizes of farms on which farmworkers are employed. Farmworkers experience multiple barriers, since they are largely foreign-born, non-English speaking, and of low socioeconomic status [12, 21, 22]. They also have high mortality and morbidity due to occupational factors, including pesticide use, outdoor setting, and frequent body strain as well as non-occupational factors, such as limited access to healthy nutrition, hygienic facilities, and financial constraints [3, 11, 15, 21, 24, 26]. There are over 150 migrant health centers in the United States and one in Iowa that serve a fraction of the farmworker population (20-33% of the United States farmworkers and 1-2% of Iowa farmworkers) [12, 22, 26, 33].

Some of the most common occupational health outcomes farmworkers experience in the United States, and even internationally, are pesticide and chemical-related health conditions, heat-related health conditions, muscle and joint pain, and eye injuries [2, 3, 11, 14, 25]. In Iowa, farmworkers are exposed to these occupational hazards through the various tasks they engage in for corn, soybean, and other crop production as well as livestock production. They are working outdoors in the heat and sun and being exposed to pesticide residues and chemicals on plants and animals, while performing repetitive motions of detasseling, weeding, harvesting, or livestock handling. Although occupational exposures seem to receive less concern from farmworkers and healthcare providers, several studies have identified that farmworkers are experiencing many occupational injuries and illnesses, but healthcare providers may not be asking about occupational exposures or they are unfamiliar with the symptoms [3, 13, 24, 26, 35]. Nonetheless, non-occupational

health outcomes, including diabetes, high blood pressure, obesity, and depression, are prevalent in this population [3, 11, 24, 28]. These eight health conditions consisting of occupational and non-occupational injuries and illnesses were targeted for this study due to their prevalent diagnoses in this population. While allergies and contact dermatitis are frequently diagnosed or a concern among farmworkers, the symptoms experienced are embedded within some of the other common health outcomes, including pesticide and chemical-related health conditions and heat-related health conditions.

Proteus, Inc., a non-profit organization that provides health services to migrant farmworkers is partnering with other organizations to provide optimal healthcare services to the farmworker population. Since farmworkers are transient and vulnerable, education regarding prevention and self-care may be important activities that may contribute to overall farmworker wellbeing. As documented in the 2012 needs assessment conducted by Proteus, farmworkers have difficulties accessing healthcare or other services due to their limitation of transportation, time, and finances [26]. For most health problems, they often first try self-treatments before seeking healthcare, but they are interested in receiving information about potential health conditions that could occur and ways to prevent them [26].

The purpose of this study was to gain knowledge about the health conditions experienced by farmworkers and their health and safety practices in order to identify opportunities for relaying health education to this population. Few studies have investigated farmworkers' healthcare-seeking behavior for occupational injuries and illnesses, or the best methods for educating this population inside and outside the healthcare system about prevention and care [3, 24, 30]. Therefore, the goal of this project was to characterize farmworkers' occupational and non-occupational health conditions, their healthcare-seeking behavior, and their use of preventive measures. This study has three Aims:

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Aim 2: Characterize healthcare-seeking behaviors in relation to occupational and non-occupational injuries and illnesses.

Aim 3: Identify barriers and opportunities for receiving information about prevention, management, and treatment for health conditions, and use of preventive measures.

## METHODS

### Study Design

A descriptive, cross-sectional study was used to collect information about (a) the respondent's experience of occupational and non-occupational injuries and illnesses, (b) healthcare-seeking behaviors, and (c) the use of preventive measures and access to health education among farmworkers in Iowa. A 39-item survey was developed (Appendix) and administered in English or Spanish through an interview with the participant. Responses were recorded into Qualtrics software. It was designed to be completed in less than 20 minutes. Specific questions included information about a subset of occupational and non-occupational injuries and illnesses during the past 12 months, healthcare-seeking behavior in the past 12 months, if they had received information regarding prevention, management, and treatment of health conditions in the past 12 months, their frequency of personal protective equipment use and hygiene practices after working in agriculture, and their interest and preferred method for receiving information about occupational and non-occupational health and safety.

### Survey Development

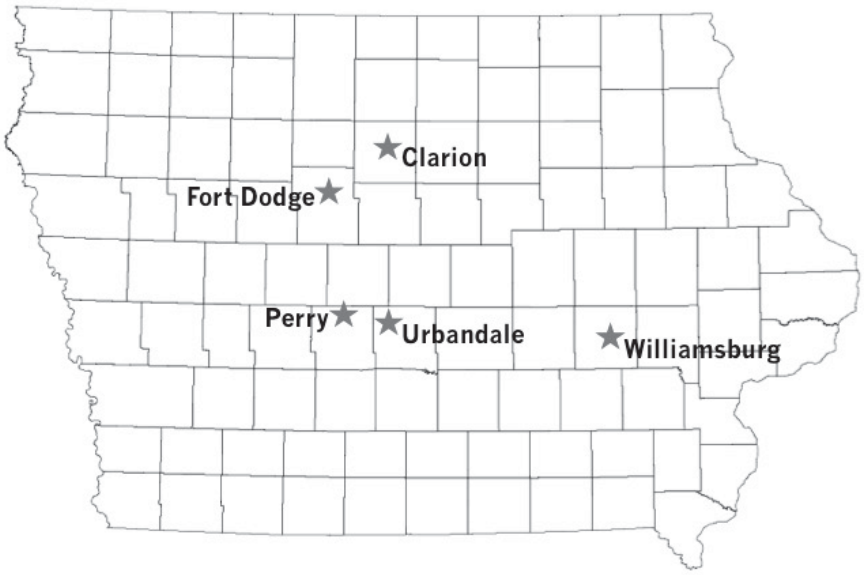
The initial survey was reviewed by experts in the agricultural safety and health field (Dr. Diane Rohlman and Dr. Brandi Janssen), and a healthcare provider and health

aide from Proteus (Ms. Emily Sinnwell and Ms. Merced Cruz). In addition to the expert review, the survey was also reviewed for technical language, and formatting and grammatical errors by Ms. Laurie McCuen, Ms. Connie Yee, Ms. Lena Swander, and Mr. Josh Ganarajah. The purpose of the review was to ensure cultural appropriateness, sufficient responses available for the questions, correct functioning of the pop-up questions, and sequential flow of the survey. Feedback contributed to revisions of the survey prior to study launch. The survey, information sheet, and study protocol were approved by the University of Iowa's Institutional Review Board.

Participants

Participants were recruited at mobile healthcare clinics hosted by Proteus, Inc., a nonprofit organization that provides health, educational, and economic services to farmworkers. The target population for this survey are those served by Proteus including workers in crop production, animal production, or food processing plants. Potential participants were informed of the study by Proteus employees when they checked in for their clinic visits or while they were waiting for another family member who was seeking treatment at the clinic. Clinics were held in town buildings located in north, central, and eastern regions of Iowa (i.e., Clarion, Fort Dodge, Urbandale, Perry, and Williamsburg) during December 2015 through February 2016 (Figure 5). Farmworkers were eligible to participate in the study based on the following inclusion criteria: worked previously or currently in agriculture, aged 18 years or older, and able to speak and understand English or Spanish.

**Figure 5 – Locations of Proteus' healthcare mobile clinics for farmworkers in Iowa**




Data Collection

Oral consent was obtained prior to the administration of the survey, which verified that the participants understood their rights and responsibilities for the study. Participants had the option to read or have the interviewer read to them a one-page information form describing the study in either English or Spanish. Participants were told they could end the survey at any time.

The survey was administered orally to 50 farmworkers in quiet, private settings. During the interview the responses were entered into Qualtrics. Depending on the farmworkers' preference, they were able to complete the survey in English or Spanish. The principal investigator directly administered the survey to English-speaking farmworkers. A translator from Proteus, Ms. Merced Cruz, translated the interview for participants who preferred to complete the survey in Spanish. Responses were entered after the test session for three participants due to lack of Internet access. All farmworkers received $10 cash for completion of the survey.

Survey Topics

Information collected during the survey included demographic variables, injury and illness status, healthcare-seeking behavior, whether they have received information about health topics, and their preferred method for receiving information (Table 1).

**Table 1 – Study variables by demographic or study aim category**

| STUDY CATEGORY | VARIABLE |
|---|---|
| **Demographics** | Age |
| | Country of origin |
| | Sex |
| | Ethnicity/Race |
| | Primary language |
| | English proficiency status |
| | Length of time working as a U.S. farmworker |
| | Annual household income |
| | Number of occupants in household |
| | Self-report health status |
| **Study Aim 1** | Occupational injury or illness status during past 12 months |
| | Non-occupational injury or illness status during past 12 months |
| **Study Aim 2** | Healthcare visits for occupational injury or illness during past 12 months |
| | Source of healthcare bill payment for occupational injury or illness |
| | Healthcare visits for non-occupational injury or illness during past 12 months |
| | Healthcare visits for pesticide or chemical-related health condition during past 12 months |
| | Healthcare visits for heat-related health condition during past 12 months |
| | Healthcare visits for muscle and/or joint pain during past 12 months |

**Table 1 – Continued**

| | |
|---|---|
| **Study Aim 2** | Healthcare visits for an eye injury during past 12 months |
| | Healthcare visits for diabetes during past 12 months |
| | Healthcare visits for high blood pressure during past 12 months |
| | Healthcare visits for obesity during past 12 months |
| | Healthcare visits for depression during past 12 months |
| **Study Aim 3** | Source of information received about pesticide or chemical-related health conditions in past 12 months |
| | Source of information received about heat-related health conditions in past 12 months |
| | Source of information received about muscle and/or joint pain in past 12 months |
| | Source of information received about eye injury in past 12 months |
| | Source of information received about diabetes in past 12 months |
| | Source of information received about high blood pressure in past 12 months |
| | Source of information received about obesity in past 12 months |
| | Source of information received about depression in past 12 months |
| | Frequency of use of personal protective equipment |
| | Frequency of washing hands after working agriculture |
| | Interest in information on occupational and non-occupational health conditions |
| | Preference for source of information about occupational and non-occupational conditions |
| | Preference for delivery method of information about occupational and non-occupational health conditions |
| | |

Data Analysis

Frequency counts and percentages were computed for demographic variables, occupational and non-occupational injuries and illnesses, healthcare-seeking behavior, information about health conditions, and uses of preventive measures. Bivariate analysis was conducted on demographic variables and use of preventive measures by sex using chi-square and Fisher's exact tests. All analyses were completed using SAS 9.3.

## RESULTS

Demographic Variables

A total of 72 farmworkers were invited to the study. Out of the 72 farmworkers that were invited, the study had a response rate of 54 farmworkers who agreed to participate. After screening for eligibility criteria, there were 50 farmworker participants for the final results and analysis (Table 2). Four of the interested participants were not eligible, because they had never worked in agriculture in the United States or they were under the age of 18.

**Table 2 – Number of farmworkers enrolled in the study at each location of Proteus' healthcare mobile clinics in Iowa**

| Site | Participants |
|---|---|
| **DECEMBER** | |
| Clarion | 2 |
| Fort Dodge | 7 |
| Urbandale | 16 |
| **JANUARY** | |
| Clarion | 6 |
| Perry | 7 |
| Urbandale | 5 |
| **FEBRUARY** | |
| Williamsburg | 7 |
| | **TOTAL: 50** |

There were approximately equal numbers of male and female participants (24 and 26, respectively), and there were no significant differences by sex for any of the demographic variables or use of preventive measures (p>0.05; Table 3).

**Table 3 – Distribution of demographics and use of preventive measures among farmworker study sample by sex**

| Characteristics | N (%) | Study Population (n, %)[1] | | p-value[2] |
|---|---|---|---|---|
| | | Male (n=24) | Female (n=26) | |
| **Age (in years)** | | | | |
| 19-25 | 8 (16.0) | 5 (20.8) | 3 (11.5) | 0.38 |
| 26-35 | 10 (20.0) | 2 (8.3) | 8 (30.8) | |
| 36-45 | 5 (10.0) | 3 (12.5) | 2 (7.7) | |
| 46-55 | 18 (36.0) | 9 (37.5) | 9 (34.6) | |
| 56-65 | 8 (16.0) | 4 (16.7) | 4 (15.4) | |
| 66-75 | 1 (2.0) | 1 (4.2) | 0 (0.0) | |
| **Country of Origin** | | | | |
| United States | 6 (12.0) | 5 (20.8) | 1 (3.9) | 0.13 |
| Mexico | 35 (70.0) | 14 (58.3) | 21 (80.8) | |
| Other (Honduras, Guatemala, El Salvador) | 9 (18.0) | 5 (20.8) | 4 (15.4) | |
| **Ethnicity/Race** | | | | |
| Hispanic or Latino | 50 (100.0) | 24 (100.0) | 26 (100.0) | -- |
| **Primary Language** | | | | |
| English | 4 (8.0) | 3 (12.5) | 1 (3.9) | 0.48 |
| Spanish | 43 (86.0) | 20 (83.3) | 23 (88.5) | |
| Other (dialect) | 3 (6.0) | 1 (4.2) | 2 (7.7) | |
| **English Language Proficiency** | | | | |
| Excellent or very good | 13 (26.0) | 7 (29.2) | 6 (23.1) | 0.83 |
| Good or fair | 12 (24.0) | 5 (20.8) | 7 (26.9) | |
| Poor or none | 25 (50.0) | 12 (50.0) | 13 (50.0) | |
| **Farmworker in U.S. (in years)** | | | | |
| 1-2 | 10 (20.0) | 5 (20.8) | 5 (19.2) | 0.33 |
| 3-6 | 14 (28.0) | 4 (16.7) | 10 (38.5) | |
| 7-10 | 9 (18.0) | 6 (25.0) | 3 (11.5) | |
| 11+ | 17 (34.0) | 9 (37.5) | 8 (30.7) | |
| **Household Income (in thousand dollars)** | | | | |
| <6-12 | 21 (42.0) | 9 (37.5) | 12 (46.2) | 0.82 |
| 12-18 | 12 (24.0) | 6 (25.0) | 6 (23.1) | |
| 18->24 | 17 (34.0) | 9 (37.5) | 8 (30.8) | |

**Table 3 – Continued**

| | | | | |
|---|---|---|---|---|
| **Persons per Household** | | | | |
| 1-3 | 15 (30.0) | 10 (41.7) | 5 (19.2) | 0.13 |
| 4 | 16 (32.0) | 8 (33.3) | 8 (30.8) | |
| 5-7 | 19 (38.0) | 6 (25.0) | 13 (50.0) | |
| **Self-Health Score** | | | | |
| Good | 16 (32.0) | 8 (33.3) | 8 (30.8) | 0.49 |
| Fair | 24 (48.0) | 13 (54.2) | 11 (42.3) | |
| Poor | 10 (20.0) | 3 (12.5) | 7 (26.9) | |
| **Use of Personal Protective Equipment** | | | | |
| Always | 39 (78.0) | 20 (83.3) | 19 (73.1) | 0.78 |
| Less than always | 5 (10.0) | 2 (8.3) | 3 (11.5) | |
| Never | 6 (12.0) | 2 (8.3) | 4 (15.4) | |
| **Hygiene Practice** | | | | |
| Always | 47 (94.0) | 21 (87.5) | 26 (100.0) | 0.10 |
| Less than Always | 3 (6.0) | 3 (12.5) | 0 (0.0) | |

[1]Row percentages
[2]Pearson chi-square or Fisher's exact p-value

The mean age of the study participants was 43.2 years (Figure 6). All of the participants self-identified as Hispanic and the majority were born in Mexico (70%), followed by other Latin American countries (18%), and the United States (12%). Spanish was the primary language spoken (86%), and half spoke little or no English. Most of the participants (88%) reported living primarily in Iowa during the past 12 months, and all of them lived in the United States year-round. On average, participants had worked in the United States for 6 years; however, several reported working in the United States for over 30 years. Although the mean household income was between $12,000-18,000 per year, almost half of the participants reported incomes of $12,000 or less per year (42%). The number of persons in a household ranged from one to seven with a mean of four persons. None of the participants rated their health as excellent, only one rated their health as very good (2%), More than half rated their health as good or fair (30% and 48%), and the rest rated their health as poor (20%; Figure 7).

**Figure 6 – Age distribution of farmworker study sample**

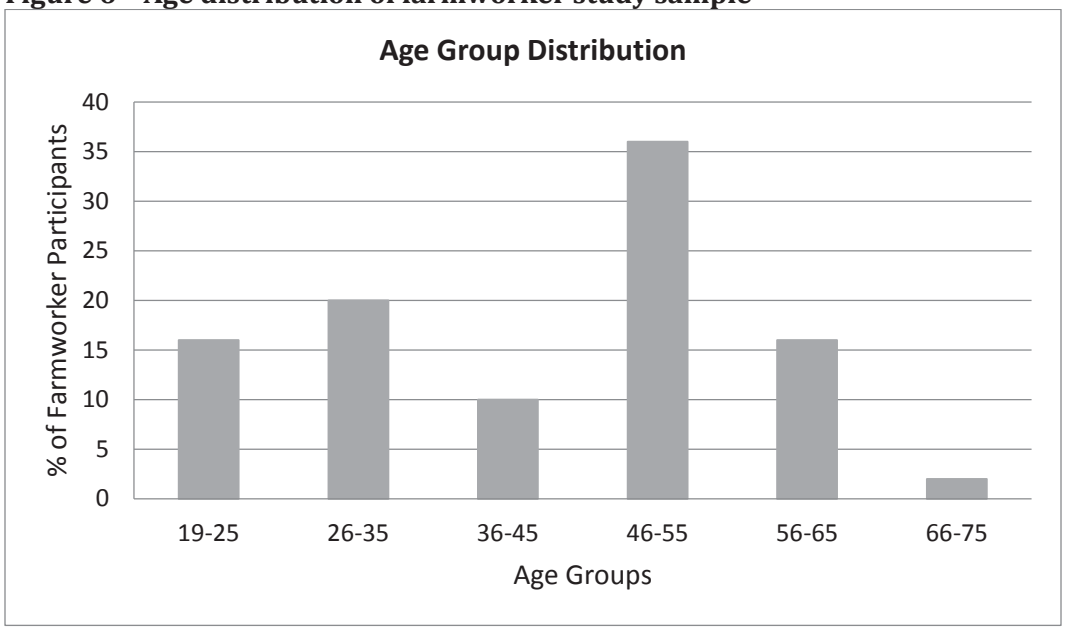



**Figure 7 – Self-report health status of farmworker study sample**


Use of Preventive Measures

The majority of participants reported wearing personal protective equipment every time they work in agriculture (78%) and also washing their hands after working in agriculture prior to eating (94%). Although not a significant difference, three of the male participants reported that they did not always wash their hands after working

in agriculture prior to eating whereas no female ever reported not washing their hands.

Study Aim 1: Occupational and Non-occupational Injuries and Illnesses

The majority of participants did not report an occupational injury or illness during the past 12 months (88% and 96%, respectively; Table 4). Among the participants who did report an occupational injury or illness, all sought treatment at a healthcare facility. Healthcare expenses related to treatment of these injuries and illnesses were typically paid for by the farmworker participant's employer or the insurance company; although one participant reported having to personally pay for the healthcare expenses.

Participants reported more non-occupational illnesses than injuries (24% and 8% of participants, respectively). All participants who experienced a non-occupational injury sought treatment at a healthcare facility. However, one participant who experienced a non-occupational illness did not seek healthcare due to fear of being deported. Payment of healthcare expenses for non-occupational injuries and illnesses was not asked. A large portion of the participants reported experiencing an on-going illness from previous years.

**Table 4 – Percentage of farmworker study sample that reported an occupational or non-occupational injury or illness during the past 12 months and their healthcare-seeking behavior for treatment**

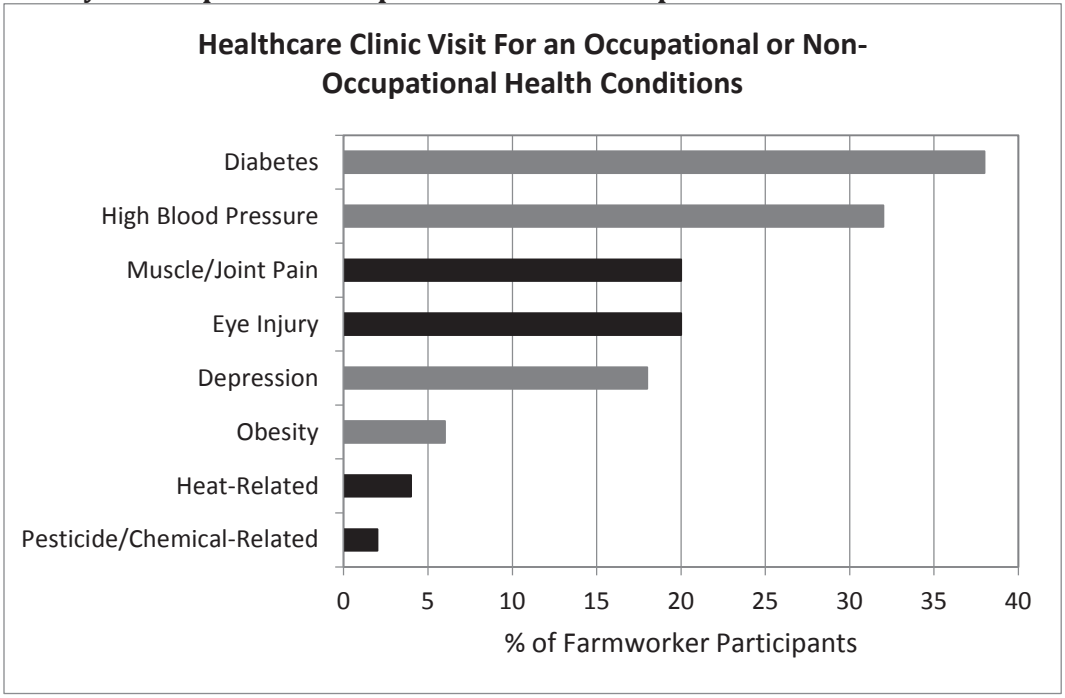
| | % of Farmworkers Injured or Became Ill in the Past 12 Months | % of Farmworkers That Sought Healthcare For Injury or Illness[1] | Source of Payment for Healthcare Expenses[1*] | | |
|---|---|---|---|---|---|
| | | | Personal | Employer | Insurance |
| **Occupational Injury** | 12% | 100% | 17% | 50% | 33% |
| **Occupational Illness** | 4% | 100% | -- | 50% | 50% |
| **Non-Occupational Injury** | 8% | 100% | -- | -- | -- |
| **Non-Occupational Illness** | 24% | 92%[2] | -- | -- | -- |

*Payment of healthcare expenses was not asked for non-occupational injuries and illnesses
[1]The proportion is among those participants who were injured (n=6 (occupational), n=4 (non-occupational)) or ill (n=2 (occupational), n=12 (non-occupational))
[2]One participant did not seek treatment due to fear of being deported

Study Aim 2: Healthcare-Seeking Behavior

Participants were much more likely to seek healthcare for non-occupational conditions compared to occupational conditions. Healthcare was sought by participants for the following occupational conditions: muscle and/or joint pain (20%), eye injury (20%), pesticide or chemical-related (2%), and heat-related (4%; Figure 8). Participants more frequently sought healthcare for the following non-occupational health conditions: diabetes (38%), high blood pressure (32%), depression (18%), and obesity (6%).

**Figure 8 – Percent of farmworker study sample that visited a healthcare clinic for any of the specified occupational or non-occupational health conditions***

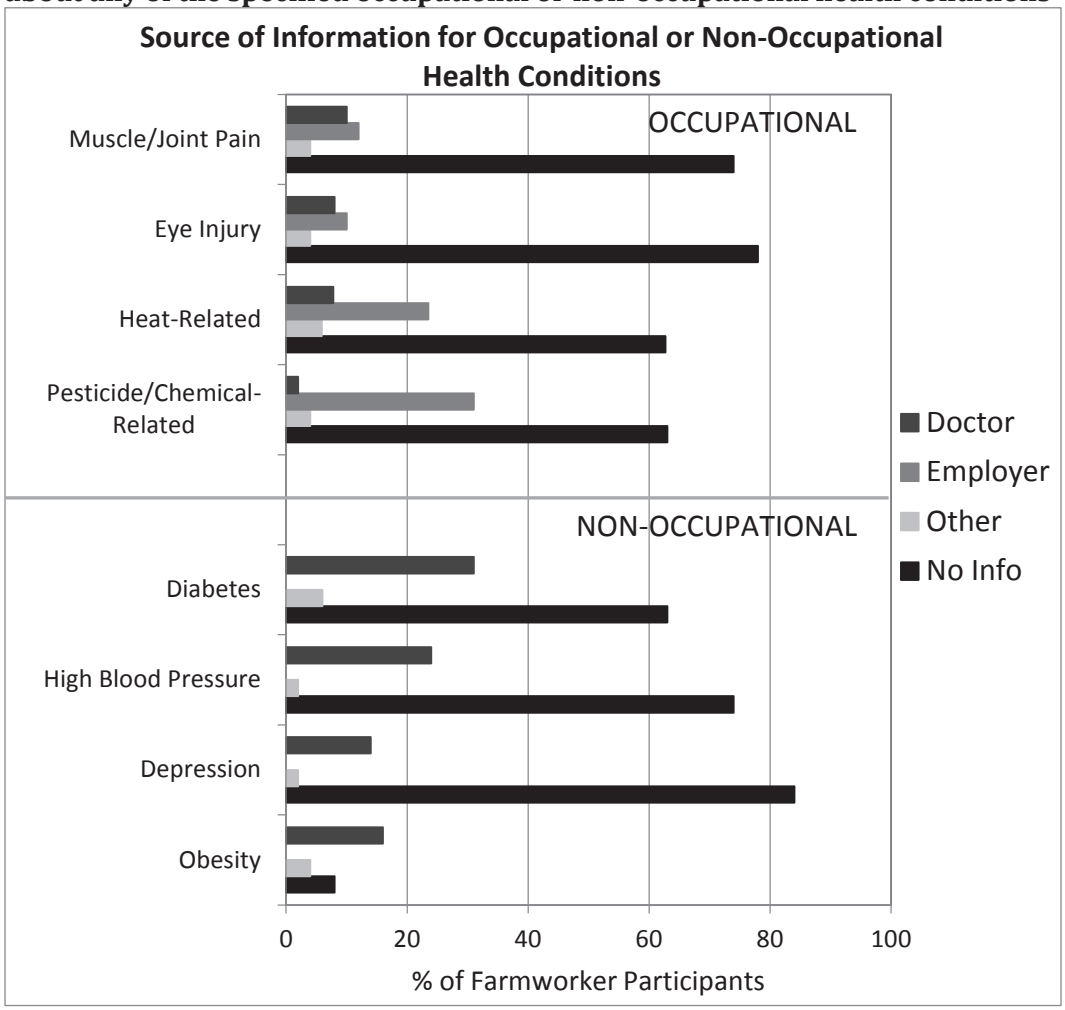



*Gray indicates non-occupational health conditions and black indicates occupational health conditions

Study Aim 3: Health Condition Information

All participants in the study, regardless if they indicated that they were seeking healthcare treatment for a health condition in the past 12 months, were asked if they had received information regarding management and treatment for the following health conditions within the past 12 months: muscle and/or joint pain, eye injury, pesticide or chemical-related, heat-related, diabetes, high blood pressure, depression, and obesity (Figure 9), and if this information included methods of how to prevent these health conditions.

**Figure 9 – Percent of farmworker study population that received information about any of the specified occupational or non-occupational health conditions**



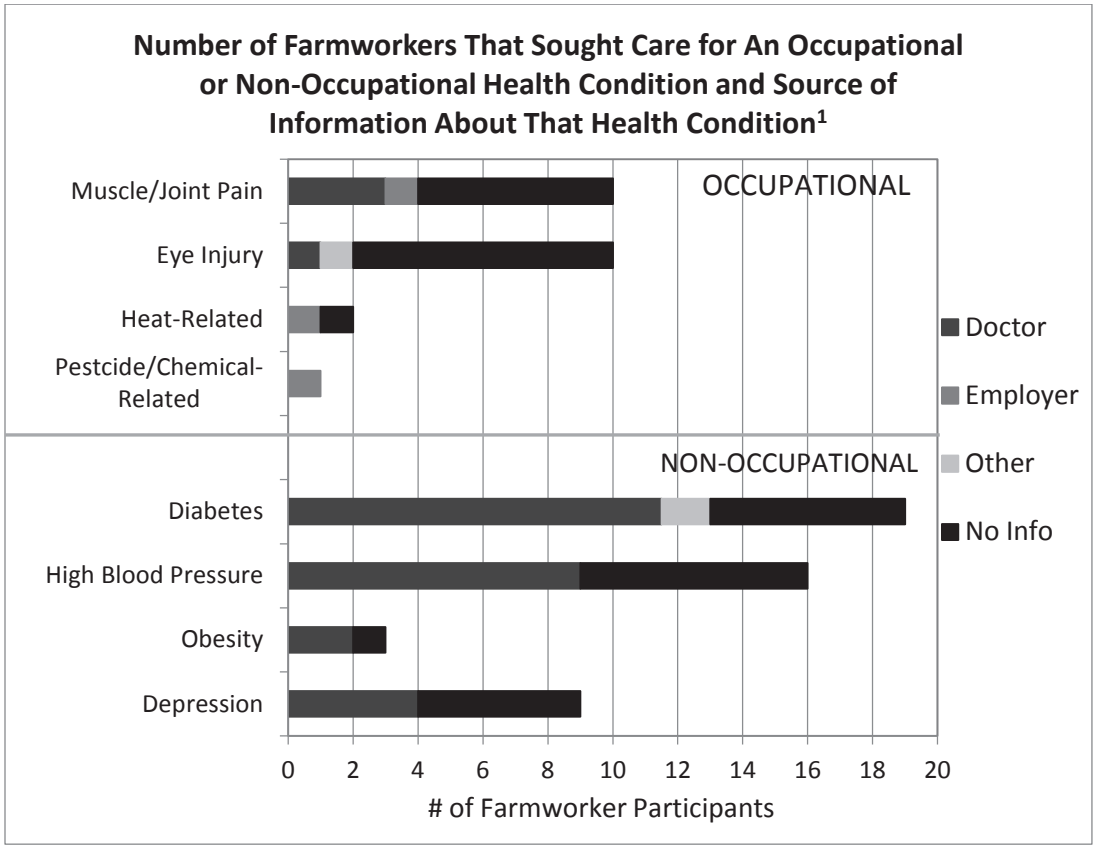

Participants reported that employers most frequently provided information about occupational health conditions with pesticide or chemical-related and heat-related being the most commonly discussed (31% and 23%, respectively) followed by muscle and/or joint pain (12%) and eye injury (10%). Participants less frequently received information about any of these health conditions from their doctor (28%) or other sources. However, participants were more likely to receive information about non-occupational health conditions from their doctor than from employers or other sources with diabetes being the most frequently discussed (31%) followed by high blood pressure (24%), obesity (16%), and depression (14%). Employers were never reported as a source of information for non-occupational health conditions. A

large portion of the participants had not received any information about occupational health conditions.

Some participants did report receiving information from sources other than their doctor or employer (18%). The most common sources included an education or training event (32%), coworker or friend (21%), school (21%), or radio (21%). In all but one situation, information addressing a specific health topic (i.e. diabetes, muscle and/or joint pain, high blood pressure, eye injury, depression, heat-related, pesticide or chemical-related, and obesity) included prevention in addition to management and treatment of the topic.

In comparison, when participants reported seeking healthcare for a specific occupational health condition (n=23), most of them did not receive information (i.e. prevention, management, or treatment) about that health condition (Figure 10). Ten participants reported experiencing muscle and/or joint pain and seeking medical care; however, over half of them (60%) reported not receiving any information about prevention, management, or treatment of muscle and/or joint pain. An even greater proportion of those who sought healthcare for eye injury (n=10) did not receive information about eye injury prevention or care (80%).

**Figure 10 – Number of farmworker study sample that visited a healthcare clinic for an occupational or non-occupational health condition and source of information for the health condition**



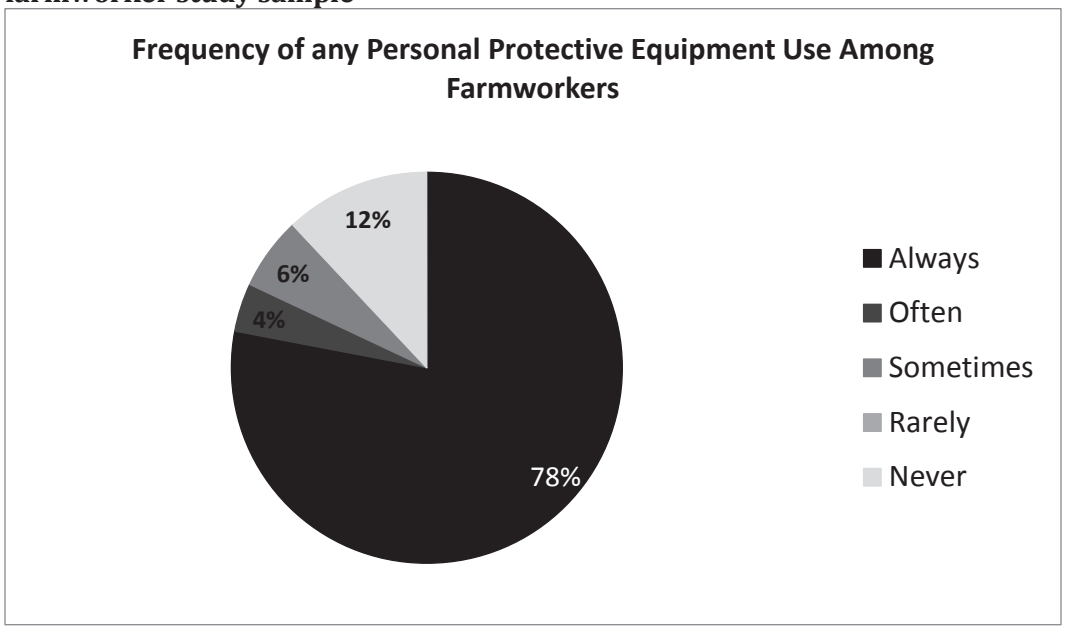

[1]Numbers are based on those who sought healthcare for an occupational health condition (n=23) and non-occupational health condition (n=47)

Unlike occupational health conditions, participants who sought healthcare for non-occupational health conditions (n=47) more often received information about how to prevent, manage, or treat that injury or illness. The primary source of information about non-occupational health conditions was a doctor and no participants reported receiving information about non-occupational health topics from an employer. Nineteen participants visited a healthcare clinic for diabetes concerns, and 13 of them received information for this health condition. There were similar findings for participants who sought healthcare for high blood pressure and obesity. Depression was the exception; over half the participants who sought a healthcare clinic for depression did not receive any information about depression.

Study Aim 3: Use of Prevention Measures

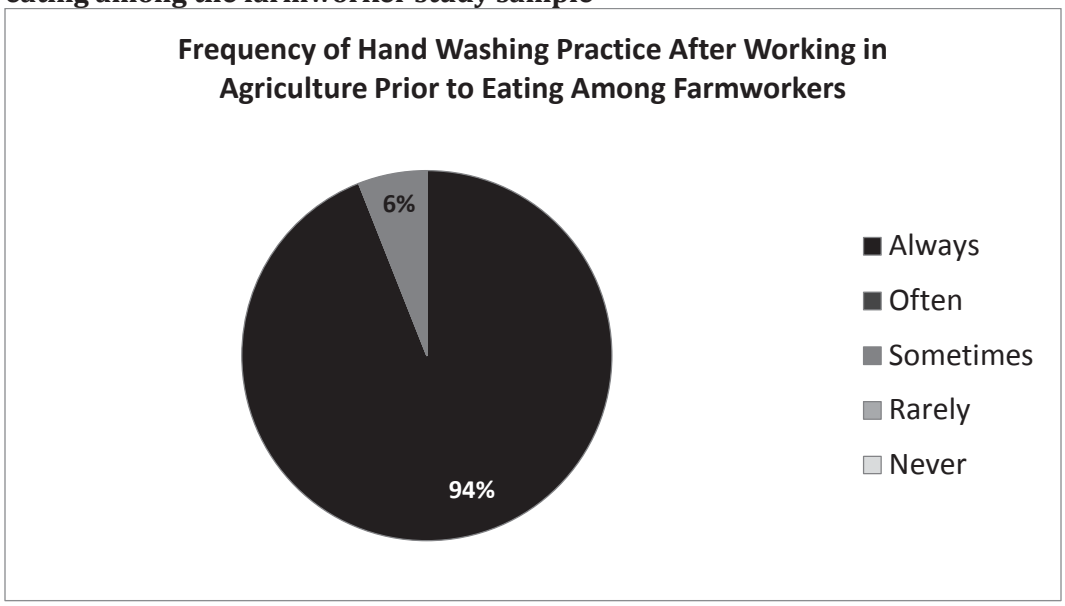
Personal protective equipment was always worn by 78% of the participants who frequently described use of at least two personal protective equipment items (e.g. boots, gloves, ear plugs; Figure 11). When asked why they always wear personal protective equipment, most replied it was required by their employer (89%). Others responded that they feared becoming injured or ill (30%), they do not like to work without it (7%), or a training or education event recommended they wear it (5%). In contrast, 12% of the participants reported never wearing personal protective equipment. When queried about why they did not wear any personal protective equipment, most indicated that it was not provided by their employer (67%), it was uncomfortable to wear (33%), or they were not concerned with wearing personal protective equipment (33%). Another response was that nobody (e.g. employer, healthcare provider, coworker) recommended that they wear personal protective equipment (22%). Among the participants who often or sometimes wore personal protective equipment, the reason for not wearing it occasionally was due to forgetting it at home with no other equipment available to borrow for the day (11%).

**Figure 11 – Frequency of use of any personal protective equipment among the farmworker study sample**



Almost all of the participants (94%) indicated that they always wash their hands after working in agriculture prior to eating (Figure 12). When queried about the reasoning for washing their hands, most replied they feared they would become ill (50%) or they do not like to eat with unclean hands (50%). Other responses included that it was required by their employer (16%), their family recommended they always wash their hands after working in agriculture (14%), or it was part of their cultural norms (10%). The participants who reported sometimes washing their hands (6%) either forgot (67%), did not have time (33%), or did not think they needed to wash their hands (33%).

**Figure 12 – Frequency of hand washing after working in agriculture prior to eating among the farmworker study sample**

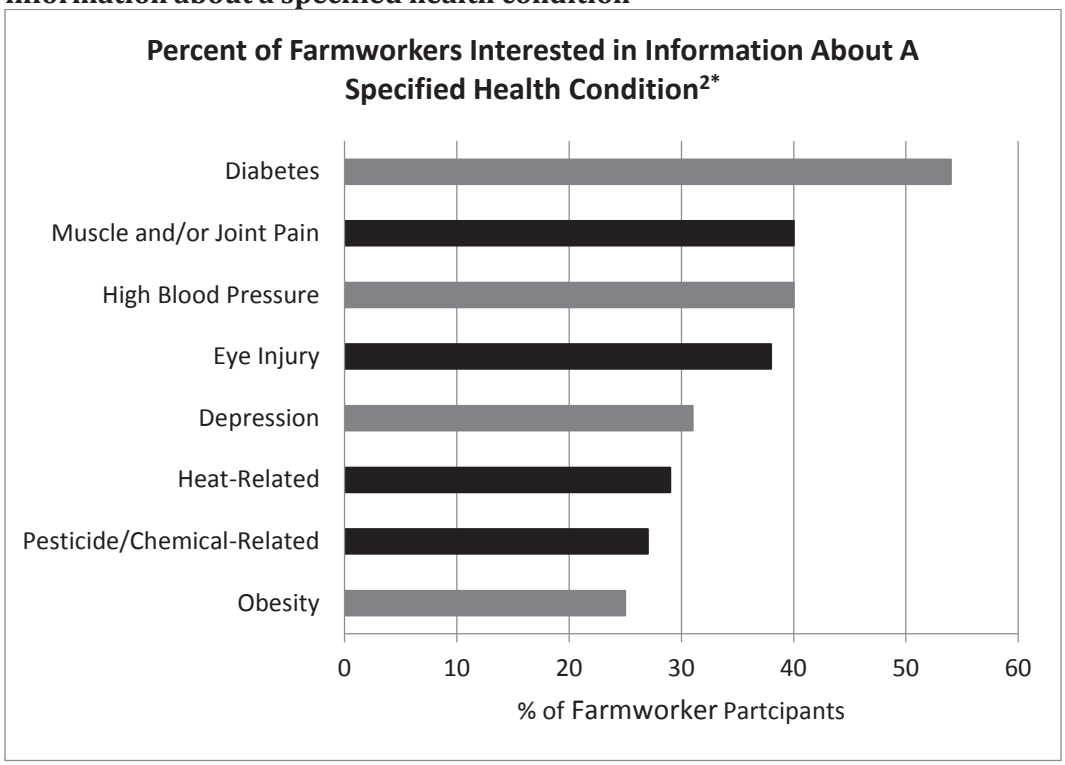



Study Aim 3: Health Condition Education Preference of Farmworker Study Sample

Among the eight health conditions listed in Figure 13 (diabetes, muscle and/or joint pain, high blood pressure, eye injury, depression, heat-related, pesticide or chemical-related, and obesity), all were of interest to at least 25% of the participants. More than half of participants (54%) reported that they would like to receive information about diabetes. Many of those surveyed also would like to receive information about muscle and/or joint pain (40%), high blood pressure

(40%), and eye injury (38%). Other topics of interest included depression (31%), heat-related (29%), pesticide or chemical-related (27%), and obesity (25%). Several participants (18%) were interested in information for all of the specified health conditions. Other health conditions of interest to the participants that were not listed in the survey included cancer, cholesterol, and hearing problems.

**Figure 13 – Percent of farmworker study sample interested in receiving information about a specified health condition**




*Gray indicates non-occupational health conditions and black indicates occupational health conditions

[2]Two of the participants indicated they would not like more information about health conditions, because they are already aware of the implications

Doctors were the preferred source for receiving information (85%) as opposed to employers (6%), or through an education or training event (6%). However, some participants indicated that it would depend upon the health topic being discussed for their preferred source for information (4%), because they would want to receive the information from someone who is an expert on that specific health topic (e.g. diabetes information from their doctor and not their employer). Brochures/pamphlets (50%) or one-on-one discussions (46%) were the most

preferred delivery methods for receiving information. Other delivery methods included video demonstrations (13%), group events (10%), online trainings (4%), and mail (2%).

## DISCUSSION

This study provides information about Iowa farmworkers' occupational and non-occupational injuries and illnesses experienced, their healthcare-seeking behavior, use of preventive measures, and health education interests. It was expected that there would be more males than females in this study, but actually there was slightly more female participation. However, some research suggests that males may be less inclined to seek care or treatment, potentially because it shows a sign of weakness [3, 27]. With equal participation of each sex, statistical analysis was performed examining the differences between males and females on injury reporting, healthcare utilization, and use of preventive measures. There were no differences between males and females, which is positive knowing that males are not reporting a higher number of injuries than females or utilizing healthcare less than females, or vice versa. While it was expected that the mean age of the study population would be close to 40 years old, which is consistent with literature finding that the farmworker population is around 40 years old; however, one-third of the participants were less than 36 years old, which is inconsistent with literature that the population is aging [21, 22]. Another interesting finding was that self-reported health status was fairly low, but use of prevention measures was very high.

Seventeen participants reported actively working in crop production, eight reported working in animal production, seven were currently working in non-agriculture job, and the remaining 18 did not report with the majority of them indicating they were not currently employed. While the majority of the participants reported working in crop agriculture, it is unknown if there were higher rates of occupational health conditions among the participants working with crops, livestock, or not working in agriculture. Severity of the injuries and illnesses is not known, and since almost all

of the participants sought healthcare treatment for their injury or illness, this may indicate that there was underreporting of less severe injuries or illnesses.

There were 24 encounters of occupational or non-occupational injuries or illnesses that were experienced by this population. Participants were not asked to report their specific injuries and illnesses experienced during the past 12 months. While there were only eight reports of an occupational injury or illness during the past 12 months, there were 23 reports of healthcare being sought for a pre-selected, listed occupational health condition. Twice as many participants reported experiencing a non-occupational injury or illness during the past 12 months (n=16); however, healthcare was sought 47 times for a pre-selected, listed non-occupational health condition.

Muscle and joint pain, eye injury, heat-related, pesticide or chemical-related, diabetes, high blood pressure, depression, and obesity were targeted health conditions for this study due to prior knowledge of these being common occupational and non-occupational injuries and illnesses experienced by farmworkers. The primary occupational health concerns of farmworkers in this study were muscle and/or joint pain and eye injury, and non-occupational concerns included diabetes and high blood pressure. Participants were more likely to seek healthcare treatment for non-occupational injuries and illnesses. Furthermore, the percentage of participants seeking healthcare for occupational health conditions were lower than expected, since it is known they are at high risk for many occupational injuries and illnesses. It is unknown if they truly were not experiencing occupational health conditions very often, or if they were experiencing them, but not seeking healthcare treatment. Based on previous literature, occupational health conditions are prominent in this population, but it has also been extensively cited that farmworkers tend to self-treat or delay healthcare treatment especially for occupational health conditions.

A minor difference in interest of occupational and non-occupational health condition education is a positive finding, since workers in agriculture tend to have a fatalistic attitude (i.e. injuries and illnesses are part of the job) when it comes to occupational health conditions [3]. Doctors were the most frequently chosen source for receiving information about health conditions (occupational or non-occupational), so there should be increased promotion within the healthcare system to educate farmworkers during every clinic visit. Both Hispanic and non-Hispanic farmworkers have reported high levels of trust in medical clinics as a source of information regarding health conditions [42, 43]. Since healthcare providers are less likely to discuss occupational health conditions, but the farmworker participants were interested in receiving information regarding these health concerns, occupational health education should be highly considered within the healthcare realm.

Half of the participants reported brochures/pamphlets (50%) as preferred delivery methods, but many participants also preferred one-on-one discussions (46%) with many indicating they had a low literacy level. Two of the participants explained that they do not need more information on prevention, management, or treatment of health conditions, because they are aware of the implications. However, they did indicate interest in motivational methods to maintain a healthy lifestyle, and prevent these health conditions from occurring.

Participants indicated that they do receive information about health from their doctors; however, they would like to receive health education more frequently. When information was provided to farmworkers regarding the targeted health conditions, it usually included content addressing management and treatment as well as prevention. This is a positive finding, and should be continued as we increase education to this population. Healthcare providers should consider providing more education about occupational health conditions, particularly muscle and joint pain and eye injury. It is important to address occupational health outcomes because

farmworkers spend over 40 hours per week working. If they are experiencing any health conditions, it can impact performance and longevity on and off the job. Due to the long workdays and week, farmworkers may not be able to access healthcare. Healthcare providers should continue and/or increase their efforts of reaching out to this population through mobile clinics, or by connecting with the employers, and hosting trainings that inform their employees about identifying hazards and caring for themselves. With the increasing number of migrant health centers and rise of technology for optimizing services to this population, this could be a great resource for occupational safety and health education as well. Occupational safety and health education could include recommending to farmworkers that they use prevention practices, such as wearing personal protective equipment when working with hazardous chemicals or machinery. Also, educating them about their workers' rights. Employers are required to provide protection equipment, breaks to cool down and fuel on water and food, and trainings concerning pesticides or tractor use.

Other State Research Similar to Iowa Study

Findings from this study are supported by similar results from other studies conducted in Michigan and North Carolina (Table 5), which also surveyed farmworkers about their injury and illness experiences and healthcare-seeking behavior [13, 37]. The Michigan study interviewed adult farmworkers about their occupational injuries and healthcare-seeking behavior. The North Carolina study examined occupational injuries, healthcare seeking behaviors, and safety behavior at the workplace among adolescent farmworkers.

There are over 51,500 farms in Michigan [44] compared to 88,500 farms in Iowa. Unlike Iowa, Michigan is known for specialty crops in addition to commodities including milk, corn, soybeans, berries and other fruits, vegetables, cattle, hogs, poultry, and floriculture [44]. Iowa is mostly known for its production of corn, soybeans, hogs, and laying hens, but there are farms that produce various

vegetables and fruits. North Carolina is more similar to Michigan than Iowa with its 52,000 farms [45]. North Carolina's agriculture is diverse, producing tobacco, cotton, corn, soybeans, peanuts, wheat, hogs, cattle, and poultry, particularly turkey [45]. Although agricultural production in these two states is different from Iowa, they all employ large numbers of farmworkers who share similar ethnicity/race and background. Furthermore, regardless of agricultural tasks, the same occupational injuries and illnesses occur among farmworkers in every state.

In the current study, as well as the Michigan and North Carolina studies, musculoskeletal injuries and illnesses were a common concern. The other studies also reported skin problems as a major concern. The Michigan study observed that working in strawberry or cucumber production was significantly related to musculoskeletal injuries [13]. The North Carolina study observed that most of their youth population was involved in tobacco production, which has several illnesses associated through the nicotine and pesticide exposure [37]. The population was also heavily involved with piece-rate berry production, which introduces several problems of neglecting safety and higher risk of injuries [37]. All studies identified that, regardless of the age or sex of the farmworker study population or source of access to the population, there is a need for prevention and care of the farmworker population, since they have high rates of health outcomes, but have multiple barriers to accessing healthcare. Study findings indicate that a great portion of the population is not seeking healthcare treatment for injuries and illnesses, even though agriculture is one of the most hazardous industries and this population is at an increased risk for numerous injuries and illnesses compared to the general American population.

**Table 5 – Comparison of findings among studies about migrant and seasonal farmworkers in Iowa, Michigan, and North Carolina**

| Measures | Iowa Study 2015-16 | Michigan Study 2008 | North Carolina Study 2013 |
|---|---|---|---|
| **N (% Male, Female)** | 50 (48.0, 52.0) | 150 (61.3, 38.6) | 87 (62.1, 37.9) |
| **Age in years (mean, range)** | Adult Farmworkers (43.2, 19-75) | Adult Farmworkers (36.7, 18-74) | Adolescent Farmworkers[1] (14-15, 10-17 |
| **Hispanic (%)** | 100.0 | 93.3 | 89.7 |
| **Study Design** | Interview-administered cross-sectional survey[2] | Interview-administered-prospective survey[2] | Interview-administered cross-sectional survey[2] |
| **Access to Population** | Proteus, Inc.[3] | Northwest Michigan Health Services, Inc. (NMHSI)[3] | Organizations that provide services and care to farmworkers[4] |
| **Study Aims** | 1) Frequency of injuries and illnesses<br>2) Healthcare-seeking behaviors<br>3) Opportunities and barriers to information and prevention practices | 1) Type and frequency of occupational injuries<br>2) Self-care and health-care seeking practices | 1) Describe the personal and work characteristics, occupational safety behaviors, and occupational injuries |
| **Reported Health Conditions** | Muscle and/or joint pain and diabetes | Musculoskeletal injuries and skin problems[5] | Musculoskeletal injury and skin problems[5] |
| **Healthcare-Seeking Behavior** | Majority sought healthcare clinic treatment | Majority self-treated[6] | Majority did not seek healthcare clinic treatment |

[1]Mean age not provided; majority of participants (39.1%) were aged 14-15 years old
[2]Self-reported responses
[3]Federally funded health clinics that provide care and services to farmworkers through mobile clinics or outreach to their residence camps
[4]Organizations include NC FIELD Coalition, Student Action with Farmworkers, NC Justice Center, Columbus County Community Health, Inc., Greene County Health Care, Inc., North Carolina Farmworkers Project, and Migrant Education Program within the North Carolina Department of Public Instruction
[5]Skin problems include sunburn, rashes, poison ivy, lacerations, and bee stings
[6]Self-treatment included rest, OTC, massage, and heat/ice application

There is still a need for further research regarding farmworkers, since they are a transient and vulnerable population. The Iowa, Michigan, and North Carolina studies all stressed the need for more research identifying greater means of access to this

population, how to provide service and care to the farmworker population, and how to overcome the barriers faced by this population. One opportunity to promote health and safety or provide information about prevention of occupational hazards, specifically musculoskeletal injuries and illnesses, skin-related problems, and chemical-related problems, is through healthcare providers. It is recommended that health education occur routinely. On a broader level, more research is needed to strengthen the support for policy changes and enforcement regarding agricultural labor practices and workplace safety and health program enforcement.

Limitations & Future Research

A limitation of this study is the small sample size (N=50). However, there is little research regarding the farmworker population in Iowa. Responses were self-reported for information about injuries and illnesses, healthcare-seeking behavior, health problem education, and use of preventive measures, which allows opportunities for error in recollection (i.e. recall bias). Although, most of the farmworkers were patients at Proteus' healthcare clinics, at least 20% of the study population were not patients, but were present at the clinics due to transporting their family or friend to the clinic or utilizing other services at the clinic locations (e.g. some Proteus clinics were set up at the farmworkers' housing sites). The majority of study participants were seasonal farmworkers (86%), most likely due to data collection occurring over the winter months. However, clinics held during April through October, when the majority of migrant farmworkers are in Iowa, would allow for a larger participation among that population.

This study demonstrates an approach that is feasible for collecting information. Collaboration with other organizations that have established a trusting and caring relationship with this population should be explored for future studies, or accessing the population through the non-healthcare programs offered by Proteus. Almost all surveys were completed in less than 20 minutes with the majority of the surveys being completed in about 12 minutes, so exhaustion from the questionnaire among

participants was not a concern. Although occupation information of crop agriculture, livestock agriculture, or non-agricultural work was collected, 18 participants could not answer because they were not currently employed. It would have been interesting to see if there were injuries or illnesses that were commonly being experienced by this population other than the already pre-selected health conditions focused on in the survey. Other studies have identified that farmworkers are more likely to self-treat or do not seek healthcare often, so alternate routes of getting information to this population should be investigated. Forming focus groups with farmworkers is highly recommended to identify other gap areas.

# CHAPTER III: FUTURE RESEARCH AND PUBLIC HEALTH RELEVANCE

## THE FARMWORKER POPULATION

Agriculture is one of the most hazardous industries in the United States, and it employs three to five million farmworkers annually. The majority of farmworkers are foreign-born, non-English speaking, and of low socioeconomic status. They work long hours in the outdoor environment while doing labor-intensive tasks. These circumstances may limit their ability to access healthcare or health education services. Therefore, efforts to educate and train farmworkers to identify occupational and non-occupational hazards and to prevent injuries and illnesses may improve the health of farmworkers. There is a large farmworker population presence in Iowa with over 80,000 farmworkers working in crop or animal production. Although the numbers of farms in Iowa are decreasing, farms are increasing in size; hence, the need for more working hands to help grow, produce, and care for the crops and livestock. Farmworkers engage in a wide-range of crop and livestock-related activities that benefit the production of agriculture at the risk of being exposed to many occupational hazards. Through outreach and education, farmworkers have the ability to learn how to identify occupational and non-occupational exposures, and when possible, they may make safer and healthier decisions to mitigate or prevent occupational and non-occupational injuries and illnesses.

## HEALTHCARE ACCESS FOR FARMWORKERS

Farmworkers are at-risk for multiple occupational and non-occupational health conditions. While healthcare is continually expanding, there are millions of farmworkers who still are not accessing or seeking healthcare. Barriers that are commonly reported by farmworkers as their reasoning for infrequent use of healthcare services include finances, transportation, and time [35, 36]. As more migrant health centers and community health centers arise, catering their services to address these barriers through making it more feasible for the farmworker

population, such as mobile clinics and after-work hours, may increase farmworker-to-healthcare contact. However, an essential method for decreasing health disparities experienced by this population may be through health education. Informing farmworkers about how to identify hazards and prevent injuries and illnesses has potential to improve their ability to self-care, since accessing traditional healthcare and educational services is not always feasible.

The migrant health center in Iowa, Proteus, provides several services to farmworkers to access healthcare including mobile clinics, low costs, transportation, and evening clinic hours. While 1,000 to 2,000 farmworkers are seeking their healthcare facilities on an annual basis, there are still over 75,000 farmworkers in Iowa that Proteus does not treat. Other farmworkers may be seeking alternative healthcare sources at community health centers or other health service options around the state. However, as indicated through a needs assessment conducted with Proteus, farmworkers tend to self-treat their injuries and illnesses, and only once they have exhausted their options and remain injured or ill, then they will seek healthcare facilities. Due to this population being mobile and hard to reach, prevention education may be an ideal tactic for stressing the importance of occupational and non-occupational health.

**FUTURE RESEARCH AND NEXT STEPS**

Some direct improvements that can come from this study include reporting the results to Proteus, the National Center for Farmworker Health, and other organizations that serve the farmworker population. These organizations may utilize the information to adapt their services according to farmworkers' experiences and preferences. Also, developing resources that are concise and of appropriate literacy level and language for farmworkers to receive from their healthcare provider or employer may improve health education. Another possibility is to expand the current pesticide and heat trainings that are conducted in Iowa and

nationally to include other occupational topics, particularly muscle and joint pain and eye injuries.

Replicating this study with a larger sample or a non-Iowa sample could increase information about the nationwide farmworker population. Also, using a larger sample may help improve the generalizability to the overall farmworker population. Similar findings may be gained by replicating this study with a non-Iowa sample, which can aid in national efforts to care for the farmworker population. Furthermore, conducting similar studies during the summer and fall months in Iowa will engage a larger population of the migrant farmworkers. Lastly, finding more detail about treatment and education of health conditions could help develop optimal methods of service.

The structure of the migrant health centers is effective for overcoming the limited access to farmworkers, but migrant health centers are still limited in resources and continually trying to change their efforts to improve their service to farmworkers. As literature has shown, hundreds of farmworkers do not seek or utilize healthcare facilities. This opens opportunities for other programs that serve this population to step in and provide prevention. Also, creating networks of healthcare providers, employers, educational services, and other organizations to support this population may be beneficial for the farmworker to have resources for health, occupational, legal, and social matters. Educational purposes should caterer to the farmworkers' preferences of face-to-face discussion, especially for those of low literacy levels, or brochures and pamphlets, which even then should be of appropriate reading level.

Prevention of occupational injury and illness starts with the awareness and recognition of occupational hazards. A successful method to preventing injuries and illnesses is through a multi-method approach. One approach may be incorporating prevention methods in the design of the workplace and equipment, in polices at the workplace, in changes to the work tasks, and education and awareness to

employees. For instance, the Worker Protection Standard that ensures worker protection from pesticide exposure is a multi-method approach. Pesticide safety training, application and restricted entry intervals, and use of personal protective equipment are all required through this standard [35]. In Iowa, Proteus has connected with employers of farmworkers throughout the state to provide pesticide and heat training. This benefits all in that employers are following the Worker Protection Standard and the farmworkers are receiving information from a source they find credible. Although, still improving, it is a step in the right direction in worker safety and health.

Non-occupational safety and health is also important for the well-being of a workforce, since many acute and chronic diseases may lead to decreased job performance or loss of employee from disability or fatality. While worksite health programs have been an increasingly popular promotion in several workplaces, smaller occupational sectors have been less proactive at implementing these types of programs [46]. Furthermore, health programs typically focus on personal and non-occupational factors, including smoking cessation, exercising, and healthier food options, with little aim towards occupational exposures [46]. Providing breaks out of the heat to drink water and prevent heat-related illnesses or providing accessible wash facilities to wash their hands after working with the chemicals, dirt, and other potential illness sources, may reduce some of the occupational health conditions and alter their behavior to practice these preventive measures at home. Also, encouraging farmworkers to drink plenty of water and choose healthy food options could also help them get in the same routine during non-work hours.

Future studies should focus on prevention of the health conditions most often experienced by this population, including muscle and joint pain, diabetes, high blood pressure, and eye injury. Health conditions that were not targeted in this study should be investigated for future research. Also, identifying preventive measures,

including personal protective equipment use, hygiene practices, and even administrative controls set by the workplace should be further explored.

Health education may be an ideal solution for helping farmworkers reduce their risk of health conditions, since they have multiple barriers to reaching healthcare and other services being a transient and vulnerable population. Healthcare providers are a trusted source by farmworkers for receiving information about prevention and care of health conditions. Occupational safety and health education could include recommendations to farmworkers about use of personal protective equipment when working with hazardous chemicals or machinery, or educating them about their rights to complete work tasks with protection equipment provided by their employer. Also, information addressing heat-related illnesses and prevention methods of these illnesses should be considered. Depression should also receive attention, since over half the farmworkers who sought a healthcare clinic for depression did not receive any information about depression. From all the barriers and stress this population faces, depression is a very prevalent illness that could lead to other injuries and illnesses. Furthermore, providing occupational safety and health trainings and services to employers may be more beneficial since they typically have the authority to implement safety and health preventive measures into the workplace.

Other studies have identified that farmworkers are more likely to self-treat or do not seek healthcare often, so alternate routes of providing information to this population should be considered. Further research regarding best methods for providing prevention education and physically incorporating prevention methods into farmworkers' occupational practices is needed. By involving farmworkers in the process of research through interviews and focus groups, researchers can better understand the culture, hardships, and practices of this population. Hosting focus groups or open-ended interviews with farmworkers will allow for collecting

information about their perceived access and concern for education, and the best methods for reaching a large audience of farmworkers feasibly.

## RELEVANCE TO PUBLIC HEALTH

There is growing literature identifying issues and methods for reaching farmworkers. Public health is the concept of several fields, organizations, and other entities networking together to create a sustainable system of care to citizens. This concept can be replicated on a smaller scale to serve farmworkers. Collaborations between county and state level public health services, migrant health centers, and researchers would be beneficial for reaching and serving the farmworker population. Each entity provides different services, which could meet different farmworkers throughout the state (i.e. not all farmworkers seek healthcare or fall under the migrant housing reporting of the state). As researchers study the farmworker population, they should consider involving them through focus groups, promotora programs, or other routes, so they can relay direct farmworker concerns to organizations that serve them.

Through this multi-disciplinary network, the number, location, and demographics of farmworkers can be better estimated for Iowa. Along with these networks should be multi-method approaches to educating and implementing health and safety in the lives of farmworkers. Teamwork between employers and healthcare providers could ensure safety and health is being discussed with the farmworkers through trainings, brochures and pamphlets, or one-on-one discussions by a trusted resource. Utilizing these multi-disciplinary networks and methods for health and safety will be most sustainable for decades later within Iowa and across the nation as immigration continues among Hispanics and other ethnicities and races.

## CONCLUSION

This study has provided new information about the health status, use of healthcare, and health education status among an Iowa farmworker sample. The majority of the

farmworkers in Iowa are foreign-born, Hispanic, and non-English-speaking. This population experiences barriers to healthcare and other services, because of language, transportation, and low income. They are also exposed to hazards in occupational and non-occupational settings.

Among the 50 farmworkers, there were 24 occupational or non-occupational injury or illness events experienced during the past 12 months, with over one-third of the population seeking healthcare for diabetes and high blood pressure, and approximately one-fourth of the population seeking healthcare for muscle and/or joint pain and eye injury. Despite these contacts with healthcare providers, most farmworkers had not received information regarding prevention, management, or treatment for any health condition during the past 12 months even if they were seeking healthcare for specific health conditions. Even though personal protection equipment use and hygiene practices were frequently reported, there is still room for improvement in these areas, starting with the workplace strongly recommending or requiring their workers to always utilize these preventive measures.

The participants were interested in receiving information about prevention, management, and treatment, which was emphasized in this study. There are many different methods for delivering health information with brochures/pamphlets or one-on-one discussions being the preferred options; however, materials should be of appropriate language and literacy levels. Since this population is limited in exposure to healthcare and educational services, healthcare providers, employers, or other professional educators should consider providing health education to the farmworkers every time they have contact with them. This could be an ideal tactic for ensuring many farmworkers are gaining knowledge about health and safety.

Limitations of this study include small sample size, self-reported responses, unequal distribution of seasonal and migrant farmworker participation, and participation by

those more likely to seek healthcare. Regardless, this study demonstrates an approach that is feasible for collecting information from a hard-to-access population through a collaborative effort with an organization that has established a trusting and caring relationship. Findings from this study can be implemented into the services of this organization that they provide to farmworkers. Although the literature is growing, there is still a large need for further research regarding best routes of health education and other services to this transient and vulnerable population.

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## APPENDIX

### SURVEY OF HEALTH AMONG MIGRANT AND SEASONAL FARMWORKERS

Q1 What is your age?

Q2 What country were you born in?
- ❍ United States (1)
- ❍ Mexico (2)
- ❍ Other (please specify) (3) _____

Q3 What is your sex?
- ❍ Male (1)
- ❍ Female (2)

Q4 What is your ethnicity or race?
- ❍ Non-Hispanic White (1)
- ❍ Hispanic or Latino (2)
- ❍ African American or Black (3)
- ❍ Native American or Alaskan Native (4)
- ❍ Asian or Asian American (5)
- ❍ Hawaiian or Pacific Islander (6)
- ❍ Mixed (7)
- ❍ Other - please, specify (8) _____

Q5 What is your primary language?
- ❍ English (1)
- ❍ Spanish (2)
- ❍ Other (please specify) (3) _____

Q6 Rate how well you speak English.
- ❍ Poor (1)
- ❍ Fair (2)
- ❍ Good (3)
- ❍ Very Good (4)
- ❍ Excellent (5)
- ❍ I don't speak English (6)

Q7 How many years have you been a farmworker in the United States (including this year)?
- ❍ 1-2 years (1)
- ❍ 3-4 years (2)
- ❍ 5-6 years (3)
- ❍ 7-8 years (4)
- ❍ 9-10 years (5)
- ❍ 11+ years (6)

Q8 What is your annual household income for your primary home?
- ❍ Less than $6,000 per year (1)
- ❍ $6,000-$12,000 per year (2)
- ❍ $12,000-$18,000 per year (3)
- ❍ $18,000-$24,000 per year (4)
- ❍ More than $24,000 per year (5)

Q9 How many people live in your household (including yourself) for your primary home?

Q10 How would you rate your overall health?

- ❍ Poor (1)
- ❍ Fair (2)
- ❍ Good (3)
- ❍ Very Good (4)
- ❍ Excellent (5)

Q11 Answer the following questions if you have had a work-related injury or illness (an injury or illness you got while at the workplace) in the past 12 months. Starting from the current month, count back 12 months. For example, if it is currently December 2015, then you would answer the questions for January 2015 through December 2015.

| | Did you get a work-related injury or illness in the past 12 months? | | Did you go to a healthcare clinic for that injury or illness? | | | Where were you working? | | | Type of Work | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Yes (1) | No (2) | Yes (1) | No (2) | Not applicable (I did not get a work-related injury or illness in the past 12 months) (3) | Iowa (1) | Other State Outside of Iowa (2) | Outside of the United States (3) | Crop - Field Agriculture (1) | Livestock - Agriculture (2) | Non-Agriculture related (3) |
| Work-related injury (1) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Work-related illness (2) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |

Answer If Answer the following questions if you have had an injury or illness in the past 12 months. Starti... Injury from work place - Did you go to a healthcare clinic for that injury or illness? - Yes Is Selected

Q12 Who paid the majority of the healthcare bills for treatment of your work-related injury?

- ❍ I paid it myself (1)
- ❍ My boss (2)
- ❍ Medicaid (insurance) (3)
- ❍ I was not required to pay (4)
- ❍ Other (please specify) (5) _____

Answer If Answer the following questions if you have had an injury or illness in the past 12 months. Starti... Illness from work place - Did you go to a healthcare clinic for that injury or illness? - Yes Is Selected

Q13 Who paid the majority of the healthcare bills for treatment of your work-related illness?

- ❍ I paid it myself (1)
- ❍ My boss (2)
- ❍ Medicaid (insurance) (3)
- ❍ I was not required to pay (4)
- ❍ Other (please specify) (5) _____

Answer If Answer the following questions if you have had an injury or illness in the past 12 months. Injury from work place - Did you seek healthcare for that injury or illness? - No Is Selected

Q14 Why did you not go to a healthcare clinic for your work-related injury?

- ❑ I didn't have time to go to the doctor (1)
- ❑ I knew I couldn't afford it (2)
- ❑ I didn't have transportation to get there (3)
- ❑ I can't understand them, because I don't speak English (4)
- ❑ I am not treated nicely or with respect (5)
- ❑ I fear I will get deported (6)
- ❑ Other (please specify) (7) _____

Answer If Answer the following questions if you have had an injury or illness in the past 12 months. Illness from work place - Did you seek healthcare for that injury or illness? - No Is Selected

Q15 Why did you not go to a healthcare clinic for your work-related illness?

- ❑ I didn't have time to go to the doctor (1)
- ❑ I knew I couldn't afford it (2)
- ❑ I didn't have transportation to get there (3)
- ❑ I can't understand them, because I don't speak English (4)
- ❑ I am not treated nicely or with respect (5)
- ❑ I fear I will get deported (6)
- ❑ Other (please specify) (7) _____

Q16 Answer the following questions if you have had a non-work-related injury or illness (an injury or illness you got outside of the workplace) in the past 12 months. Starting from the current month, count back 12 months. For example, if it is currently December 2015, then you would answer the questions for January 2015 through December 2015.

| | Did you get an injury or illness that was not from your work place in the past 12 months? | | Did you go to a healthcare clinic for that injury or illness? | | | Where were you living? | | |
|---|---|---|---|---|---|---|---|---|
| | Yes (1) | No (2) | Yes (1) | No (2) | Not applicable (I did not get a non-work-related injury or illness in the past 12 months) (3) | Iowa (1) | Other State Outside of Iowa (2) | Outside of the United States (3) |
| Injury not from work place (1) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Illness not from work place (2) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |

Answer If Answer the following questions if you have had an injury or illness in the past 12 months. Injury not from work place - Did you go to a healthcare clinic for that injury or illness? - No Is Selected

Q17 Why did you not go to a healthcare clinic for your non-work-related injury?

- ❑ I didn't have time to go to the doctor (1)
- ❑ I knew I couldn't afford it (2)
- ❑ I didn't have transportation to get there (3)
- ❑ I can't understand them, because I don't speak English (4)
- ❑ I am not treated nicely or with respect (5)
- ❑ I fear I will get deported (6)
- ❑ Other (please specify) (7) _____

Answer If Answer the following questions if you have had an injury or illness in the past 12 months. Illness not from work place - Did you go to a healthcare clinic for that injury or illness? - No Is Selected

Q18 Why did you not go to a healthcare clinic for your non-work-related illness?

- ❑ I didn't have time to go to the doctor (1)
- ❑ I knew I couldn't afford it (2)
- ❑ I didn't have transportation to get there (3)
- ❑ I can't understand them, because I don't speak English (4)
- ❑ I am not treated nicely or with respect (5)
- ❑ I fear I will get deported (6)
- ❑ Other (please specify) (7) _____

Q19 Which of the following health problems have led you to go to a doctor in the past 12 months? Starting from the current month, count back 12 months. For example, if it is currently December 2015, then you would answer the questions for January 2015 through December 2015. Select all that apply.

- ❑ Diabetes (1)
- ❑ High blood pressure (2)
- ❑ Overweight/obesity (3)
- ❑ Depression (4)
- ❑ I have not gone to the doctor for any of the above health problems in the past 12 months (5)

Q20 Answer the following questions regarding information you have received about each health problem in the past 12 months. Starting from the current month, count back 12 months. For example, if it is currently December 2015, then you would answer the questions for January 2015 through December 2015.

| | In the past 12 months, where did you receive information about this health problem? (select all that apply) | | | | Did the information include methods on how to prevent this health problem? | | |
|---|---|---|---|---|---|---|---|
| | Doctor/ Healthcare Clinic (1) | Employer/ Work (2) | Other (3) | I have not received information about this health problem in the past 12 months (4) | Yes (1) | No (2) | Not Applicable (I did not receive information) (3) |
| Diabetes (1) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| High blood pressure (2) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Overweight/obesity (4) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |
| Depression (5) | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ | ❍ |

Answer If Answer the following questions regarding information you have received about each health problem. Diabetes - In the past 12 months, where did you receive information about this health problem? (select all that apply) - Other Is Selected

Q21 Since you selected "other" for receiving information about diabetes, where did you receive this information from besides your doctor or employer? (select all that apply)

- ❑ Co-worker or friend (1)
- ❑ Education or training event (2)
- ❑ Internet (3)
- ❑ School (4)
- ❑ Pharmacist (5)
- ❑ Family (6)
- ❑ Other (please specify) (7) _____

Answer If Answer the following questions regarding information you have received about each health problem. High blood pressure - In the past 12 months, where did you receive information about this health problem? (select all that apply) - Other Is Selected

Q22 Since you selected "other" for receiving information about high blood pressure, where did you receive this information from besides your doctor or employer? (select all that apply)

- ❑ Co-worker or friend (1)
- ❑ Education or training event (2)
- ❑ Internet (3)
- ❑ School (4)
- ❑ Pharmacist (5)
- ❑ Family (6)
- ❑ Other (please specify) (7) _____

Answer If Answer the following questions regarding information you have received about each health problem. Overweight/obesity - In the past 12 months, where did you receive information about this health problem? (select all that apply) - Other Is Selected

Q23 Since you selected "other" for receiving information about overweight/obesity, where did you receive this information from besides your doctor or employer? (select all that apply)

- ❑ Co-worker or friend (1)
- ❑ Education or training event (2)
- ❑ Internet (3)
- ❑ School (4)
- ❑ Pharmacist (5)
- ❑ Family (6)
- ❑ Other (please specify) (7) _____

Answer If Answer the following questions regarding information you have received about each health problem. Depression - In the past 12 months, where did you receive information about this health problem? (select all that apply) - Other Is Selected

Q24 Since you selected "other" for receiving information about depression, where did you receive this information from besides your doctor or employer? (select all that apply)

- ❑ Co-worker or friend (1)
- ❑ Education or training event (2)
- ❑ Internet (3)
- ❑ School (4)
- ❑ Pharmacist (5)
- ❑ Family (6)
- ❑ Other (please specify) (7) _____

Q25 Which of the following health problems have led you to go to a doctor in the past 12 months? Starting from the current month, count back 12 months. For example, if it is currently December 2015, then you would answer the questions for January 2015 through December 2015. Select all that apply.

- ❑ Pesticide or chemical-related health problems (1)
- ❑ Heat-related health problems (2)
- ❑ Muscle and/or joint pain (3)
- ❑ Vision problems (4)
- ❑ I have not gone to the doctor for any of the above health problems in the past 12 months (5)

Q26 Answer the following questions regarding information received about each health problem in the past 12 months. Starting from the current month, count back 12 months. For example, if it is currently December 2015, then you would answer the questions for January 2015 through December 2015.

| | In the past 12 months, where did you receive information about this health problem? (select all that apply) | | | | Did the information include methods on how to prevent this health problem? | | |
|---|---|---|---|---|---|---|---|
| | Doctor/Healthcare Clinic (1) | Employer/ Work (2) | Other (3) | I have not received information about this health problem in the past 12 months (4) | Yes (1) | No (2) | Not Applicable (I did not receive information) (3) |
| Pesticide or chemical-related health problems (1) | ❑ | ❑ | ❑ | ❑ | ❍ | ❍ | ❍ |
| Heat-related health problems (2) | ❑ | ❑ | ❑ | ❑ | ❍ | ❍ | ❍ |
| Muscle and/or joint pain (4) | ❑ | ❑ | ❑ | ❑ | ❍ | ❍ | ❍ |
| Vision problems (6) | ❑ | ❑ | ❑ | ❑ | ❍ | ❍ | ❍ |

Answer If Answer the following questions regarding information received about each health problem. Pesticide or chemical-related health problems - In the past 12 months, where did you receive information about this health problem? (select all that apply) - Other Is Selected

Q27 Since you selected "other" for receiving information about pesticide or chemical-related health problems, where did you receive this information from besides your doctor or employer? (select all that apply)

- ❑ Co-worker or friend (1)
- ❑ Education or training event (2)
- ❑ Internet (3)
- ❑ School (4)
- ❑ Pharmacist (5)
- ❑ Family (6)
- ❑ Other (please specify) (7) _____

Answer If Answer the following questions regarding information received about each health problem. Heat-related health problems - In the past 12 months, where did you receive information about this health problem? (select all that apply) - Other Is Selected

Q28 Since you selected "other" for receiving information about heat-related health problems, where did you receive this information from besides your doctor of employer? (select all that apply)

- ❑ Co-worker or friend (1)
- ❑ Education or training event (2)
- ❑ Internet (3)
- ❑ School (4)
- ❑ Pharmacist (5)
- ❑ Family (6)
- ❑ Other (please specify) (7) _____

Answer If Answer the following questions regarding information received about each health problem. Muscle and/or joint pain - In the past 12 months, where did you receive information about this health problem? (select all that apply) - Other Is Selected

Q29 Since you selected "other" for receiving information about muscle and/or joint pain, where did you receive this information from besides your doctor or employer? (select all that apply)

- ❑ Co-worker or friend (1)
- ❑ Education or training event (2)
- ❑ Internet (3)
- ❑ School (4)
- ❑ Pharmacist (5)
- ❑ Family (6)
- ❑ Other (please specify) (7) _____

Answer If Answer the following questions regarding information received about each health problem. Vision problems - In the past 12 months, where did you receive information about this health problem? (select all that apply) - Other Is Selected

Q30 Since you selected "other" for receiving information about vision problems, where did you receive this information from besides your doctor or employer? (select all that apply)

- ❑ Co-worker or friend (1)
- ❑ Education or training event (2)
- ❑ Internet (3)
- ❑ School (4)
- ❑ Pharmacist (5)
- ❑ Family (6)
- ❑ Other (please specify) (7) _____

Q31 Do you wear special equipment when you are working in agriculture?

- ❍ Never (3)
- ❍ Rarely (4)
- ❍ Sometimes (5)
- ❍ Often (6)
- ❍ Always (7)

Answer If Do you wear special equipment when you work in agriculture? Sometimes Is Selected Or Do you wear special equipment when you work in agriculture? Often Is Selected Or Do you wear special equipment when you work in agriculture? Always Is Selected

Q32 Why do you wear special equipment while working in agriculture? (select all that apply)

- ❑ Doctor told me to wear it (1)
- ❑ It is required by my boss to wear it (2)
- ❑ My friends and other co-workers wear it (3)
- ❑ An education or training event told me to wear it (4)
- ❑ My family told me to wear it (5)
- ❑ I am afraid I will get injured or sick if I don't wear it (6)
- ❑ I do not like to work without special equipment (7)
- ❑ Other (please, specify) (8) _____

Answer If Do you wear special equipment when you work in agriculture? Never Is Selected Or Do you wear special equipment when you work in agriculture? Rarely Is Selected Or Do you wear special equipment when you work in agriculture? Sometimes Is Selected

Q33 Why do you not wear special equipment while working in agriculture? (select all that apply)

- ❑ I was never told that I should wear special equipment (1)
- ❑ I do not have any special equipment (2)
- ❑ Nobody else wears special equipment (3)
- ❑ It is uncomfortable to wear (4)
- ❑ I do not think I need to wear special equipment (5)
- ❑ Other (please, specify) (6) _____

Q34 Do you wash your hands before you eat after working in agriculture?

- ❍ Never (1)
- ❍ Rarely (2)
- ❍ Sometimes (3)
- ❍ Often (4)
- ❍ Always (5)

Answer If Do you wash your hands before you eat after working in agriculture? Always Is Selected Or Do you wash your hands before you eat after working in agriculture? Often Is Selected Or Do you wash your hands before you eat after working in agriculture? Sometimes Is Selected

Q35 Why do you wash your hands before you eat after working in agriculture? (select all that apply)

- ❑ Doctor told me I should wash my hands before I eat (1)
- ❑ It is required by my boss to wash my hands before I eat (2)
- ❑ My friends and other workers wash their hands before they eat (3)
- ❑ An education or training event told me I should wash my hands before I eat (4)
- ❑ My family told me to wash my hands before I eat (5)
- ❑ I am afraid I will get sick if I do not wash my hands (6)
- ❑ I do not like to eat with unclean hands (7)
- ❑ Other (please specify) (8) _____

Answer If Do you wash your hands before you eat after working in agriculture? Never Is Selected Or Do you wash your hands before you eat after working in agriculture? Rarely Is Selected Or Do you wash your hands before you eat after working in agriculture? Sometimes Is Selected

Q36 Why do you not wash your hands before you eat after working in agriculture? (select all that apply)

- ❑ I was never told that I should wash my hands before I eat (1)
- ❑ I do not have a place to wash my hands before I eat (2)
- ❑ Nobody else washes their hands before they eat (3)
- ❑ The temperature of the water is uncomfortable to wash my hands in before I eat (4)
- ❑ I do not think I need to wash my hands before I eat (5)
- ❑ Other (please specify) (6) _____

Q37 Which of the following health problems would you like to receive more information on? (select all that apply)

- ❑ Diabetes (1)
- ❑ High blood pressure (2)
- ❑ Overweight/obesity (3)
- ❑ Depression (4)
- ❑ Pesticide or chemical-related health problems (5)
- ❑ Heat-related health problems (6)
- ❑ Muscle and/or joint pain (7)
- ❑ Vision problems (8)
- ❑ Other (please specify) (9) _____

Q38 Who would you prefer to receive this information from? (select all that apply)

- ❑ Doctor (1)
- ❑ Boss (2)
- ❑ Education or training events (3)
- ❑ Co-workers (4)
- ❑ Internet (5)
- ❑ Other (please specify) (6) _____

Q39 How would you like to receive the information (select all that apply)?

- ❑ Brochure or pamphlet (1)
- ❑ Group event (2)
- ❑ One-on-one event (3)
- ❑ Video demonstration (4)
- ❑ Online training (5)
- ❑ Novela (6)
- ❑ Other (please specify) (7) _____