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Exploring Living Conditions and Asthma Among Migrant Farmworkers

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LIVING CONDITIONS AND ASTHMA AMONG MIGRANT FARMWORKERS

Exploring Living Conditions and Asthma Among Migrant Farmworkers

Jenelle Williams

Submitted to the dissertation committee and the graduate faculty of
Dr. Pallavi Patel College of Health Care Sciences,
Department of Health Sciences at Nova Southeastern University
on July 28, 2021, in fulfillment of the requirements for the degree of
Doctor of Philosophy in Health Science



We hereby certify that this dissertation, submitted by **Jenelle Williams**, conforms to acceptable standards and is fully adequate in scope and quality to fulfill the dissertation requirement for the degree of Doctor of Philosophy in Health Science.

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Abstract

Migrant farmworkers are exposed to many physical, chemical, and biological hazards that pose human health risks. Quality of housing is a major factor that contributes to asthma disparities around the world; however, no study to date has explored the factors associated with the high rates in this population. Poor housing conditions are associated with a wide range of health conditions, including respiratory infections and asthma. Addressing housing issues offers public health practitioners an opportunity to address an important social determinant of health. Using the Social Ecological Model, the objective of this quantitative, cross-sectional dissertation study is to examine the presence of asthma based on the housing location, overcrowding, and the type of housing among migrant farmworkers. Using the National Agricultural Workers Survey (NAWS) dataset obtained from the United States Department of Labor (DOL), interviews were used to examine demographic, employment, and health data among migrant farmworkers. Logistic regression models were applied to explore the relationship between asthma diagnosis and housing among this population. Results of this dissertation study revealed that there is a relationship between the housing location and the type of housing migrant farmworkers reside in and asthma.

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Chapter 1: Introduction

Introduction to the Chapter

Migrant farmworkers are an important aspect of America's agricultural landscape. Agricultural jobs consist of harvesting, maintaining crops, picking fruit, and other agricultural goods. Oftentimes housing is provided for migrant farmworkers as a condition for employment. Migrant farmworkers and their families live in a range of housing types. In addition to traditional housing such as single-family homes and apartments, farmworkers reside in mobile homes and motels. Farmworkers are more likely to contract certain diseases or have health issues than other populations due to the type of work and working conditions that they are exposed to (La Cooperativa, 2020). Limited information is available to document the relationship between migrant farmworkers' housing and asthma. Asthma can severely affect the lives of migrant farmworkers due to occupational exposures. Migrant farmworkers are likely to suffer from occupational exposures including pesticides, sun, poor field sanitation, and mechanical injuries (Eamranond & Hu, 2020).

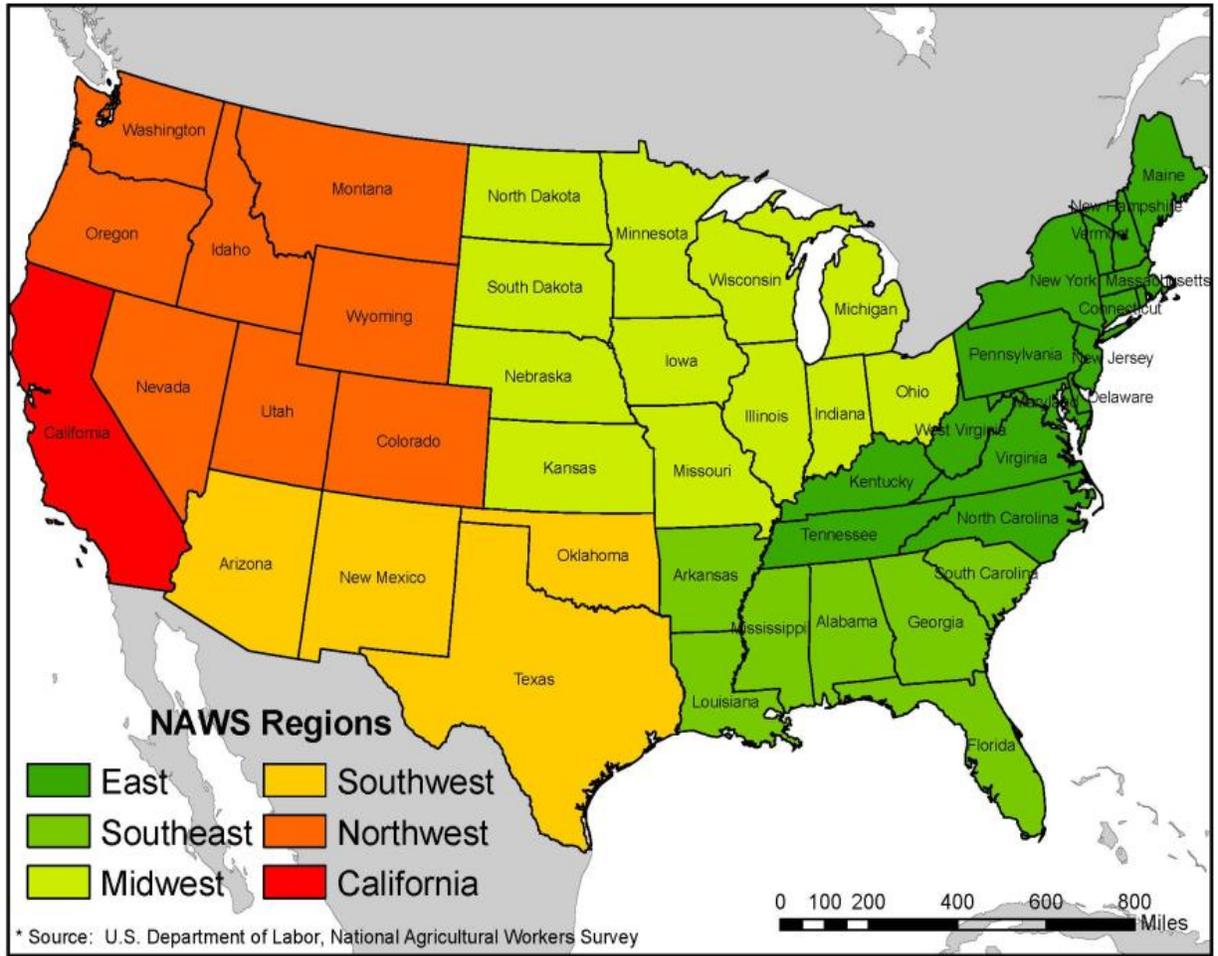
Understanding the relationship between asthma triggers and housing is difficult because most health surveys lack data on housing types and locations (Hendey & Cohen, 2017). The health issues that migrant farmworkers and underserved populations face are similar to those faced by the general population but are often magnified or compounded by their migratory lifestyle (Kugel & Zuroweste, 2010). Migrant farmworkers in the United States are routinely exposed to pesticides of multiple classes and are often unaware of their exposure (Quandt et al., 2017). They may also be exposed to harmful indoor exposures due to substandard housing types and locations (Arcury et al., 2015). Temporary housing for farmworkers may have poor

ventilation, increased concentration of pesticides, infestations, and severe overcrowding, all of which are associated with respiratory morbidity (Vallejos et al., 2011).

This quantitative research study addresses the gap of harmful indoor exposures with a focus on the issue of housing, whether residing on or off the farm, type of housing, and asthma among migrant farmworkers. The results of this study are vital as it has the potential to enact social change by demonstrating the need for improved population health data and additional research into other variables, beyond the scope of housing, that contribute to asthma risk in migrant farmworkers. This dissertation study used secondary data from the National Agricultural Workers Survey (NAWS) dataset collected by the United States Department of Labor (DOL). The NAWS is unique for its broad coverage of the characteristics of hired crop workers and their dependents and its nearly year-round interviewing schedule. The last NAWS data was collected in 2016, and was collected throughout the year, over three cycles, to reflect the seasonality of agricultural production and employment. Additionally, the data was collected in regions. Figure 1 shows the map of the sampling regions and the states in each region.

Figure 1:

Map of Sampling Regions and States



Background to the Problem

Migrant and seasonal farmworkers constitute a vulnerable population and are an integral support to the nation's agricultural industry. Nearly three million workers earned their living through migrant or seasonal farm labor (Rosenbaum & Shin, 2005). The majority of these workers are young, male, foreign-born, and undocumented (Chaney & Torres, 2017). They often have low-income and low educational attainment, lack documents to live and work in the United States, and lack access to health care (Arcury & Quandt, 2007). Migrant farmworkers journey long distances to the United States, traveling on crowded buses shuttled by their employers (Das et al., 2001). Migrant farmworkers may also be policed and segregated along racial, ethnic, and language lines, increasing isolation and exploitation (Caxaj & Cohen, 2019). Health disparities

of migrant workers are related to environmental and occupational exposures and are a result of language/cultural barriers, access to healthcare, immigration status, and the political climate of the host country (Moyce & Schenker, 2018). Housing is a major pathway through which health disparities emerge and are sustained over time. The link between housing and health is well established and long-standing, however much of the evidence relies on self-reported health measures (Clair & Hughes, 2019).

Farm labor housing is diverse, which includes group quarters as well as individual housing units, and those farmworkers who live in group quarters generally reside in employer-provided labor camps that are composed of farmhouses, trailers, or barracks (Arcury et al., 2015). Research findings derived by Kearney et al. (2014) suggested that farm labor housing has been described as among the worst in the nation, oftentimes with poor and unsanitary indoor living conditions. Substandard housing and indoor environmental exposures have been linked to increased indoor allergen exposure and sensitization and greater asthma morbidity and mortality (Pacheco et al., 2014). Indoor environmental exposures may consist of household and industrial cleaners, industrial manufacturing products, and other chemical exposures; these chemical exposure poses a huge range of health risks. Additionally, some research suggested that housing migrants on their employer's property can create a disciplinary dynamic among workers that can promote competition or hyper-productivity that has a detrimental impact on their autonomy and dignity (Caxaj & Cohen, 2019).

Overcrowded living conditions and exposure to diseases may contribute to health crises among migrant farmworkers. Overcrowding is defined as having a greater number of occupants than rooms which increases safety and health concerns (Healthy People, 2020). Overcrowding has been linked to a variety of health problems including respiratory and infectious diseases,

injuries in the home, and tuberculosis (Thompson et al., 2007). The World Health Organization [WHO, 2020] stated that overcrowding is a major factor in the transmission of diseases with epidemic potential such as acute respiratory infections, meningitis, typhus, cholera, scabies, etc. (WHO, 2020). Overcrowded homes can impact educational attainment (e.g., comfortability and quiet-time) as well as affect indoor air quality (e.g., dampness-related agents), which can have a direct impact on residents physical and mental health status (Sharpe et al., 2017).

Farmworkers are a unique population within rural communities. Yet, there are gaps in knowledge about farmworkers' access to care. There are increasing numbers of farmworkers from indigenous communities of Mexico making up 20-25% of the farmworkers (National Center for Medical Education Development and Research, 2019). Indigenous farmworkers face unique language barriers, as many indigenous individuals prefer to speak their own language, and some do not speak English or Spanish. Indigenous workers may experience discrimination by both the mainstream United States population and other migrant workers (Farquhar et al., 2008). Unfortunately, they also face many of the health issues that non-rural farmworkers face due to work-related injuries and occupational exposures.

There is good evidence that links people's health to the conditions of their everyday lives (Bharmal et al., 2015). In 2015, the National Center for Farmworker Health (NCFH) reported 3% of the participants described having asthma (NCFH, 2015). In 2018, the Centers for Disease Control and Prevention (CDC) reported 24,753,379 or 7.7% of asthma prevalence nationally (CDC, 2020). Occupational asthma is the most prevalent occupational lung disorder in industrialized countries, accounting for approximately 15% of new asthma cases in adults (Bepko & Mansalis, 2016). The diagnosis of asthma is a clinical one with the history and physical examination being significant, but objective measures, such as pulmonary function

testing, can be used to aid in the diagnosis (Nanda & Wasan, 2020). Many factors, including environmental exposures, have been related to the increase in the occurrence of asthma, but only few have been tested (Omland et al., 2011).

Occupational exposures due to farming increases the risk for developing different types of occupational lung parenchymal and airway disease (Holguin & Schenker, 2017). Farmers may be at increased risk for adverse respiratory outcomes compared with the general population due to their regular exposure to dusts, animals, and chemicals (Hoppin et al., 2014). Although asthma occurrence has remained an important public health issue, studies focused on the causative factors of increased asthma frequency among migrant farmworkers remain limited. The aim of this dissertation study is to provide a unique perspective of the relationship between housing and asthma among migrant farmworkers.

Statement of the Problem

The Centers for Disease Control and Prevention (CDC) stated that asthma is a disease that affects the lungs. It causes repeated episodes of wheezing, breathlessness, chest tightness, and nighttime or early morning coughing. Nearly 65% of all adults with asthma are classified as persistent asthma; 35% have intermittent asthma (CDC, 2015). Farming work increases the risk of asthma because workers have prolonged exposure to pesticides, dust, and live-in low-quality housing with poor ventilation and mold (Cheatham & Marechal, 2018). Housing quality impacts sleep quality, and poor sleep is associated with poor health among farmworkers (Sandberg et al., 2014; Sandberg et al., 2016). Crowded, substandard housing is especially challenging for female farmworkers who often have to work and take care of their children which contributes to poor health outcomes including asthma (Farmworker Justice, 2018).

Migrant and seasonal farmworkers overwhelmingly reside in poor housing conditions (Arcury et al., 2012). Some workers live in employer-owned housing that is licensed and state-regulated, though even this may be in disrepair, and many live in unlicensed, hazardous labor camps, which are often owned by farmers (Wiltz, 2016). Farmworker housing conditions are often shocking to those who have not visited farmworker communities (Arcury & Summers, 2015). A study by Arcury and Quandt (2011) revealed that the housing available to farmworkers, whether in migrant farmworker camps controlled by farmers or contractors or in rural communities, is overwhelmingly substandard. Previous studies described farmworker housing as being in unsanitary conditions, overcrowded, isolated from essential services such as health clinics, grocery stores, public transportation and lacking basic utilities.

Farmworker housing includes government housing, grower-owned, and private housing. Not only do many farmworkers live in poor housing conditions, but they also must deal with inflated housing prices. In the case of grower-owned and privately rented housing, the landowner can have control, possession, or a monopoly on available housing, which allows them to overcharge. This is especially true in isolated rural areas, where other housing options simply do not exist, and thus workers have no alternative but to pay these rates (National Farm Worker Ministry, 2017). Allowing this makes migrant farmworkers even more vulnerable.

Despite the state and federal housing requirements, substandard housing conditions are a common issue faced by farmworkers. These exposures overtime pose an increased risk to the health of this vulnerable population. Substandard housing among farm laborers exposes them and their families to toxicants, including lead and pesticides; to allergens, including mold, mildew, and insect and rodent dander, and to crowded conditions (Arcury & Quandt, 2011). A recent study by Furgurson and Quandt (2020) determined that migrant housing has not changed

over the years as it still is often crowded, in poor repair, lacking in security and privacy, and, at least in the southeastern United States, excessively hot; and seasonal farmworker housing is similarly deficient.

Relevance

Health studies of migrant farmworkers have traditionally focused on a specific health issue or domain (e.g., mental health, hazardous working conditions, or access to health care). The purpose of this study will be to expand the scope of understanding regarding the role of housing as an important environmental determinant of health among migrant farmworkers by examining the role of housing in the occurrence of asthma among migrant farmworkers who reside on- or off-farm. In addition, it is undetermined if overcrowding plays a role in asthma rates. Crowded households are also often exposed to housing risks including poor quality. This study investigated whether migrant farmworkers have increased odds of an asthma diagnosis based on the housing type. To address this gap of asthma and housing, quantitative secondary data was examined.

Elements

Theories

Historically, deficit thinking holds oppressed populations responsible for the challenges and inequalities they face (Bruton, Robles-Pina, 2009; Haggins, 2006; McKay & Devlin, 2016; Solarzano & Yosso, 2001; Valencia, 2012; Weiner, 2003). Many studies have focused on deficit thinking to explain the challenges faced by Latino migrant farmworkers yet lack references to personal experiences. Migrant workers lacked educational opportunities, lived in poverty and terrible housing conditions, and faced discrimination and violence when they sought fair

treatment (Equal Justice Initiative, 2014). Too many farmworkers are exposed to a broken immigration system with little oversight to end racial disparities.

The Critical Race Theory (CRT) focuses on racial identity. Research by Daftary (2018) supports that the CRT is a relevant theoretical framework especially when investigating historically disenfranchised populations as it aspires to empower voices and perspectives that have been marginalized, and encourages a problem to be placed in social, political, and historical context while considering issues of power, privilege, racism, and other forms of oppression. CRT challenges traditional interpretations of cultural capital. It is vital to examine agricultural law, policy, and racial discrimination as these are factors that impact migrant farmworkers. Today's concern for the quality of the produce on our plates has done little to guarantee United States farmworkers the necessary protections of sanitary housing, medical attention, and fair labor standards.

The political discourse on farmworkers' rights is dominated by the view that migrant workers are not entitled to better protections because they are "noncitizens," as either immigrants or transients (Martínez-Matsuda, 2020). Although there are federal and state laws prohibiting housing discrimination, it is still common. Latinx farmworkers possess at least two marginalized identities — class and ethnicity — which expose them to prejudice and discrimination (Areguin et al., 2020). Migrant farmworkers must endure a range of social injustices. Because of migrant farmworkers residency and/or mobile status, reports of prejudice, hostility, harassment, and discrimination in their communities in which they work and live go unreported (Stop Unpaid Wages, 2019). The CRT addresses social, economic, and environmental factors and these include housing among migrant farmworkers. Exploring the CRT may also highlight how iniquities, people of color, and poverty influences housing affordability and overcrowded conditions.

Although CRT pertains to the migrant farmworkers population and the norms that follow in regard to housing, the Social Ecological Model (SEM) theoretical framework is the primary theory for this study as it engages migrant farmers and their health. The SEM enables the examination of ecological human development (Bronfenbrenner, 1977). Bronfenbrenner (1977) suggested that the entire lifespan, settings, environment, social structures, institutional, and cultural patterns of individuals had to be considered when attempting to understand individuals. Bronfenbrenner suggested that there are four levels that influence the health of individuals: the microsystem, mesosystem, exosystem, and macrosystem. The SEM suggests the environment in which individuals reside is a multilayered system comprised of social, physical, and cultural aspects that affect health (Golden & Earp, 2012). Figure 2 shows the SEM with the layers of influence on health.

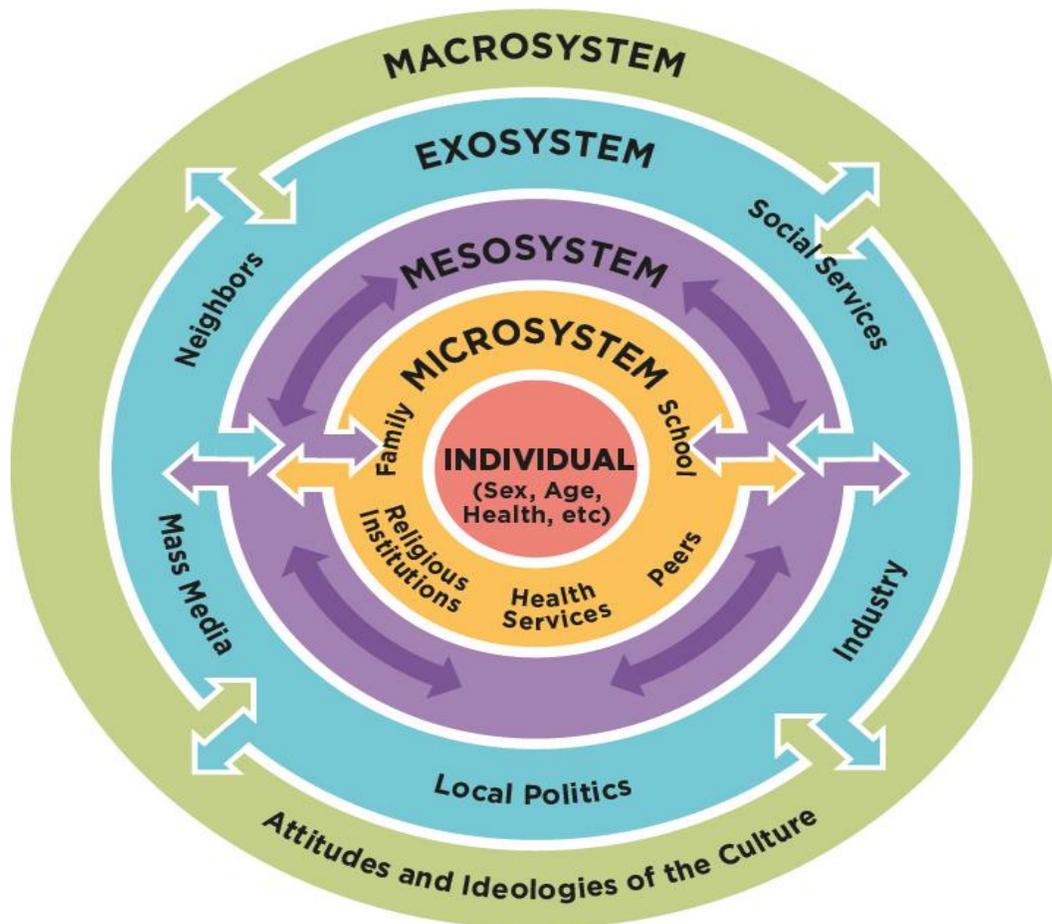
At the center of the Social Ecological Model is the “Individual” or viewed as the migrant farmworker. This represents the individual who affects and is affected by their environment. It also characterizes the farmworker’s health, age, knowledge, beliefs, and behaviors. The first level, “Microsystem” represents family, peers, school, church, and health services as they are a person’s social network that may affect the farmworker’s attitudes or behaviors. The second level, “Mesosystem” represents the physical working environment, culture, rules, and regulations that affect the migrant farmworker’s health, safety, and wellbeing. The third level, “Exosystem” represents the local policies and working industry surrounding community such as how migrant farmworkers are perceived and treated. Also, within this level is the types of social services available in the community to assist migrant farmworkers and could include healthcare services. The fourth level of the model “Macrosystem” represents the attitudes and ideologies of the

culture. This can also include social norms and perceptions that affect the culture of migrant farmworkers.

Each layer of the theory contains risk factors from different areas of an individual's life. The relationship between risk factors, the SEM, and asthma make this model an appropriate theoretical framework to examine the frequency of asthma in a sampled population. Many asthma interventions have embraced the SEM and thus incorporate home, school, and community-based components to address the multi-factorial nature of asthma self-management (Gupta et al., 2013). Many public health interventions, however, have focused on the role of policies and organizations in producing individual change, rather than on the conditions and environments within which health-promoting policies and organizations are formed (Golden et al., 2015). Further, this shows that previous research is relevant and future literature is needed to examine the presence of asthma in various populations.

Figure 2:

Social Ecological Model (SEM)



Research Aim

The aim of this research was to assess the relationship between migrant farmworker housing and asthma. The aim of this dissertation study is achieved through the following objectives:

- (a) To determine if there is a relationship between migrant farmworkers residing on or off the farm and having asthma.
- (b) To determine if there is an association between type of housing and asthma.
- (c) To determine if overcrowding is a significant predictor of asthma.

In order to validate the inferences that emerge from this dissertation study, demographic variables including age, gender, marital status, health insurance, and injuries are assessed to understand what role they play in a farmworker's diagnosis of asthma.

Research Questions and Hypotheses

This dissertation study seeks to answer the following research questions to better understand if there is a relationship with residing on the farm, overcrowded housing, and type of housing among farmworkers who participated in the NAWS.

Research Question #1: Is there a relationship between asthma and migrant farmworker residence (on or off the farm)?

Research Question #1 Hypothesis: There is a relationship between having asthma and migrant farmworker residence (on or off the farm).

Research Question #2: Is there an association between the type of housing and asthma among migrant farmworkers?

Research Question #2 Hypothesis: There is an association between the type of housing and asthma among migrant farmworkers.

Research Question #3: Is overcrowding a significant predictor for asthma among migrant farmworkers?

Research Question #3 Hypothesis: Overcrowding is a significant predictor for asthma among migrant farmworkers.

Definition of Terms

The following terms will be used throughout the remaining sections of this dissertation:

Asthma is defined as “chronic airway disease, which affects more than 300 million people and is associated with immune system activation, airway hyperresponsiveness (AHR), epithelial cell activation, mucus overproduction and airway remodeling” (Boonpiyathad et al., 2019).

Housing is defined as “buildings or structures that individuals and their family may live in that meet certain federal regulations” (Business Dictionary, 2020).

Migrant farmworker is defined as “a seasonal farmworker whose employment required travel that precluded the farmworker from returning to his or her domicile (permanent place of residence) within the same day” (United States Department of Labor, 2013).

Seasonal farmworker: See Migrant farmworker.

Substandard housing is defined as “housing that is unsanitary, contains moderate to severe housing defects, or can be considered a hazardous home environment” (Hayward et al., 2015; Holupka & Newman, 2011).

Operational Definitions

The following operational definitions describe how each variable used in this dissertation study were measured. Each definition provided has been adapted from the variable definitions used in the National Agricultural Workers Survey (2016).

Overcrowding is defined as “condition where the number of occupants exceeds the capacity of the dwelling space available, whether measured as rooms, bedrooms or floor area, resulting in adverse physical and mental health outcomes” (World Health Organization [WHO], 2018).

Living quarters is defined as “the categorical classification of the ownership type of the dwelling represented by the home in that the migrant farmworker resides”. This may include

mobile home, single family home, apartment, motel, and barracks. For the purpose of this dissertation study, living quarter is the type of housing the migrant farmworker resides in.

Description of Variables

This dissertation study was an analysis of secondary data collected nationally from the United States Department of Labor (DOL) from 2014 to 2016. A quantitative research method was used for this study. The use of quantitative research methods allows for the examination of the relationship between significant variables related to housing and asthma within migrant farmworkers. The cross-sectional research approach addressed the research aims of the study. The cross-sectional research design also allowed for the determination of whether overcrowding housing and asthma outcomes among migrant farmworkers were related.

The independent variables for the first research question were migrant farmworkers who resided on the farm and off the farm (Table 3). The dependent variable for this research question was asthma diagnosis (Table 2). The second research question was designed to investigate whether there was a significant association between the type of housing and asthma among migrant farmworkers (Table 4). The independent variable was the type of housing or living quarters. The dependent variable for the second research question was also asthma diagnosis (Table 2).

Table 1

Variable: MIGRANT

Code	Description	2014	2015	2016
.	Missing	6	6	3
0	Not Migrant	2393	2379	2168
1	Migrant	424	449	337
All	Totals	2823	2834	2508

Table 2

Variable: NH01 – Asthma – (Have you ever in your whole life been told by a doctor or nurse that you have the following conditions: ASTHMA)?

Code	Description	2014	2015	2016
0	No	2737	2743	2415
1	Yes	86	91	93
All	Totals	2823	2834	2508

Table 3

Variable: D35 – Where are your living quarters located?

Code	Description	2014	2015	2016
.	Missing	17	15	12
1	Off-Farm (Property Not Owned/Administered by Present Employer	2273	2147	2058
2	Off-Farm (Property Owned/Administered by Present Employer	93	101	65
3	On-Farm of the Grower I Currently Work For	431	558	372
7	Other: Specify:	9	13	1
All	Totals	2823	2834	2508

Table 4

Variable: D34A – Living Quarters (In what type of living quarters do you live now (housing structure at this location)?

Code	Description	2014	2015	2016
.	Missing	5	5	2
1	Mobile Home	527	627	550
2	Single Family Home	1600	1594	1335
3	Duplex, Triplex, etc.	60	59	50
4	Apartments	540	465	498
5	Dormitory or barracks	57	53	48
6	Campsite or tent	10	1	5
7	Motel or hotel	0	6	0
8	Without shelter	1	0	1
97	Other	23	24	19
All	Totals	2823	2834	2508

The aim of the third research question was to determine if overcrowding housing was a predictor for asthma among the migrant farmworkers (Table 5). The independent variables for the third research question were overcrowding. The dependent variable for this research question was also asthma diagnosis (Table 2). Data collected to assess the relationship between asthma and housing among migrant farmworkers will be analyzed using logistic regression.

Table 5

Variable: CROWDED1 – Household is Crowded, based on the United States Census Bureau Definition that a Housing Unit in which the Number of Persons Per Room Exceeds One is Considered Crowded

Code	Description	2014	2015	2016
0	No	1857	1930	1725
1	Yes	966	904	783
All	Totals	2823	2834	2508

Rationale

Migrant farmworkers constitute a vulnerable population that endures economic hardships and occupational hazards with comparatively little known about the social context of their daily lives (Arcury & Marín, 2009). Previous researchers have only examined the topic of substandard housing to understand its effects on overall health. Studies have yet to narrow the topic of focus to migrant farmworkers — the population whose respiratory health is most frequently affected by substandard housing conditions and occupational risks. This study addressed this gap with a focus only on the issue of housing and asthma among migrant farmworkers.

Understanding the type of housing in which migrant farmworkers reside in, is critical to the development of policies that appropriately target important housing issues such as substandard housing. The results of this study have implications to expand the scope of understanding and the knowledge base regarding the role of adequate housing in the prevention of asthma among migrant farmworkers. This research study provided a basis that can be used to promote social change in the current policies and standards that outline the accepted requirements for adequate housing environments.

Assumptions

In this dissertation study, the investigator assumed that the secondary data sources used to conduct the study were collected in a manner reflective of acceptable scientific rigor. Additionally, the assumption was made that the interviewers responsible for collecting the health data used for this dissertation study did not deviate in any way from the assigned survey protocol. The assumption in this dissertation study was that there is a relationship between the presence of asthma based on the housing type of migrant farmworkers. The investigator also

assumed that there were no existing personal biases that may influence the way this study was conducted.

Summary of the Chapter

This dissertation study attempted to fill a gap in the literature by describing migrant farmworkers housing and asthma diagnosis. Housing has been long recognized as a factor that affects health. However, data on the topic of asthma and housing regarding migrant farmworkers remains limited. In this dissertation study the constructs of the Social Ecological Model (SEM) were applied to examine the role of housing in the resulting asthma diagnosis among migrant farmworkers. In the next chapter, the origins and relevant theory of the SEM will be outlined. A comprehensive review of the literature regarding the general topics of asthma and housing is provided in Chapter 2.

Chapter 2: Review of the Literature

Introduction to the Chapter

The overall aim of this dissertation study was to investigate the relationship between migrant farmworker housing and asthma. The topic of asthma and occupational exposures among migrant farmworkers has been studied; however, few studies have focused on the housing and the occurrence of asthma in migrant farmworkers. Although United States farmers may have a lower occurrence of asthma compared to the general population, little is known about asthma occurrence among the United States farmworkers on a national level (Arroyo et al., 2018). Migrant farmworkers have long struggled under some of the most challenging economic and housing conditions in America. Migrant farmworkers often seem like an invisible population due to the nature of their work and demographic characteristics. The World Health Organization (WHO) stated that asthma is under-diagnosed and under-treated, creating a substantial burden to individuals and families and possibly restricting individuals' activities for a lifetime (WHO, 2017). The health problems migrant farmworkers and their families face because of their low-income status and unfamiliarity with the culture are compounded by a migratory lifestyle and the inherent dangers and health risks involved in their occupations. Thus, the purpose of this dissertation study was to examine the relationship between asthma and housing among migrant farmworkers.

The literature review provided a comprehensive view of current literature regarding disparities in asthma that affect migrant farmworkers including federal housing requirements, substandard housing, overcrowding, and the aspects of housing that are the most relevant to examining asthma among migrant farmworkers. Using the theoretical framework of the Social Ecological Model, major health issues including risk and protective factors among this

population were discussed. The need for the current study is presented and key concepts summarized.

Historical Overview

There is a strong tradition and history of agricultural production in the United States. Migrant farmworkers enter other countries from their home country to work in agriculture farms. Most of these farmworkers are temporary or seasonal workers. There are several challenges facing migrant farmworkers. Migrant farmworkers must survive numerous challenging conditions in order to provide for their families. Agricultural jobs are not an easy job, but these migrant farmworkers are willing to take these physical exhausting jobs because of the economic hardship and lack of jobs in their country of origin. The United States has a robust agricultural industry and this research will give attention to these individuals and provide clarity on the perceptions of housing migrant farmworkers. Future work is needed to investigate the underlying factors that significantly cause associations of asthma and housing, and the health of migrant farmworkers.

Social Ecological Model

The theoretical framework that guided this dissertation study was the Social Ecological Model (SEM). The ecological model, first suggested by Bronfenbrenner (1977), considered the entire lifespan of individuals. The SEM provided a foundation to fully understand the multitude of factors that come together when making decisions about asthma among migrant farmworkers. The SEM emphasizes the importance of multiple levels of factors including the social and physical environments that shape patterns of disease as well as responses to them, providing a broader view of important determinants of health (Fielding et al., 2010). The model also recognizes the influential force that the environment exerts on the health behaviors of individuals

(Bronfenbrenner, 1977). This theoretical framework can also be used in future studies to examine adequate housing and access of healthcare. Thus, the SEM provided insight into how asthma and housing relate to migrant farmworkers by drawing from multiple influences such as indoor housing conditions and presence of pesticides that may impact their health.

History of Migrant Farmworkers in the United States

According to the United States Department of Agriculture (USDA), the United States agricultural industry has been and continues to be dependent upon an immigrant workforce (USDA, 2020). Farmworkers' contributions are more critical than ever. Migrant farmworkers have a heartbreaking history full of historical struggles, and their stories are all too common. From indentured servants to African slaves to Asian immigrants to Mexican Braceros, the United States has a long history of importing agricultural labor (Barger & Reza, 1994; Martin, 2017). When observing the experiences of migrant farmworkers, it is vital to also examine the history of these people. Without examining the history of such a significant part of today's society a fundamental part of American history is misplaced. Furthermore, when recalling the history of migrant farmworkers, it is necessary to look to the present condition of these farmworkers and compare the past. Through the difference of the origination of migrant farm work and the present conditions, one can gain an understanding of what the future holds for migrant farmworkers who make agricultural industry in the United States what it is today.

Although migrant farmworkers are a foundational part of the United States agricultural system, they still face biases and discrimination. Farmworkers and their families face entrenched poverty, environmental racism, and lack of opportunity. Discrimination and lack of worksite protection may impact immigrant farmworkers' injury experiences, including their apprehension of reporting injuries because they fear being fired (Penn State News, 2017). Research by Snipes

et al. (2017) states that a growing body of literature suggests that discrimination is often implicated in Latino farmworkers' risks of injury. Factors like immigrant and ethnic discrimination, the type of contract under which they work (hourly vs. piece-rate), and workplace violence and threats from employers (e.g., deportation) keep workers from reporting their injuries (Snipes et al., 2017). This suggests the need for policies that better safeguards these vulnerable workers.

Demographics, Gender, and Employment

The majority of farmworkers in the southeastern United States are migrants from Latin America, with some representation from other regions (Sologaistoa, 2011). In 2007, there were 2.2 million farms and 3.3 million farm operators in the United States (Mazurek et al., 2015). According to national reports from the United States Department of Agriculture and the United States Department of Labor, there are an estimated two to three million migratory and seasonal agricultural workers in the United States (National Center for Farmworker Health, 2018).

The majority (73%) of all agricultural workers were foreign born, 69% of all agricultural workers were born in Mexico, and 27% were from the United States and Puerto Rico (National Center for Farmworker Health, 2018). Gender of the migrant farmworkers is comprised of 72% males and 28% females. Additionally, 85% of migrant farmworkers said they were hired directly by the grower or producer, while 15% said they were employed by a labor contractor (National Center for Farmworker Health, 2018). Migrant farmworkers also move within a state, between states, internationally, or from region to region, looking for work (Arcury & Quandt, 2011). Less than half of all farmworkers, and only 24% of undocumented farmworkers, have health insurance and if farmworkers do get sick, they likely do not have access to paid leave to take time away from work to access medical care (Willingham & Mathema, 2020). This is another

barrier they face in receiving the care that they need to recover and keep themselves, their family, and their communities safe.

Relevant Theory

Housing

When a migrant farmworker arrives in the United States and is employed by a crop grower, the migrant farmworker is provided housing. Any farm that provides housing to farmworkers must ensure that it complies with state and federal housing standards. Farmworkers come to the United States looking for economic opportunities, but frequently undocumented workers' ability to be financially independent is untenable given that the debts owed by farmworkers to a contractor — who provides housing to farmworkers — varies in different regions. The hired personnel contribute to less than 1% of the wages of all United States salary and wage workers but are essential to the success of United States agriculture (Chaney & Torres, 2017). The National Center for Farmworker Health provides valuable insights into the characteristics of farmworkers in the United States. The crop grower typically finances the farmworker's travels and living expenses, while expecting full reimbursement plus interest before the farmworker leaves his/her job (National Center for Farmworker Health, 2018).

The working and living conditions of migrant farmworkers generate unique health hazards, due to both occupational challenges as well as injury and illness that stem from the conditions imposed by the culture of migrant farm work, including dependency and poverty (Borre et al., 2010). Although regulatory standards exist for health and safety of farm labor housing, living conditions are often unfavorable and farmworkers are reluctant to complain due to fear of work-related consequences (Kearney et al., 2014). Although many growers are complying with the standards, sometimes it is just not enough. Migrant housings or units are

usually overcrowded and shared with non-family members. The lack of privacy and overcrowded space can create stress which can lead to anxiety and depression (Forti, 2016).

H-2A Housing Program

In 1964, the United States Federal H-2A temporary agricultural program was created to meet agricultural production needs. The H-2A temporary agricultural program enables farmers who are unable to recruit sufficient domestic workers to bring foreign workers to the United States to perform agricultural labor or services of a temporary or seasonal nature (Bail et al., 2012). Employers participating in the H-2A program are required to provide no-cost housing for their workers (Diaz et al., 2016). If the employer elects to secure rental (public) accommodations for such workers, the employer is required to pay all housing-related charges directly to the housing's management (United States Department of Labor, 2013). To meet this requirement employers frequently use older houses and mobile homes located on or near the farm. All of the workers granted an H-2A visa through the employer often reside together, sharing sleeping quarters, kitchens, and bathroom facilities; this migrant farmworker housing is often unclean and in poor condition (Diaz et al., 2016).

Like other residential dwellings in the United States, the housing must be inspected and certified in advance to ensure that it complies with applicable health and safety standards. Unfortunately, there is little oversight and enforcement of H-2A provisions (Donham & Thelin, 2016). Sparse data exists on H-2A farmworkers and their health since the NAWS data collection strategy specifically excludes these workers (Guild et al., 2016; Tonozzi & Layne, 2016). Although it would be valuable information, the history is not clear about why the NAWS excludes these agricultural workers. While this may pose a disadvantage for some applications, this feature is attractive in this circumstance of this study since H-2A workers are protected by

minimum wage legislation while other migrant workers are exempt. These types of temporary fixes to labor shortages create and intensify structural vulnerabilities (Weiler et al., 2016). As workers in the United States, H-2A workers have a legal right to be protected from dangerous working conditions and exploitation as well as have a decent standard of living.

Despite the hazards that farmworkers face, they receive far fewer legal protections than most other workers. In 2020, the Center for American Progress reported that farmworkers are not entitled to overtime pay, and farms with fewer than seven workers in a given quarter may not have to pay even the federal minimum wage. Moreover, federal law does not protect farmworkers' right to organize unions, making it difficult for them to band together to bargain for better pay and working conditions (Willingham & Mathema, 2020). But as the H-2A program has expanded, it has left more guest workers vulnerable to abuse (Khimh & Silva, 2020). Due to employers owning and controlling the visa status of their H-2A employees, H-2A workers have been afraid to complain about mistreatment; they risk being fired and deported, so as an incentive, they withhold complaints (Costa, 2020).

Housing Types

People move from one place to another because of wanting to provide a better life for themselves and their families. Migrant farmworkers move from farm to farm and stay in housing that is provided as part of the working conditions. There are different types of housing that farmworkers live in, varying widely based on geographic location, immigration status, etc. The most common types of farmworker housing include government housing, grower-owned, and private housing. Farmworker housing may also be categorized as on-farm or off-farm housing. In private housing, multiple people share sinks, bathrooms, showers, cooking, and laundry

facilities, and this is problematic because lack of hygiene facilities can promote pesticide exposure and the spread of disease (National Farm Worker Ministry, 2017).

Farmworker housing conditions and needs vary by type, location, tenure, and condition. Migrant farmworkers often reside in formal or informal labor camps, RV, mobile home parks, old motels, apartment homes, and campgrounds. Some farmworkers sleep in cars, motels, garages, converted school buses, and reportedly even chicken coops. Many more share apartments with strangers, sometimes dozens of them, leading to public health concerns (Michaels, 2018). Today, on-farm housing, while much improved from past decades, often only affords the most basic arrangements (such as simple concrete barracks or older manufactured homes), typically of lower quality than off-farm housing (Farmworker Justice, 2014). Research on this significant public health topic will help broaden the understanding of the relationship between housing, asthma, and migrant farmworkers.

Migrant farm camp characteristics also play a major role in housing. Migrant housing facilities vary in their size and configuration. Houses, apartments, and trailers originally constructed as family housing, or barracks specially built for group quarters are commonly used (Quandt et al., 2013). These aspects of farmworker housing — housing type, sanitation, and crowding — affect the presence, quality, and sufficiency of facilities for preparing, storing, and eating food (Quandt et al., 2013). Given the close relationship between housing and health, it is impractical to address the health needs of farmworkers without addressing their housing needs. There is a need to improve camp characteristics for safer, cleaner living environments.

Housing Conditions

Farmworkers soon realize how difficult and expensive it is to live in the United States. They may find that they have to work many more hours, share housing with multiple people,

skip meals, or try to find additional sources of revenue to survive economically. These groups endure great poverty in addition to poor working and living conditions. Many must survive challenging conditions that expose them to numerous hazards. Increased knowledge of the conditions or type of housing in which migrant farmworkers reside in may have implications for health and safety.

Federal and state laws set minimum standards for migrant worker housing. Migrant farmworkers face significant hazards at work including heat stress, pesticide exposure, and injuries. The housing provided to migrant farmworkers may create added health and safety risks. Many farmworkers also live in low-quality housing, which may not protect them from weather conditions even after working for hours (Sandberg et al., 2014; Zhang et al., 2016). Housing conditions for farmworkers and their families historically have been substandard, whether the type of housing is affordable or not. The nature of their employment and working conditions means that farmworkers' housing options — in terms of arrangement, costs, and quality — often are substantially different from other populations' options.

Substandard Housing

The linkage between substandard housing conditions and poor health is well documented (Thomson et al., 2001). Substandard conditions include unsanitary conditions, exposed plumbing and electrical wiring, holes in the roof, open wells, and pesticide exposure (Housing Assistance Council, 2001). The unsanitary, crowded and poorly ventilated living conditions pose risks to workers' health, increasing their vulnerability to everything from infectious diseases to heat strokes (Wiltz, 2016). In addition to the health impact, poor housing quality can lead to an unsafe environment. Dilapidated and deteriorated housing can lead to increased risk of falls and injuries;

nonworking smoke detectors or faulty electric systems can lead to power outages and fires, increasing the risk of injury and even death (Sims et al., 2020).

Migrant farm work is one of the few occupations where housing is often included as part of compensation (Vallejos et al., 2011). A few studies have examined the conditions of migrant camps and all report that substandard conditions are very common (Vallejos et al., 2011; Villarejo et al., 2010). Migrant camps vary in cleanliness and access to basic amenities such as bathrooms, hot water, and laundry facilities (Arcury et al., 2012; Farquhar et al., 2009; Vallejos et al., 2011). A study conducted in North Carolina found 89% of the migrant houses had at least one condition that violated housing regulations in the Migrant Housing Act and two-thirds of the houses were moderately standard and 20% were severely substandard (Vallejos et al., 2010).

Throughout the United States, the quality of migrant farmworker housing is often cited as a concern by those who provide health and other services to this population. However, little research has documented farmworker housing quality. The few studies that have investigated housing conditions universally decry the abysmal state of this housing (Arcury et al., 2012). Some characteristics of migrant farmworker housing quality may be considered “optional” and subject to personal taste; these are not subject to current regulations. Having dividers between toilets or showers for privacy are such characteristics. The importance of these optional characteristics for safety, health, or quality of life is subject to interpretation (Arcury et al., 2012).

Overcrowding

Overcrowding and substandard housing conditions at migrant camps has been identified as a health and safety hazard for all family members (Wilkerson, 2005). Crowded housing conditions in migrant farmworker camps can also influence pathogen exposure and transmission

risk (Clarke et al., 2021). Overcrowding and poor-quality housing conditions have a direct link to poor mental health, developmental delay, below average height, and heart disease; many of the diseases can occur later in life (Bashir, 2002). In California, migrant housing demands often exceed the availability of housing units; therefore, workers crowd into one house or find shelter in garages, vehicles, and animal stalls (Villarejo et al., 2010). In North Carolina, almost half of all migrant camps had three or more people per bedroom (Vallejos et al., 2010). Therefore, sanitary conditions of housing vary, and crowding is known to be a common problem.

Farmworkers experience similarly disproportionate high rates of overcrowding which has occurred almost two decades. The County of Ventura, California report found that many farmworkers experienced overcrowded housing, lived without adequate bathroom or kitchen facilities, and paid more than a third of their income for housing (County of Ventura, 2020). Previous research has found that lack of housing and the overcrowding found in temporary housing for the homeless also contribute to morbidity from respiratory infections and activation of tuberculosis. Overcrowding and inadequate ventilation also increase interior moisture. Damp houses provide a nurturing environment for mites, roaches, respiratory viruses, and molds, all of which play a role in respiratory disease pathogenesis (Krieger & Higgins, 2002). There are public health implications of asthma, and it can be concluded that housing conditions can have direct effects on respiratory health.

Asthma

Asthma creates difficulties in breathing for millions of people across the world (WHO, 2017). Asthma affects about 7.5% of adults in the United States, resulting in 1.8 million hospitalizations and 10.5 million physician office visits per year (McCracken et al., 2017). According to the American College of Allergy, Asthma & Immunology, there are various types

of asthma which includes adult-onset, seasonal, allergic, non-allergic, exercise-induced, and nocturnal. Occupational asthma is another type of asthma that can be directly related to an individual working environment. Some causes of occupational asthma that might be in an individual working environment include chemicals, enzymes, metals, animal substances, and plant substances (American College of Allergy, Asthma & Immunology, 2014).

In recent decades, both asthma prevalence and incidence have been increasing worldwide, not only due to the genetic background, but mainly because of the effect of a wide number of environmental and lifestyle risk factors (Nunes et al., 2017). Deaths due to asthma are rare and are thought to be largely preventable; however, in 2018, the CDC reported 3,441 deaths (CDC, 2020b). Despite major advances in the treatment of asthma and the development of several asthma guidelines over the past decades, people still die of asthma (D'Amato et al., 2016). Therefore, preventing asthma symptoms whenever possible is vital because it can help people seek suitable medical care.

More than 80% of people with asthma also suffer from allergic rhinitis or sinusitis (Egan & Bunyavanich, 2015). Knowing the risk of allergens has the potential to reduce having asthma-related issues. Bedroom allergen exposures contribute to allergic disease morbidity because people spend considerable time in bedrooms, where they come into close contact with allergen reservoirs (Salo et al., 2018). Physical housing characteristics may affect exposure to triggers independent of socioeconomic status (SES; Long, 2018). Some indoor pollutants (e.g., mold, cigarette smoke) are known asthma triggers. House dust mite (HDM) allergens are ubiquitous pyroglyphidae that live in human dwellings. The mite's gut contains potent digestive enzymes, notably proteases that persist in the feces, and these are thought to induce allergic sensitization

and asthma (Gautier & Charpin, 2017). Removing as many asthma triggers as possible from the home is important in controlling asthma.

Asthma and Housing

Housing problems have been associated with a wide array of health complications, including lead exposure and toxic effects, asthma, and depression (Sandel & Desmond, 2017). In a recent study by Mehta et al., (2018), the authors examined whether subsidized housing, specifically public housing, and rental assistance, is associated with asthma in adult population. They analyzed a pooled cross-sectional sample of 9554 adults taking part in three Boston Behavioral Risk Factor Surveillance System surveys from 2010 to 2015. The authors concluded that public housing and rental assistance were strongly associated with asthma in this large cross-sectional sample of adult Boston residents (Mehta et al., 2018). Moreover, the lack of stable housing compromises the ability of clinicians to treat low-income patients with medical complexity, not only because eviction and residential insecurity thwart treatments and continuous care but also because families are often forced to choose between medication costs or rent (Sandel & Desmond, 2017).

A person's home is supposed to be a safe haven and a comforting oasis, but changes around the home can place families at risk for other health issues such as shortness of breath, and throat irritation. The home is an important exposure site for various indoor allergens, and it is a major predictor of health. Evidence has shown a strong relationship between housing quality and health outcomes (Pacheco et al., 2014). The study by Pacheco et al., (2014) explored the relationship of race and housing condition among low-income families, by examining the domiciles of non-Latino White, Black, and Latino households enrolled in the Kansas City Safe and Healthy Homes Program (KCSHHP). They hypothesized that Black and Latino households

experienced more home maintenance concerns in the home and that children in those households have more asthma-related issues when compared with non-Latino Whites enrolled in the study. The study concluded that Latino and Black homes had significantly more areas of concern (Pacheco et al., 2014).

Asthma and Migrant Farmworkers

Hired farmworkers are a vulnerable population with routine occupational respiratory health exposures such as abnormal breathing pattern due to increased exposure to pesticides (Mirabelli et al., 2011). Arroyo et al., (2018) conducted a study from 2003 to 2014 which sought to determine the asthma prevalence among United States farmworkers and to investigate the association between demographic/occupational factors and reported lifetime or recent asthma, using data from the National Agricultural Workers Survey (NAWS) (Arroyo et al., 2018). Data was collected through face-to-face interviews and included interviews from 25,021 farmworkers from 2003 to 2014. The study concluded that United States farmworkers report a low asthma prevalence, though occupational pesticide exposure was significantly associated with reported lifetime asthma (Arroyo et al., 2018).

Agricultural workers have been shown to have increased rates of respiratory symptoms and diseases due to respiratory irritants, toxic chemicals, and allergens (Greskevitch et al., 2008). In a study by Saglan et al., (2020) the research sought to determine the prevalence and risk factors of asthma and asthma-like symptoms in seasonal agricultural workers living in fields with toxic chemical exposure. The 2017 cross-sectional study was conducted on seasonal agricultural workers working in the rural area in Turkey. The results showed the current prevalence of asthma attacks in seasonal agricultural workers in one year was 11.2%, the cumulative prevalence of asthma was 15.1%, and the prevalence of cumulative asthma was higher in

seasonal agricultural workers with allergic rhinitis. Additionally, the results concluded that seasonal agricultural workers are exposed to the worst conditions of working groups. Asthma was also identified as an important health problem among seasonal agricultural workers (Saglan et al., 2020). Because migrant farmworkers work outdoors, farmworkers are often exposed to environmental factors such as climate change, and exposure to hazardous substances in the air, water, soil, and food that put them at higher risk for respiratory issues (Castillo et al., 2021).

Asthma is a major public health problem with increasing incidence (Nunes et al., 2017). Migrant farmworkers have a greater probability of developing asthma due to their working environments. Roman et al. (2018), stated that in the United States, approximately 60% of agricultural workers are immigrants who are at risk for noninfectious diseases (asthma, COPD, hypersensitivity pneumonitis, and interstitial fibrosis) and infectious respiratory illnesses (e.g., tuberculosis, which is more easily transmitted in crowded housing or work conditions). Migrant farmworkers remain one of the most vulnerable populations and seeking to recognize and improve their health remains an upmost priority.

Relevant Context

Although migrant farmworkers are considered an at-risk population, they face numerous barriers and issues. This quantitative dissertation study relies on data collected and gathered by the United States Department of Labor (DOL) which included documentation of their health from 2014 to 2016 in the United States. Known barriers in this population include access to healthcare and transportation, and language and cultural factors as they are living in another country. The primary purposes of the NAWS are to monitor the terms and conditions of agricultural employment and describe the demographic characteristics of hired crop workers. Interviews are allocated proportionately to each region/cycle strata based on the amount of farm

labor in that region during that cycle. Spanish is the primary language spoken by migrant farmers; however, data collected from the DOL is in English. Additionally, non-response of potential participants due to language barriers, unavailability, failed communication, privacy concerns, and disinterest may have also affected the quality of the data contained within the secondary dataset (CDC, 2016).

Summary of Literature

Farmworkers are a vulnerable population that face a tremendous social disadvantage. They face deleterious health outcomes as consequence of their employment. This chapter reviewed the scholarly literature that identifies a need for continued research to examine the migrant farmworkers housing and asthma. The theoretical framework guiding this investigation was the SEM. The SEM provided the groundwork to understand the multitude of factors that converge when making decisions about migrant farmworkers. Migrant farmworkers experience substandard housing conditions, overcrowding, and federal regulations that are not always carried out in accordance with the regulations; all of which potentially play a role in adverse health outcomes. Agricultural work is one of the most dangerous occupations in the United States (Brown, 2017), yet migrant farmworkers perform these duties to provide for themselves and their families.

Improving the health, safety, and well-being of migrant farmworkers will require a multi-pronged, socioecological approach as individuals cannot be disconnected from their environment. The term substandard housing has been used to describe home environments that contain inadequate living accommodations and many substandard home environments contain multiple health risks. Migrant farmworkers should have access to healthcare and a decent standard of living for themselves and for their families. Migrant farmworkers are a marginalized

group within the United States. These individuals work in a product and service industry, but as human beings, they have limited rights. Migrant farmworkers face significant health challenges at multiple levels and these challenges must be explored in order to improve their living and working environments. The next chapter will discuss the methodology used for analyzing migrant farmworkers, asthma, and housing.

Chapter 3: Methodology

Introduction to the Chapter

Migrant farmworkers populations are at greater risk from developing respiratory diseases (Roman et al., 2018). Moving to a new country or farm often involves a change in occupational and environmental exposures. Although housing has been a risk factor for asthma in various populations, the topic has been studied from the perspective of occupational and environmental hazards rather than regarding the respiratory health outcomes that result from housing. Exploration of the possible relationship between substandard home environments and increased asthma rates among migrant farmworkers presents an opportunity to address this health disparity from an alternative perspective. In this chapter, the research design, sample population, ethical considerations, and data collection procedures of the study are described. The central purpose of this dissertation study was to examine the relationship between housing and asthma prevalence among migrant farmworkers.

Research Design and Methodology

Data from the National Agricultural Workers Survey Public Access Data secondary dataset was used to identify migrant farmworkers between the years of 2014 and 2016 to investigate housing factors: location, overcrowding, and type of housing that are associated with a lifetime prevalence of asthma among migrant farmworkers. As a result, in this dissertation study, the investigator used a nonexperimental, quantitative research design to ensure statistical accuracy.

This dissertation sought to answer the following questions:

1. Is there a relationship between asthma and migrant farmworker residence (on or off the farm)?

2. Is there an association between the type of housing and asthma among migrant farmworkers?
3. Is overcrowding a significant predictor for asthma among migrant farmworkers?

Study Design

A quantitative research approach with secondary dataset used to address gaps in the housing among migrant farmworkers. The use of secondary data allowed the investigator to conduct research on migrant farmworkers without the necessity to survey this vulnerable population. The quality and accessibility of housing is, however, a particularly appropriate area for public health involvement (Krieger & Higgins, 2002). A quantitative research design was used to produce data that could be analyzed to identify the statistical significance of any relationship that may exist between housing and asthma occurrence in the included sample of migrant farmworkers, that offered generalizations that could be applied to the overall population. In early 2020, the Coronavirus Disease 2019 (COVID-19) impacted the world and was classified as a pandemic with a serious global health threat. Although further regulations placed a strain on the workforce, having safety protections for agricultural and migrant workers during the COVID-19 pandemic is important to the health of this population. Additionally, by conducting secondary data analysis, the investigator limited face-to-face contact with this vulnerable population.

Rationale

A cross-sectional research design was used because there was not a need to determine directional causality; the investigator only sought to determine the significance of the association between housing and asthma in migrant farmworkers. The cross-sectional research design allows for the use of secondary data sources, that contained nationally representative data, while also

ensuring that the identities of the migrant farmworkers were protected. Secondary datasets are widely used in public health research studies. The use of secondary datasets has been useful in cases where the research effort aims to investigate issues that affect vulnerable segments of the population, or in cases where members of the target population may be difficult to reach for primary data collection (Hayward et al., 2015; Novoa et al., 2015).

Threats

This dissertation study is representative of a cross-sectional study design and as such there are several potential threats to its validity. The most significant threat to the external validity of the dissertation study involved non-response of potential participants due to unavailability, failed communication, privacy concerns, and disinterest may have also affected the quality of the data contained within the secondary dataset (CDC, 2016). To address potential bias, survey weights were incorporated within the data analysis. Incorporating the survey weights was essential to correct this bias and produce estimators with suitable statistical properties. The migrant farmworkers health data was collected using face-to-face interviews and data is only collected when the migrant farmworker is present. Another potential external threat is the validity of the variables contained within the United States Department of Labor, National Agricultural Workers Survey (NAWS) dataset.

A threat to the internal validity was the use of self-report measures (Brossart et al. 2002), which may have led to the migrant farmworkers responding in a socially desirable manner, misunderstanding items, and potential recall bias (Althubaiti, 2016). In order to address these concerns, interviews were conducted at the worksite, either before work, after work or during breaks, or at another location that is more convenient (DOL, n.d.). They were provided examples on what types of housing they reside in. Other threats include omitted variables, missing data,

and sample selection. An additional threat to the internal validity is the multi-stage sampling survey that takes into account the seasonal and regional fluctuations in the level of farm employment. This will be addressed by capturing seasonal fluctuations in the agricultural work force, and the fiscal year is divided into three interviewing cycles. The primary purpose of the NAWS was to monitor the terms and conditions of agricultural employment and describe the demographic characteristics of hired crop workers (DOL, n.d.). The data may have introduced reliability issues resulting from the manner in that the data was reported by the migrant farmworker.

Strengths and Weaknesses of Design

There are strengths and weaknesses with this research design examining migrant farmworkers, housing, and asthma. Quantitative research studies strength allows for providing data that is descriptive, for example, allowing an investigator to capture a snapshot of a user population. Another strength of a quantitative study is that when interpreting the data and presenting those findings, it is straightforward and less open to error and subjectivity. Furthermore, repeating the study is possible because of standardized data collection procedures and it will be beneficial to continue with the study over a long period. A weakness of the design is that the research can be subjective and misleading. There may also be gaps between different groups of participants because of their work history. The strength of cross-sectional studies is that they are relatively quick and inexpensive to conduct, and they are the best way to determine the prevalence and can study the associations of multiple exposures and outcomes (Mandal et al., 2021; Wang & Cheng, 2020). The weaknesses of cross-sectional studies include associations identified might be difficult to interpret, and unable to investigate the temporal relation between outcomes and risk factors (Wang & Cheng, 2020). As a correlational study, one of the strengths

is that the relationship between asthma and housing may help predict outcomes. On the other side, the primary weakness of the study is that it can only show if and to what extent a relationship exists between asthma and housing but cannot determine cause and effect. Even if two variables are related to one another, that does not mean we can say for certain how the cause-and-effect relationship works.

Specific Procedures

Due to the study design, a correlational, cross-sectional, secondary data analysis of de-identified, retrospective, archival, quantitative data, there are no associated recruiting procedures or study setting to report. The sample of migrant farmworkers was derived from all the available cases contained within the 2003 to 2016 NAWS dataset that satisfied the inclusion criteria outlined by the parameters of the study. The dataset chosen to investigate the aims of this dissertation study were the United States Department of Labor data collected through the National Agricultural Workers Survey Public Access Data (NAWSPAD) for the 2014-2016 years. Use of this dataset allowed for the examination of asthma occurrence and the housing conditions of the homes that migrant farmworkers reside in. The survey also generated information for various federal agencies that oversee farmworker programs. NAWS findings have been used for occupational injury and health surveillance, estimating the number and characteristics of farmworkers and their dependents, and program planning (DOL, n.d.). Using the Boolean logic defines logical relationships between terms in a search. They connect the search words together to either narrow or broaden the set of results. The Boolean search operators are “and”, “or” and “not”.

Participants

This dissertation study utilized secondary data collected by the United States Department of Labor (DOL) from 2014 to 2016. The most current data collected was in 2016. The DOL uses the National Agricultural Workers Survey (NAWS), which is an employment-based, random-sample survey of United States farmworkers that collects demographic, employment, and health data in face-to-face interviews (DOL, n.d.). To capture regional variation, workers are sampled in six regions. The regions include East, Southeast, Midwest, Southwest, Northwest, and California. California is the only single-state region. Over the years, NAWS has captured data which included information on if migrant farmworkers were told by the doctor or nurse that they have asthma. Refer to Figure 1 as it shows the map of the sampling regions and the states in each region.

Power

G*Power 3.1.9.2 software was used to calculate the sample size for each of the research questions to be investigated in this dissertation study. The first research question examined whether there was a relationship between asthma and migrant farmworkers residence (residing on or off the farm). The second research question examined whether there was a significant association between type of housing and asthma among migrant farmworkers. The third research question examined if overcrowding housing was a predictor for asthma among the migrant farmworkers. An alpha level of $p < .05$ will be used for the statistical power analyses. Power was assessed for each paired relationship using the logistic regression model using f^2 statistic.

Sample Size

This dissertation study examined migrant farmworkers housing and the presence of asthma in the United States. All migrant farmworkers residing off-farm (property not owned and

owned or administered by present employer) and on-farm (property of the grower the migrant farmworkers currently work for) was included in this sample. The sample size was determined based on the number of eligible participants from the dataset that meet the inclusion and exclusion criteria. The initial study population consisted of 8,165 participants who participated in the NAWS between the years of 2014 to 2016. Of this, 1,210 were migrant farmworkers. Data for all the participants that satisfy the inclusion parameters of this study was used to examine each research question.

Inclusion and Exclusion Criteria

The initial dataset for this analysis includes all migrant farmworkers who completed the NAWS between the years of 2014 and 2016 which was 1,210. This included those migrant farmworkers who occupied housing and were told by the doctor or nurse that they have asthma. Migrant farmworkers who did not complete the survey, or had data missing from the study years, outliers, and incomplete data were excluded from the analysis.

Characteristics

The participants are all respondents to the NAWS dataset who met the inclusion and exclusion criteria. The methodological framework is one that relied primarily on the quantitative dataset and emphasizes participant observation and in-depth interviewing. The study maximized all of these characteristics by examining quantitative analysis to answer the research questions and by using participant observation to its fullest extent.

Recruiting Procedures

Due to the nature of a secondary data analysis of de-identified, retrospective, archival data, there are no associated recruiting procedures associated with the proposed dissertation study. Participants provided responses to questions on demographics, employment, and health.

Resource Requirement

The role of the investigator in quantitative research is to act independently in an unbiased manner. For a correlational, cross-sectional, analysis of de-identified, retrospective, archival, quantitative data, few resources are needed and mainly include the NAWS dataset, and the IBM SPSS Statistics (Version 27) predictive analytical software. A personal laptop computer to calculate the data results was required. The investigator was able to obtain an electronic file of the dataset and a codebook at no charge. SPSS and a personal laptop were previously purchased; hence, there is no added cost.

Reliability and Validity

The main goal of this dissertation study was to evaluate asthma and the type of housing migrant farmworkers reside in. To help evaluate the reliability and validity of the study, it is vital that it is replicable. The NAWS collects data from employed workers on their demographics, employment and earnings, and health and social services used, but collects data from employers. The NAWS is capable of collecting data from a large number of respondents and numerous questions are asked about a participant, giving extensive flexibility in data analysis. Additionally, the farmworkers were randomly sampled at their farm job sites. Randomly selected workers were interviewed at the worksite, either before work, after work or during breaks. By interviewing the migrant farmworkers in this manner, it can reduce or prevent geographical dependence among the migrant farmworkers.

Regarding validity, measurements are needed to be accurate and determining if they are actually measuring what they are intended to measure. The NAWS was validated by the DOL when it was entered into their database. Regional and national estimates were provided from the NAWS with sufficient validity and accuracy (DOL, n.d.). The NAWS provided high quality data

on farmworkers eligible families. Additionally, to ensure the reliability and validity of the questionnaire for this dissertation study, questions related to demographics, employment, and health were used. Variable correlations were examined to determine the extent of the different instruments (Microsoft Excel and SPSS) that measured the same variable.

Ethical Considerations and Review

The investigator successfully met the Nova Southeastern University (NSU) requirement for the Collaborative IRB Training Initiative Program for Human Subjects Research Course. Reasons for concern about migrant farmworker housing are both ethical and practical. Ethically, adequate housing is globally regarded as a basic human need (Amoah, 2019). To be compliant in maintaining the highest ethics for the use of human subject records, the investigator will create a Research Qualified Form in the NSU IRB Manager and submit it for a College Level IRB Review. Once the investigator received IRB approval to proceed with the dissertation study, the investigator study was monitored by the NSU IRB committee and remained committed to addressing any ethical concern.

To diminish the potential ethical concerns that could have arisen when collecting data from migrant farmworkers, secondary data collected by the National Agricultural Workers Survey (NAWS) was used. To ensure the privacy of NAWS participants, all possible sources of identification were removed from the data contained within NAWS dataset. As an additional precautionary measure, statistical totals that may have allowed for a specific location to be identified that could reveal the identities of survey participants were withheld from all datasets. Survey participants were also given a detailed explanation of the anticipated use of the data collected, and the steps taken to protect each participant's privacy (DOL, n.d). The data contained within the dataset contained no information that could be matched in a manner that

revealed the identity of participants. Additionally, the investigator completed the CITI training on research ethics and has a current CITI training certificate on file.

Funding

The dissertation study was an unfunded study.

Study Setting

The dissertation study was a secondary data analysis of de-identified, retrospective, archival, quantitative data, and therefore does not have a study setting.

Instruments and Measures

The NAWS gathers information on medical history, use of health services, safety training, and the location and type of housing, including whether the respondent rents from the employer or a non-employer, owns the home, etc. Data is collected throughout the year, over three cycles, to reflect the seasonality of agricultural production and employment. The NAWS differs from other federal worker surveys in that workers are interviewed at their workplaces rather than at home; only currently employed persons are sampled; and data is collected directly from farmworkers. The names and addresses of employers and respondents are not included in the files.

The raw data and codebook were provided to the investigator by downloading from the NAWS website (see Appendix B and C). The participants were coded as Migrant. The outcome variable used in the dissertation study was Asthma prevalence or NH01. The predictor variables for this dissertation study are (a) Living on-farm or off-farm or D35, (b) Living quarters or D34A, and (c) Overcrowding or CROWDED1. The covariates or predictor variables included (a) Gender or GENDER, (b) Age or RESPONDENT AGE, (c) Married or MARRIED STATUS, (d)

Health Insurance or A21A, (e) Injured at work or D22, (f) Workers Compensation or D23, and (g) Injured off the job or D24.

Data Collection Procedures

The data collection involved reviewing secondary data from 2014 to 2016 from the DOL NAWS in Microsoft Excel. The NAWS is unique for its broad coverage of the characteristics of hired farmworkers and their dependents. Farmworker interviews were completed by trained staff members who were fluent Spanish speakers. Interviews assessed health data, demographic information, and housing features. Farmworkers who completed the interviews helped with an assessment of their living quarters.

For nearly three decades, the United States Department of Labor has conducted the National Agricultural Workers Survey (NAWS) to collect information from migratory and seasonal agricultural workers (crop workers) in the United States and has been one of the most accurate sources for obtaining demographic information on this group. The NAWS is an employment-based, randomized survey of the demographic, employment, and health characteristics of the United States crop labor force (DOL, n.d.). The information is obtained directly from agricultural workers through face-to-face interviews. The NAWS is performed under contract to the United States Department of Labor, and its information is made available to the public through periodic research reports and a public use dataset. Each year, between 1,500 and 3,000 workers are interviewed.

Data Analyses

Data collected from the NAWS were used to investigate the housing characteristics and the asthma prevalence in migrant farmworkers from 2014 through 2016. Descriptive statistics calculated and used to describe the participants and their social factors by the different housing

characteristics. Continuous data was expressed by means and standard deviations. Categorical variables were expressed as counts and percentages and chi-square test determined if there were any associations between asthma and living conditions experienced by the migrant farmworkers, and a non-significant Hosmer and Lemeshow test was used to check the goodness of fit of each model.

Logistic regression analyses were used to estimate odds ratios (OR) and significant predictors of asthma prevalence among migrant farmworkers at the 95% confidence intervals (95% CI). The purpose of using this statistical technique was to calculate the probability of a binary event occurring and predict the likelihood of all kinds of “yes” or “no” outcomes (Thanda, 2021). Predictor variables included in this dissertation study were age, gender, marital status, and health insurance status. The variables that described housing included location, type of housing or living quarters and overcrowding.

Several regressions were developed to assess the effects of the housing and individual variables associated with the prevalence of asthma. Logistic regression was used to assess the health outcome (lifetime diagnosis of asthma), because it is a binary; in addition, four separate models were fitted: controlling for age, gender, marital status, health insurance status, etc. Specific logistic regression models were used to assess variation in the prevalence of asthma for migrant farmworkers with similar living quarters, housing location, and overcrowding status, and what to assess what factors contribute to such differences (if any). Both the standardized beta coefficient and the significance of each independent variable were found from the coefficient table, and a *p*-value of less than .05 was used to determine the significance of each predictor. For the regression models, the chi-square was used to assess the overall significance of the model, and a non-significant Hosmer and Lemeshow test was used to check the goodness of fit of each

model. In addition, the adjusted R^2 was used to determine the proportion of variance that was explained by the independent variables. The data were analyzed using IBM SPSS Statistics (Version 27) predictive analytics software.

Format for Presenting Results

The results are formatted in a written report along with data tables. All tables will supply references for each variable range and coding for ease of interpretation, as well as the p values to demonstrate statistical significance. A descriptive analysis was provided for participants to include whether migrant farmworker reside on or off-farm, housing type, and overcrowding.

Summary of the Chapter

In this chapter, the investigator provided an outline of the methodology used to conduct this dissertation study. This quantitative research study examined the presence of asthma based on the housing characteristics of migrant farmworkers. This chapter described with the research design and methodology used in investigating the housing of migrant farmworkers as it correlates of asthma. This chapter also included a description of the study population, sample size, sampling method and rationale, thorough explanation of data gathering procedure, instrumentation, and analysis procedure. The selected research design and methodology selected allowed for each of the research questions of interest to be examined in a manner which protected the anonymity of the migrant farmworkers of interest. The author submitted a College Level Review IRB proposal to request approval to proceed with the proposed dissertation study, to ensure the protection of human subjects' rights, and adherence to scientific principles in accordance with Nova Southeastern University's policies.

Chapter 4: Results

Introduction to the Chapter

This chapter summarizes the study results based on the methodologies discussed in the previous chapter. First descriptive characteristics of the study population were discussed followed by the findings carried out in support of determining the relationship between asthma and farmworker residence (on or off the farm), the association between the type of housing and asthma among migrant farmworkers, and the significance of overcrowding as a predictor for asthma among migrant farmworkers.

Using the IBM SPSS Statistics (Version 27) predictive analytics software, logistic regression modeling was used to investigate the impact of migrant farmworkers and their housing conditions. This chapter outlined the process of data collection and analysis, explained the results determined by the statistical analyses performed, and summarized of the findings in accordance with the research questions.

Descriptive Statistics

Several variables reflected the demographics of the participants. They were age, race, ethnicity, demographic, marital status, health insurance status, and housing characteristics i.e., housing location, overcrowding, and type of housing status (see Table 6). The asthma prevalence among the study population is 3.53%. A total of 1,210 migrant farmworkers were included within this analysis. There were more male respondents than females (77.18% and 22.82%, respectively). Overall, 70% of the migrant farmworkers identified their ethnicity as Mexican, 11% Mexican American, and 5% not Hispanic or Latino. The results showed that ethnicity was more likely to be a significant predictor of asthma, especially Mexican or Mexican American descents ($p < .0001$). The average age of respondents was 37.2 years (ranging from 16-80 years

of age). Most farmworkers report having no health insurance or uninsured (68.34%). The results showed that having health insurance and diagnosis with asthma from a doctor or nurse is a significant predictor of asthma ($p < .0001$). Respondents were in six regions: East (14.5%), Southeast (12%), Northwest (13.6%), Northeast (9.5%), Southwest (15%), and California (35%). The results indicated that region is a significant predictor of asthma ($p < .0001$). The average number of years worked for the current employer was 4.8 years, ranging from 1-49 years. Most of the respondents report that if they got injured or sick OFF THE JOB, the employers would not pay for health care or provide health insurance (70.3%), whereas 68% reported if they got injured or sick AT WORK the employers would pay for health care or provide health insurance.

The housing variables were used to collect information about housing locations, type of housing and overcrowding. Most of the respondents resided on the farm (76%), while others reported residing off the farm (24%). These results showed that majority of the migrant farmworkers reported residing in Single Family Home (54.91%), Mobile Home (21.57%), Duplex/Triplex/Apartment (18.84%), Dormitory/Barracks/Campsites/Tents/Hotel or Motel 4.68%. The results also demonstrated that 45% of the participants reported housing as overcrowded and 55% reported housing as not being overcrowded (see Table 6).

Table 6

Descriptive Characteristics of Study Population by Asthma Prevalence, NAWS 2014-2016

	Total Sample (%)	Asthma Diagnosis (%)**	No Asthma Diagnosis (%)**	<i>p</i> -value*
INDIVIDUAL-LEVEL VARIABLES				
Age, years	37.2 (Average)			0.1214
16-35	55.29	70.16	54.74	
36-55	30.92	19.74	31.33	

56+	13.79	10.10	13.92	
Race (if you choose)				0.0820
White	14.11	16.92	14.01	
Black, African\American	0.91	1.90	0.87	
American Indian, Alaska Native	0.68	3.63	0.57	
Asian	0.25	1.06	0.22	
Other	84.04	76.49	84.32	
Ethnicity (if you choose)				<.0001
Mexican\American	11.09	20.04	10.78	
Mexican	70.50	37.03	71.69	
Chicano	0.65	0	0.68	
Other Hispanic	9.81	2.3	10.08	
Puerto Rican	3.25	28.21	2.36	
Not Hispanic or Latino	4.69	12.42	4.41	
Gender				0.3405
Male	77.18	71.33	77.39	
Female	22.82	28.67	22.61	
Marital Status				0.1558
Not Married	47.02	57.39	46.64	
Married	52.98	42.61	53.36	
Health Insurance				<.0001
Insured	30.87	66.43	29.57	
Uninsured	68.34	33.57	69.81	
Don't Know	0.79		0.81	
Region		46.6	53.4	<.0001
East	14.49	33.32	13.80	
Southeast	12.04	9.32	12.14	
Midwest	13.64	0.55	14.12	
Southwest	9.51	6.44	9.63	
Northwest	15.00	35.61	14.24	
California	35.33	14.76	36.08	
HOUSING VARIABLES				
Housing Location				0.0199
On the Farm	76.22	61.72	76.75	
Off the Farm	23.78	38.28	23.25	
Housing Type				<.0001
Mobile Home	21.57	26.25	21.40	
Single Family Home	54.91	28.99	55.86	
Duplex/Triplex/Apartment	18.84	26.15	18.57	
Dorm/Barrack/Campsite/ Tent, Hotel or Motel	4.68	18.62	4.17	
Overcrowding				0.5582
Yes	44.97	40.71	45.13	
No	55.03	59.29	54.87	

Note. Table reproduced from IBM SPSS Statistics software, Version 27.0 output.

*Chi-square test for associations between Asthma prevalence.

**The denominator for each weighted percentage is the number of migrant farmworkers sampled.

Research Outcome

Research Question #1:

Is there a relationship between asthma and migrant farmworker residence (on or off the farm)?

It was hypothesized that there were differences in asthma prevalence among migrant farmworkers residing on the farm compared to those living off the farm. Logistic regression was used to address Research Question #1 and was performed on the variables, NH01 and D35 to determine if residing on or off the farm is a significant predictor of asthma. Overall, respondents living on the farm had higher odds of having asthma (OR = 2.05; 95% CI = 1.1-3.7) than those living off the farm. The results showed that residence of farmworkers is a significant predictor of asthma ($p = 0.0224$) (see Table 7); however, after assessing additional individual factors, housing location (or on off the farm) was no longer a significant predictor of asthma ($p = 0.6934$) (see Table 9) and therefore failed to reject the H_0 .

Research Question #2:

Is there an association between the type of housing and asthma among migrant farmworkers?

It was hypothesized that there is an association between the type of housing and asthma among migrant farmworkers. Logistic regression was used to address Research Question #2 and was performed on the variables, NH01 and D34A to determine if type of housing is a significant predictor of asthma. Respondents living in single family homes had lower odds of having asthma (OR = 0.42; 95% CI = 0.19-0.94) than those living in mobile homes. Additionally, those living in

dorms/barracks/campsites, or tents had higher odds of having asthma (OR = 3.64; 95% CI = 1.43-9.26) compared to those living in mobile homes. The results showed that single family home ($p = 0.0350$) and dorms/barracks/campsite/tents/hotel or motels ($p = 0.0067$) was a significant predictor of asthma. The results showed that duplex/triplex/apartment was not a significant predictor of asthma ($p = 0.7438$); therefore, living in a duplex/triplex/apartment did not influence the odds of having asthma. Because of the differences found in housing types and asthma, the H_0 was rejected (see Table 7).

Research Question #3:

Is overcrowding a significant predictor for asthma among migrant farmworkers?

It was hypothesized that there was an association between overcrowding and asthma.

Logistic regression was used to address Research Question #3 and was performed on the variables, NH01 and CROWDED1 to determine if overcrowding contributed to asthma prevalence among migrant farmworkers. Respondents living in overcrowded housing had slightly lower odds of having asthma (OR = 0.84; 95% CI = 0.46-1.53) than those not living in overcrowded housing, but the differences are not statistically different ($p = 0.5587$). Even after adding additional covariates, overcrowding was not found to be a significant predictor for asthma. Because there were no differences found in overcrowding and asthma, I failed to reject the H_0 (see Table 7).

Table 7

Binary Logistic Regression Results for Asthma and Housing Types, NAWS 2014-2016

<i>Logistic Regression Results for Asthma and Housing Types</i>								
	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
On Farm	0.7169	0.3139	5.2147	1	0.0224	2.048	1.107	3.789

Overcrowding	-0.1805	0.3087	0.3419	1	0.5587	0.835	0.456	1.529
Housing Types								
Single Family Home	-0.8605	0.4080	4.4475	1	0.0350	0.423	0.190	0.941
Duplex/Triplex/ Apartment	0.1378	0.4216	0.1068	1	0.7438	1.148	0.502	2.622
Dorm/Barrack/ Campsite/Tent/ Hotel or Motel	1.2921	0.4767	7.3461	1	0.0067	3.640	1.430	9.266

Note. Table reproduced from IBM SPSS Statistics software, Version 27.0 output.

Model 1 (Housing Location): R-Square 0.0954; Max-rescaled R-Square 0.3495; -2 Log L 259.254

Model 2 (Housing Types): R-Square 0.0164; Max-rescaled R-Square 0.0591; -2 Log L 369.339

Model 3 (Overcrowding): R-Square 0.0003; Max-rescaled R-Square 0.0010; -2 Log L 389.294

***The denominator for each weighted percentage is the number of migrant farmworkers sampled.*

A chi-square test was conducted to determine if there were any associations or any relationships on categorical variables between asthma and living conditions experienced by the migrant farmworkers (see Table 6). Additionally, a non-significant Hosmer and Lemeshow test was used to check the goodness of fit of each model that determined whether the model adequately describes the data. Based on the analyses, the Hosmer and Lemeshow test appeared to be a good fit for the model for housing location and housing type. Overcrowding indicated a poor fit for the model (see Table 8).

Table 8

Hosmer and Lemeshow Goodness-of-Fit Test for Asthma and Housing Types, NAWS 2014-2016

Hosmer and Lemeshow Goodness-of-Fit Test	
	Chi-Square
Housing Location	4.8905
Housing Type	20.9399
Overcrowding	1.5874

Note. Table reproduced from IBM SPSS Statistics software, Version 27.0 output.

An additional logistic regression model was used to analyze asthma, housing types, and covariates among migrant farmworkers to determine if the covariates in the analysis increases precision and power and does not bias the estimates of the effect. The results indicated that migrant farmworkers residing in single family homes housing was significant ($p = 0.0496$). In determining health insurance effects, health insurance, injured at work, injured off the job, and workers compensation was analyzed. The results indicated that migrant farmworkers who have health insurance was significant ($p < .0001$) compared to those who did not know they had health insurance. Migrant farmworkers who were injured at work (don't know) were found to be significant ($p = 0.0102$) compared to those who were injured at work or got sick as a result of work and were aware that their employer provided health insurance or provided pay for their health care. Migrant farmworkers who were injured at work or got sick and did not know they receive workers compensation were found to be significant ($p = 0.006$) compared to those who were injured at work or got sick and receive workers compensation (see Table 9).

Table 9

Full Logistic Regression Results for Asthma, Housing Types, and Covariates, NAWS 2014-2016

<i>Logistic Regression Results for Asthma, Housing Types, and Covariates</i>								
	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Housing Characteristics								
On Farm	0.1872	0.475	0.1554	1	0.6934	1.206	0.475	3.059
Overcrowding	0.0853	0.4104	0.0432	1	0.8354	1.089	0.487	2.434
Single Family Home	-0.9573	0.4876	3.8542	1	0.0496	0.384	0.148	0.998

Duplex/Triplex/ Apartment	-0.9997	0.6315	2.5058	1	0.1134	0.368	0.107	1.269
Dorm/Barrack/ Campsite/Tent/ Hotel or Motel	0.4138	0.6617	0.391	1	0.5317	1.513	0.414	5.532
Demographics								
Gender	0.5069	0.4258	1.4171	1	0.2339	1.66	0.721	3.825
Married	-0.1285	0.4083	0.099	1	0.753	0.879	0.395	1.958
Age Group (36-55)	-0.6627	0.4626	2.0521	1	0.152	0.515	0.208	1.276
Age Group (56+)	-0.7804	0.6246	1.561	1	0.2115	0.458	0.135	1.559
Health Insurance								
Injured AT WORK (Yes)	-0.2624	0.8448	0.0965	1	0.7561	0.769	0.147	4.028
Injured AT WORK (Don't Know)	2.5634	0.9981	6.5963	1	0.0102	12.979	1.835	91.792
Workers Compensation (Yes)	0.4876	0.5798	0.7071	1	0.4004	1.628	0.523	5.073
Workers Compensation (Don't Know)	-2.2585	0.8222	7.5445	1	0.006	0.105	0.021	0.524
Injured OFF THE JOB (Yes)	-1.0268	0.6747	2.316	1	0.1281	0.358	0.095	1.344
Injured OFF THE JOB (Don't Know)	-2.5895	1.2991	3.9733	1	0.0462	0.075	0.006	0.958
Health Insurance (Yes)	1.6925	0.4168	16.4915		<.0001	5.433	2.4	12.298
Health Insurance (Don't Know)	-11.6852	1015.7	0.0001	1	0.9908	<0.001	<0.001	>999.999
Region								
East	0.9201	0.6177	1.0488	1	0.1363	2.51	0.748	8.421
Southeast	0.7033	0.7191	0.1066	1	0.3281	2.02	0.494	8.271
Midwest	-3.3759	2.1377	3.8511	1	0.1143	0.034	<0.001	2.257
Southwest	0.4126	0.7936	0.0562	1	0.6032	1.511	0.319	7.157
Northwest	1.5158	0.5386	7.3809	1	0.0049	4.553	1.584	13.084

Note. Table reproduced from IBM SPSS Statistics software, Version 27.0 output.

Model 4 (Full Model): R-Square 0.1018; Max-rescaled R-Square 0.3626; -2 Log L 261.770

***The denominator for each weighted percentage is the number of migrant farmworkers sampled*

Summary of the Chapter

This chapter presented an overview of the demographics, number of participants, housing, marital status, health insurance status, and region in which migrant farmworkers are employed and reside in. Descriptive statistics inclusive of frequency and the percentage distributions of the independent variables were analyzed. Chi-square test for associations between asthma prevalence was analyzed. Asthma was found to be statistically significant ($p < .0001$) between the covariates (a) ethnicity, (b) health insurance, and (c) region among migrant farmworkers. The use of logistic regression was appropriate in helping to determine factors that contribute to asthma prevalence among migrant farmworkers. An exploratory logistic regression analysis was used to determine there was a relationship between migrant farmworkers residence (on or off the farm) and asthma ($p = 0.0224$). Additionally, the logistic regression analysis determined there was a relationship between migrant farmworkers residing in single family homes ($p = 0.0350$) and dorms/barracks/campsite/tents/hotel or motels ($p = 0.0067$) and asthma. Overcrowding housing indicated that there were no statistically significant correlations ($p = 0.5587$) among migrant farmworkers, signifying that the estimates of the regression coefficients were reliable and stable. Chapter 5 offers an interpretation of the study findings, implications, limitations of the study, recommendations, and investigator's experience.

Chapter 5: Discussion

Introduction to the Chapter

This chapter describes the significance of the findings as it relates to the research questions and current literature. Additionally, this chapter includes implications, study limitations, recommendations for future research, and the investigator's experience. The purpose of this dissertation study was to examine the relationship between asthma and housing among migrant farmworkers. I also sought to determine whether housing types — such as residing on or off the farm, types of housing, and overcrowding — were significantly related to asthma diagnosis among migrant farmworkers. The National Agricultural Workers Survey (NAWS) dataset obtained from the United States Department of Labor (DOL) was used to as a source for the analysis. The housing types and asthma diagnosis comprised of data collected between the years of 2014 to 2016.

Integration of the Findings with Previous Literature

There are different types of housing that farmworkers reside in with the most common types being government housing, grower-owned, private housing, and the housing types vary widely based on geographic location and immigration status (National Farm Worker Ministry, 2017). Additionally, housing can vary based on the state, rural areas, and affordability. Some migrant workers rent short-term housing on the private market, but more often they live in group quarters or individual homes, or trailers provided and regulated by their employer (Quandt et al., 2013). Farmworker housing may also be categorized as on-farm or off-farm housing. The housing provided to migrant farmworkers may create added health and safety risks (Arcury et al., 2012b). The housing available to most farmworkers is substandard and unacceptable in 21st-

century America and many of these federal and state regulations no longer reflect current employment and housing trends, and enforcement success varies greatly (Joyner et al., 2015).

In the dissertation study, a logistic regression was performed in response to the first research question, “Is there a relationship between asthma and migrant farmworker residence (on or off the farm)?” The initial results indicated that the location in which migrant farmworkers reside in was a significant predictor of asthma; however, after assessing additional individual factors, housing location was no longer a significant predictor of asthma. At this time, study findings contradict each other and not all researchers are convinced that housing is not a significant predictor of asthma (Jie et al., 2011; Lee et al., 2018; Farabi et al., 2019) as further research is needed and there are other factors (e.g., genetics, smoking, income level, and environmental) that play a role; however, literature from Arcury and Quandt (2011) supports that housing is a significant predictor of asthma. Arcury and Quandt (2011) stated that respiratory conditions are common in the regions where farmworkers are employed and housing available to farmworkers is a hazard that farmworkers experience, whether in migrant farmworker camps controlled by farmers or contractors or in rural communities. In addition, Vallejos et al., (2011) stated that migrant farmworkers are a group whose housing quality in the United States is directly linked to employment, sometimes as a part of their compensation. Farmworkers will remain in the same housing, though they may travel to different employers over a wide geographical area. Therefore, migrant farmworkers work and live-in close proximity to one another and they congregate living in the housing that is provided by their employer. There are health risks to the health of the farmworkers and their family members such as spouses and children. The results also show that living quarters provided by an employer in connection with agricultural work, whether residing on or off the farm, is a significant predictor of asthma.

Furthermore, the results of the first research question are similar to the results of a study by Kearney et al., 2014, in which the researchers evaluated the association between indoor environmental risk factors and respiratory health among migrant farmworker occupants living in employer-provided housing. A cross-sectional sample of adult, Latino, male farm laborers were administered a questionnaire to identify the prevalence of major respiratory symptoms. Findings from their study provided evidence that indoor environmental risk factors may be contributory factors for respiratory health problems among migrant farmworkers as this dissertation study examined living in employer-provided housing or housing provided by their present employer. Although little is known about the relationship between migrant farmworkers residence (on or off the farm) and asthma, this dissertation study demonstrated that there is a plausible relationship between asthma amongst migrant farmworkers and where they live. Individual factors such as substandard housing, inadequate housing, and environmental factors, such as poor air quality play a role in asthma and housing (Harris et al., 2019).

The second research question was designed to investigate whether there was a significant association between type of housing and asthma among migrant farmworkers. Based on the logistic regression, the second research question, “Is there an association between the type of housing and asthma among migrant farmworkers?” was analyzed. The independent variable was the type of housing or living quarters which included Mobile Home, Single Family Home, Duplex/Triplex/Apartment, and Dormitory/Barracks/Campsite/Tent, and Motel. Based on the initial statistical results of the logistical regression, there were significant relationships between asthma and the type of migrant farmworkers living quarters. Preliminary findings show that those residing in single family homes were less likely to have an asthma diagnosis compared to those residing in mobile homes; even after assessing additional individual factors, migrant

farmworkers residing in single family homes continued to be less likely to have an asthma diagnosis. Therefore, the results indicated that the type of housing has an impact on a migrant farmworkers respiratory health. This is important because it has been found that farmworkers in migrant housing may face asthma and worsening asthma symptoms (Rosenbaum & Shin, 2005; Cheatham & Marechal, 2018). Additionally, existing conditions like asthma and allergies can be made worse (CDC, 2015b). The dissertation study results were consistent with previous literature that demonstrated that the type of housing impacts asthma (Arroyo et al., 2018; Arcury et al., 2012).

Migrant farmworkers work life and home life often intertwine. In the Kearney et al., 2014 study, migrant farmworkers resided in various types of camps that included barracks, houses, trailers, apartments, mobile homes, communal residences, or a cluster of residences. The results of their study demonstrated 42% of farmworkers reported currently living in barracks; almost half (48.3%) resided in their dwelling 12 or more weeks out of the year. Furthermore, 26% had the presence of mold in the sleeping room, and 9% of those who had mold in the sleeping room had asthma; findings from this study signifies indicative evidence that indoor environmental risk factors may be contributory factors for respiratory health problems among this vulnerable population. Handal et al., 2020, stated that chronic diseases such as obesity, diabetes, asthma, and cardiovascular problems are often linked one's working and living conditions. Results from this dissertation study revealed that migrant farmworkers living in dorms/barracks/campsites, or tents had higher odds of having asthma compared to those living in mobile homes which further supports this study that migrant farmworkers residing in barracks are more susceptible to asthma. Though further research is needed to address the risk of asthma in this vulnerable population, this

dissertation study provided further evidence that the type of housing in which migrant farmworkers live is associated with increased risk of asthma.

Research by Early et al. (2006) examined housing characteristics of farmworker families. Their research analysis used data from four surveys of North Carolina farmworker communities conducted in 2001 and 2003 to document aspects of housing quality that could affect farmworker family health. The three housing domains consisted of: dwelling characteristics, household characteristics, and household behaviors. There were similarities in the relevant housing characteristics as their study found that most farmworker families lived in mobile homes which was consistent to this dissertation study that migrant farmworkers also reported residing in mobile homes. Their findings also suggested that the health of farmworker families was at risk due to inadequate housing and further research on housing-related health effects among farmworker families is needed.

As with all large-scale employment involving many people and vast infrastructure, agriculture or farming business depends on migrant labor and the arrangement for farmworker housing; often, the housing facilities are characterized by overcrowding and poor ventilation (Schenker et al., 1998). Overcrowded housing is often referred to as undesirable (United States Census Bureau, 2014). Previous research has shown that migrant farmworkers are more likely to live in overcrowded housing and face health risks from poor sanitation (Camarota & Zeigler, 2020). To address the third research question, “Is overcrowding a significant predictor for asthma among migrant farmworkers?”, a logistic regression analysis was performed. This research question explored the relationship between asthma and overcrowded housing. The research sought to determine the odds of having an asthma diagnosis among the migrant farmworkers who resided in overcrowded living quarters. The results indicated that migrant

farmworkers who resided in an overcrowded home did not have a statistically significant increase in risk of asthma. This contrasted with several studies that found migrant farmworkers are faced with many health issues such as asthma overcrowding housing (Lee et al., 2020; Caxaj & Cohen, 2019; Hendrix, 2021). The results of the third research question also resulted in the inability of the investigator to draw a relationship between asthma and overcrowded housing which has been shown in the literature to place individuals at an increased risk for asthma symptoms such as respiratory infections (Linaker & Smedley, 2002; Krieger, 2010; WHO, 2018).

The majority of Florida's farmworkers are originally from countries in South and Central America, and most of these hired farmworkers are Mexican — a group that has shaped the United States agricultural system (United States Department of Housing and Urban Development, n.d.; Hazlett-Norman, 2019). The results of this dissertation study indicated that there is a relationship between ethnicity, especially Mexican or Mexican American descents, and asthma among migrant farmworkers. Stoecklin-Marois et al. (2015), evaluated associations of agricultural work and migration on self-reported respiratory symptoms among 702 farmworkers in California through interviews in a community-based cohort. The researchers found that there was an association between respiratory health and Latino or Latin American farmworkers. The individual level statistical analysis in the dissertation study was consistent with the literature which stated that migrant farmworkers are more likely to be of Mexican origin and are less likely to be from other origins.

Migrant workers often experience limited access to healthcare (McCoy et al., 2016). Further, farmworkers rarely have coverage through their employers or public programs, and they do not earn enough money to pay for health insurance (MHP Salud, 2014). Research by Hoerster

et al., 2011, stated that farmworkers face numerous barriers to healthcare: lack of insurance and knowledge of how to use or obtain it, cost, lack of transportation, not knowing how to access care, few services in the area or limited hours, difficulty leaving work, lack of time, language differences, fear of the medical system, losing employment, and immigration officials. The results of the individual level statistical analysis indicated a significant relationship between migrant farmworkers and health insurance (insured, uninsured, and don't know); however, the results also indicated that migrant farmworkers reported having no health insurance. Therefore, the results imply that migrant farmworkers may be disproportionately affected by asthma, but migrant farmworkers access healthcare cautiously (if they have it) (McCoy et al., 2016; Davis, 2001). Educating migrant farmworkers about healthcare is important as it has a chance to reduce damaging health effects. Although this finding is an important finding, more research on farmworker healthcare use is needed that would include why respondents who reported if they got injured or sick OFF THE JOB, the employers would not pay for healthcare or provide health insurance. This could be due to migrant farmworkers not being aware that health insurance covers injuries or illnesses that happen off the job (NC Farmworker Health Program, 2021). Enhanced efforts to educate farmworkers about services is needed as well.

In order for the National Agricultural Workers Survey (NAWS) to capture regional variation, migrant farmworkers were sampled from various regions throughout the United States (DOL, n.d.). These regions included East, Southeast, Midwest, Southwest, Northwest, and California (only single-state region). The results of the individual level statistical analysis indicated a significant relationship between migrant farmworkers and the regions in which the migrant farmworkers employ and reside. This implies that migrant farmworkers are more likely to be diagnosed with asthma in the region which they employ and reside. The results also

indicated that California had the highest number of farmworkers but less asthma diagnosis. This could be due to California being a global leader in the agricultural sector (Pathak et al., 2018) which is consistent with the literature that California is an agricultural state. Research from Martin et al., (2017) stated that California has led the nation in farm sales since 1950, when Los Angeles County had more farm sales than any other county in the United States, largely because of specialization in the production of high-value fruit, nut and vegetable crops.

Likewise, the East and Southwest region had the lowest number of farmworkers but more asthma diagnosis. This could be due to the larger geographical region or states compared to California. For example, Florida is included in the Southeast region and North Carolina is included in the East region. Florida has between 150,000 and 200,000 migrant and seasonal farmworkers working every year (Florida Department of Health, 2021) and over 150,000 farmworkers and their family members are estimated to reside in North Carolina (NC Department of Health and Human Services, 2021). The results are consistent with the previous literature (Mirabelli et al., 2011; Kearney et al., 2014) that there is an association of respiratory symptoms and indoor housing conditions among migrant farmworkers in eastern North Carolina.

Implications

Research has shown that housing is a significant predictor of health, particularly among migrant farmworkers (Rolfe et al., 2020; Swope & Hernández, 2019; Vallejos et al., 2011). However, the availability of data from agencies that can be used to concurrently assess the relevant variables is limited. The results derived from this dissertation study demonstrated the need for improved approaches for obtaining health and housing data at the individual level. Furthermore, an emphasis on the prevention of poor respiratory health conditions among migrant farmworkers, such as asthma, is necessary. Gathering more comprehensive data to improve

migrant farmworkers health is vital for this population. Without data, it is difficult to provide evidence for the need to create programs and policies to address these vulnerable, hard to reach populations. Although the overcrowding and asthma was shown to not be significant, the housing location and type of housing was found to be significant. Due to these factors, it is important to use this study as a starting point for determining the type of additional data that is needed to address the impact of housing quality on health. Overall, the study quality or other specific methodological characteristics did not have a negative effect on the study. The findings imply there is a link between housing and health, but other factors should be considered in further efforts to examine adverse health outcomes.

Implications for Practice

When there are changes in programs and policies, it may provide valuable insight into issues among migrant farmworkers and asthma. Based on the findings, it is imperative that migrant farmworkers are educated about health and safety concerns; however, this should not be constrained to only occupational health issues, although they are major concerns that should be dealt with. Migrant farmworkers are exposed to toxic pesticides, contaminated drinking water and air polluted with harmful dust particles and farm machinery exhaust. These safety concerns should be addressed, and existing public health policies should be reexamined. As a way to tackle this obstacle, practitioners should be aware when conducting inspections. There should be particular concern, especially in the development of new-onset asthma with individuals.

Migrant farmworkers ought to be educated about their rights as workers. These problems all make it tougher to treat underlying health conditions and to identify and address emerging health concerns. Previous studies implied that many migrant farmworkers do not report labor violations because they are unclear about their rights or fear being deported or losing their job

(Willingham & Mathema, 2020; Moyce & Schenker, 2018, Bernhardt et al., 2009). For many of them, working in the agricultural workplace is the only way to provide for themselves and their families. With the advocate groups, migrant farmworkers should also feel more comfortable with addressing their concerns to the crop growers and other officials that are there to better understand the potential impacts of their housing on health and safety.

The results of this study have implications to expand the awareness and the knowledge base regarding the role of adequate housing in the prevention of asthma among migrant farmworkers. Companies and individuals working with migrant farmworkers should deliver this information as a tool for assessing the housing conditions of migrant farmworkers. This tool or guidance can be disseminated by professional development, training sessions, interventions, and seminars. Initial screening criteria can be used to determine asthma diagnosis. It is hoped that this dissertation study might then provide a framework for further studies of disease variation.

Implications for Further Research

From the perspective of migrant farmworker knowledge, a gap continues to exist related to a few important areas: (a) housing quality inspections, (b) asthma outcome measures, (c) data collection sharing among states, and (d) reporting housing complaints. Evidence from this dissertation study supported the idea that environmental factors affected migrant farmworkers participation in the NAWS. Current policies that protect the rights of those with allergies and asthma in the home may be missing asthma triggers. Housing quality inspections may overlook threatening hazards, such as mold and leaks (plumbing, roof, etc.) because they may not be visible to the naked eye. However, without more evidence-based information or online data sharing among states for crop growers and migrant farmworkers, current laws, policies, and procedures to protect migrant farmworkers may result in these policies being less enforced.

Agencies must be held accountable for working conditions, and sadly, the agricultural industry has been shown to avoid traditional regulations. Furthermore, based on the research study findings, migrant farmworkers with a history with asthma or, who have been diagnosed by a doctor or nurse, rarely see a healthcare provider because of health insurance. Housing influences should be also studied. Older and poorly maintained buildings with a combination of genetic and environmental risk factors can cause further detrimental health outcomes for individuals residing in the building.

Further research should focus on inspections and federally mandated housing quality inspections may ignore less noticeable but endangering hazards, such as roof or pipes leaks and mold. These hazards require a unique approach, but few programs and resources train inspectors to look for more problems or to help crop growers settle these problems (Whalley et al., 2009). Exploring these opportunities more closely may provide additional insights into how to develop specific training programs. When researchers are selecting a dataset to work with, it is important to choose quality, relevance, and usability data. It is important to collect primary data as it has the potential to answer additional research questions. There is a potential that there will be challenges with the sharing and reuse of datasets among researchers in this field, but a follow-up project that is researching guidelines would be beneficial for further research. The research presented in this dissertation study is a starting point to collecting preliminary data and relevant material.

The knowledge gained from this dissertation study can also be used to persuade local, state, and federal politicians and healthcare providers towards expanding a more inclusive healthcare program for migrant farmworkers. The overall conclusions of this dissertation study urge further examination of asthma risk factors that expand further than the home environment.

There is a possibility that other variables beyond the scope of focus for this study influenced the occurrence of asthma among migrant farmworkers.

Another implication is related to the use of the existing theoretical framework that represent the complexities related to migrant farmworkers. The Social Ecological Model (SEM) provided the framework that guided the development of the research questions and the basis for data analysis and discussion of findings. The purpose was to evaluate one characteristic of the environment that shapes the health outcomes of migrant farmworkers — housing. The SEM aids in identifying a viable theory and method for examining the frequency of asthma among this population for future research in demographic data, prevention programs to address asthmatic risk factors, and understanding those different influences and their relationship to one another. The findings of this study and future research can be used as a preliminary point of consideration when attempting to assess the contribution of asthma and migrant farmworkers housing. The presence of additional environmental factors that influence the risk of asthma and migrant farmworkers supports the underlines message of the SEM. It also influences the need to consider the overall environment of an individual when trying to investigate a particular health outcome.

Lastly, a final implication is related to importance of reporting non-statistically significant research results at an alpha level of 0.05. Given that this is an exploratory study the investigator could have chosen an alpha of 0.1 to report on whether or not the variables age, race, gender, marital status, and overcrowding were significant predictors of asthma among migrant farmworkers. Notably, scientific research does not require that results of a study to be statistically significant to be valid or important. Indeed, statistical significance is merely a measurement of how likely it is that the difference between two groups, models, or statistics occurred by chance or occurred because two variables are related to each other (Gallo, 2016),

and not how large the effect is (scientific significance). Additionally, sometimes negative results are valuable as positive results, it simply means that the scientific process may require a longitudinal approach or the inclusion of moderating and/or mediating variables that can better explain the process.

Limitations and Delimitations

A number of study limitations were recognized. First, this study represents a snapshot in time, and since it used a cross-sectional design, causality cannot be determined. Secondly, this study included secondary data, small sample size, and sampling design. The use of secondary data also did not allow for follow-up data to be obtained from participants that may, in some cases, change a specific response given. The National Agricultural Workers Survey (NAWS) data was limited because the NAWS sampling universe does not include persons employed at eligible establishments who do not perform crop-related work, such as secretaries or mechanics, unless such workers also perform crop-related work, and crop workers with a H-2A visa. The size of the dataset may have influenced the results. A too small sample may prevent the findings from being extrapolated (Faber & Fonseca, 2014). Unfortunately, depending on the size of sample, the findings may not be generalizable or producible.

Further limitations in relation to the NAWS dataset is that it only crop workers were interviewed, as a result information provided within this factsheet does not encompass agriculture workers of other agricultural industries, such as animal production, poultry or aquaculture. Additionally, the NAWS interviews farmworkers who are currently working in agriculture. Farmworkers who have been out of work for over a year were not included in the sampling frame. The health condition variables report diagnoses over the life of the respondent and may not represent health conditions at the time of interview. The use of self-reported health data

posed a significant limitation to the validity of the confirmed or denied response indicating whether the migrant farmworker had ever been told by a doctor or nurse that they had asthma. Other limitations include information on how long they have worked in the farming industry and how long they have lived in farm sponsored housing. Lastly, another limitation is whether these individuals had a history of smoking or other congenital respiratory health issues, such as prematurity as this was not available.

The Coronavirus Disease 2019 (COVID-19) also provided a limitation in conducting face-to-face interviews with migrant farmworkers. The COVID-19 pandemic with a serious global health threat. According to the Centers for Disease Control and Prevention (CDC), COVID-19 is caused by the virus SARS-CoV-2 which is a new virus in humans causing respiratory illness which can be spread from person-to-person (CDC, 2020c). Farmworkers often have close contact to one another both in the fields and indoors. The CDC also stated that farmworkers may be exposed to COVID-19 through respiratory droplets in the air, for example, when workers who have the virus cough, sneeze, or talk. Exposure could also occur when workers have contact with contaminated surfaces or objects, such as tools, equipment, tractors, workstations, toilet facilities, or breakroom tables and then touch their own mouth, nose, or possibly their eyes (CDC, 2020c). In March 2020, the federal government designated farmworkers as essential workers, emphasizing that they play a critical role in supporting the country's infrastructure and that they have a duty to maintain their normal work schedules.

There were also delimitations based on the results. This study was focused on the trends associated with asthma occurrence in migrant farmworkers that are related to housing. This study was clearly a "snapshot in time" as only three years of the dataset will be analyzed. Data from

the United States was analyzed; however, county level data was not included as the dataset is not available at the county level.

Recommendations

This study is, by nature, an introductory look into migrant farmworkers, housing, and asthma. It is highly recommended that research is continued with migrant farmworkers across the United States but particularly in Florida as over 200,000 migrant and seasonal farmworkers and their families annually travel and work in Florida. One of the delimitations was that county-level data was not included. County level data can be useful in comparing changes over time for a set geographic area. County level data is also useful in that they can be applied to different urban or rural measures. Moreover, research is needed regarding the potentially dangerous aspects of working in the fields and bringing back harmful chemicals into the home.

Many states and federal regulations inspect farmworkers homes. There is a possibility that migrant farmworkers are not aware of housing inspections and the dangers that they are placing themselves and their families in. In Florida, migrant labor camps and residential migrant housing are inspected at least twice quarterly during periods of occupancy; except housing authorities, which is inspected twice annually (Florida Department of Health, 2021). These inspections consist of inspecting the buildings and structures, water supply, insect and rodent control, plumbing, and beds and bedding (Florida Department of Health, 2021). It is recommended that future research focus on Florida migrant farmworkers population within each local county. In addition, the research should also focus on examining the housing conditions of migrant farmworkers, how they move within the state, and their experiences relocating from their home.

Research has shown that families living in substandard housing are more likely to be exposed to harmful asthma triggers (CDC, 2015; Krieger, 2010). The results of previous studies suggested that some homes may be harmful due to asthma triggers. Triggers include pollen, mold, dust mites, and cigarette smoke and they can exacerbate asthma symptoms. Nonetheless, additional research is needed to determine how to reduce asthma triggers in the home. Such research should focus more on migrant farmworkers home inspections as they can detail what a home condition is really like.

The findings from this dissertation study offer numerous areas of opportunity for continued research in various aspects of environmental and occupational health. A better understanding of how migrant farmworkers live, and the type of housing conditions will offer insightful information for future research. Farmworkers have long lived in overcrowded conditions and with COVID-19, migrant farmworkers may lack proper personal protective equipment (PPE) or enough room for social distancing (Haley et al., 2020; Tutor Marcom et al., 2020; Handal et al., 2020). Similarly, research is needed on how moving from one location to another location several times a year influences migrant farmworkers health. Occupational health risks are specific; therefore, obtaining data from migrant farmworkers in different crops may affect each level of the SEM.

Migrant farmworkers living in substandard, mobile homes and who already have an illness like asthma, should try to find permanent housing that meet the state and federal requirements. Unfortunately, affordable housing is not possible for many of these workers, particularly the ones who are new or temporary workers. Many choose to live in overcrowded conditions because they are financially sustaining their families in their country of origin. Some crop growers often do not have the means to make the upgrades. Future research and

interventions could focus on reasons why crop growers or property owners may not change their air filters regularly, repair damages and leaks, and ensure homes are cleaned frequently (Koebel & Daniels, 1997; Arcury et al., 2012). Some farmworkers may be uncomfortable complaining or making suggestions regarding housing to their employer; these factors affect health outcomes (Costa, 2020). It is important to recognize the huge disparities in quality of housing, not only off-farm, apartments, and mobile homes. Reducing the number of migrant farmworkers could potentially reduce moderately or severely inadequate conditions.

Farmworkers are employed in one of the most hazardous and lowest paying jobs in the entire United States (Handal et al., 2020). In addition, a majority of migrant farmworkers lack proper healthcare which may have contributed to the low number of participants who reported an asthma diagnosis (Hansen & Donohoe, 2003). Farmworkers and migrant health professionals report deficiencies of awareness of available healthcare services, along with misunderstanding in directing healthcare providers and insurance programs (National Farm Worker Ministry, 2018). To ensure this population receives adequate healthcare, the barriers they face must be addressed. Oftentimes, barriers such as transportation, lack of interpreters, problems, or delays in accessing health cards or coverage, limited education and literacy, cultural differences, and poor health literacy prevent workers from accessing healthcare. These barriers lead migrant farmworkers to wait until their health problems are agonizing to seek medical attention.

The local community or areas where migrant farmworkers reside should assist with this underrepresented population by advocating or promoting justice, staying informed through education, and increasing access to services. Migrant farmworkers are occasionally hidden, and their voices are often unheard and underrepresented due to sex, gender, ethnicity, and linguistic ability; however, they are the backbone of the food system. Since many migrant farmworkers are

undocumented, many live in the shadows of our communities and therefore lack access to resources. Even those who offer essential services in communities may not be aware that migrant farmworkers are in the area. In order to educate and advise the local communities about the health, demographic, social, occupational, and environmental characteristics of migrant farmworkers, changes are needed so that all involved could adapt to some of the policies for change.

Though progress has been made in understanding the role of numerous aspects of the environment that result in significant health disparities such as asthma among migrant farmworkers, health providers must ensure that health initiatives and disease prevention interventions are carried through for this population. An observational research design would also help to authenticate self-reported information from migrant farmworkers. For example, observations could be done at the health services office or at the migrant farmworker homes to verify living conditions at homes or camps. Collecting specimens from migrant farmworkers would also provide factual information about exposures and potential health issues. Practical recommendations to reduce the health burden due to unsafe and substandard housing is a necessity. Safe, decent, and affordable migrant farmworker housing fosters good health for them and their families.

Summary of the Chapter

This dissertation study examined the demographic, environmental, occupational, and health characteristics of migrant farmworkers. Respiratory health issues such as asthma have been identified as an important health problem among migrant farmworkers. Additionally, many respiratory illnesses are the result of toxic chemicals and environmental exposures which should be investigated in migrant farmworkers. The overall aim of this dissertation study was to

investigate the relationship between migrant farmworker housing and asthma. This study demonstrated significant associations between migrant farmworkers housing and asthma which included housing location and type of housing. Although overcrowding and asthma was found not to be significant, this dissertation study was essential because the topic can contribute to further conversations on the need of adequate housing conditions, social change, and access to care. Furthermore, this study is a starting point for a larger study with a larger sample size and face-to-face interviews with migrant farmworkers will assist in examining the living conditions.

Housing conditions have been found to affect respiratory health outcomes in migrant farmworkers in previous research (Kern et al., 2001; Mirabelli et al., 2011; Kearney et al., 2014). Many farmworkers are also undocumented and lack the formal legal protections further threatening their safety (Guild & Figueroa, 2018). Further research is still needed to aid in understanding this population. Cultural or environmental issues such as housing conditions and asthma are likely to affect migrant farmworkers health. The conceptual framework used to guide the research questions and the basis for data analysis and discussion was the Social Ecological Model (SEM). The findings from this dissertation study contribute to the literature related to migrant farmworkers' health. Findings from this study can also enhance awareness of the challenges migrant farmworkers experience while residing in migrant farmworkers housing. As stated in the discussion, the results can be used to change local, state, and federal healthcare policies towards promoting an efficient, high quality, comprehensive healthcare that is accessible for migrant farmworkers. It is believed that when local, state, and federal officials conduct extensive focus-group discussions with community members and migrant farmworkers to determine both their healthcare priorities, they will learn about the obstacles migrant farmworkers face every day.

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Appendix A: NSU IRB Approval Letter

NOVA SOUTHEASTERN UNIVERSITY
Institutional Review Board

MEMORANDUM

To: Jenelle Williams
Dr. Pallavi Patel College of Health Care Sciences

From: Monique Mokha, PhD LAT ATC CSCS
College Representative, Dr. Pallavi Patel College of Health Care Sciences

Date: December 13, 2020

Subject: IRB Exempt Initial Approval Memo

TITLE: Exploring Living Conditions and Asthma of Migrant Farmworkers– NSU IRB
Protocol Number 2020-634

Dear Principal Investigator,

Your submission has been reviewed and Exempted by your IRB College Representative or their Alternate on **December 13, 2020**. You may proceed with your study.

Please Note: Exempt studies do not require approval stamped documents. If your study site requires stamped copies of consent forms, recruiting materials, etc., contact the IRB Office.

Level of Review: Exempt

Type of Approval: Initial Approval

Exempt Review Category: Exempt 4: Use of previously-collected records, data, specimens, tissues, etc.

Post-Approval Monitoring: The IRB Office conducts post-approval review and monitoring of all studies involving human participants under the purview of the NSU IRB. The Post-Approval Monitor may randomly select any active study for a Not-for-Cause Evaluation.

Annual Status of Research Update: You are required to notify the IRB Office annually if your

Page 1 of 2

research study is still ongoing via the *Exempt Research Status Update xForm*.

Final Report: You are required to notify the IRB Office within 30 days of the conclusion of the research that the study has ended using the *Exempt Research Status Update xForm*.

Translated Documents: No

Please retain this document in your IRB correspondence file.

CC: Monique Mokha, PhD LAT ATC CSCS

Kamilah Thomas-Purcell, PhD, MPH, MCHES

Appendix B: National Agricultural Workers Survey Public Data Files

File Name	File Size (MB)	Link To Download
NAWS_A2E185	Compressed: 3.63	(download link)
	Unzipped: 22.8	(download link)
NAWS_F2Y185	Compressed: 2.39	(download link)
	Unzipped: 21.5	(download link)

Appendix C: National Agricultural Workers Survey Codebook

[NAWSPAD Codebook 2003-2016](#)