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Hispanic Agricultural Workers: The Nexus of Demographics, Employment Characteristics, and Health

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**HISPANIC AGRICULTURAL WORKERS:
THE NEXUS OF DEMOGRAPHICS, EMPLOYMENT
CHARACTERISTICS, AND HEALTH**

Ashley Michelle Bush

The College of Public Health

University of Kentucky

2016

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CHARACTERISTICS, AND HEALTH

ABSTRACT OF CAPSTONE

A Capstone project submitted in partial fulfillment of the
requirements for the degree of Doctor of Public Health in the
College of Public Health
at the University of Kentucky

By:

Ashley Michelle Bush
Lexington, Kentucky

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HISPANIC AGRICULTURAL WORKERS: THE NEXUS OF DEMOGRAPHICS, EMPLOYMENT CHARACTERISTICS, AND HEALTH

Agriculture, which is home to elevated occupational injury and illness rates, has a substantial demographic makeup of Hispanic workers. Hispanic farmworkers are at increased risk of poor occupational health outcomes due to the precarious nature of work and other socio-ecological influences. These adverse occupational health outcome counts are inadequate and undercounted, failing to capture the true scope of agricultural work. To gain more knowledge about agriculture, this capstone will focus on the personal and work characteristics of agricultural workers to help further understand disparities within the agricultural sector by: providing a literature review of agricultural worker health; examining missed work due to work-related illness among Hispanic agricultural workers; exploring farmworker characteristics in two agricultural subsectors; and, offering implications for public health practice and research.

KEYWORDS: agriculture, Latino workers, Hispanic workers, health and safety, health disparities, occupational illness

Ashley Michelle Bush

July 15, 2016

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CHAPTER I

INTRODUCTION

I. Background

Traditionally, agricultural work and practices have been intensive and relied on manual labor to produce foods, fibers, and products for civilization. This intense industry has been home to vulnerable worker populations, minority populations, and immigrants over time to help meet labor shortages. Even today, these populations are not only marginalized but may face additional hazards due to the precarious nature of their work in agriculture.

Estimates of the number of farmworkers in the United States are hard to quantify as the definition of a farmworker varies, and various factors, such as seasonality, temporariness of work, and farmworker characteristics (e.g., documentation status) may affect worker counts. Current estimates show 1,063,000 farmworkers in the United States according to the Farm Labor Survey of the National Agricultural Statistics Service (Hertz, 2015). The Current Population Survey (CPS) by the United States Census Bureau approximates 787,000 hired workers in the agricultural industry. In addition, the National Center for Farmworker Health (2015; 2012) reports 2.4 to 3 million agricultural workers in the United States.

Agricultural work is dangerous and those working in this industry encounter threats to their health and safety. Agricultural workers, who are also known as farmworkers, are at a heightened risk for poor occupational health outcomes, as they experience the highest fatal injury rate (BLS, 2015c) and the second-highest nonfatal occupational illness rate (BLS, 2015a; BLS, 2015b) among industries. Federal agencies have recognized the need for attention to and allocation of resources to the agriculture industry to promote occupational health and safety. Since 1989, the United States Department of Labor has recognized the

need to understand the agricultural worker population through the creation and administration of the National Agricultural Workers Survey (NAWS), which collects data from a national sample of agricultural crop workers on demographic, work, and health related information. In 1999, NIOSH housed within the Centers for Disease Control and Prevention (CDC), developed the NIOSH Agriculture Health and Safety Initiative, which established Education and Research Centers to conduct research, provide education, and promote prevention within the agricultural industry. The Environmental Protection Agency (EPA) created the Worker Protection Standard in 1992 to help offer protection to pesticide handlers and agricultural crop production workers (persons growing plants on farms or in greenhouses, nurseries, or forests) through training, provision of personal protective equipment, and educational signage in efforts to reduce adverse health outcomes associated with pesticides. Then in 1996, NIOSH created the National Occupational Research Agenda, which in part focuses on promoting research and improving practices in the agriculture industry.

Agriculture heavily relies on workers to grow and harvest crops, as well as to breed and raise animals, but also reports high fatal injury (BLS, 2014 April; Steege et al., 2014) and non-fatal illness (BLS, 2015a; BLS, 2015b) rates. The agricultural industry is divided into two categories: agricultural crop production and agricultural animal production; 56 percent of the CPS estimates work in crop production, and the remaining 44 percent work in animal production (USDA, 2015).

i. Agricultural crop production

Under the North American Industry Classification System, code 111 is the crop production industry, a sub-industry of agriculture. This subsector involves the growing of crops for food and fiber often on farms, orchards, groves, greenhouses, and nurseries (BLS, 2016a). In 2012,

over two hundred and nine billions dollars of agricultural crop products were sold (USDA, 2014). This industry experienced 224 fatalities in 2013, and 2014 preliminary counts are even higher (248) (BLS, 2016a). In 2014, 5.5 per 100 full-time workers reported recordable cases, and 3.3 of these cases involved days away from work, job restriction, or transfer. Of the 3.3 cases per 100 full-time workers, 1.6 involved days away from work and 1.7 involved days of job transfer or restriction (BLS, 2016a).

ii. *Agricultural animal production*

Under the North American Industry Classification System, code 112 is the animal production industry, a sub-industry of agriculture. Approximately 1,854,000 full-time workers were employed in production agriculture in the US in 2012 (NIOSH, 2014). This subsector participates in the raising or fattening of animals for their sale or production of their products (BLS, 2016a). The work environment can range from confinement to open fields (BLS, 2016a). Animal production also includes the raising and production of aquatic animals and related products (BLS, 2016a). In 2012, over one hundred and eighty-five billion dollars of agricultural animal products were sold (USDA, 2014). This industry experienced 136 fatalities in 2013, and 2014 preliminary counts are even higher (166) (BLS, 2016c). In 2014, 7.1 per 100 full-time workers reported recordable cases, and 4.4 of these cases involved days away from work, job restriction, or transfer. Of the 4.4 cases per 100 full-time workers, 2.5 involved days away from work and 1.9 involved days of job transfer or restriction (BLS, 2016c).

Agricultural workers are at risk of exposure to various hazards, such include chemicals and pesticides (Swanberg et al., 2012; Langley & Morrow, 2010; Waggoner et al., 2011), environmental and psychosocial stressors (Swanberg et al., 2012), respiratory irritants (Swanberg et al., 2012; Swanberg et al., 2013), high physical work demand (Swanberg et al.,

2012), machinery (Waggoner et al., 2011), and animals (Swanberg et al., 2015; Langley & Morrow, 2010; Douphrate et al., 2009; Iba et al., 2001; Norwood et al., 2000).

Other factors may also contribute or augment the workers' risks for poor occupational health and safety outcomes. Specifically, factors common to agriculture that may increase the likelihood of illness range from organizational practices (inadequate and/or lack of safety training, and provision of personal protective equipment), the work environment (weather and hazardous situations) to work processes (ergonomics and long work hours), and psychological and physical work demands (stress and exhaustion) (Culp & Umbarger, 2004). These workers may also report poor and/or limited access and utilization of healthcare and preventive services. Agriculture is also known for its limited or nonexistent labor protections that can potentially reduce hazardous exposures and practices within the industry. Workers' compensation coverage varies among states, and certain exemptions exist even among those states mandating coverage. In some states requiring workers' compensation coverage, coverage is not mandated for temporary, part-time, and or undocumented agricultural workers and/or small farms. Exposures to such factors and the combination of any factors can jeopardize the health and well-being of farmworkers.

High-risk worker groups

Persons with an education less than or equivalent to a high school degree, born in a foreign country, earned low wages, and/or are male have an increased odds of working in a high-risk industry than their counterparts, respectively (Steege et al., 2014). In the high-risk agriculture industry, the median education level is sixth grade and 13% have completed high school (FMC, 2012). According to the United States Department of Agriculture Economic Research Service, approximately 42% of all hired agricultural workers are foreign-born (USDA, 2015),

and 45% are Hispanic (USDA, 2015). Most of these foreign-born farmworkers cannot read, write, or speak English (Liebman & Augustave, 2010). The Bureau of Labor Statistics (2016b) reports the median wage of agricultural workers is \$19,330 per year or \$9.30 per hour, while the median wage for all occupations in the United States is \$17.09 per hour (BLS, 2015d). Lastly, eighty-two percent of all hired farmworkers are male (USDA, 2015).

As agriculture is ever-increasingly comprised of Latino and Hispanic¹ workers (Frank et al., 2013), Hispanic workers are more likely to work in physical, stressful and low-paying jobs (Gallo et al., 2009) and experience higher fatality rates than non-Hispanic workers (Steege et al., 2014). For agriculture, Latino fatal and nonfatal injury rates are higher than the national rate (Swanberg, Clouser, Westneat, et al., 2014). Latino workers also face a disproportionate number of adverse risks to their health and safety. In fact, the aforesaid work-related exposures and factors in agriculture not only may create but also perpetuate occupational health disparities among Latino agricultural workers. Latino fatal occupational rates were higher than the national average and non-Latino workers (BLS, 2014 April).

Moreover, Hispanic workers face additional circumstances in the workplace that augment their risk for adverse occupational safety and health outcomes. For instance, cultural and language barriers in the workplaces can contribute to misunderstandings and poor communication, decrease employee morale and social support, foster discrimination, and create cultural insensitivity. Additionally, Latino farmworkers may be less likely to report health and safety violations, injuries and/or illness, complaints and/or concerns regarding the workplace due being uninformed of their workplace safety and rights, and to fear of reprimand, job loss and deportation (especially among those with questionable legal status).

¹'Latino' and 'Hispanic' are used interchangeability throughout this work.

Correspondingly, farmworkers most likely do not receive work-related benefits, such as sick leave, retirement, overtime pay, vacation pay, and health insurance, which may further exacerbate their conditions and well-being.

Research has shown that Latino agricultural workers not only encounter the hazardous exposures of agricultural work but another set of separate risk factors for poor health outcomes due to their demographic makeup. Cultural, social, and economic factors may further intensify their occupational health and safety risks (NIOSH, 2012; Culp & Umbarger, 2004; Steege et al., 2009), as their minority status, documentation status, and/or culture can further influence their mental and physical health outcomes (Flores et al., 2008) directly in the workplace and/or indirectly spillover to the work environment. In addition, farmworkers may face inadequate housing and sanitation.

II. Problem statement

Through the years, occupational health and safety measures have helped to decrease work-related injuries and illness in agriculture. From 2001-2010 occupational safety was considered a top ten greatest US public health achievements (CDC, 2011); however, the agricultural industry still experiences high rates of occupational injuries and illnesses per national statistics. The existing statistics for the agricultural industry inadequately capture and underreport the true nature of work occurring within the industry. These statistics are often limited in their interpretation as injury and illness reporting is not mandated for all agricultural employers; management practice may discourage reporting; and, personal worker characteristics may influence workers not to report. Workers may resist reporting injuries/illnesses due to unsecure immigration status, precarious work situations, minimal/no

sick leave allotment, management, language barriers, and poor access to healthcare (Swanberg, Clouser, Bush, & Westneat, 2015; Azaroff, Levenstein & Wegman, 2002; Brown et al., 2002; Quandt et al., 2006). Furthermore, Hispanic workers, who comprise almost half the agricultural workforce face the highest injury rates compared to non-Hispanics. Literature offers several reasons specific to Latino workers for the high injury and fatality rates, which may include literacy and language barriers, exemptions from labor protections (e.g., minimum wage and overtime provisions), legal documentation, and risk perceptions (Orrenius & Zavodny, 2009). Even more so, the known picture of agriculture-related health outcomes may be inadequate as exposures are difficult to assess in the workplace, and a potential disconnect exists between primary care providers and their understanding of the workplace as a source of illness and injury. Hence, more research is needed to investigate adverse health outcomes among farmworkers, especially those outside of the much explore crop production subsector, to help fill a knowledge gap about differences between agricultural production subsectors (e.g., both animal and crop production).

III. Purpose of Dissertation

Specifically, the animal production and crop production subsectors are examined in this dissertation. The second chapter will provide a literature review of agricultural worker health with a focus on Latino health disparities.

The third chapter will examine missed work due to work-related illness among Latino animal production workers. This study will use data from a large employer- and community-

engaged research project, the *Thoroughbred Worker Safety and Health Study*² or *Proyecto de Salud y Seguridad del Trabajador Equino* that was aimed at improving the understanding of occupational health and safety of Latino thoroughbred farmworkers in the southeastern United States (Swanberg, Clouser, & Westneat, 2012).

The third chapter will examine missed work due to work-related illness among Latino animal production workers. The fourth chapter will explore animal and crop production workers in detail, as the literature suggests that variation exists within the agricultural production industry with regard to farmworker characteristics, farming practices, injury risks, hazardous exposures, geography, and other related health outcomes. (Arcury & Marín, 2009; Reed, 2004; Stoecklin-Marois et al., 2011; Swanberg, Clouser, & Westneat, 2012). This chapter reports results from a study utilizing two cross-sectional datasets: *Thoroughbred Worker Safety and Health Study* (TWHS) and the other from the Department of Labor's National Agricultural Workers Survey (NAWS). The TWHS is composed of the data on animal production workers in the Southeast. NAWS is a secondary dataset of hired crop production workers from a national sample, which will be restricted to Latino workers in the Southeast region, as well. The analysis will examine personal, employment, and health-related characteristics for each dataset, which will be used to identify potential differences between these worker populations.

This dissertation focuses on furthering the understanding of Hispanic and/or Latino workers within the hazardous agricultural industry's subsectors: animal production and crop production. The first study (Chapter III) will:

1. Describe the prevalence of missed work due to work-related illness among Latino animal production workers;

² This work is supported by the Southeast Center for Agricultural Health and Injury Prevention through CDC/NIOSH Cooperative Agreement 5U54OH007547-16.

2. Identify personal and work-related factors associated with missed work due to work-related illnesses;
3. Determine predictive factors for missed work due to work-related illness among male workers; and,
4. Describe health symptoms and other characteristics potentially associated with those workers missing work due to work-related illness in the past year.

The second study (Chapter IV) will:

1. Describe personal, employment, and health characteristics among a sample of Latino animal production workers and a national sample of Latino crop production workers;
2. Examine differences with respect to personal, employment, and health characteristics between these agricultural worker samples; and,
3. Describe selected personal, employment, and health characteristics of agricultural production workers, including one animal production worker sample and four crop worker samples from various regions of the United States.

IV. Scope and Importance

Occupational health is considered a significant contributor to an individual's health. Public health can focus its energies towards improving health and safety of workers as a person's average working lifetime is 40 years. Additionally, a typical worker actually works an average of 1789 annual hours a year (OECD, 2016). Likewise workers spend their time traveling to work, and may or may not bring their work and related exposures home with them. Public health professionals can optimize the use of this time to intervene and prevent adverse

occupational health and safety outcomes. Furthermore, occupational health and safety is one of the Healthy People 2020 Objectives to “promote the health and safety of people at work through prevention and early intervention” (CDC, 2016). Occupational health and safety is addressed through the National Occupational Research Agenda (NORA), which is created by the Centers for Disease Control and Prevention, particularly NIOSH. Agriculture is one of the sectors of NORA, and the research and research-related goals for this industry are surveillance; vulnerable populations; and outreach, communications and partnerships.

By the same token, agricultural work, performed by a vulnerable worker populations, is essential to the production of commodities for domestic and international consumption. This population often experiences low-wages, language barriers, questionable legal statuses, and other related factors that can contribute to or augment existing poor occupational health outcomes. Agriculture workers are often excluded from labor protections, such as labor organizing (e.g. National Labor Relations Act of 1935), minimum wage and overtime pay (e.g., Fair Labor Standards Act of 1938 and 1978) (FMC, 2012). Other exclusions include collective bargaining by agricultural workers under the National Labors Relations Act of 1935 (Liebman & Augustave, 2010). This is especially true of smaller farms due to Occupational Safety and Health Administration (OSHA) regulations (Standard 1904) which exempts occupational illness and injury reporting among employers with ten or fewer employees, and small farms make up 95% of farms in the U.S. (Hansen & Donohoe, 2003). It is estimated that only 4-10% of US farms are subject to OSHA reporting regulations (Davis & Kotowski, 2007). The Fair Labor Standards Act of 1978 also mandates minimum wage to large farms only (FMC, 2012). Furthermore, OSHA offers no specific standards to the agricultural industry and workers’ compensation coverage varies by state; both of which can contribute to poor worker health and safety.

Hence, Hispanic/Latino farmworkers are at increased risk of poor occupational health outcomes due to the nature of work and other socio-ecological influences. Agriculture leads industries with adverse occupational safety and health outcomes, as they have the second highest nonfatal occupational illness rate (e.g., 1.75 times the national rate) (BLS, 2015a; BLS, 2015b), and the highest occupational injury rate. Furthermore, these adverse occupational health outcomes are inadequate and undercounted, failing to capture the true scope of agricultural work. To gain more knowledge about agriculture, this dissertation will focus on the personal and work characteristics of agricultural workers to help further understand disparities within the agricultural sector.

V. Limitations

Limitations are inherent as a result of cross-sectional study designs. Generalizability is limited as well, as both studies explore personal and worker characteristics among Latino agricultural workers in the southeastern region of the U.S. More detailed information on the limitations may be found in the respective chapter.

VI. Definition of Terms

See text.

VII. Advance Organizer For Dissertation

The chapters of the dissertation are organized to reflect two separate papers on agricultural worker populations. This chapter (Chapter I) provides an introduction to the subsequent

chapters. Chapter II provides a literature review of agricultural worker health. Chapter III describes missed work due to work-related illness among Hispanic agricultural animal production workers. Chapter IV examines personal and work characteristics of two worker samples. Chapter V provides a summary of the findings from the research in Chapters III and IV, as well as offers recommendations for future research and occupational safety and health interventions.

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CHAPTER II

LITERATURE REVIEW

Farmworkers, a vulnerable subpopulation, are at risk for poor health (NCFH, 2012) and work in one of the most dangerous industries (BLS, 2014a). Agricultural workers are exposed to various hazards in the work environment, such as chemicals and pesticides (Swanberg et al., 2012; Calvert et al., 2008; Langley & Morrow, 2010; Waggoner et al., 2011; Quandt et al., 2006; Variyam & Mishra, 2005; Villarejo, 2003; Linaker & Smedley, 2002), toxic medicines (Swanberg et al., 2012; Loving, 2009), heat stress (Jackson & Rosenberg, 2010; May, 2009), stress (Swanberg et al., 2012; Hovey & Seligman, 2006; Fraser et al., 2005; Kirkhorn & Schenker, 2002), long work hours, equipment and machinery (Waggoner et al., 2011; McBride, 2003), vibration (Stocks et al., 2010), animals (Swanberg et al., 2013a; Langley & Morrow, 2010; Douphrate et al., 2009; Frank et al., 2004; McBride, 2003; Iba et al., 2001; Norwood et al., 2000), respiratory irritants and allergens (Swanberg, Clouser, Gan et al., 2015; Swanberg et al., 2012; Swanberg et al., 2013a; Villarejo, 2003; Linaker & Smedley, 2002; Airaksinen, 2006), infectious agents (Culp & Umbarger, 2004; Linaker & Smedley, 2002), noise (May, 2009; McBride et al., 2003; Kirkhorn & Schenker, 2002) and heavy loads and physical exertion (Meyers et al., 2000), all of which potentially jeopardize their health and well-being on a daily basis.

As agriculture exposes workers to a wide array of environmental and occupational health hazards (Stoecklin-Marois, Hennessy-Burt, & Schenker, 2011), these exposures may result in work-related illnesses and injuries, though the latter is the most frequently documented (Swanberg et al., 2013b; Leigh, 2011; Douphrate et al., 2009; Quandt et al., 2006; Langley &

Morris, 2009; McCurdy & Carroll, 2000; Norwood et al., 2000). The agriculture industry has the highest fatal injury rate across all industries (BLS, 2015d) and second-highest nonfatal occupational illness rate (BLS, 2015a; BLS, 2015b). Data from national repositories (e.g., Bureau of Labor Statistics (BLS)) may underreport the true injury and illness rates for agriculture. Rosenman and colleagues (2006) found the BLS to underreport the injuries and illnesses by nearly three times the actual amount. Also, a disconnect in data collection and quality between the BLS, trauma registries, administrative claims, worker compensation systems, etc. has been noted by several sources (Ruser, 2008; Azaroff et al., 2002), as data are inconsistent and fail to cast the same net to capture worker incidents.

Secondly, the lack of government oversight, participation, and national regulations for the agricultural industry means lack of standardization of occupational safety and health practices. Unlike other industries agriculture has remained a hands-off industry with little government supervision (e.g., Occupational Safety and Health Administration (OSHA)). Currently, no OSHA regulations are specific to the agriculture industry. In addition, OSHA does not regulate smaller farms, which make up 95% of farms in the United States (Hansen & Donohoe, 2003), as occupational illness and injury reporting do not apply to those employers with ten or fewer employees. In essence, small farms are “out-of-scope” of BLS data (e.g., Survey of Occupational Injuries and Illnesses) counts (Ruser, 2008, 20), as they are not required to report occupational illnesses and injuries that call for missed work time, medical care, work-related restrictions, death, loss of consciousness, etc. (US OSHA Act 29 CFR Section 1904). Even more so, employers may underreport due to incentive programs for no reportable injuries (Azaroff et al., 2002) as well as reduce the chance of OSHA inspection, lower worker compensation premiums, and improve public relations (USHR, 2008).

Unique worker characteristics pertinent to the agricultural labor force may influence the reporting of agricultural work-related incidents. At the individual level, workers may resist reporting injuries/illnesses due to unsecure immigration status, precarious work situations, minimal/no sick leave allotment, management practices, language barriers, and poor access to healthcare (Swanberg, Clouser, Bush, & Westneat, 2015; USHR, 2008; Azaroff et al., 2002; Brown et al., 2002; Quandt et al., 2006). Moreover, agriculture is dependent on a large portion of immigrant workers (Carroll, et al., 2011; Orrenius & Zavodny, 2009; Gouveia, 2005; Magaña & Hovey, 2003). Agriculture is one of the top three industries with the highest occupational mortality and injury rates that also employ the highest number of immigrant workers (Schenker, 2010). Current work-related statistics may inadequately capture farmworker health, as they may be more inclined to underreport due to language, fear of deportation and/or employer retaliation, language and cultural barriers, and occupational safety and health risk perceptions (Earle-Richardson et al., 2008; USHR, 2008; Orrenius & Zavodny, 2009). In the agriculture sector, 42% of workers are foreign born and 45% of all hired agricultural workers are Hispanic (USDA, 2015)³. Furthermore, fatal injury rates are higher among foreign born workers than native workers (Byler, 2013). Hansen and Donohoe (2003) note that the extent of underreporting may be significant due to limited health services access, the fear of job loss and/or wages, and different cultural conceptions of health and illnesses among Hispanics and immigrants.

³ This statistic most likely does not capture out-of-scope workers.

Agricultural Illness

Agricultural work makes workers vulnerable to developing work-related illnesses. As agricultural work is related to high illness rates (Spurzem, Romberger, & Von Essen, 2002), the most commonly investigated agricultural illnesses examined in the literature show that respiratory disease (NCFH, 2013 March; Stocks et al., 2010; Hansen & Donohoe, 2003; Kirkhorn, 2002; Rautiainen & Reynolds, 2002; Spurzem et al., 2002), mental illness (Fraser et al., 2005; Hansen & Donohoe, 2003; Grzywacz et al., 2010), skin irritation and diseases (NCFH, 2013 March; Stocks et al., 2010; May, 2009; Culp & Umbarger, 2004; Arcury, Quandt, & Mellen, 2003; Hansen & Donohoe, 2003; Spurzem et al., 2002), and cancer (Hansen & Donohoe, 2003; Spurzem et al., 2002) are associated with agricultural work exposure. Agricultural illnesses and injuries common to all agricultural workers also at similar and sometimes higher rates than non-Hispanic/Latino farmworkers. A few findings on respiratory, mental, skin health, and cancer are presented below expanding on the commonness of work-related illness and injury among non-Hispanic and Hispanic farmworkers.

Agricultural respiratory symptoms and diseases may be a result of exposures to molds (Culp & Umbarger, 2004; Kirkhorn, 2002; Spurzem et al., 2002), endotoxins (Kirkhorn, 2002; Spurzem et al., 2002), inorganic dusts (Kirkhorn, 2002; Kirkhorn & Schenker, 2001, Schenker, 2000), pesticides (Kirkhorn, 2002; Kirkhorn & Schenker, 2002; Sprince et al., 2000), gases from fermenting manure and silage (Kirkhorn, 2002; Spurzem et al., 2002), chemicals (Culp & Umbarger, 2004; Kirkhorn, 2002), carbon monoxide (Kirkhorn, 2002), disinfectants (Kirkhorn, 2002), barn storage mites (Kirkhorn, 2002; Spurzem et al., 2002), horses (Kirkhorn, 2002; Spurzem et al., 2002), livestock (Rautiainen & Reynolds, 2002; Spurzem et al., 2002), and bedding material (Airaksinen, 2006). Among agricultural workers, common respiratory symptoms include wheezing, coughing, and dyspnea (Linaker & Smedley, 2002), while the

more common respiratory diseases range from rhinitis and asthma to respiratory infections and hypersensitivity pneumonitis (Linaker & Smedley, 2002; Kirkhorn, 2002; Spurzem et al., 2002; Kirkhorn & Garry, 2000). In addition, it is often difficult to identify which agricultural work exposures led to the acquiring of a respiratory disease (Schenker, 2000). High rates of lung disease have been reported among livestock farmers and agricultural work has been shown to increase the likelihood of developing chronic bronchitis (Rautiainen & Reynolds, 2002). Respiratory problems, such as allergies, bronchitis, and asthma, are also prevalent among migrant farmworkers due to their work exposures (Culp & Umbarger, 2004). Upper respiratory symptoms were twice as likely to be reported among Latino animal production workers with limited or no use of dust masks than were twice more likely to report upper respiratory symptoms than those who used dust masks more frequently (Swanberg, Clouser, Gan et al., 2015).

The literature depicts mental illness as another potential concern among farmworkers (Hofmann et al., 2009; Hiott et al., 2008), as impaired neurological function, depression, and suicide are common among agricultural workers (Fraser et al., 2005). High rates of suicide, which is commonly related to poor mental health, have been found among farmworkers and farmers (Stocks et al., 2010; Gregoire, 2002). Alderete (2000) reports 20% of Californian farmworkers to have at least one mental health disorder (e.g., substance abuse, anxiety, or mood disorders). Grzywacz (2009) suggests that one in two farmworkers in the Eastern United States have a mental health condition. Furthermore, stress, substance abuse, depression, and anxiety are highly prevalent among farmworkers (Burke Winkelman, Chaney, & Bethel, 2013). Anxiety disorders may include: panic disorders, obsessive-compulsive disorder, generalized anxiety disorder, social phobia, agoraphobia, etc. (NCFH, 2013 May). The nature of agricultural work (e.g., long work hours, and limited/no benefits) has also been considered a

contributing factor to poor mental health (NCFH, 2013 May). Poor mental health is also frequently observed among a considerable number of Latino farmworkers in the Midwestern and Eastern U.S. where access to mental health care is limited (Grzywacz et al., 2010). Alderete et al. (2000) found psychiatric disorders to be less prevalent among Mexican-born farmworkers than the general U.S. population. Depression has also been significantly associated with disability among Hispanic farmworkers (Mazzoni et al., 2007). Factors like social support, family support, and group identity are suggested to be protective against mental health in Latinos. Poor mental health status has been linked to acculturation among farmworkers (Grzywacz et al., 2010). Furthermore, Mexican mental folk illnesses, such as *susto* and *nervios*, are found among farmworkers who may not be prone to seek western (U.S.) mental health treatment (NCFH, 2013 May) and rely on traditional healers for cures (CDC, 2014). *Nervios* is considered a reliable indicator of psychiatric vulnerability among Latinos (O'Connor, Stoecklin-Marois, & Schenker, 2015).

Occupational skin disease and disorders are common in the agriculture industry (May, 2009; McDonald et al., 2006; Belsito, 2005; Rautiainen & Reynolds, 2002; Arcury, Quandt, & Mellen, 2003), and even more common among crop production workers (NIOSH, 2009). Contact dermatitis (skin irritation and allergic reaction), prevalent among farmworkers, is due to exposure to chemicals (Stocks et al., 2010; Hofmann et al., 2009; McDonald et al., 2006; Belsito, 2005; Culp & Umbarger, 2004), pesticides (Belsito, 2005; Culp & Umbarger, 2004; Kirkhorn & Schenker, 2002), poison oak/ivy (Culp & Umbarger, 2004), and ragweed (Culp & Umbarger, 2004). Belsito et al. (2005) also notes other exposures contributing to dermatitis to include microtrauma, caustic materials, and water. Workers are at risk for indirect exposures to hazards, such as chemicals through drifts and residues (Steege et al., 2009). Sunburn and fungal infections have also been reported as a leading skin disorder among farmworkers in the

Eastern United States (May, 2009). Moreover, Lushniak (2003) notes agricultural to have one of the higher incidence rates for days away from work due to skin disorders. The provision and use of personal protective equipment, the job activity, and individual hygiene can influence farmworker susceptibility to skin disease (Krejci-Manwaring et al., 2006), as well.

Lastly, cancer has also been associated with agricultural work, particularly lip cancer and multiple myeloma (Kirkhorn & Schenker, 2002; Rautiainen & Reynolds, 2002). Stocks et al. (2010) reports neoplasms of the skin due to agricultural work-related exposures. Rautiainen and Reynolds (2002) reinforce that skin cancer is prevalent agricultural workers at elevated rates. Evidence between agricultural work and other cancers (prostate, skin, melanoma, brain, leukemia, and soft-tissue carcinoma) is mixed (Kirkhorn & Schenker, 2002; Rautiainen & Reynolds, 2002). Interestingly, brain tumors were found among children whose mothers worked in animal production (pigs and horses) during pregnancy (Kirkhorn & Schenker, 2002). Cancer may also be a result of pesticide exposure (NCFH, 2013 March; Rautiainen & Reynolds, 2002). The herbicide imazethapyr, commonly found in agriculture, increases one's risk of bladder and colon cancers (NCI, 2011), and the herbicide 2, 4-D, phenoxyacetic acid is linked to non-Hodgkin's (Frank et al., 2004). Moreover, farmers have a two-fold increase of prostate cancer when exposed to high levels of pesticides, and some association exists between prostate cancer and diesel exhaust (Parent, Désy, & Siemiatycki, 2009). In addition, the Agricultural Health Study showed elevated prostate and ovarian cancers among agricultural pesticide applicators (Alavanja et al., 2005).

Hispanic Farmworker Health

As Hispanics are more inclined to work in physical, stressful, and low-paying jobs than non-Hispanic workers (Gallo et al., 2009), such as agriculture, they face an elevated level of

adverse occupational health outcomes compared to non-Latino workers (Byler, 2013; Premji & Krause, 2010; CDC, 2008; Swanberg et al., 2013a). They also experience the highest occupational fatality rates among all ethnic and racial groups (BLS, 2014a; Byler, 2013). Hispanic workers spend more days away from work due to an occupational illness or injury than other workers (Schenker, 2010), as well. Despite such work-related findings, Hispanics are reported to have better or similar health outcomes than non-Hispanics in the U.S. (e.g., also known as the Hispanic paradox (CDC, 2014; Franzini & Fernandez-Esquer, 2004). Moreover, Hispanic immigrants have better health outcomes (mental health, infectious diseases, obesity, cardiovascular disease, diabetes, cancers, self-reported general health, injuries, mental health, etc.) than the general U.S. population and U.S.-born Latinos (Casillas et al., 2012).

Research has shown that Latino agricultural workers not only encounter the hazardous exposures of agricultural work, but another separate set of risk factors for poor health outcomes due to their culture and minority status, as well. There are social, cultural, and perhaps economic barriers that may undermine the occupational safety and health among Latino workers (NIOSH, 2012; Culp & Umbarger, 2004; Steege et al., 2009), thereby perpetuating occupational health disparities among this agricultural worker group. The minority status and culture (language, immigration, assimilation, and legal status) of Hispanics may further affect their mental and physical health (Flores et al., 2008).

For example, lower literacy levels are more commonly reported among non-native English speakers, immigrants, those with limited education, and persons with low incomes (Garbers & Chiasson, 2004), such as agricultural workers. Deficits in the native language (Spanish) literacy and education are likely to transfer to the second language (Delgado, 2006). Limited education and literacy levels may potentially cause negative work-related health ramifications,

particularly communicating in the English language when workers' dominant language is Spanish (Gallo et al., 2009; Steege et al., 2009).

Furthermore, as Hispanics are more likely to acculturate or integrate their cultural values with dominant U.S. values (CDC, 2014). It is suggested that acculturation may impact the health among Latinos negatively (e.g., diet, illicit drug use, alcohol use, tobacco use, mental health, stress) and positively (e.g., healthcare access, insurance coverage, and self-assessed health) (Lara et al., 2005). It is also noted that as Hispanic workers' residency in the U.S. increases, their health begins to decline (CDC, 2014; Gallo et al., 2008; Villarejo, 2003). However, these relationships are complex and still being understood (Lara et al., 2005). In the workplace there may be cultural insensitivity as a result of lack of understanding of Hispanic culture and values.

Because of acculturation, Hispanics/Latinos bring their own set of beliefs and values. Of particular interest are those that can affect worker health outcomes. Only a few beliefs will be covered in this review; see Marin and Marin (1991) for further elaboration. *Machismo* is a value that promotes strong male identity and gender roles. Hispanic culture's *machismo* may mean Hispanic males and their families delay healthcare until their health issues are emergent and potentially life threatening (CDC, 2014). It may also promote risky behaviors, chauvinism, anxiety, stress, chivalry, and depression (Fragoso & Kashubeck, 2000). Furthermore, some Hispanics believe in *fatalismo*, as Hispanics are generally more concerned with morbidities and diseases than mortality, which are results of environmental factors and lifestyle behaviors (CDC, 2014). Particularly among Latino/Hispanic farmworkers, it is accepted that occupational health outcomes are in the hands of God, luck, or the boss (fatalism), as well as the individual (e.g., passivity) (Grieshop, Stiles & Villanueva, 1996). Lastly, *familismo* is the notion of the

importance and value of family to Hispanics. Strong family-orientation is linked to better mental health outcomes and health seeking behaviors (Gallo et al., 2009).

The abovementioned factors may influence workers' risk perception and attitudes towards their health and healthcare (Premji & Krause, 2010). Despite Hispanics having better health outcomes than their non-Hispanic counterparts, they face multiple barriers to healthcare: insurance coverage (i.e., Hispanics are less likely to have health insurance than other ethnic groups (Gallo et al., 2009; Dey & Lucas, 2006; Morales et al., 2002), geographic proximity to health services, transportation (Culp & Umbarger, 2004), access to care (Culp & Umbarger, 2004), and language (Culp & Umbarger, 2004). Due to these barriers and other factors (e.g., economic and cultural), they underuse healthcare and mental health services (Morales et al., 2002). In addition, this worker group may be unaware of the potential hazards affecting their health (O'Conner, 2003), the legal rights available to protect them from such hazards (Steege et al., 2009), and the health and social services available in their workplace (Premji & Krause, 2010; Steege et al., 2009) or community. Farmworkers are also medically underserved (Grzywacz et al., 2014), which can contribute to poorer health outcomes and may support findings that Hispanic health deteriorates as residency in the U.S. lengthens (Villarejo, 2003).

Conclusions and Future Directions

Agricultural work is one of the oldest industries in the U.S. still operating today. As other industries have become standardized in their practices, policies, and protections, agriculture has not; thereby exposing farmworkers, a vulnerable labor force, to a wide variety of potentially hazardous exposures and inadequate protections. As agriculture is dangerous, it is important to examine various characteristics of the worker population, which too may influence agricultural worker health and well-being. It is important to establish a baseline understanding

of the health and characteristics of Latino farmworkers to understand future directions to address occupational health disparities in the agriculture industry. Research is needed to understand the extent of the vulnerabilities within this worker population that integrates personal, living, and work characteristics and their influence on occupational health outcomes. The next chapter will examine missed work due to occupational-related illness among Latino farmworkers, followed by a comparison piece examining Latino agricultural crop and animal production farmworker samples.

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CHAPTER III

MISSED WORK DUE TO OCCUPATIONAL ILLNESS AMONG HISPANIC ANIMAL PRODUCTION FARMWORKERS

I. Introduction

Agriculture, one of the most dangerous industries for occupational health and safety hazards (USDOL BLS CFI, 2014), exposes workers to a wide array of potential hazards ranging from chemicals (The Horse, 2013; Swanberg et al., 2012; Langley & Morrow, 2010; Waggoner et al., 2011; Calvert et al., 2008; Quandt et al., 2006a; Variyam & Mishra, 2005; Villarejo, 2003; Linaker & Smedley, 2002), stress (Swanberg et al., 2012; Fraser et al., 2005; Kirkhorn & Schenker, 2002), machinery (Waggoner et al., 2011; McBride, 2003), physical exertion (Meyers et al., 2000), animals (Swanberg et al., 2013a; Langley & Morrow, 2010; Douphrate et al., 2009; McBride, 2003; Iba et al., 2001; Norwood et al., 2000) to respiratory irritants and allergens (Swanberg, Clouser, Gan et al., 2015; Swanberg et al., 2012; Swanberg et al., 2013a; Villarejo, 2003; Linaker & Smedley, 2002; Airaksinen, 2006). Much of the agricultural literature focuses on injuries (Swanberg et al., 2013b; Norwood et al., 2000; Douphrate et al., 2009; Quandt et al., 2006a; Langley & Morris, 2009; McCurdy & Carroll, 2000), as agriculture has the highest fatal injury rate among industries (BLS, 2015d); however, fewer sources report on illnesses acquired from work-related exposures (Leigh, 2011).

Agricultural work is associated with high illness rates (Spurzem et al., 2002). Currently, the agriculture industry reports 31.1 nonfatal occupational illnesses (skin conditions, respiratory disorders, poisonings, hearing losses, and other) per 100,000 full-time workers in 2014 (BLS, 2015a; BLS, 2015b)—second highest to the manufacturing industry, and 1.75 times the national rate (17.5 per 100,000 full-time workers).

Underreporting of agricultural illnesses

Work-related illnesses, often resulting from a combination of personal and occupational behaviors and exposures (Alavinia et al., 2009), in agriculture are inadequately counted and underreported (May, 2009; Ruser, 2008; Rosenman et al., 2006; Strong & Zimmerman, 2005; Frank et al., 2004; Goetzel et al., 2004; Hansen & Donohoe, 2003). Some explanations for the undercount may involve the long latency period of work-related illnesses; the separation of and incomparabilities across current data systems (e.g., workers; compensation, BLS, and administrative claims); some illnesses are never reported; and, difficulty in contributing the illness to the work environment (USHR, 2008; Ruser, 2008). Other reasons include the precarious work situation of the individual, unsecure immigration status, minimal/no sick leave allotment, management practices (e.g., zero injury culture, lower worker compensation expenses, incentive programs, and public appeal), language barriers, and poor access to healthcare (Swanberg, Clouser, Bush, & Westneat, 2015; USHR, 2008; Hansen & Donohoe, 2003; Azaroff et al., 2002; Brown et al., 2002; Quandt et al., 2006a). Additionally, no Occupational Safety and Health Administration (OSHA) regulations are specific to the agriculture industry. OSHA requires employers to report occupational illness and injuries that call for missed work time, medical care, work-restrictions, etc. (U.S. OSH Act 29 CFR Section 1904). However, this regulation does not apply to those employers with ten or fewer employees; small farms compose 95% of farms in the U.S. (Hansen & Donohoe, 2003). In the equine industry, approximately 11% of farms surveyed have less than five full-time (year-round) employees, and 35% average 5-15 employees (DDAF, 2014).

Agricultural workers suffer elevated nonfatal occupational illness rates with a national incidence of nonfatal occupational illnesses of 5 per 100 full-time employees, and an even

higher rate for the animal production subsector (7.1 per 100 full-time employees) (BLS, 2015d). Literature notes that the work-related illness data inadequately depicts the agricultural production industry (NIOSH, 2012), especially among Hispanic workers (Strong & Zimmerman, 2005), who make up a large portion of the agriculture workforce (Orrenius & Zavodny, 2009). Current estimates show 45% of the hired agricultural workforce is Hispanic (USDA, 2015). In the animal production (thoroughbred horse) subsector of agriculture, which involves the housing, grazing, breeding and/or feeding of animals (BLS, 2016b), Latinos compose two-thirds of the workforce (AHC, 2005). Research suggests Latino agricultural workers not only encounter the hazardous exposures of agricultural work but another set of separate risk factors for poor health outcomes due to their culture, language, and minority status, which may further intensify their occupational health and safety risks (NIOSH, 2012; Culp & Umbarger, 2004; Steege et al., 2009).

The horse production industry subjects workers to its own hazards. Particularly, work in the thoroughbred industry poses risks to workers due to the unpredictable nature and quick temperament of thoroughbred horses, which are bred for their agility, speed, and strength. Thoroughbred farm operations include the sale, boarding, racing, and breeding of thoroughbred horses (Swanberg et al., 2013a). Procreation is live, requiring direct worker engagement to assist the stud and mare, which places the assisting workers at risk for adverse occupational health outcomes (Swanberg, Clouser, Bush, et al., 2016). Besides breeding, other job duties can include grooming, landscaping, performing maintenance, working night watch, raising and training horses, foaling, and mucking stalls. (DDAF, 2014; Swanberg et al., 2013a; Swanberg et al., 2012). Little is known about the occupational health and safety of workers in the thoroughbred horse breeding industry (Swanberg, Clouser, Bush, et al., 2016). Literature concerning the equine industry indicates workers are at risk for exposure to toxic

chemicals (Arcury et al., 2006; Shipp et al., 2005; The Horse, 2013; Swanberg et al., 2012), medicines (Swanberg et al., 2012), zoonotic diseases (e.g., campylobacteriosis, leptospirosis, methicillin-resistant *staphylococcus aureas*, and vesicular stomatitis (CDC, 2015)), respiratory irritants (Swanberg, Clouser, Gan et al., 2015; CDC, 2009; Elfman et al., 2009; Mazan et al., 2009; Speed & Andersen, 2008; Mazan et al., 2009), animal bites (Doupbrate et al., 2009; Iba et al., 2001; Langley & Morris, 2009; Swanberg et al., 2012), heavy postural loads and improper body mechanics (CDC, 2009; Löfqvist & Pinzke, 2011; Löfqvist et al., 2009), and injuries (Swanberg, Clouser, Bush & Westneat, 2015, Swanberg et al., 2013a; Doupbrate et al., 2009; Speed & Andersen, 2008; Iba et al., 2001; Norwood et al., 2000). Researchers have found respiratory problems (e.g., 62% of thoroughbred workers experienced any upper or lower respiratory symptom) (Swanberg, Clouser, Gan et al., 2015), injuries (Swanberg, Clouser, Bush, & Westneat, 2015), horse bites (Swanberg, Clouser, Bush, & Westneat, 2015), horse kicks (Swanberg, Clouser, Bush, & Westneat, 2015), and musculoskeletal discomfort (Swanberg, Clouser, Gan, et al., 2016) to be prevalent among thoroughbred farmworkers.

Agricultural illnesses

Investigations of agricultural illnesses in the literature reveal associations between respiratory disease (NCFH, 2013 March; Stocks et al., 2010; Hansen & Donohoe, 2003; Kirkhorn, 2002; Spurzem et al., 2002), mental illness (Fraser et al., 2005; Hansen & Donohoe, 2003; Grzywacz et al., 2010), skin irritation and disease (NCFH, 2013 March; Stocks et al., 2010; May, 2008; Culp & Umbarger, 2004; Arcury et al., 2003; Hansen & Donohoe, 2003; Spurzem et al., 2002), and agricultural work. The provision and use of personal protective equipment, job activity, and individual hygiene habits can make farmworkers more susceptible to work-related ailments.

Respiratory disorders may occur from exposures to molds (Culp & Umbarger, 2004; Kirkhorn, 2002; Spurzem et al., 2002), endotoxins (Kirkhorn, 2002; Spurzem et al., 2002), inorganic dusts (Kirkhorn, 2002; Kirkhorn & Schenker, 2001, Schenker, 2000), pesticides (Kirkhorn, 2002; Kirkhorn & Schenker, 2002; Sprince et al., 2000), gases from fermenting manure (Kirkhorn, 2002; Spurzem et al., 2002), chemicals (Culp & Umbarger, 2004; Kirkhorn, 2002), disinfectants (Kirkhorn, 2002), barn storage mites (Kirkhorn, 2002; Spurzem et al., 2002), bedding material (Airaksinen, 2006), and horses (Kirkhorn, 2002). Agricultural work involving animals has been considered a risk factor for work-aggravated and occupational asthma (Spurzem et al., 2002). In addition, working with livestock other than cattle has been associated with increased prevalence of dyspnea (Rautiainen & Reynolds, 2002). Horse workers have reported symptoms, such as asthma, pneumonia, bronchitis, and allergies (Speed & Andersen, 2008).

Mental illness may manifest itself as impaired neurological function, depression, and suicide among farmworkers (Stocks et al., 2010; Fraser et al., 2005; Gregoire, 2002). Among Hispanic farmworkers, depression is associated with disability (e.g., functional impairment) (Mazzoni et al., 2007). Stress, substance abuse, depression, and anxiety are highly prevalent among farmworkers (Burke Winkelman, Chaney, & Bethel, 2013). The nature of agricultural work (e.g., long work hours, and limited/no benefits) has been also considered a contributing factor to poor mental health (NCFH, 2013 May).

Work-related skin diseases, common to agriculture (May, 2009; McDonald et al., 2006; Belsito, 2005; Rautiainen & Reynolds, 2002; Arcury & Quandt, 2001), particularly contact dermatitis (skin irritation and allergic reaction) is due to exposure to chemicals (Stocks et al., 2010; Hofmann et al., 2009; McDonald et al., 2006; Belsito, 2005; Culp & Umbarger, 2004), pesticides (Belsito, 2005; Culp & Umbarger, 2004; Kirkhorn & Schenker, 2002), poison oak/ivy

(Culp & Umbarger, 2004), and ragweed (Culp & Umbarger, 2004). Sunburn and fungal infections are also leading skin disorders among farmworkers (May, 2009). Moreover, agriculture has one of the higher incidence rates for days away from work due to skin disorders (Lushniak, 2003).

Workers with a work-related illness may need to miss work, a culmination of work and personal life factors (Alavinia, et al. 2009; Strong & Zimmerman, 2005), in order to recuperate to the extent they can perform their work duties. Missed work time may affect the individual, employer, and society through reduced productivity and business efficiency, medical care, and other indirect costs. Missing work time due to work-related illness may indicate the worker's commitment and pressure to go to work (Melchior et al., 2003).

More attention is needed to understand work-related illnesses among animal production workers, as existing research on occupational illness fails to adequately depict the nature of illnesses within the agricultural production industry (NIOSH, 2012). In an effort to gain further understanding of agricultural illnesses, this study will describe the prevalence of missed work due to work-related illnesses among Latino animal production farmworkers; examine work-related and demographic factors associated with missed work due to work-related illnesses; identify health symptoms and work-related characteristics potentially associated with work-related illness; and, further examine factors associated with missed work.

II. **Methods**

The data are from a larger employer- and community-engaged research project, the *Thoroughbred Worker Safety and Health Study* or *Proyecto de Salud y Seguridad del Trabajador Equino*, aimed at improving the understanding of occupational health and safety of Latino thoroughbred farmworkers in the southeastern United States (Swanberg, Clouser, &

Westneat, 2012). Data were collected from a cross-sectional survey of thoroughbred farm workers from December 2013 to April 2014. Detailed methods on sampling, survey development, data collection, and cultural relevancy can be found elsewhere (Swanberg, Clouser, Bush, & Westneat, 2015).

Sampling

Community-based purposive convenience sampling was employed to recruit workers to participate in the study. The study was promoted via study fliers, word-of-mouth, and a local Spanish radio infomercial. Participants were eligible when they self-identified as Latino or Hispanic, 18 years of age or older, and were currently employed for at least 9 months (consecutive or non-consecutive but in total) of the previous year by a thoroughbred horse farm. Trained *promotoras*, also known as community health workers, were used in the recruitment of this hard-to-access population. Recruited participants were informed about the study, including the procedures, risks, and benefits orally and through printed material. Oral consent was given prior to participation. The survey collected over 450 items on demographics, health, injuries, illnesses, workplace tasks, hazards, and work organization factors. Two-hundred and twenty-five farmworkers participated in this 1-1.5 hour survey administered in English or Spanish per the worker's preference. Gift cards were provided to workers for their participation. Study methods were approved by the University of Kentucky Institutional Review Board.

Measures

- i. Dependent variable

For the purposes of this paper, an illness experienced in the past 12 months at work that required time-off from work [which is modified from the Onsite Aquaculture Safety and Health Interview (Myers & Cole, 2008)] is the binary outcome (yes/no) of interest. This measure was self-reported by the worker and not confirmed through employer or healthcare records, and the specificity of the illness causing missed work was also not collected. Missed workdays due to work-related illness may be used as a proxy for the severity of illness. Missed workdays may be reflective of other contributing factors, such as the worker's ability to take time off; the worker's perception of the illness; the worker's ability to avoid exposure; the employer's permission for time off; and, the employer's ability to cover the missing worker's responsibilities.

ii. Demographic variables

The measures used to collect information on demographics were modified from the National Agricultural Workers Survey (versions 2005 and 2010) and have been used previously in research with Latino and immigrant worker groups. These measures included gender (male or female), nativity, U.S. residency time (years and months), marital status (married/living as married or not married/living as married), spouse residency (with or without worker), children (at least one child 18 years or younger), and house location (on or off farm where working) (USDOL, 2010; USDOL, 2005). The education attainment measure, was modified from the Farmworkers and Visual Impairment Instrument (Arcury, 2009); in the survey it was a 7-level item that was dichotomized (elementary school education and lower and greater than elementary education) to complement the Mexican educational system (*primaria*) where sixth grade completes elementary education.

iii. Health variables

Health-related items, current smoking status (Mazan et al., 2009; Rylander, Peterson & Donham, 1990), and the presence of health symptoms in the past year (Mazan et al., 2009; Rylander, Peterson & Donham, 1990) were binary variables measured yes/no. Health symptoms included headache, throat irritation, nasal irritation, dry cough, productive cough, sinus trouble, chest tightness, and wheezing. Workers were asked if these symptoms improved when they were at least one day away from the barn; if they ever wake up at night because of wheezing, whistling, coughing or difficulty breathing; and, if any of the symptoms have caused them to miss work or normal activities (Mazan et al., 2009; Rylander, Peterson & Donham, 1990). Doctor-diagnosed health conditions were also assessed for asthma, skin irritation, eye irritation, and Chronic Obstructive Pulmonary Disease (NAWS, 2010; NAWS, 2005). Ware et al.'s (1996) validated and reliable general health status measure was used to capture workers' self-reported health perceptions utilizing a Likert scale (Excellent/Very Good/Good/Fair/Poor).

Mental health was a continuous variable measuring the sum of 10-items from the CES-D Depression Symptoms Index (Kohout et al., 1993), a screening tool for depression and depressive disorders. Each mental health item was measured on a Likert scale measuring the frequency of symptoms in the past week; the four response options included "rarely or none of the time" (less than 1 day, value=0), "some or a little" (1-2 days, value=1), "occasionally or a moderate amount of time" (3-4 days, value=2), and "most of the time" (5-7 days, value=3). The sum of the 10-items were then calculated and a 10 point cutoff (≥ 10) (Andresen et al., 1994) was used as an indicator of depression. Other research demonstrates the validity of these 10-items to measure mental health among immigrants and Latino farmworkers (Grzywacz et al., 2009; Grzywacz et al., 2006).

Personal healthcare coverage was assessed using a NAWS (2010) measures that provided three options (yes, no, or do not know). Workers were asked if they had come to work when they were ill in the past year (yes/no). Information was also collected as to why workers chose to come to work when ill (open-response).

iv. Work variables

Work-related factors included continuous variables: work history (length of time worked at on horse farms in general), hours worked per day, and days worked per week, and hours worked per week. In addition, farm size, measured by the total number of employees, was used (USDOL, 2005). Farm size was dichotomized into two categories (less than or equal to 10 employees, and greater than 10 employees) to be more consistent with OSHA's standard 1904 that exempts places of employment with 10 or fewer employees from the reporting of occupational injuries and illnesses and enforcement of occupational standards. Farm size also may affect the control of respiratory hazards (Kirkhorn, 2002) and other hazards due to the OSHA exclusion.

Farm work practices concerning the barn environment were also collected. Measures, such as hay storage (in barn, or separate building), horse bedding material, and hours per week spent in the barn, came from the questionnaires assessing respiratory disease and exposures in equine personnel (Mazan et al., 2009; Rylander, Peterson & Donham, 1990). Bedding type assessed both plant (straw) and wood (wood shavings and sawdust) bedding materials.

Questions assessing the occurrence and frequency (hours per week) of job tasks were adapted from the JUSTA Study Survey (Arcury & Grzywacz, 2013) for the horse farmworker population to measure occurrence and frequency of the following tasks: landscape, maintenance, horse handling, raising horses, riding horses, night watch, and breeding horses. The number of hours per week spent working with horses, a continuous variable, was

calculated by taking the average of the abovementioned horse-related tasks (horse handling, raising horses, riding horses, night watch, and breeding horses).

Work-related stress, measuring the frequency of finding work stressful during a typical day, originated from The Quality of Worklife Module (NIOSH, 2010).

Work benefits were also assessed. Health insurance coverage was measured using a NAWS (2010) measure. Health coverage information was collected using NAWS (2005) measures: 1) If the worker becomes sick or injured as a result of his or her work, the farm provides health insurance; 2) If the worker becomes sick or injured as a result of his or her work, the farm pays for the worker's healthcare; and 3) If the worker becomes sick or injured as a result of his or her work, the farm provides worker's compensation (i.e., payment for recuperation).

For workers that reported receiving paid vacation days, the number of paid vacation days were collected. The paid sick days variable measure allowed individuals to report the number of paid sick days received per year or the option of "as many [paid sick days] as I need." Those respondents electing the "as many as I need option" were assigned the average of all respondents in order to report a more accurate average.

v. Covariates

Covariates used in each model included gender (male vs. female), having a child (yes vs. no), living on the farm of employment (yes vs. no), farm size (small vs. not small), work history, sawdust bedding used in barns (yes vs. no), straw bedding used in barns (yes vs. no)⁴, current cigarette smoker (yes vs. no), self-assessed general health status (\leq good vs. $>$ good), stress, hours worked with horses. Work history was dichotomized into less than or equal to 9 years

⁴ Wood shavings was not used in the models due to only a limited number of workers reporting its use for bedding (<3%).

and greater than 9 years (referent group) based on the median distribution of this variable. The work-related stress variable measuring the frequency of finding work stressful during a typical workday, was a categorical variable with three levels: Never (referent group), Sometimes, and Often/Almost Always. The hours spent working with horses per week, originally a continuous variable, was dichotomized by the median distribution point as less than or equal to 16 hours a week, and greater than 16 hours a week (referent group).

Analysis

Data were analyzed using SAS (SAS Institute Inc., 2013) with a p-value of 0.05 denoting statistical significance. Descriptive statistics performed included means, standard deviations, ranges, medians, and interquartile ranges for continuous variables, and frequencies and percentages for categorical variables. Bivariate associations were examined between variables of interest and the dependent variable using chi-square statistics, t-tests, prevalence ratios, and 95% confidence intervals. The bivariate associations helped to guide interpretations and the input of potential predictors for missed work due to the acquired work-related illness analysis.

Statistical modeling using a Generalized Linear Model was used to provide prevalence ratio estimates and the 95% confidence interval. Prevalence ratios rather than odds ratios were used due to the dichotomous nature and increased frequency of the outcome (missed work due to work-related illness) within the study sample. Only predictors with p-values of 0.20 or lower from the bivariate associations were included in the multivariate analyses (Hosmer & Lemeshow, 2000; Maldonado & Greenland, 1993). For the variable inclusion criteria, it was decided not to limit variables to the 0.05 or less parameter to allow for the identification of relevant factors influencing the outcome.

The first log binomial regression model provides an overall depiction of the relationships between potential predictors and the outcome. Relevant variables (e.g., housing location, general farm experience, and current smoking) were added to the model despite the significance levels being greater than the 0.20 parameter. Variables were then removed using interactive backward elimination, where variables were removed in order of least significance until those remaining with a p-value of 0.05 were left using the Likelihood Ratio Estimates. The second model was gender-specific and examined all the predictors previously examined in the first model. A male only model was used as female workers represented only 15% of the sample. The third model was limited to males-only and interactive backward elimination was employed until all remaining variables had a p-value of 0.20 or less.

III. Results

Of the 225 workers who participated in this study, workers were predominately male (86%), Mexican (84%), 35 years of age (SD: 10 years), and had lived in the United States for an average of 14 years (SD: 8 years) (Table 1.). They were also married and/or living as married (68%), had at least one child that was 18 years or younger (65%), and had completed at least middle school (73%).

Table 1. Hispanic Farmworker Demographic Characteristics (n=225)

WORKER CHARACTERISTICS		N	%
Demographics Characteristics			
Gender			
	Male	193	85.78
	Female	32	14.22
Age (years)			
	Mean (SD), Range	35.37 (9.62)	18-65
	Median, IQR	34.0	14.0
Marital Status			
	Married/Living as Married	152	67.56
	Single	73	32.44
Has children 18 or <			
	At least one child	146	65.18
	No children	78	34.82
Education			
	No school	6	2.67
	Elementary (<i>primaria</i> , grades 1-6)	85	37.78
	Middle school (<i>secundaria</i> , grades 7-9)	79	35.11
	High school (<i>preparatoria</i> , grades 10-12 and/or GED)	45	20.00
	Some college or more	10	4.44
Time in the U.S. (years)			
	Mean (SD), Range	14.46 (8.44)	0.42-45
	Median, IQR	12.00	9.50
Nativity			
	Mexico	190	84.44
	Central America ¹	28	12.44
	United States	2	0.89
	South America ²	5	2.22
Dominant Language (n=224)			
	Spanish	213	95.09
	English	9	4.02
	Spanish & English	2	0.89
Lives on farm where works		59	26.22

Notes: ¹Central America included Guatemala, Nicaragua, and Honduras. ²South America included Peru, Chile, Argentina, Venezuela, and Columbia.

Only 16% of workers were current smokers and 47% had consumed no alcohol in the past year. Workers reported good health or greater (72%). The most prevalent respiratory symptoms were throat irritation (45%), nasal irritation (41%), and dry cough (33%). Only 33% had personal health insurance coverage, and 1% were uninformed about their personal health coverage. The prevalence of missing any work due to work-related illness in the past year was 32%. The most commonly cited reasons for coming to work when ill were financial (36%), having no other options (23%), and feeling it was his/her responsibility to work (21%).

Table 2. Hispanic Farmworker Personal Health Characteristics (n=225)

WORKER CHARACTERISTICS	N	%
Personal Health Characteristics		
Smoking behavior		
Ever smoked cigarettes (n=224)	96	42.86
Currently smokes cigarettes (n=225)	37	16.44
Drinks alcohol in past year (n=224)		
No drinks	105	46.88
1-2 drinks/week	41	18.30
3-4 drinks/week	17	7.56
5+ drinks/week	34	15.18
General health status		
Good health or greater	161	71.88
Less than good health	63	28.13
Mental health score (n=219)		
Mean (SD), Range	5.42 (5.24)	0-28
Median, IQR	4.00	7.00
Has ever been diagnosed by a doctor with ...¹		
Asthma	8	3.56
Skin irritation	20	8.89
Eye irritation	34	15.11
Has had this health symptom in the past year...¹		
Headache	113	50.22
Throat irritation	101	44.89
Nasal irritation	93	41.33
Dry cough	74	32.89
Productive cough	59	26.22
Sinus trouble	55	24.44
Chest tightness	21	9.33
Wheezing	14	6.22
Has missed work due to work-related illness in the past year (n=218)	69	31.65
Has went to work when ill in the past year (n=221)	97	43.89
Reasons for coming into work when ill in the past year (n=98)²		
Need the money	35	35.71
Had to/Had no other options	23	23.47
It's my responsibility	21	21.43
Fear of job loss	9	9.18
Don't like missing work	8	8.16
Illness was not too serious	8	8.16
Chronic illness that I just have to work through	2	2.04
Has any personal health insurance coverage		
Yes	75	33.33
No	147	65.33
I don't know	3	1.33

Notes: ¹May have had more than health condition or respiratory symptom. ²Some workers offered more than one reason for working when ill.

As for employment characteristics, workers had an average of 10.5 years (SD: 7.3 years) of general horse farm experience. On average, workers worked 48 hours a week (Range 24-72 hours); of these hours an average of 15 were spent working with horses and 24 hours spent working in the barn. The most predominate job tasks included handling yearlings (70%), handling mares (63%), raising horses (58%), and landscaping (57%). Seventy-two percent of the workers could receive workers' compensation if they became injured or ill on the job. Eighty-seven percent reported receiving vacation time.

Table 3. Hispanic Farmworker Work Characteristics (n=225)

WORKER CHARACTERISTICS	N	%
Work Characteristics		
General horse farm experience (years)		
Mean (SD), Range	10.5 (7.31)	0.75-39
Median, IQR	9.1	7.67
Total hours worked/week		
Mean (SD), Range	48.31 (5.91)	24-72
Median, IQR	48.00	0
No. hours per week working with horses		
Mean (SD), Range	15.45 (10.51)	0-57
Median, IQR	16.00	13.17
No. hours per week spent in the barn		
Mean (SD), Range	24.38 (12.78)	0-56
Median, IQR	24.00	18.00
Perform the following work tasks¹		
Landscaping	128	56.89
Maintenance	120	53.33
Handling stallions	50	22.32
Handling mares	142	63.39
Handling yearlings	158	70.22
Raising horses	130	57.78
Riding horses	11	4.93
Night watch	16	7.17
Breeding	27	12.05
Worker compensation coverage for illness or injury on the job (n=193)		
Yes	138	71.5
No	55	28.50
No. of paid sick days a year (n=100)		
Mean (SD), Range	5.25 (1.16)	1-12
Median, IQR	5.25	1.0
Farm offers paid vacation (n=221)		
	192	86.88
No. of paid vacation days per year (n=193)		
Mean (SD), Range	8.47 (5.01)	0-30
Median, IQR	7.0	3

Notes: ¹Workers may have performed multiple work tasks.

Compared to those workers who missed no work due to work-related illness, statistically significant differences were found between gender, sawdust bedding, straw bedding, general health status, and stress (Table 4.). Those workers who were male (PR 0.62, 95% CI 0.40, 0.95), worked where sawdust bedding was used in barns (PR 0.51, 95% CI 0.29, 0.90), had good health or greater (PR 0.62, 95% CI 0.42, 0.92), and experienced no stress during a typical work day had decreased risk of missing work than their referent group, respectively. Workers who used straw bedding in barns experienced an increased risk of 3.4 times for missing work due to work-related illness. Sometimes or often having stress also increased risks for missed work due to work-related illness by at least 2.5 times than those with no stress.

Table 4. Bivariate Associations for Individual and Organizational Level Predictors of Missed Work Due to Work-related Illness among Hispanic Farmworkers in the Past Year (n=218)

	Missed Work		No Missed Work		p-value	Prevalence Ratio	95% CI
	N	%	N	%			
DEMOGRAPHICS							
Gender					0.0450	0.62	0.40, 0.95
Male	54	29.03	132	70.97			
Female (ref)	15	46.88	17	53.13			
Has children 18 years or younger					0.0904	1.47	0.93, 2.33
At least one child	50	35.21	92	64.79			
No children (ref)	18	24.00	57	76.00			
Lives on farm where works					0.4372	0.83	0.52, 1.33
Yes	16	27.59	42	72.41			
No (ref)	53	33.13	107	66.88			
FARM							
Farm size (# employees)*					0.1206	1.36	0.92, 2.01
Small (<=10)	36	37.11	61	62.89			
Not small (>10) (ref)	33	27.27	88	72.73			
General horse farm experience					0.2633	1.25	0.84, 1.85
<=9 years	38	35.19	70	64.81			
>9 years (ref)	31	28.18	79	71.82			
Sawdust bedding in barn					0.0119	0.51	0.29, 0.90
Yes	11	18.64	48	81.36			
No (ref)	58	36.48	101	63.52			
Straw bedding in barn					0.0289	3.38	0.90, 12.78
Yes	67	33.84	131	66.16			
No (ref)	2	10.00	18	90.00			
GENERAL HEALTH							
Currently smokes cigarettes					0.3690	1.26	0.78, 2.03
Yes	13	38.24	21	61.76			
No (ref)	56	30.43	128	69.57			
General perceived health status					0.0187	0.62	0.42, 0.92
Good health or greater	42	27.10	113	72.90			
Less than good health (ref)	27	43.55	35	56.45			
MENTAL HEALTH							
Mental Health Score					0.1838	0.71	0.45, 1.14
Good mental health (<=10)	56	29.95	131	70.05			
Poor mental health (>10) (ref)	13	41.94	18	58.06			
Finds work stressful during a typical day					0.0018**		
Sometimes	37	35.92	66	64.08	0.00298	2.48	1.28, 4.77
Often/Almost Always	23	43.40	30	20.13	0.00057	2.99	1.52, 5.89
Never (ref)	9	14.52	53	85.48			
TASKS							
Hours spent working with horses					.0551	1.50	0.98, 2.31
≤16 hours	47	36.17	81	63.28			
>16 hours (ref)	22	24.44	68	75.56			

Notes: *Farm size is consistent with OSHA regulations on reportable work illnesses/injuries. **P-value for all three levels of this variable

Table 5. displays the bivariate associations for predictors of missed work and covariates and three log binomial regression models. Model 1 is a general model examining all etiological factors for missed work. The significant predictors for Model 1 are general health status, and stress. Model 2 is the gender-specific model, stratified by males only; the statistically significant predictors were having children, stress, and number of hours spent working with horses. Model 3 is the adjusted gender-specific model that utilizes a p-value =.20 for factor inclusion. When adjusting Model 2, the significant predictors remained for Model 3: having children, stress, and hours spent working with horses. The use of sawdust bedding approached statistical significance ($p=0.0515$) in Model 3.

Table 5. General and Gender-specific Log Binomial Regression Models for Predictors of Missed Work Due to Work-related Illness among Hispanic Farmworkers in the Past Year

CHARACTERISTICS	Model 1: General Etiological (n=216)		Model 2: Stratified by Male Gender (n= 185)		Model 3: Stratified by Male Gender (p<.20) (n=185)	
	Prev. Ratio	95% CI	Prev. Ratio	95% CI	Prev. Ratio	95% CI
PERSONAL						
Male vs. Female	0.98	0.60, 1.59	0.9305	--	--	--
Has children 18 or < vs. none	1.57	0.9994, 2.47	0.0503	1.86	1.09, 3.16	0.0229
Lives on farm where works vs. does not	0.99	0.62, 1.60	0.9764	1.07	0.61, 1.89	0.8198
FARM						
Small farm vs. not small farm	1.25	0.87, 1.82	0.2301	1.03	0.66, 1.61	0.9007
<=9 years gen horse farm vs. >9 years	1.29	0.85, 1.95	0.2330	1.31	0.84, 2.04	0.2305
Sawdust bedding vs. none	0.68	0.37, 1.26	0.2237	0.60	0.30, 1.19	0.1409
Straw bedding vs. none	1.53	0.36, 6.47	0.5671	1.42	0.33, 6.17	0.6360
≤16 hours vs. >16 hours horse work	1.50	0.97, 2.34	0.0716	1.98	1.193, 3.28	0.0082
GENERAL HEALTH						
Currently smokes cigarettes vs. does not	1.41	0.88, 2.27	0.1577	1.31	0.76, 2.25	0.3388
≥Good vs. <Good health status	0.69	0.49, 0.98	0.0392	0.71	0.46, 1.10	0.1247
MENTAL HEALTH						
Good (≤10) vs. poor (>10) mental health	0.71	0.44, 1.14	0.1566	0.69	0.38, 1.26	0.2263
Sometimes vs. Not find work stressful typical day	2.05	1.05, 4.01	0.0345	2.52	1.18, 5.37	0.0168
Often/Almost Always vs. Not find work stressful typical day	2.64	1.30, 5.37	0.0074	3.09	1.39, 6.86	0.0056
				0.69	0.40, 1.18	0.1758
				2.58	1.25, 5.32	0.0105
				2.93	1.36, 6.29	0.0058

Table 6. displays characteristics of farmworkers reporting missing work due to work-related illness. Among those farmworkers missing work, only 42% reported having health insurance coverage. The most common health symptoms reported in the past year were throat irritation (58%), headache (57%), and nasal irritation (52%). Of those reporting at least one symptom, 74% noted that their symptom improved while away from the barn for more than one day. Also, the prevalence of having doctor-diagnosed eye irritation was 14% and asthma was 7%. These workers reported having steady work (94%), and working an average of 48 hours per week. Among those who missed work due to work-related illness the average number of workdays missed was 7 (SD 19; median 2), and a range of 1-150 days. (Variable mw4, n=69). The mean number of paid sick days among those who missed work was 5.2 (SD 1.1, range 1-7, n=38).

Table 6. Characteristics of Hispanic Farmworkers Who Missed Work Due to Work-related Illness in the Past Year (n=69)

	Workers Who Missed Work	
	N	%
Personal Health Characteristics		
Time in the U.S. (years)		
Mean (SD), Range	13.95 (7.85)	4-42
Median, IQR	11.17	9.9
Currently smokes	13	18.84
Has ever been diagnosed by a doctor with...¹		
Asthma	5	7.25
Eye irritation	10	14.49
Skin irritation	4	5.8
Chronic Obstructive Pulmonary Disease	1	1.45
Has had this health symptom in the past year...¹		
Headache	39	56.52
Throat irritation	40	57.97
Nasal irritation	36	52.17
Dry cough	31	44.93
Productive cough	23	33.33
Sinus trouble	19	27.54
Chest tightness	8	11.59
Wheezing	5	7.25
Symptoms improve when at least one day away from barn (n=46)	34	73.91
Has any symptoms ever caused you to miss work or your normal activities (n=48)	5	10.42
Ever wake up at night because you have wheezing, whistling, coughing, or difficulty breathing (n=49)	11	22.45
Works when ill in past year (n=68)	39	57.35
Has personal health insurance coverage (n=68)	29	42.65
Work Characteristics		
Has steady work	65	94.20
Hours worked per week		
Mean (SD), Range	47.61 (5.91)	36.00
Median, IQR	48.00	0
Administered medicines to horses in the past year	52	75.36
Loaded, mixed or applied pesticides, herbicides, insecticides or rodenticides in the past year	26	37.68
Farm provides health insurance if work-related injury or illness (n=66)	36	54.55
Farm pays for healthcare if work-related injury or illness (n=64)	48	75.00
Farm provides workers' compensation if injured or become ill on the job (n=62)	49	79.03
Can call in sick or take day off when sick without worrying about job loss (n=55)		
Yes	48	69.57
No	7	10.14
Sometimes	14	20.29
Receives pay on days when sick		
Yes	38	55.07
No	18	26.09
Sometimes	13	18.84
Receives paid vacation days	54	78.26

Notes: ¹May have had more than one health condition or respiratory symptom.

In effort to further understand the association between bedding materials and respiratory symptoms, bivariate associations were calculated (Table 7.) for those workers reporting any of the top 5 reported health symptoms (headache, throat irritation, nasal irritation, dry cough, and productive cough). Those workers reporting use of both sawdust and straw bedding had a two-fold increased risk of reporting at least one health symptom than those workers using only sawdust bedding (PR 2.05, 95% CI 1.03, 4.05). Workers reporting only using straw bedding were 1.9 times more likely to report at least one health symptom than those using only sawdust bedding (PR 1.93, 95 CI 0.99, 3.75).

Table 7. Examination of Health Symptoms and Bedding Type among Hispanic Farmworkers (n=225)

Bedding Type	Any Symptom ¹ N (%) (n=140)	No Symptoms N (%) (n=85)	p-value	Prev. Ratio	95% CI
Neither	1 (33.33)	2 (66.67)	*	*	*
Both ²	30 (68.18)	14 (31.82)	0.0116	2.05	1.03, 4.05
Straw only	103 (64.38)	57 (35.63)	0.0104	1.93	0.99, 3.75
Sawdust only (ref.)	6 (33.33)	12 (66.67)	--	--	--

Notes: ¹Symptoms were limited to workers reporting any one of the top five reported respiratory symptoms (headache, throat irritation, nasal irritation, dry cough, and productive cough) by workers who missed work due to work-related illness (see previous table). ²Both included the use of sawdust and straw bedding materials at work. *Sample size inadequate to calculate p-value, prevalence ratio, and 95% confidence intervals.

IV. Discussion

This study examined missed work due to work-related illness among Latino horse farmworkers. The four key findings identified were: 1) the prevalence of missed work due to work-related illness among Latino workers; 2) the attention needed when selecting horse barn bedding type; 3) the need to further understand personal

characteristics (e.g., having children) and 4) work-related characteristics (e.g., stress and work hours spent with horses) and their relationship with missed work time.

Missed Work Due To Work-Related Illness

Missed work due to work-related illness served as a proxy for the severity of illness. Thirty-two percent of the workers interviewed had suffered from a work-related illness in the past year that they believed was severe enough to miss work. Data from national surveys indicate that a rate of 2.3 per 100 full-time animal production workers experience nonfatal occupational injuries and illnesses that involve days away from work (NIOSH, 2009).⁵ In this Latino farmworker study, only 29% of males missed work for a work-related illness compared to 47% of female workers. This agrees with the Current Population Survey results with females having a higher illness or injury absence rate (2.4 per 1,000 workers) than males (1.6 per 1,000 workers), while examination of missed work time by ethnicity revealed an absence rate of 1.8 per 1,000 Latino workers (BLS, 2016). Furthermore, the median number of days away from work was 2 days (range 0.5-150 days), compared to the six days for the national occupational injuries and illnesses for farming, fishing, and forestry occupations (BLS, 2015c). These results only depict days away from work for farms with 11 or more employees. Even so, 44% of workers reported going to work despite being ill. Farmworkers reported they had to attend work due to financial pressure, which may or may not include getting paid only when they do work and the lack of paid sick leave. This contrasts with the current health

⁵ This statistic does not include farms with fewer than 11 employees (small farms).

recommendation for workers to remain home from work to prevent the spread of disease to fellow workers.

Improving worker health can help reduce work-related absences (e.g., sick days, disability, family medical leave, and workers' compensation leave) by 33%, as the other 66% is contributed by non-health related reasons (e.g., personal reasons, entitlement, and family issues) (Circadian, 2005). It is recommended that farms document employees' missed work and associated reasons for missing work in order to capture a baseline rate of absences among their workers and to better understand the health of their workforce, including trends and patterns. Missed work also has indirect effects on the employer, as it can contribute to lower productivity and safety issues (Circadian, 2005).

Horse Barn Bedding Type

Findings show that the use of sawdust bedding in barns is protective for missed time due to illness whereas straw bedding increases the opportunity for missed work by 60%. Bedding material is used to keep horses clean and reduce the level of manure gases (Airaksinen, 2006). Quality bedding material should be used in barns; bedding characteristics that should be considered include: cushioning, palatability (Westendorf & Krogmann, 2013; Thomas, 2007), absorption capacity (Westendorf & Krogmann, 2013), dustiness (Westendorf & Krogmann, 2013; Thomas, 2007), microbial quality, cost and availability (Westendorf & Krogmann, 2013; Thomas, 2007), ease of handling and cleanup (Westendorf & Krogmann, 2013; Thomas, 2007), and the bedding's ability to decompose quickly with manure. Westendorf & Krogmann (2013) note that more

absorbent bedding results in less being used. Farms should assess these factors in conjunction with the potential impact on worker health when deciding upon bedding materials, as well as incorporate proper storage practices for bedding to help reduce microbial growth in order to improve the health of workers and horses. In addition, it is recommended that workers use an N-95 NIOSH-approved mask when working near dusty and moldy environments (e.g., straw bedding). Swanberg, Clouser, Gan et al., (2015) determined that dust mask use led to a decrease in self-reported respiratory symptoms among Latino horse workers. Symptomatic persons should be monitored as 74% of the symptoms of workers improved when they were at least one day away from the barn; such symptoms included headache, throat irritation, nasal irritation, and cough. However, this study did not verify whether missed work was due to respiratory issues.

Currently, the literature demonstrates that straw bedding, the most commonly used bedding type on farms (Westendorf & Krogmann, 2013), is a source of microbial exposure and mold on farms and has been linked to hypersensitivity pneumonitis (Spurzem et al., 2002; Westendorf & Krogmann, 2013). Workers who handle hay bedding are at increased risk of developing respiratory illness (NCFH, 2013 March; Thomas, 2007) and irritation (Westendorf & Krogmann, 2013). Worksites are also encouraged to dry hay and straw before storage to help prevent mold growth (Kirkhorn, 2002). It is also recommended that farms using straw bedding should educate their workers to lightly wet the straw (if dusty) before mucking the stall (Thomas, 2007), especially as agricultural dust exposures have caused a significant part of the reported agricultural respiratory illnesses (Schenker, 2000). These findings further echo

Kirkhorn's & Schenker's (2001) call for a change in bedding practices in order to decrease Farmer's Lung (hypersensitivity pneumonitis) and other respiratory disorders. Swanberg, Clouser, Gan et al., (2015) suggested improved ventilation levels help lower horse worker exposure to respiratory hazards, such as bedding.

This study suggests that wood materials, such as sawdust, may protect against work-related illness, while plant materials such as straw may increase a worker's chance of developing a work-related illness; however these findings may be true, spurious, or biased. Findings suggest that employers should use sawdust instead of straw bedding. Sawdust is easily cleaned up, fairly compostable, has a high absorption capacity, low palatability for horses, and its dust is manageable (Westendorf & Krogmann, 2013). Nevertheless, there is a potential for the sawdust to irritate the horses' noses and eyes (Thomas, 2007), as well as those of workers. However, this study did not elaborate on the effects of specific bedding types on worker health, but it was determined that respiratory and other health symptoms improved with time away from the barn for the 74% of workers reporting missing work due to work-related illness in the past year. Upon further examination of bedding material and health symptoms, a significant association was found as those workers using both sawdust and straw bedding were twice as likely to report a health symptom than workers using only sawdust bedding. Furthermore, as the market for straw increases, farms could opt for sawdust bedding, if available. On another note, these findings may be due to chance as the survey was not designed to address missed-work due to work-related illness and further information could be collected on this outcome. Also, this finding may be potentially biased due to participant selection and data quality. Future studies should

collect information on bedding type and use, examining different bedding types (e.g., pellets, straw, sawdust, peat, and shavings) used, and the frequency of exposure to and specific tasks (e.g., mucking the stalls) involving bedding materials.

Personal Characteristics

Our study finding of 65% of farmworkers with children is comparable to U.S. Census results of 62% of Hispanic households having children under the age of 18 (CDC, 2014). Children are important part of Hispanic culture (*familism*) (CDC, 2008). Interestingly enough, among all workers those who were parents had a 57% increased risk of missing work than non-parent workers, and this risk increased to 71% when examining male only workers. The increased risk may be due to children serving as additional vectors of disease and bringing home illnesses to the parents that may be manifested as respiratory symptoms that are commonly found among farmworkers (Garcia et al., 1996). Some researchers have found that those workers with fewer children (under the age of 18) are more inclined to miss work than their counterparts (Cohen and Golan, 2007). In addition, children may cause additional stress for the farmworker parent, as familial stress was commonly reported among Latinos (Flores et al., 2008; Hovey, Magaña & Booker, 2003). A focus group of North Carolina farmworkers revealed that stress commonly arises from family responsibilities. Winkelman et al. (2013) further elaborated on these family stressors that included taking care of children and spouses, having family in home countries, and other home responsibilities. Furthermore, this study's findings concerning children agree with

previous studies showing the influence of family characteristics on missed work time (Senel & Senel, 2012).

Self-reported general health status was also found to be a significant etiological factor for missed work due to work-related illness for all workers. This protective effect showed that workers who rated themselves with good or greater health status were 0.7 times less likely to miss work than those rating themselves with less than good health status. This finding aligns with other literature that shows illness-related absenteeism to be associated with poorer self-related health (Jenkins, 2014; Eriksson et al., 2008). Among only male workers, self-reported health remained protective against missed work, but was not significant despite remaining in the final adjusted model.

However, more workers in this study assessed their health as good or better (72%), which contradicts other studies showing that foreign-born adults, 99% of this sample, self-rate their health as poor or fair (Grzywacz et al., 2014; Franzini & Fernandez-Esquer, 2004). Also, other studies show foreign-born adults rate their health status lower than their U.S.-born counterparts (Dey & Lucas, 2006; Morales et al., 2002); however, self-assessed health among Hispanics is inconsistent and complex (Argeseanu Cunningham et al., 2008; Franzini & Fernandez-Esquer, 2004). The higher self-reporting of health may indicate that this worker group is more optimistic about their health and potentially healthier than other study populations, and may support the Hispanic paradox (Franzini & Fernandez-Esquer, 2004) or healthy immigrant effect (Morales et al., 2002). Furthermore, the self-reporting of poor mental health also supports the Hispanic paradox as only 14% of those studied reported poor mental health (i.e., depressive symptoms), which is higher than a national sample of crop

workers (Grzywacz et al., 2014) and lower than Californian Mexican farmworkers (Alderete et al. 1999) or North Carolina farmworkers (Grzywacz et al., 2010). As Latinos are traditionally considered mentally and physically healthy, this could suggest a misallocation of resources from the true need for mental and physical health support among this population.

Work Characteristics

Occupational stress is considered to be “one of most significant workplace health hazards” (Spector 2002, 133) and has been cited as a principal reason for sick leave and health-related expenses (Houtman et al. 1998). This study’s findings of stress as a significant predictor of missed work were similar to other studies finding an association between work stress and sickness absence (Head et al., 2006; Melchior et al., 2003), and agreed with previous findings of the effects of stress on health-related outcomes. The source of work-related stress include work demands, supervisor–worker relationships, and work communication practices (Burke Winkelman et al., 2013). Other identified stressors involve language, finances, being away from family members, and not having medical care (Hovey, Magaña & Booker, 2003). Hiott et al. (2008) found that stressful work was strong predictor of depression among North Carolina farmworkers. This study demonstrated a positive relationship between the amount of work-related stress and the prevalence of missed work due to work-related illness for all workers. This association was further amplified when only male workers were considered, which suggests potential gender-specific differences (i.e., males are more affected by work stress than females). Other researchers have also found that psychosocial work factors

have greater effects on missed work among males than females (Melchior et al., 2003). This contrasts with Flores and colleagues' (2008) findings of females having higher stress than males. Melchior et al. (2003) state that missing work may also reveal a worker's coping behaviors towards stress.

Future interventions should focus on educating farmworkers with elevated stress levels on preventive measures, such as education on stress management techniques and positive coping behaviors, as well as how to access mental health services (e.g., counseling, hotlines, and support groups). Community health workers, shown to be effective at outreach (Swider, 2002; Love, Gardner & Legion, 1997; Witmer et al., 1995), may be used to help facilitate access and use of the U.S. health and mental health systems among farmworkers. Ergerter et al. (2008) offer some work-based strategies to reduce work-related stress, such as decreasing job strain, fostering social support, stress management, and supporting work-life balance. Future research should target psychosocial factors of the work environment to help address work-related illness missed time. Laaksonen and colleagues (2010) discovered job satisfaction had more influence on missed work among males, whereas the degree of occupational control influenced missed work among females. Additionally, parents whose work-related stress carries over to family life are more prone to suffer from substance abuse, anxiety, and mood disorders (Ergerter et al., 2008). Interventions directed at reducing work-related stress can also benefit workers and their children (Ergerter et al., 2008).

The literature notes that horses are one of the most common workplace hazards for horse workers, putting them at risk for injury (Swanberg, Clouser, Bush & Westneat, 2015, Swanberg et al., 2013; Douphrate et al., 2009; Iba et al., 2001; Norwood et al.,

2000). However, this study found farmworkers working with horses more than 16 hours per week to be less inclined to miss work due to work-related illness than workers working 16 hours or less a week with horses. This may indicate that the workers working fewer hours with horses are subjected to other exposures as they perform other jobs on the farm. These jobs may include maintenance, cleaning barns, mucking stalls, and landscaping, which may expose the workers to poor air quality (e.g., dry climates), pesticides, chemicals, etc. This may also be related to job seniority and duration of employment. A 30% risk difference was observed between males and females for missed work and hours working with horses, while controlling for all other variables, which demonstrates that males working less hours with horses have an increased risk of missed work. Future studies examining horse production farmworkers should examine the nature of other job tasks on the farm and their relation to missed work time and health.

Other Notable Findings

Health insurance is one of the most critical determinants of access to healthcare, and not having it can be a significant barrier to healthcare (Morales et al., 2002). Persons in this industry are often uninsured, ineligible for health benefits, and most likely unable to pay for health services (Frank et al., 2013). Among animal production farmworkers, only 33% reported having personal health insurance coverage⁶, which is much lower than national estimates of 60% health insurance coverage for farmworkers (Stallones, 2001), including the 2013 estimated national coverage rate of 87%, and 76%

⁶ Worker participants were surveyed prior to the enactment of the Affordable Care Act.

for Hispanics (Smith & Medalia, 2014)⁷. The lack of healthcare coverage among this group of farmworkers may be explained by the absence of state mandates for healthcare coverage for hired farmworkers in the sample area (Stallones, 2001). This lack of coverage may indicate workers are not receiving appropriate healthcare and preventive services. Furthermore, these study participants may seek healthcare outside of the U.S. as the majority of the study participants were Mexican and immigrants, two-thirds of whom lacked health insurance. Obtaining medications outside of the U.S. (i.e., Mexico) may be more affordable, accessible, and less dependent on a doctor's order (CDC, 2014). Cultural factors may also influence health choices among these farmworkers (e.g. they may rely on traditional healers and home remedies for care (CDC, 2014).

These factors may contribute to the underreporting of occupational health conditions among farmworkers. It was thought that health insurance coverage among these workers would improve following the implementation of the Affordable Care Act; however, the mandated coverage is limited to farms employing 50 or more employees. Therefore, workers working on smaller farms (less than 50 employees), which compose at least 85%⁸ of thoroughbred farms in the study region (Nutt et al., 2011), are still not receiving necessary healthcare and prevention services. Outreach and policy efforts should focus on improving health insurance access among this vulnerable population. On another note, worker compensation coverage was reported by 72% of the

⁷ Estimates are calculated based on data from the 2014 Current Population Survey Annual Social and Economic Supplement and the 2013 American Community Survey.

⁸ 70% employed ten or fewer workers, 15% employed 11-25 workers, and 11% employed more than 25 workers

participants, despite workers' compensation coverage not being mandated in the sample area (Stallones, 2001). This may suggest that workers are receiving some reimbursement and potentially health services due to being ill or injured on the job.

When workers are able to seek healthcare, it is recommended that primary care providers expand their understanding of the workplace as a source of illness and injury, adequately document the worker's occupational history and related exposures, and offer preventive management techniques to mitigate hazardous and especially unnecessary agricultural exposures (Kirkhorn, 2002). It is also noteworthy for health practitioners to remember that Hispanic workers may be reluctant to connect their illnesses to the workplace in fear of job loss, reprimand, and/or deportation.

Limitations

This study assessed the perspectives of agricultural production farmworkers regarding missed work due to work-related illnesses. Actively working farmworkers participated in the study, which may underestimate the true prevalence of missed work due to the healthy worker effect and thus introduce selection bias. Recall bias may be an issue as well, as data is based on self-reporting of workers. Self-reported data may make it difficult to estimate the true characteristics and associations of the outcome of interest. Also, the missed work variable could have been better defined (e.g., asking workers how many days they missed work excluding the day the illness occurred) in order to better capture the severity of illness. The worker perspective allows for additional awareness of work-related illnesses compared to using employer reports, which have been criticized for underreporting occupational illnesses (Breslin et al.,

2008; Rosenman et al., 2006; Azaroff et al., 2002). This study did not utilize employers as a means of accessing workers in an effort to protect the worker from potential job loss and/or other adverse outcomes due to the sharing of potentially sensitive information. The use of self-reported information poses its own limitations and bias, especially the potential influence of Hispanic culture on health and health-seeking behaviors. This study does offer insight into what illnesses the worker believes he or she acquired from his or her work environment, even though clinical diagnoses and employer reports were not obtained and/or assessed to confirm worker self-reports. These illnesses may not call for emergency and/or medical care, which also may contribute to underreporting. Hence, this survey did not collect information on the nature of the perceived workplace-related illnesses, including types, exposures, and symptom onset, causing missed work. This study was cross-sectional in design and causation cannot be proven. Other limitations include the dichotomization of continuous variables, which may limit the statistical power and increase chances of study error. Interactions were not assessed due to sample size.

Generalizability is limited as only Hispanic horse farmworkers from the southeastern United States were surveyed using convenience sampling. There was an insufficient number of female workers to examine differences between genders on missed work due to illness. The study may not capture migrant workers, who have their own vulnerabilities in respect to lifestyle, as inclusion criteria required employment for 9 months on a farm. This study also did not investigate disparities within the Latino/Hispanic ethnicity, as the majority of the participants were Mexican-born. However, this study relied on collaborations from academia, industry, and the

community to help reach a vulnerable and dispersed worker population (Swanberg et al., 2015). The study also employed trained community health workers, *promotoras*, to capture the occupational health experiences of a hard-to-reach Latino population.

V. **Conclusion**

Until more research offers insight into work-related illnesses among horse farmworkers, this study adds value by describing predictive factors associated with missed work time due to work-related illness while controlling for a large number of covariates. Key findings from this study reveal that having at least one child, having poor self-reported general health, experiencing stress during a typical workday, working with specific horse bedding types, or spending less time with horses are significant predictors of missed work among Hispanic animal production farmworkers.

Interventions can be designed to help identify workers most susceptible to missing work time and provide resources to help reduce missed work time. Future research should examine work-related illness in agricultural animal production, including personal and work-related factors, in order to help diminish occupational health disparities among Latino workers, who are more likely to be employed in hazardous work. This study echoes the need for more robust data on occupational morbidities.

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CHAPTER IV

PERSONAL, EMPLOYMENT AND HEALTH-RELATED CHARACTERISTICS: A COMPARISON OF LATINO HORSE WORKER AND NATIONAL LATINO CROP WORKER SAMPLES

I. Background

The Hispanic population in the United States has rapidly increased over the past decades as traditional migration to the southwestern regions have expanded to southeast (Duchon & Murphy, 2001; Kochhar, Suro, & Tafoya, 2005; Turner, 2014) for employment opportunities chiefly in migrant-dense industries (Kochhar, 2005), such as agriculture. There are several reasons why immigrants are attracted to agricultural work. First, these positions are more readily available as native workers may be less inclined to engage in positions that often require minimal skills, lower education levels, and manual labor (Kochhar, 2005; Turner, 2014). Additionally, as the seasonal job needs have increased, immigrants seek jobs that appear similar to their previous work histories (Kochhar, 2005; Turner, 2014). Often agriculture appeals to new arrivals and persons with questionable immigration statuses because it often offers limited work agreements, minimal background checks, and seasonal job availability (Kochhar, 2005; Turner, 2014). Agriculture heavily relies on Latino and Hispanic⁹ workers for manual labor (Davis & Kotowski, 2007) to grow and harvest crops, as well as to breed and raise animals, but also reports the highest fatal injury¹⁰ (BLS, 2015a) and non-fatal injury and

⁹'Latino' and 'Hispanic' are used interchangeability throughout this paper. North American Industry Classification System.

¹⁰ Agriculture composes part of Agriculture, Forestry, Fishing, and Hunting Industry, North American Industry Classification System (NAICS) 11.

illness (BLS, 2015b) rates among all industries. Hispanic workers are not only working in a dangerous industry, they also experience the highest occupational fatality rates among all ethnic and racial groups (BLS, 2014b; Byler, 2013).

Agriculture exposes workers to a wide array of environmental and occupational health hazards (Stoecklin-Marois, Hennessy-Burt, & Schenker, 2011). Although much of the research examining agricultural health and safety has often focused on crop workers, the agricultural industry consists of two subsectors: crop production and animal production. Variation exists within the agricultural production industry regarding farming practices, injury risks, hazardous exposures, and farmworker characteristics (Arcury & Marín, 2009; Reed, 2004; Stoecklin-Marois et al., 2011; Swanberg, Clouser, & Westneat, 2012). For example, nationally animal production workers, who are involved in the housing, grazing, breeding, and/or feeding of animals (BLS, 2015c), experience the highest nonfatal injury rate across all agricultural industries including crop production workers (BLS, 2014c), who are involved in growing plants and crops for food and fiber (BLS, 2015d). Swanton, Young, and Peek-Asa (2016) analyzed data from the Census for Fatal Occupational Injuries for the Midwest region (12 states) and observed crop workers experiencing more fatal work-related injuries than animal production workers. Furthermore, it is suggested that geographical differences exist in the farmworker personal characteristics, health, and well-being. It is speculated that understanding such characteristics can help inform social justice efforts for farmworkers (Arcury & Marín, 2009).

Different hazards are more frequent in the agricultural subsectors. For example, animal production hazards include the animal as the chief source of injury, whereas

crop production may experience more machinery and chemical hazards (Swanton et al., 2016). Evidence is mixed on whether crop and animal farmworker groups experience similar pesticide and chemical exposures (Lee et al., 2002; Swanberg et al., 2012).

Distinctions have also been cited in regard to Latino crop and animal farmworkers. Swanberg et al. (2012) found that Latino crop workers experience more physical demands, work-related stress, work-related illness, environmental stress, and musculoskeletal problems in comparison to Latino horse workers. They also noted that one-quarter of both Latino populations reported work-related injuries in the last year (Swanberg et al., 2012). Among horse workers specifically, Swanberg, Clouser, Westneat, Marsh, and Reed (2013) found that Latino horse workers were more apt to suffer from horse-related injuries (e.g., being struck, trampled or stepped on), while non-Latino horse workers suffered non-horse related injuries (e.g., injuries from lifting, contact with equipment, slips, trips, falls, insects, or plants). Additionally, Latino horse (animal production) farmworkers may have different work and perhaps living characteristics than other farmworkers (Bush, Flunker, Clouser, & Swanberg, 2015; Swanberg, Clouser, Bush, Westneat, & Reed, 2014; Swanberg et al., 2012), such that Latino thoroughbred farmworkers have more job stability and benefits, yet earn lower wages than national estimates for farmworkers (Swanberg, Clouser, Bush, Westneat, & Reed, 2014). Other findings show that horse workers live with more persons than crop workers, work in permanent job positions, and earn higher hourly wages (Bush et al., 2015). Latino horse workers experienced less work-related illnesses than crop workers in another study (Swanberg et al., 2012). Regional variations may contribute to differences in personal, work, and health characteristics within farmworker populations

(Arcury & Quandt, 2009). Furthermore, the geographical region influences commodity production of farms due to differences in weather, environmental conditions, and terrain (Davis & Kotowski, 2007). Politics and state level protections with regard to farmworkers also vary by state and region, which can affect worker health and well-being.

By gaining a baseline understanding of farmworker characteristics on- and off- the job, researchers and advocates can work to understand and assess health disparities within the agricultural industry. In efforts to understand differences between agricultural production worker groups, this study seeks to describe the personal, employment, and health-related characteristics among Latino thoroughbred farmworkers, and understand how these workers compare to a regional Latino crop worker sample from the Eastern United States. In addition, selected characteristics will be compared across the Eastern, Midwestern, and Western United States regional worker samples. This study may contribute to the scant literature on different Hispanic agricultural production worker groups.

II. **Methods**

Data Sources & Collection

Data were accessed from a community- and employer-engaged research project, *Thoroughbred Worker Health and Safety Study* (TWHS), a cross-sectional survey of thoroughbred horse workers sampled between December 2013 and April 2014 (N=225) (Swanberg et al., 2012). The second dataset, the referent sample, was drawn from the Department of Labor's National Agricultural Worker Survey (NAWS), a cross-sectional

survey of hired crop production workers from 2009 to 2012¹¹. NAWS Cycles 2009-2012 were merged to account for small sample size and regional variation (N=1333)¹². Both datasets were limited to the Eastern United States¹³ in order to draw more appropriate comparisons. NAWS data were restricted to workers in the East (North Carolina, Virginia, Kentucky, Tennessee, West Virginia, Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, Vermont, Delaware, Maryland, New Jersey, Pennsylvania), and Southeast (Arkansas, Louisiana, Mississippi, Alabama, Georgia, South Carolina, Florida) regions.

i. Description of horse worker dataset

To be eligible to participate in the TWHS, workers had to (1) self-identify as Latino, (2) be over eighteen, (3) have worked at a thoroughbred farm for at least nine months in the past year, and (4) be a seasonal, temporary, or permanent employee. Participants (N=225) were recruited for an interviewer-administered survey via a community-based, purposive sampling strategy in the eastern region of the U.S. Random sampling was not feasible for the TWHS, as an employer (farm) registry was not available. Research staff and lay health promoters (*promotoras*) recruited workers by word-of-mouth, handouts, and a radio advertisement. Workers were interviewed in the community at various venues (stores, churches, or social events) by four experienced lay health promoters.

¹¹For the purposes of this study, workers from the *Thoroughbred Worker Health and Safety Study* are referred to as horse workers, and those from the National Agricultural Worker Survey will be referred to as crop workers.

¹²NAWS Cycles 2009-2012 were used for the analysis portion of this study as suggested by NAWS to have an adequate sample size. Furthermore, NAWS 2013-2014 data were not available at the time of this analysis.

¹³ For this analysis, what NAWS refers to as the East region and Southeast region were combined to represent the eastern portion of the United States.

The lay health promoters were native Spanish speakers, who were trained on human subjects' protection, the study purpose and overview, and survey administration. The interviews lasted 1-1.5 hours and were conducted in either English or Spanish based on the worker's preference. Fifteen dollar gift cards were given for participation. Interview items were adapted and translated from standardized measures when available. All methods were approved by the University of Kentucky's Institutional Review Board.

ii. Description of crop worker dataset

To be eligible to participate in the crop worker study, workers had to (1) have worked in the past year, (2) be employed in crop production (pre-harvest, harvest, and post-harvest) or crop-related work (supervising workers, operating machinery, and packing crops), (3) not possess a H-2A visa, and (4) be a seasonal, temporary, or permanent employee. The Department of Labor has conducted NAWS since 1989; this study utilizes data from NAWS Cycles 2009-2012. NAWS respondents were limited to Latino/Hispanic workers only¹⁴. The sampling frame consisted of eligible crop work establishments (e.g., places of employment with North American Industrial Classification System code 111 and/or 1151) from the Quarterly Census of Employment and Wages or from commercial farm listings and other informed sources. A national probability sample of workers was used to randomly select workers. Multi-stage sampling was used by NAWS to account for seasonal and regional variations in employment; for more detailed information see USDOL (2014; 2005).

¹⁴ Suggested weights for the NAWS dataset were not applied as only worker samples were used (USDOL, 2010).

Interviews were divided into three cycles to best capture seasonal labor changes and each cycle used six level of selection: region, county clusters, county, Zip Code™ region, employer, and respondent. Interviews cycles begin in February, June, and October. Workers were interviewed at their farms (e.g., crop worker establishments by trained staff in English or Spanish based on worker preference. Participants were given twenty dollars for their participation.

An additional element of the analysis called for the examination of select characteristics of crop workers across the U.S. The East region consisted of North Carolina, Virginia, Kentucky, Tennessee, West Virginia, Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, Vermont, Delaware, Maryland, New Jersey, Pennsylvania, Arkansas, Louisiana, Mississippi, Alabama, Georgia, South Carolina, and Florida. The Midwest region consisted of Illinois, Indiana, Ohio, Iowa, Missouri, Kansas, Nebraska, North Dakota, South Dakota, Michigan, Minnesota, and Wisconsin. The West Region included Arizona, New Mexico, Oklahoma, Texas, Idaho, Montana, Wyoming, Colorado, Nevada, Utah, Oregon, and Washington. California remained its own region. Crop workers across these regions were compared to the horse workers in the East region, as it was postulated that regional variations may contribute to differences within farmworker populations (Arcury & Quandt, 2009).

Survey Items

The majority of the survey items analyzed for this study originated from the NAWS (USDOL, 2010). The use of identical questions helped to enhance comparability between the worker groups for personal, employment, and health-related traits. Other

questions were slight deviations from the NAWS items, but still enabled comparisons to be drawn.

Personal characteristics consisted of demographic traits and living arrangements among workers. Binary data were obtained on: gender, marital status, parental status, housing location (e.g., on or off farm in which the farmworker was employed), spouse living arrangement (e.g., lives with or without farmworker). Continuous variables were age, years of residency in the United States, the number of persons living in the household, the number of children in the household, number of relatives in the household, and the number of household members doing farm work. Categorical variables included education (never attended school, elementary school, middle school, high school, and at least some college), dominant language (English, Spanish, Mixtec, Kanjobal, Zapotec, and Other), housing type (e.g., trailer, house, apartment, tent, and other), and housing arrangements (e.g., free employer-provided; pay for employer-provided; rent from non-employer; owns home or lives with friends or relatives; pays for housing by government; charity, and non-work related; and, other).

Employment characteristics were based primarily on the workers' current employment details, except for the item pertaining to years doing farm work (horse work or crop work). Both worker surveys interviewed workers with permanent (part-time and full-time) or seasonal employment status, which was categorized as worker type (permanent or seasonal employment). Other employment items included the number of hours worked a week, and payment type (hourly, per unit, combination, or salary), hourly pay (for those reporting hourly work), and whether or not the worker had worked with pesticides (e.g., applied, mixed or loaded) in the past year.

Health related information included doctor diagnosed asthma (yes/no) also examined one personal health question: whether the worker has ever been diagnosed by the doctor with asthma. Other measures examined health insurance coverage: personal health insurance coverage (yes/no), health insurance payer (worker, spouse, employer, spouse's employer, government, and other), and coverage related to work-related injuries and illness (e.g., farm paying for health insurance/care and workers' compensation), as well as off-work coverage for injuries/illnesses (yes/no).

Analysis

Data were analyzed using SAS (SAS Institute Inc., 2013). Univariate descriptive statistics, chi-square tests, and Fisher's exact tests were performed to assess the Eastern region horse and crop workers. Missing values in the analysis were dropped for that respective variable.

III. Results

Horse workers and crop workers were predominantly male (86% and 80%, respectively), and an average of 35 years of age (Table 1). Horse workers (68%) were more often married than crop workers (57%). Horse workers (65%) more often reported having children than crop workers (56%). Thirty-eight percent of horse workers reported only completing some elementary school education (preschool to 6th grade), while 50% of crop workers achieved this level. Thirty-five percent of horse workers completed some or all of middle school education (grades 7-9) compared to 24% of crop workers.

The majority of horse (84%) and crop (74%) workers were born in Mexico. Fewer horse workers were from Central America (12%) and the U.S. (1%) compared to crop workers (17%, and 7%, respectively). Most horse (96%) and crop (93%) workers were comfortable speaking Spanish as opposed to other languages, such as English. Additionally, horse workers reported holding 14.5 years residency in the U.S. compared to 13 years among crop workers.

Table 1. Demographic Characteristics of Latino horse and crop workers

Demographic Characteristics	N=225 ¹	Horse Workers % (n)	N=1333 ¹	Crop Workers % (n)	P-value
Age in years mean(SD)	223	35.4 (9.6)	1332	35.3 (11.7)	0.9403
Gender					0.0304
Male		85.8 (193)		79.6 (1061)	
Female		14.2 (32)		20.4 (272)	
Education					<0.0001
Never attended school		2.7 (6)		6.8 (91)	
Elementary school (pre-K - 6 th grade)		37.8 (85)		51.6 (688)	
Middle school (7 th - 9 th grades)		35.1 (79)		23.5 (313)	
High school (10 th - 12 th grades/GED)		20.0 (45)		15.5 (206)	
At least some college		4.4 (10)		2.6 (35)	
Marital Status			1332		0.0025
Married ²		67.6 (152)		56.8 (757)	
Single ³		32.4 (73)		43.2 (575)	
Parent⁴	224				0.0078
Yes		65.2 (146)		55.7 (742)	
No		34.8 (78)		44.3 (591)	
Birth country					0.0009
United States ⁵		0.9 (2)		6.7 (89)	
Mexico		84.4 (190)		74.4 (992)	
Central America		12.4 (28)		17.2 (229)	
Other ⁶		2.2 (5)		1.7 (23)	
Dominant Language	222		1330		0.0002
English		4.0 (9)		3.7 (49)	
Spanish		96.0 (213)		93.1 (1238)	
Mixtec		0 (0)		0.5 (7)	
Kanjobal		0 (0)		0.7 (9)	
Zapotec		0 (0)		0.3 (4)	
Other		0 (0)		1.7 (23)	
Ability to speak English			1330		<0.0001
Not at all		3.6 (8)		36.8 (489)	
A little		29.3 (66)		44.1 (586)	
Somewhat		37.8 (85)		11.4 (152)	
Well		29.3 (66)		7.7 (103)	
Ability to read English			1328		<0.0001
Not at all		12.9 (29)		53.7 (713)	
A little		36.4 (82)		32.1 (426)	
Somewhat		26.2 (59)		7.2 (95)	
Well		24.4 (55)		7.1 (94)	
Lived in United States Mean (SD)	223	14.5 (8.4)	1272	13.3 (9.9)	0.0732

Notes: ¹This is the sample size for the following survey items unless otherwise noted. ²Marital status consisted of married and/or living as married. ³Single status consisted of those who never married, were divorced, separated and/or widowed. Parental status for the horse workers was measured by having a child 18 years of younger, while NAWS directly asked the farmworker if they had children. ⁵The United States includes Puerto Rico. ⁶Other birth country category consisted of countries from South America, Caribbean, and other (unclarified) countries.

Living quarters were found to be located off the farms for the majority of persons in both samples (Table 2). The top three housing types were apartments, houses, and trailers/mobile homes for both groups. For horse workers, one of their household members was most likely a spouse, as significantly more horse workers (77%) live with their spouse than crop workers (66%). Horse workers had significantly more children living with them (Mean 1.3, SD 1.6) than crop workers (Mean 0.7, SD 1.2). Additionally on average, horse workers reported significantly less household members doing farm work (Mean 1.3, SD 1.4, Range 0-6) than crop workers (Mean 2.2, SD 2.7, and Range 0-30).

Table 2. Living Characteristics of Latino horse and crop workers

Housing Characteristics	N=225 ¹	Horse Workers % (n)	N=1333 ¹	Crop Workers % (n)	P-value
House Location			1324		0.1180
On farm		26.2 (59)		31.4 (416)	
Off farm		73.8 (166)		68.6 (908)	
Housing type			1330		<.0001
Trailer or mobile home		23.6 (53)		38.8 (516)	
House ²		36.4 (82)		44.6 (593)	
Apartment		40.0 (90)		12.3 (163)	
Other		0 (0)		4.4 (58)	
Housing Arrangements	224				0.0005
Employer provided housing		1.3 (3)		7.7 (102)	
Paid by government/charity/non-work related institution		2.7 (6)		1.0 (13)	
Free housing from employer		25.5 (57)		26.3 (351)	
Owns the home or a family member does		13.4 (30)		14.9 (198)	
Rent from non-employer		57.1 (128)		49.9 (665)	
Other		0 (0)		0.3 (4)	
Lives with Spouse	150	77.3 (116)	793	65.7 (521)	0.0053
Number of Persons in Household³		3.8 (2.2)		3.8 (2.6)	0.7755
Mean(SD)					
Number of Children in Household^{3,4}		1.3 (1.6)		0.7 (1.2)	<.0001
Mean(SD)					
Number of Non-relatives in Household³		1.3 (1.9)	948	2.3 (3.0)	<.0001
Mean(SD)					
Number of Relatives in Household³		2.4 (2.4)		2.2 (2.2)	0.1202
Mean(SD)					
Number of Household Members		1.3 (1.4)		2.2 (2.7)	<.0001
Doing Farmwork³					
Mean(SD)					

Notes: ¹This is the sample size for the following survey items unless otherwise noted. ²House consists of single-family, duplex, triplex, etc. ³Count excludes the worker. ⁴Children are not necessarily related to the farmworker nor are the farmworkers' own children. Children in the household for horse workers are 18 years and younger, whereas NAWS includes children only under 18 years of age.

Employment characteristics varied between the worker groups (Table 3). Horse workers (10.5 years) were significantly less experienced in their respective farm work than crop workers (Mean 12.4 years). Almost all of horse workers were comprised of permanent workers holding full-time or part-time statuses (99%), whereas crop workers held a combination of permanent (67%) and seasonal (33%) positions. The majority of horse and crop workers were paid hourly wages; however, more horse workers received salary pay (19.9%) and less per unit work (1%) compared to crop workers (4%

and 13%, respectively). Horse workers earned a significantly higher average wage per hour (\$10.25 U.S.) than did crop workers (\$8.38 U.S.) with a mean difference of \$1.87 per work-hour between the groups. In the last year, more horse workers (31%) reported working with pesticides as part of the job than crop workers (18%).

Table 3. Employment Characteristics of Latino horse and crop workers

Employment Characteristics	N=225¹	Horse Workers % (n)	N=1333¹	Crop Workers % (n)	P-value
Years doing farmwork Mean(SD)		10.5 (7.3)	1331	12.4 (10.1)	0.0009
Worker Type			1253		<.0001
Permanent ²		99.1 (223)		67.2 (842)	
Seasonal		0.9 (2)		32.8 (411)	
Work payment methods	221		1332		<.0001
Hourly		79.6 (176)		81.8 (1090)	
Per Unit of Work		0.5 (1)		12.6 (168)	
Combination ³		0 (0)		1.5 (20)	
Salary ⁴		19.9 (44)		4.1 (54)	
Hourly pay (U.S. dollar) Mean(SD)	177	10.25 (2.41)	1106	8.38 (1.64)	<.0001
Hours worked a week Mean (SD)		48.3 (5.9)	1325	44.9 (12.1)	<.0001
Loads, mixes, or applies pesticides as part of job⁵		31.1 (70)	1330	17.7 (236)	<.0001

Notes: ¹This is the sample size for the following survey items unless otherwise noted. ²Permanent work consisted of full- and part-time positions that occur on a year-round basis. ³Combination work methods included hourly wage and piece rate payment methods. ⁴Salary consisted of other payment methods not included in the methods listed above. ⁵Pesticide application reported by the worker had to have occurred within the past year at which the survey was administered.

Health-related characteristics differed between the two agricultural worker samples (Table 3). Ever being diagnosed with asthma was reported at a higher rate among horse workers (4%) than crop workers (1%). More horse workers (33%) reported having health insurance compared to crop workers (15%). Unlike crop workers, more horse workers were uninformed about whether or not they had personal health insurance coverage. The main health insurance payers for horse workers were: the employer

(87%), the worker (45%), and the employer of the worker's spouse (8%). Whereas the main health insurance payers for NAWS crop workers were: the employer (50%), the government (20%), and the worker (17%).

More horse workers (65%) reported their employer pays for work-related injuries or illnesses than crop workers (62%). Less horse workers (7%) knew whether or not their farm pays for work-related injuries or illnesses as opposed to crop workers (21%). More horse workers (61%) reported that their employer (farm) will receive workers' compensation if the worker becomes injured or ill on the job than did crop workers (49%). Less horse workers (14%) did not know whether or not their employer received workers' compensation than crop workers (30%).

A higher percent of horse workers (18%) reported knowing whether their employer pays for health care related to injuries and/or illnesses acquired off the job than crop workers (14%). Similar percentages of horse (67%) and crop workers (68%) reported not having coverage for non-work related incidents; only 15% of horse and 18% of crop workers reported non-work related health coverage.

Table 4. Health-related Characteristics of Latino horse and crop workers

Health-related Characteristics	N=225 ¹	Horse Workers % (n)	N=1333 ¹	Crop Workers % (n)	P-value
Doctor-diagnosed asthma		3.6 (8)		1.4 (18)	0.0418
Has personal health insurance in U.S			1332		<.0001
Yes		33.3 (75)		15.1 (201)	
No		65.3 (147)		84.0 (1119)	
Do not know		1.33 (3)		0.9 (12)	
Who pays for health insurance²	75		199		
Worker pays		45.3 (34)		16.6 (33)	<.0001
Spouse pays		5.3 (4)		4.0 (8)	0.7411
Employer pays		86.7 (65)		49.8 (99)	<.0001
Spouses' Employer pays		8.0 (6)		6.0 (12)	0.5875
Government pays		1.3 (1)		25.6 (51)	<.0001
Other		0 (0)		3.0 (6)	0.1933
If your injury/illness is work-related, the farm pays for health insurance or care					<.0001
Yes		65.3 (143)		61.9 (825)	
No		27.8 (61)		17.0 (227)	
Don't know		6.9 (15)		21.1 (281)	
If your injury/illness is work-related, the farm gets workers' compensation					<.0001
Yes		61.3 (138)		49.0 (653)	
No		24.4 (55)		21.5 (286)	
Don't know		14.2 (32)		29.6 (394)	
If your injury/illness is off the job, the farm pays for health care					0.2268
Yes		18.2 (41)		14.4 (192)	
No		67.1 (151)		67.8 (904)	
Don't know		14.7 (33)		17.8 (237)	

Notes: ¹This is the sample size for the following survey items unless otherwise noted. ²Workers were able to select more than one health insurance payer.

As Eastern horse workers were compared to crop workers from various regions (East, Midwest, West, and California) of the United States, characteristics among Latino farmworkers varied (Table 5.). Eastern horse workers were more apt to report speaking and reading English well than crop workers across the Midwestern, Western, Californian, and Eastern regions. Horse workers also reported working in more permanent positions than all crop workers. Western Region (17 years) and Californian

(16 years) crop workers reported a longer farm work history than did Midwestern (13 years) and Eastern crop workers (12 years), as well as Eastern horse workers (11 years). The hourly wage was highest among Eastern horse workers (\$10.25 U.S.), and lowest among Eastern crop workers (\$8.38 U.S.). Pesticide use in the past was more frequently reported among Eastern horse workers (31%) and Western crop workers (29%); the lowest was found among Midwestern crop workers (9%). Personal health insurance coverage in the U.S. was more frequently reported among Eastern horse workers (33%) and Californian crop workers (31%). Eastern horse workers were more likely to rely on a combination of the worker and the employer to pay for health insurance coverage, whereas crop workers across the regions relied more on the employer and the government to pay for health insurance.

Table 5. Selected Characteristics across Regional Samples of Latino Farmworkers

Latino Farmworker Characteristics	N=225 ¹	East Horse Workers % (n)	N=1333 ¹	East Crop Workers % (n)	N=423 ¹	Midwest Crop Workers % (n)	N=1336 ¹	West Crop Workers % (n)	N=2497 ¹	Californian Crop Workers % (n)
Demographics Characteristics										
Male		86 (193)		80 (1061)		72 (306)		84 (1124)		82 (2051)
Education					422		1335		2495	
Never attended		3 (6)		7 (91)		4 (16)		4 (53)		5 (137)
Elementary school		38 (85)		52 (688)		49 (208)		48 (637)		53 (1327)
Middle school		35 (79)		23 (313)		21 (87)		22 (296)		22 (553)
High school/ GED		20 (45)		15 (206)		22 (94)		22 (298)		16 (406)
≥Some college		4 (10)		3 (35)		4 (17)		4 (51)		3 (72)
Married		68 (152)	1332	57 (757)		66 (280)		72 (967)	2493	68 (1701)
Parent	224	65 (146)		56 (742)		64 (269)		65 (866)		63 (1576)
Mexican nativity		84 (190)		74 (992)		82 (345)		88 (1180)		94 (2335)
Years in U.S. Mean (SD)	223	14.5 (8.4)	1272	13.3 (9.9)	369	15.6 (9.8)	1196	18.6 (11.0)	2393	17.3 (11.5)
Speaks English well		29 (66)	1330	8 (103)	422	20 (83)	1335	16 (215)	2489	8 (196)
Reads English well		24 (55)	1328	7 (94)	419	18 (74)	1333	15 (196)	2485	8 (187)
Permanent work		99 (223)	1253	67 (842)	379	41 (157)	1233	59 (731)	2265	54 (1213)
Housing Characteristics										
Lives on farm where works		26 (59)	1324	31 (416)	421	29 (121)	1326	18 (235)	2483	10 (249)
Housing type			1330				1335		2482	
Trailer or mobile home		24 (53)		39 (516)		30 (127)		33 (434)		13 (320)
House ²		36 (82)		45 (593)		55 (231)		50 (663)		62 (1541)
Apartment		40 (90)		12 (163)		15 (63)		17 (221)		24 (590)
Housing Arrangements	224						1335		2495	
Employer provided		1 (3)		8 (102)		4 (18)		4 (49)		3 (79)
Free from employer		25 (57)		26 (351)		29 (122)		14 (192)		7 (164)
Owns home or family member does		13 (30)		15 (198)		24 (101)		32 (433)		18 (440)
Rents from non-employer		57 (128)		50 (665)		42 (179)		48 (641)		72 (1795)

Latino Farmworker Characteristics	N=225¹	East Horse Workers % (n)	N=1333¹	East Crop Workers % (n)	N=423¹	Midwest Crop Workers % (n)	N=1336¹	West Crop Workers % (n)	N=2497¹	Californian Crop Workers % (n)
Employment Characteristics										
Years doing farmwork Mean (SD)		10.5 (7.3)	1331	12.4 (10.1)		13.0 (9.9)	1331	16.7 (11.6)	2491	15.6 (11.5)
Permanent worker type³		99.1 (223)	1253	67.2 (842)	379	41.4 (157)	1233	59.3 (731)	2265	53.6 (1213)
No. of household members doing farmwork⁴ Mean (SD)		1.3 (1.4)		2.2 (2.7)		1.3 (1.6)		1.1 (1.8)		1.5 (1.9)
Hours per week Mean (SD)		48.3 (5.9)	1325	44.9 (12.1)	410	43.0 (11.0)	1302	47.5 (13.0)	2424	45.4 (11.5)
Hourly pay (U.S. dollar) Mean (SD)	177	10.25 (2.41)	1106	8.38 (1.64)	383	8.88 (1.73)	1148	9.30 (1.85)	2115	8.91 (1.74)
Loads, mixes, or applies pesticides as part of job		31 (70)	1330	18 (236)		9(36)		29 (381)	2492	17 (434)
Health-related Characteristics										
Has personal health insurance in U.S.		33 (75)	1332	15 (201)		25 (106)	1334	20 (269)	2496	31 (772)
Who pays for health insurance⁵	75		199		104		266		769	
Worker		45 (34)		17 (33)		15 (16)		15 (41)		20 (152)
Employer		87 (65)		50 (99)		36 (37)		50 (134)		56 (433)
Government		1 (1)		26 (51)		42 (44)		27 (71)		33 (257)
If work-related injury/illness, farm gets workers' compensation		61 (138)		49 (653)		51 (214)		64 (858)	2495	71 (1783)

Notes: ¹This is the sample size for the following survey items unless otherwise noted. ²House consists of single-family, duplex, triplex, etc. ³Permanent work consisted of full- and part-time positions that occur on a year-round basis. ⁴Count excludes the worker. ⁵Workers were able to select more than one health insurance payer.

IV. Discussion

This study described demographic, employment, and living characteristics among a Latino horse farmworker sample, and to understand how these characteristics compare to a referent regional Latino crop worker sample. To the author's knowledge, this study is one of the few directly examining characteristics between Latino agricultural worker samples.

The demographic characteristics of these samples are comparable to those among other agricultural worker samples—workers being Spanish-speaking Mexican-born married men with low educational attainment (Carroll, Georges, & Saltz, 2011; Carroll, Samardick, Bernard, Gabbard, & Hernandez, 2005; Hertz, 2015; Kandel, 2008; Thierry & Snipes, 2015; Villarejo et al., 2010). Overall, horse workers seem to have established a more settled and family-style commitment to the personal and work environment. Horse workers more often reported being married, having a child, living with fewer nonrelatives than crop workers, and having permanent job positions. Horse workers appear less familiar and experienced with their work processes due to having a shorter farm employment history. However, horse workers averaged three work hours more a week than crop workers. The longer work hours for horse workers could be due to more horse workers more often being salaried compared to crop workers, as well as holding more permanent employment positions. Working six 8-hour work days a week is a horse industry standard due to the steady, year-round nature of working with horses, while crop work may be more contingent on the weather and the type of crops being harvested, which may appeal to more transient, seasonal, or migrant farmworkers. Animal production employees often work in full-time and year-round positions (Arcury &

Marín, 2009). Historically, income from animal production work has been higher than that of crop production work (Lee et al., 2002); as is portrayed in this study, which reveals horse workers earning \$1.82 (U.S. dollar) more an hour than crop workers.

Pesticide use was more frequently reported among the horse worker sample. Such findings contribute to the literature as it helps to identify a specific worker group at risk for pesticide exposure—horse workers, which contradicts traditional thought and research specifically examining pesticide use among crop workers (Arcury & Marín, 2009; Das, Steege, Baron, Beckman, & Harrison, 2001; Rothlein et al., 2006; Strong et al., 2004). However, crop workers have more protection under the recent revision of the U.S. Environmental Protection Agency's Worker Protection Standard, which specifically targets pesticide applicators and crop workers through annual worker safety training, minimal age limits, and early-entry guidelines. Furthermore, farmworkers living on farms (at least 25% of both samples) may be at an increased risk of pesticide exposure compared to their counterparts (Early et al., 2006; Fenske et al., 2000; Housing Assistance Council, 2013; McCauley et al., 2001; Rull, Ritz, & Shaw, 2006; Vallejos et al., 2011).

Employer dependency was observed among both farmworker samples, as horse (26.8%) and crop workers (34%) used some form of employer-provided housing and health insurance (87% and 50%, respectively). Some workers received housing as part of compensation, while others had housing deducted from worker income. Furthermore, a quarter of both samples lived on the farms where they worked. The majority of horse workers also depended on his or her employer to pay for their personal health insurance

and care, whereas crop workers across regions relied on the employer in conjunction with the government for healthcare coverage.

Of importance, both samples, including regional crop worker samples, reported limited health insurance coverage in the U.S.¹⁵ Health insurance is a contributing factor for healthcare access, health outcomes (National Center for Health Statistics, 2012), and financial burden (Kaiser Commission on Medicaid and the Uninsured, 2012). Uninsured persons are less likely to use preventive health services (Sudano & Baker, 2003), and health services for chronic diseases and other health problems (Kaiser Commission on Medicaid and the Uninsured, 2012). However, these farmworkers may be paying out-of-pocket for rendered health services, and/or not seek health services due to cultural reasons. Furthermore, some farmworkers were uninformed about their health insurance, which raises concern, especially for healthcare availability, affordability, and accessibility. Uninformed, as well as uninsured, workers most likely are not receiving preventive care, such as vaccinations for work-related illnesses, to help avoid preventable health conditions and maintain current health statuses (Institute of Medicine of the National Academies, 2009). From an occupational health and safety perspective, personal health insurance coverage may not be an issue as approximately three-fifths of both worker samples were covered for work-related injuries and illnesses through their respective farm's workers compensation. Additionally, some workers were unaware of work-related health coverage. Future recommendations for employers, especially those employing crop workers in the Eastern United States, is to help or

¹⁵Survey information from both samples was collected before the implementation of the Affordable Care Act. The provisions of the Affordable Care Act may have made coverage among agricultural workers more feasible.

provide information to workers about other sources of health insurance to help facilitate coverage when employer-sponsored insurance is not offered. Moreover, the Affordable Care Act aims to provide more insurance options for authorized immigrant agricultural workers, making them feel safe about seeking medical care for all health concerns, including work-related issues.

Limitations

Both cross-sectional surveys examined personal and occupational characteristics of their respective samples from the worker's point of view. Even though self-reported data has limitations with validity issues, the collection of this information permitted both TWHS and NAWS to reach vulnerable occupational populations. The analysis was limited by what variables were comparable between the two samples. There are limitations (i.e., response and selection bias) in drawing conclusions as this study compared a larger regional sample to a smaller sample. Generalizability issues exist, as both studies only interviewed workers who were employed at the time of survey, survey participation eligibility requirements varied (i.e., horse workers required 9 months of employment at one farm location, and NAWS workers were ineligible if they had not worked for over a year, and/or had H-2A visas), and the sampling methods differed (e.g., NAWS relied on a random employer-based sample and horse workers were attained through community-based purposive sampling). Horse workers were not interviewed at their farms of employment due consideration for the worker as the interview may threaten or jeopardize employment. Furthermore, documentation status for either worker population was not explored; however, NAWS' employment of random selection may suggest that more undocumented workers were explored compared to

TWHS. TWHS did not capture any information in regard to workers' immigration status as the team did not want to make the interviewees feel threatened and/or uncomfortable. Lastly, this study only examined a sample of workers from the horse production industry, which is only one subsector of the animal production industry. Other animal production subsectors, including different equine industries, should be investigated and compared to crop production to help assess worker health and well-being.

V. **Conclusion**

Future research should not solely rely on existing crop worker literature to base decisions and policies for worker health and safety across the agricultural industry, as this study helped to establish baseline characteristics to describe two worker samples, and suggests that differences exist between different agricultural production farmworker groups (e.g., horse and crop workers). Hence, an investigator should not assume horse workers have the same characteristics and circumstances as those of crop workers. As regional differences exist across farmworker groups, a fuller understanding of whether the noted differences are due to commodity, regional differences, time, aspects of the data collection process, and/or other factors is warranted. Future studies should enable comparisons to be drawn between these agricultural animal and crop production worker populations, which experience high occupational injury and illness rates, as personal and work-related factors influence worker behaviors and well-being. More consistent data collection efforts are needed across states and among researchers (e.g., specifically quality and standard measures)

to ensure adequate and appropriate comparisons can be drawn from animal production worker research.

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CHAPTER V

IMPLICATIONS FOR PUBLIC HEALTH

Hispanics are a minority population in the United States, but in some industries they are majorities. These industries often offer hazardous work and rely on Hispanic workers to maintain production efforts, as observed in the agricultural industry. General occupational health and safety movements through the years have offered some protection for workers in agriculture, yet this industry is still experiencing among the highest illness and injury rates. Additionally, these occupational illness and injury rates are underreported and undercounted, not depicting the true nature of agricultural worker. Moreover, the high rates may be partially explained by occupational health disparities. Of particular emphasis is agriculture's reliance on a vulnerable worker population, such as Hispanics, whose characteristics may further compound usual agricultural risks and hazards. Hispanic and other special populations may face additional costs to their health and safety due to the social, cultural, language, and economic factors that may spillover into the workplace. This capstone investigated some potential contributing factors to occupational illness, as well as offer insights into characteristics of other agricultural worker subgroups as much of what is known concentrates on a national crop worker population.

Key findings from the investigation of missed work due to work-related illness shows that workers working with specific barn bedding type, having children, self-rating their health status as poor, experiencing work-related stress, and/or spending less work time with working with horses are more inclined to miss work due to work-related illness. This study (Chapter III) illustrates that work-related illnesses are a culmination of personal and work characteristics. With regards to bedding materials, future research and efforts

can investigate the impact of bedding materials on worker health; call for the use of N-95 respirators when working in moldy and dusty environments; assess worker respiratory health of horse workers; and help to improve barn ventilation and bedding practices. Stress management techniques and resources should also be offered to workers to help manage their work-related stress, as well as educating workers about available social support and mental health services. Furthermore, as agricultural production research often depicts interventions focusing on the animal as a source of hazardous exposure, future research should examine agricultural work away from the animal to help identify exposures related to developing a work-related illness.

The study (Chapter IV) examining characteristics among a Hispanic horse worker and Hispanic crop worker samples suggests that differences do exist within the agricultural production industry and that future investigations of farmworker health should examine workers outside of the crop production sector. Animal production workers appear to have different characteristics and circumstances that may contribute to occupational health outcomes differently. Pesticide use was also commonly noted among both animal and crop production workers. The study also alludes to geographical differences between farmworker groups, which corresponds with the existing literature noting how the environment and climate influence agricultural commodity production.

Inadequate health insurance coverage was also noted in both of the abovementioned studies. Health insurance is a critical determinant of healthcare access and use. It also ensures that the workforce is receiving appropriate prevention services and healthcare to reduce jeopardizing occupational health and safety. Outreach efforts

should focus on improving access to these agricultural worker populations. More emphasis should be placed on identifying farm workers working on farms employing 50 or fewer full-time workers as the Affordable Care Act coverage mandate applies to only for farms employing more than 50 employees.

Although it is premature to draw any conclusions, these studies offer insights into Hispanic agricultural workers and their work experience. Additional research focusing on this diverse worker population is required to better inform the workplace, industry, general health and safety, government, and other practices. Data collection efforts should be consistent across states and among researchers (e.g., specifically quality and standard measures) in order to ensure adequate and appropriate comparisons between subsectors, including animal production, within the agricultural industry. Moreover, an improved understanding of the workers, such as Hispanics, composing the agricultural production subsectors, should help fill existing knowledge gaps and determine if current agricultural health and safety endeavors and resources are being appropriately allocated. Research and attention is required to address the health and safety dangers of the agricultural work encountered by workers as depicted by high industry occupational injury and illness rates.