Cross-Sectional Analysis of Health Care Utilization and Outcomes
amongst North Carolina Migrant and Seasonal Farmworkers in 2013

By
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Abstract

Migrant and seasonal farmworkers in the United States are a growing population that are at an increased risk for illness and injury compared to the average American. Farmworkers operate dangerous machinery, perform arduous farm labor, and are exposed to potentially harmful agricultural and chemical toxins on a daily basis. Additionally, they severely underutilize health care due to sociocultural, financial, linguistic, and logistical obstacles. There are currently over 3 million Latino farmworkers in the United States and over 80,000 currently reside in North Carolina. A systematic review was performed on health outcomes affecting North Carolina migrant and seasonal farmworkers since 2000 which cover issues such as mental health, occupational health, eye conditions, skin conditions, and dental health. Results showed that there are high self-reported rates of these conditions however little effect on quality of life. More research must be performed on mental health and its implications on farmworker well-being as articles investigating mental health did not report quality of life measures. Another study was performed which analyzed 2013 primary clinic data from the North Carolina Farmworker Health Program to get a better understanding of health care utilization patterns and the most prominent health issues facing migrant and seasonal farmworkers in North Carolina. Results showed that almost half (47%) of the North Carolina farmworker population accessed health services in 2013. Seasonal farmworkers accessed significantly more health care services than migrant farmworkers. Among the study population, rates of chronic disease such as hypertension and diabetes were significantly lower than those found among Americans. This result indicates that chronic disease among farmworkers often goes underreported and therefore unmanaged while they work in the United States. Further research must be performed to gain accurate prevalence
rates of chronic diseases among farmworkers to help organizations such as the North Carolina Farmworker Health Program target health interventions such as education and clinic referrals.
Abstract

Agricultural workers are put at increased risk for injury and illness due to significant occupational hazards. This is especially true for Latino migrant and seasonal farmworkers who often defer seeking health care when needed due to financial, cultural, and legal constraints. North Carolina has the 6th highest farmworker population in the United States of about 83,516 and there has not been a recent literature review on the most prevalent health issues affecting this population.\(^1\) Twenty-one cross-sectional analyses investigating health outcomes affecting North Carolina migrant and seasonal farmworkers since 2000 were included in a systematic review. The included articles focused on mental health, occupational health, eye conditions, skin conditions, and dental health. Most articles used self-reported data which showed that there is a high prevalence of health issues amongst migrant and seasonal farmworkers. Although studies reported high rates for both skin related disorders (95\%)\(^2\) and eye-related symptoms (27\%),\(^3\) the effects on disease-specific quality of life were minimal. Mental illness had a very high prevalence amongst farmworkers especially depression and anxiety that reached rates as high as 52\% and 18\% respectively.\(^4,5\) Articles investigating mental health did not measure quality of life scores and more research must be done to understand the relationship between mental health and overall farmworker well-being. Additionally, there were no published studies on chronic disease prevalence amongst North Carolina farmworkers. Given the low health care utilization rates amongst this population, further work must be done to understand farmworker chronic disease burden to target health interventions and ensure that they receive timely care.
Introduction

Latino farmworkers are a medically underserved demographic group in the United States. This population is at significant risk for disease and injury that is likely to go unrecognized and untreated. The National Center for Farmworker Health estimates that there are currently over 3 million Latino farmworkers in the United States. These individuals are born primarily in Mexico (68%), speak little or no English, and are largely uneducated. They are employed in the fruit and vegetable industry and have some of the lowest salaries of any segment in the United States workforce. They have little to no access to worker’s compensation, health insurance, or disability compensation packages. These barriers are due in part to the fact that 48% of Latino farmworkers do not have legal authorization to work in the United States.

The National Center for Farmworker Health classifies farmworkers as either migrant or seasonal workers. A seasonal farmworker is an individual whose employment is in agriculture on a seasonal basis. Seasonal farmworkers often have established residency in the United States. Migrant farmworkers are defined as those who have moved within the past 2 years to find work in agriculture and use a temporary home during their period of employment. Forty-two percent of the national farmworker population has been identified as migrant while 58% are seasonal agricultural workers.

Latino farmworkers are at an increased risk for illness and injury because their work requires operating dangerous machinery and exposure to potentially harmful agricultural chemicals and pesticides. They are also susceptible to mental illness triggered by stressful working conditions without the support of family or community. Farmworkers receive little to no preventive care or attention to chronic diseases such as hypertension and diabetes which often go
undetected and unmanaged. This lack of care is partly due to shortage of health care services, in addition to their unwillingness to seek care because of fear of detection or lack of awareness of health care options.

Programs such as the North Carolina Farmworker Health Program (NCFHP) are nonprofit agencies that provide health education and health services to farmworkers. The program identifies hard-to-reach farmworker camps and offers health evaluations, transportation to clinics, and mobile clinic services. It also funds primary care at a variety of clinical sites through 11 migrant health grantees scattered across the state with the help of the Bureau of Primary Health Care. NCFHP faces a unique challenge supporting its farmworker population because North Carolina farmworkers are more likely to be foreign born, less acculturated, speak little to no English, and tend to migrate more than farmworker counterparts in other states. For these reasons the North Carolina farmworker population is at risk for having health care issues go unrecognized and undermanaged. The real and potential consequences are serious illness, injury, and loss of work.

The NCFHP provides surveillance health data on farmworkers; however collecting information on this population is difficult. Many farms employ few workers and are exempt from OSHA reporting regulations. Federal surveillance data regarding agricultural illness and injury is therefore incomplete. Also, most of the existing health information is clinic-based. The validity of using clinic records as the primary source of data is compromised by the fact that, when ill, farmworkers often leave or lose their employment, seek treatment in Mexico, or refuse to report illness to employers due to fear of job loss. Lack of health care utilization is further compounded
by their illegal status and limited English proficiency and health literacy. These farmworkers simply do not seek care when needed, which leads to severe underreporting of data.\textsuperscript{10}

The combination of increased risk of illness and injury compounded by underreporting of data has led to a need for better understanding of the health issues facing Latino farmworkers. The goal of this systematic review is to provide critical analysis of the recent literature of the health needs of migrant and seasonal farmworkers in North Carolina.

Methods

Search Strategy

A literature review was performed in PubMed and Google Scholar using the key word: “Migrant farmworkers.” One author reviewed each retrieved title, then abstract and full text as necessary, for possible inclusion.

Inclusion and Exclusion Criteria

To be included, an article had to present a cross-sectional analysis of health issues facing adult farmworkers (18-65 years old). Studies that collected primary data in the United States after 1999 were included in the analysis. Only studies reporting data within the last 15 years were included because the findings should be reflective of current issues facing migrant and seasonal farmworkers. Important variables subject to change that may affect migrant worker health include legal status, migratory patterns, country of origin, age, highest level of education achieved, and health literacy. Additionally the services offered to farmworkers are continually growing and macro-level forces such as the economic downturn change the farmworker health profile.\textsuperscript{4}
Only articles that reported health outcomes were included. Articles reporting intermediate outcomes such as blood and urine screens for pesticide exposure were excluded. Studies investigating housing conditions, water safety, risk factors for illness and injury, the effectiveness of intervention and prevention efforts, wages, or behavioral studies looking at drug and alcohol abuse were not included.

Studies were only included if data were collected in North Carolina in order to make the data more homogenous and pertinent to a specific population.

*Comparison of North Carolina and Other Regional Farmworkers*

Demographic information was collected and summarized from studies that met all inclusion criteria besides data collection in North Carolina to explore any baseline differences between North Carolina farmworkers and farmworkers from other regions of the United States. Farmworker populations between states can be very different from each other in terms of gender, average age, migratory status, and education level. The purpose of this comparison was to screen for any risk factors that may put North Carolina farmworkers at unique risk for illness and injury.

Demographic information was compared based on “migrant streams.” Migrating farmworkers are often grouped according to a “stream” that is a distinct agricultural pattern that workers follow each year. There are 3 identified streams: the Eastern Stream begins in Florida, goes through Ohio, New York and Maine. The Midwestern Stream begins in Southern Texas, and branches off through several Midwestern states. The Western Stream begins in Southern

![Figure 1: Migrant streams in the United States](http://www.ncfh.org/?pid=4&page=3)
California and goes up to Washington and northeast from central California to North Dakota.\(^\text{11}\)

In this review, the Eastern Stream includes articles collecting data from Georgia, North Carolina, and the Northeast which includes Maine, New York, New Jersey, Pennsylvania, Maryland and Connecticut. The Midwestern Stream includes articles collecting data from Texas, New Mexico, and Illinois. The Western Stream includes articles collecting data from Arizona, California, Idaho, Washington, and Oregon. There are also articles that take national data that applies to the entire United States.\(^6\)

**Data Abstraction**

One author read and abstracted the data from reviewed articles. The author focused on prevalence of disease as a primary outcome in addition to risk factors for disease and quality of life scores when available as secondary outcomes.

**Quality Assessment**

Included articles were appraised for quality based on the accuracy, validity, and value of the results. The author used a 10-question tool adapted from a previously published, validated critical appraisal tool for cross-sectional analyses.\(^\text{12}\) Each question was graded on a scale of “+/++,” where an article with “+++” answered the question better than an article with “+.” The results are shown in *Table 1*. 
Results

Search Findings: Title and Abstract Review

*PubMed* search returned 281 articles and *Google Scholar* search returned 3,880 articles that underwent title and abstract review. A title review yielded 60 articles that fit the inclusion criteria. Further abstract review excluded several published articles for reasons such as being a systematic review that used secondary data, focusing on a non-agricultural migrant population such as poultry workers, collecting data before 2000, and focusing on intermediate outcomes. The combined review yielded 36 articles which were subsequently read and evaluated for inclusion in the analysis.

Full Text Review and Evaluation

Of the 36 cross-sectional studies that followed the inclusion criteria after title and abstract review, 15 articles were excluded because they did not collect data within North Carolina. The 15 articles reporting data from outside North Carolina used farmworker samples from Maine, New York, Pennsylvania, Maryland, Connecticut, Texas, Arizona, New Mexico, California, Illinois, Oregon, Washington, Idaho, and Georgia. Twenty-one articles were ultimately included in the analyses. The search strategy is shown in *Figure 1* and the included articles are shown in *Table 2*.

Comparative Demographic Characteristics

North Carolina farmworkers were on average more likely to be male, be born in Mexico, and be migratory compared to farmworkers in other geographical regions. The average percentage of male workers in North Carolina studies was 87% in contrast to percentages as low
as 51% along the Western stream. Sixty-eight percent of North Carolina farmworkers are migratory while seasonal workers make up the majority in other geographical regions such as the Midwestern stream (72%). Data gathered from national databases show that by comparison North Carolina farmworkers are younger, are more migratory, speak less English, and are more likely to be born in Mexico.

The regions of the Eastern stream are similar in demographic information to each other – especially between Georgia and North Carolina farmworkers. These two regions are comparable in male percentage, age, migratory status, and English speaking abilities. Across all geographic regions, migrant and seasonal farmworkers tend to be poorly educated except in the Midwest stream where 69% of farmworkers reported more than 10 years of education. The results are shown in Table 3.

**Health Outcomes**

In the 21 studies that reported health care outcomes (*Table 2*), data was gathered in the form of face-to-face interviews at either a farmworker health clinic or farmworker campsite. Interviews were conducted in English or Spanish based on farmworker preference.

**Skin Conditions**

The studies reviewed were longitudinal surveillance studies conducted over several weeks. Investigators used surveys and questionnaires to determine whether farmworkers have experienced one of several dermatologic injuries or conditions over the agricultural season. Questionnaires were developed in English and translated to Spanish. Primary outcomes were
self-reported skin problems with secondary outcomes being risk factors, health care utilization, and quality of life scoring.

Seven of the eight studies collected data at farmworker campsites and 1 study at a migrant health clinic. In the latter study, the farmworker had to be presenting to the clinic with a primary or secondary diagnosis of skin disease. All but one study used telemedicine procedures employing a dermatologist to review standard images of participants who reported one of several skin outcome measures.

Based on self-report, one study showed that 95.1% of farmworkers reported a skin problem within the prior 7 days of the interview. Skin fungus and sunburn were the 2 most commonly reported skin problems, each with a cumulative prevalence of 58.6%. Additional self-reported outcomes were bumps/acne (48.4%), calluses (48.4%), itching (46.1%), rash (42.8%), insect bite (38.2%), nail fungus (36.2%), superficial wounds (27.3%), warts (19.7%), pigmentary change (16.1%), blisters (13.8%), and poison ivy (10.5%).

Six studies reported the prevalence of workers developing skin conditions over the course of an agricultural season. All diagnoses were reviewed by dermatologists, and were grouped into broader categories: the most common disease category was minor infections (48.1-78.3%), followed by inflammatory diseases (38.9-57.2%), pigmentary disorders (14.8-19.7%), and traumatic conditions (34.5%). One study showed that over course of an agricultural season 96.4% of farmworkers had at least 1 skin condition in another study reported 77.7% had at least 1 skin condition. The most commonly diagnosed skin diseases overall were tinea pedis and acne/folliculitis.
In the study that collected data only from clinic patients, the most commonly diagnosed skin disorders were contact dermatitis (33%), melasma (12.7%), tinea pedis (12.7%), seborrhea keratosis (6.3%), and impetigo (5.0%). Most skin conditions were banal, chronic and in patients who come to clinic for non-dermatologic complaints.20

Two studies focused on skin-related quality of life using the Dermatology Life Quality Index instrument which was translated to Spanish. In one study, the mean QOL score was 0.8 +/- 1.59 where 0-1 is “no effect of QOL,” and 2-5 is “small effect on QOL.”14 In the other study, 15% of the farmworker sample reported clinically meaningful dermatologic impact on QOL. Based on self-report, poison ivy, blisters, and itching were associated with total elevated DLQI score. Compared to self-reported injury, dermatologists diagnosed skin disease was less strongly related to lower quality of life scores.13

**Occupational Health**

The included study was a cross-sectional survey of musculoskeletal health and safety in the workplace among migrant and seasonal farmworkers.21 Questions were taken from existing scales that had been validated in Spanish from previous farmworker research. The primary outcome measure was musculoskeletal discomfort at the time of interview. Farmworkers who had work-related pain rated the severity of their discomfort which ranged from no pain (0) to unbearable (4). They were asked about 8 distinct body parts including neck, shoulders, elbows, wrists, hands, lower back, knees, and ankles. Secondary outcomes were days working while injured or ill and work safety climate.

Of the 300 farmworkers, 40.0% of farmworkers reported elevated musculoskeletal discomfort and 5.0% reported having worked at least 1 day in the current agricultural season
while injured or ill. Most of these participants had worked 1-8 days while injured or ill, while 2 participants reported working 40 and 45 days respectively while injured or ill. Older farmworkers and individuals who were involved in loading and barning rather than topping tobacco reported more elevated musculoskeletal discomfort and more days working while injured or ill.\textsuperscript{21}

\textit{Mental Health}

The studies included used both focus group interviews and cross-sectional surveys to explore farmworker mental health. Data were collected at farmworker camps and outcome measures were depression, anxiety, and stress with secondary outcomes being housing conditions, alcohol use, and sleepiness. Mental health is often difficult to evaluate and these studies used a variety of validated tools to quantify outcome measures.

Studies that measured depression used the Center for Epidemiologic Studies, Depression (CES-D) method which has been shown to perform well among immigrant Latino farmworkers.\textsuperscript{22} The tool assesses level of depressive symptoms within a previous week and consists of either 10 or 20 items ranked on a scale from 0-3 with higher scores indicating higher depression. 3 studies used the 10-point CES-D using an accepted cut-off of 10 points and 2 studies used the 20-point CES-D using an accepted cut-off of 16 indicating clinically significant depressive symptoms.

The 5 studies that used CES-D evaluation found that 28\%, 52\%, 45\%, 42\%, and 40\% of farmworkers met clinically meaning levels of depressive symptoms at the time of the interview\textsuperscript{23,4,24,5,25}. One study showed that across the agricultural season, depressive symptoms followed a U-shaped curve whereby depression peaked at the beginning and end of the
Increased depressive symptoms correlate with poor housing, daytime sleepiness, perceived crowding, and concerns about documentation, immigration, discrimination, and separation from family. One study showed that migrant workers may be at an elevated risk for depressive symptoms than seasonal workers (p = 0.09). The Migrant Farmworker Stress Inventory (MFWSI) is a tool that has been used to assess farmworker stress levels, and asks farmworkers to identify stressors from a list of 39 situations that were identified as stressful for farmworkers. Four of the studies using this tool to screen migrant workers identified a cut-off of 80 which has been reported to be indicative of stress levels posing a significant risk of immigrant mental health. The MFWSI has been studied and validated in farmworkers populations in the Midwestern United States. One study showed the mean MFWSI score was 86.03 which suggest a perceived high level of stress in the farmworker environment. Substantial stressors were, “It is difficult to be away from family members,” followed by, “It bothers me that other people use drugs,” and “I worry about not having medical care.” One study showed that 75% of farmworkers had not seen their wives in the past 6 months. Compared with seasonal workers, migrant farmworker reported higher levels of perceived stress in the mobile lifestyle. Being a migrant worker was the single most significant variable related to increased stress followed by job/legal security and language barriers. Other high ranked stressors were related to an insufficient financial resources and occupational issues.

Four studies investigated farmworker anxiety levels using either the Personality Assessment Inventory (PAI) (n = 2), Perceived Stress Scale (n = 1) or the Beck Anxiety Inventory (n = 1). The PAI scale has found to have adequate internal reliability and
construct validity among farmworker and Mexican-American samples. It has a cut-off of 60 which indicates significant anxiety that may impair functioning.\textsuperscript{5} The PSS has not been tested among Latino farmworkers and has no distinct cut-off. The Beck Anxiety Inventory has been shown to be reliable and has good transferability from original Castilian Spanish to the Spanish used by immigrants from Latino America.\textsuperscript{4}

The 2 studies that used the PAI method showed that 18.4\% and 17.0\% of farmworkers reported anxiety levels that suggest impairment of function.\textsuperscript{5,24} Another study showed that 16.4\% of farmworkers report moderate to severe anxiety and 41.8\% of farmworkers report mild anxiety symptoms.\textsuperscript{4} Grzywacz measured the association of “Familial ambivalence” defined as less frequent contact with family members and anxiety scores. He found that less contact with family was associated with higher anxiety scores. Men who called home once a week had average anxiety scores of 25.6 vs. men who called home daily who had scores of 17.8 on the PAI scale.\textsuperscript{25} One survey showed that 75\% of farmworkers had not seen their families in the past 6 months and another survey conducted in 2004 showed that 42.8\% of Latino farmworker homes in North Carolina did not have a telephone in their residence.\textsuperscript{24}

\textit{Dental Health}

The included study used face-to-face interviews at farmworker camps to investigate self-reported oral health problems.\textsuperscript{28} Oral health problems were grouped into functional and cosmetic categories. The authors used a Spanish version of the OHIP-14 scale to assess oral health-related quality of life.\textsuperscript{28} The OHIP instrument has not been validated for migrant populations.

The most commonly reported functional problem was dental caries (52.3\%) followed by sensitivity (40.4\%), problems with gums (39.7\%), missing teeth (34.7\%), fractured teeth
(32.5%), broken filling (28.5%), teeth needing extracting (21.5%), toothache (17.2%), and denture problems (4.0%). The most common cosmetic problem was discoloration of teeth (51.3%) followed by crooked teeth (30.0%). Of the 151 participants, only 9.9% reported no functional problems and 36.4% reported no cosmetic problems at the time of the interview. The study population had a median of 2 functional problems.

The OHIP scale has 14 questions that has a maximum score of 56, with higher scores indicating poorer oral-health related quality of life. The mean OHIP was 3.22 (5.55) which indicates that a large number of farmworkers had favorable oral quality of life while a small number had poorer quality of life scores. Poorer oral health scores were related to number of functional dental problems. Only 20.5% of farmworkers received dental services within the last year – 6.4% received these services in the United States.\textsuperscript{29}

Eye Conditions

Two of the included studies conducted interviews at farmworker camp sites and 1 at a migrant health clinic. The latter study recruited patients who presented to clinic with a skin condition. One of the studies focused specifically on pterygium\textsuperscript{30} and used telemedicine diagnostic procedures while the other 2 used farmworker self-reported data.\textsuperscript{3, 31}

Of the studies focusing on self-reported data, one study found that 5.0% of farmworkers sustained eye injuries in the work place over the course of an agricultural season. These injuries mostly were penetrating wounds, followed by chemical gas injury, then foreign body injury. Branches, pesticides, machinery, and stones were the most common causes of injury.\textsuperscript{31} More than 20% of farmworkers recruited at a clinic reported eye symptoms in the 7 days prior to clinic
visit. These symptoms include pain or burning (21.5%), redness (26.6%), and itching (25.5%).

More than 38% of farmworkers never received eye care.3

One study reported that 23.3% of farmworkers had pterygium present in at least 1 eye. Of these, 13.9% had it unilaterally and 9.5% had it bilaterally. Only age was associated with presence of pterygium (OR = 1.07) with a 7% increase in pterygium prevalence for every additional year of age.30

Discussion

There are many reasons for the high prevalence of reported health issues among farmworkers in North Carolina. Agricultural work exposes workers to a variety of skin irritants that include pesticides, plants, bacteria, fungi, fertilizers, and petroleum products.14 Daily tasks include operating heavy and dangerous equipment, repetitive motions, bending, stooping, and lifting heavy objects which can result in acute and chronic musculoskeletal discomfort and injury.32 Lastly, working under strenuous conditions without the support of family leads to excessive stress, depression, and anxiety. There not many mental health resources for these workers; the rural health care system is not well equipped to support this growing community of farmworkers with depression and anxiety. The NCFHP reports that there has been a decline in specialty services, that includes mental health, for farmworkers over the past few years.8

Farmworkers reported prevalence rates as high as 95% for skin-related disorders, 52% for depression, 40% for musculoskeletal discomfort, and 27% for eye-related related symptoms. Although these data was largely derived from self-reported interviews, which could overestimate disease prevalence, several of these outcomes were assessed by health care professionals which
often resulted in similar rates. In one study, 96% of farmworkers were diagnosed by a dermatologist as having a dermatologic diagnosis compared with 95% prevalence in self-reported data.²

Despite high self-reported prevalence rates, the studies that assess disease-related quality of life showed that disease prevalence does not necessarily translate to low quality of life scores. Although the strong majority of farmworkers had skin diagnoses, most skin conditions were chronic, non-significant and had no effect of quality of life. Additionally, over 50% of farmworkers reported dental disease however the mean dental-related quality of life scores were very good.

Quality of life scores were not assessed in articles that focused on mental health which is an important gap in farmworker data. It has been established in the medical community that mental health plays an equal if not larger part than physical health on overall well-being.³³ Although high prevalence of skin and eye disease did not contribute to low quality of life scores, it can be hypothesized that high levels of depression would have much more of an effect on QOL data. Self-reported psychiatric data is controversial due to the possibility of misunderstanding the questionnaire, lack of insight, and response bias.³⁴ These sort of biases can lead to overestimation of the prevalence of mental disease. However self-reported depression prevalence rates ranging from 28-52% certainly warrant further investigation on effect on overall quality of life.

Of these farmworkers who reported mental disease, the migrant population shoulders a significant amount of the disease burden. Migrant status is the single most significant variable related to increased depression and stress scores. Additionally those farmworkers who had frequent contact with their families – those who tend to be seasonal workers - had lower average
anxiety scores. This point is significant because North Carolina farmworkers are more migratory than seasonal and the number of migrant farmworkers has doubled over the last 20 years in North Carolina.\textsuperscript{9} The combination of growth of migrant workers and the high prevalence of disease within this population is a call to arms for migrant health clinics to offer more mental health services.

Limitations

The limitations of this review should be considered when evaluating its results. In terms of search criteria, studies were only included if there was access through the UNC library system. Several articles met inclusion criteria for title and abstract but were unable to be full-text reviewed due to lack of access.

The majority of the data was self-reported which can be subject to recall bias, subjective evaluation, and difficulty understanding the questions. This is particularly true for depression related surveys where studies have shown an over self-reporting of poor social adjustment and greater dissatisfaction with social roles in depressed patients.\textsuperscript{34} Several studies also used telemedicine to confirm self-report diagnosis which can result in misdiagnosis due to relying on photographs rather than on samples or clinical evaluation. For example, the difference between onychomycosis and psoriatic nails are difficult to distinguish without samples.

Growers did not permit investigators to interview farmworkers and farmworkers refused permission to be included in several included studies. This may underrepresent farmworkers who are wary of being detected such as those working without legal authorization. Also farmworkers living in geographically hidden camps far from paved roads who tend to be more socially
marginalized are less likely to be included in studies. This selection bias could underestimate prevalence of mental disease in illegal and isolated farmworker populations.

**Strengths**

Despite the limitations, the literature review has several strengths. Despite the uncertainty inherent in self-reported data, it is a very important tool to assess community-level needs. Self-report sheds light on perceived treatment needs and can highlight general areas of health problems that go undetected in clinical settings. Health data is typically gathered in clinics which only tells the story of those who receive care.\(^3^5\) This fact is particularly important in a farmworker health evaluation because many farmworkers would rather work sick than miss work or bear the expense of medical care.\(^3^5\) Additional barriers to seeking health care include language barriers, lack of transportation, low health literacy and not knowing when he/she needs treatment, lack of health insurance, and scarcity of health facilities. Therefore clinic based farmworker data is subject to significant underreporting of true disease prevalence.

Most methods to evaluate self-reported data were shown to be reliable and accurate in migrant farmworker populations which were delivered by bilingual interviewers. Also most studies used a site-based sampling plan which is a tool for recruiting a representative sample in a population that is difficult to enumerate.\(^2^2\) The information in this review is generalizable to migrant and seasonal farmworkers in Eastern North Carolina.

**Conclusions and Implications for Future Research**

The literature shows that migrant farmworkers are at increased risk for mental illness compared to seasonal workers. According to the Employment Security Commission, the majority
of the North Carolina farmworker population is migratory (72%) and the proportion of seasonal farmworkers has declined over recent years. More research must be done to understand the health profile of this specific population because of its size and higher risk for mental illness. Theoretical studies include cross-sectional analyses of health issues and health care utilization patterns of migrant workers as well as surveys investigating unique barriers to health care that they face. By understanding their perceived health care needs, programs like the NCFHP can deliver appropriate services to lower disease prevalence and increase health care access for migrant workers.

There is also a lack of farmworker data on chronic disease in North Carolina. The studies included in the review were point-prevalence estimates which do not look at chronic illnesses such as diabetes, hypertension, hyperlipidemia, and asthma. Farmworkers are more likely to suffer from these illnesses with similar overall rates of chronic disease as other low income and minority populations. The data available on chronic diseases amongst farmworkers is from the Bureau of Primary Care which only gives clinic-based data. This is subject to selection bias in that it does not offer information about those farmworkers who do not have access or are unwilling to visit a health clinic - which is unfortunately a significant proportion. More cross-sectional data must be obtained from farmworker camps in order to understand the magnitude of the chronic disease burden amongst this population.
**Tables and Figures**

**Figure 1.** The figure above shows selection methodology for finding articles that met inclusion criteria for the systematic review. Those papers that met criteria after title and abstract review (n = 15) were included into *Table 2*. 

- **Papers for review of title and abstract**
  - Google Scholar: n=3,880
  - PubMed: n=281

- **Papers for review of title and abstract**
  - n=60

- **Papers for review of full text**
  - n=36

- **Papers excluded:**
  - Systematic Review (n =2)
  - Not farmworker specific (n=1)
    - Poultry workers
  - Case Study (n=1)
  - Includes children (n=3)
  - Data collected before 2000 (n=11)
  - Intermediate outcomes (n=5)
  - No quantifiable data (n=1)

- **Papers excluded:**
  - Data collected outside NC (n=15)

- **Studies included (n=21)**

  **Breakdown:**
  - Dermatology (n=8)
  - Ophthalmology (n=3)
  - Occupational (n=1)
  - Mental Health (n=8)
  - Dental (n=1)
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**Table 1.** Critical appraisal of included articles. “+” indicates that the article addressed the given question less adequately than “+++”.
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<td>Migrant Clinic</td>
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Table 2. List of included articles in the systematic review.
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Table 3. Baseline demographic information for studies that met inclusion criteria after title and abstract review.
Abstract

There are currently approximately 83,516 migrant and seasonal farmworkers in North Carolina who support a lucrative fruit and vegetable industry. Farmworkers are at disproportionate risk for injury and illness compared to the average American. This is due to occupational hazards and cultural, logistical, and financial barriers to health care which results in low health care utilization. The purpose of this study was to gain a better understanding of the health care utilization patterns and most prominent health issues facing migrant and seasonal farmworkers in North Carolina. The study population was predominantly Latino (98%) and migrant (74%) with an average age of 35 years. Almost half (47%) of the farmworker population accessed health services during the 2013 agricultural season. The most common diagnoses at NCFHP funded primary care visits were back pain, diabetes, hypertension, and dermatitis. Comparing migrant and seasonal farmworkers, seasonal workers were on average older and had significantly higher odds of accessing health care services and having a diagnosis of diabetes compared to migrant workers. Rates of diabetes and hypertension amongst all farmworkers were 3.9% and 4.2% respectively. These rates are much lower than the respective rates amongst Americans which suggests that chronic disease amongst migrant and seasonal farmworkers often goes undiagnosed and unmanaged while they work in the United States. This study adds to the body of knowledge related to farmworker health needs which will help farmworker organizations provide and target appropriate health services and education to the farmworkers who need it the most.
Introduction

The National Center for Farmworker Health currently estimates that there are over 3 million migrant and seasonal farmworkers in the United States. Migrant workers are defined as individuals who have moved within the past 2 years to find work in agriculture. This population includes “point-to-point” workers who move around the country to follow the crop, and those with H-2A Visas, which allows foreigners to temporarily work in agriculture. Migrant workers are required to be absent overnight from their permanent place of residence for work. Seasonal workers are those who have lived at a current address for longer than 2 years, and only work agriculture part of the year. They typically have permanent residence in the United States.

The Employment Security Commission estimates that there are 83,516 farmworkers employed in North Carolina. Over the past decade there has been a 23% decrease in the farmworker population, but in the past 2 year there has actually been an 8% increase in farmworkers. The majority of this population is migratory (72%) and the relative proportion of seasonal farmworkers has declined over recent years (28%). The North Carolina Farmworker Health Program reports that 75% of farmworkers speak only Spanish and 94% are Latino. These trends are different from other states with farmworker populations where workers are less likely to be foreign born, more likely to speak more English, and more likely to be seasonal.

Latino farmworkers are responsible for provision of approximately 28 billion dollars of fruit and vegetables in the United States. While delivering these services they are at risk for illness and injury due to occupational hazards and underutilization or lack of access to health care resources. Farm work requires operating dangerous machinery and contact with harmful agricultural and chemical exposures on a daily basis. Additionally, farmworkers are less likely to
access health care because many do not speak English, have limited health literacy, or are not aware of the resources available to them. There are a limited number of health care facilities for farmworker populations that are close by, affordable, and open in the evenings when farmworkers are available. Farmworkers who lack documentation may be frightened to bring themselves to the attention of medical personnel or other authorities. Many farmworkers lack any transportation and are reliant on their employers for trips away from their camp out by the fields.\textsuperscript{35} Additionally NCFHP estimates that 89\% of North Carolina farmworkers are uninsured and 99\% have incomes 200\% and under the federal poverty line, which makes it difficult for farmworkers to bear the expense of medical treatment.\textsuperscript{1} Due to this fact, farmworkers with chronic diseases such as hypertension and diabetes may have their illness go unmanaged and undiagnosed while working in the United States which leads to an increased risk for complications.

Compared to farmworker populations of other states, these issues with health care access and utilization are more severe in North Carolina because more of the population is migratory. Migrant laborers do not have permanent residence in the United States and move into temporary housing for work while following the crop. Therefore they are generally less familiar with local resources available to them and subsequently use less health care.\textsuperscript{1} Studies have also demonstrated that migrant workers shoulder a significant amount of disease burden compared to seasonal workers, especially when it comes to mental health.\textsuperscript{25} The North Carolina Farmworker Health Program (NCFHP) is one of several programs designed to meet the health care needs of farmworkers in North Carolina. The program provides enabling services to farmworkers which link farmworkers to health care and promote a healthier lifestyle. These services include weekly education lessons, outreach to their places of residence, case management, referral, and
Transportation for farmworkers to affordable health clinics. The NCFHP also helps pay for primary medical care at 11 sites through a grant from the Bureau of Primary Health care.\(^1\)

The purpose of this study is to examine health care utilization and issues facing the North Carolina migrant and seasonal farmworker population. The analysis is cross-sectional and investigates the prevalence of the most common diagnoses made in the medical appointments that are funded by the North Carolina Farmworker Health Program (NCFHP). The NCFHP uses a variety of medical venues to provide primary care, including county health departments, hospitals, rural health centers, federally qualified community health centers, and private practices. This study also explores differences in trends of farmworker health care utilization between migrant and seasonal farmworkers. These findings will further the understanding of the disease burden shared by farmworkers and identify vulnerable populations who access care the most. This data will be able to help farmworker support organizations such as the NCFHP create interventions to improve farmworker health outcomes and access to health care to those who need it.

**Methods**

**Data Source**

Each year, the North Carolina Farmworker Health Program sends employees to farmworker camps to provide enabling services for farmworkers. The NCFHP contracts with 11 health sites that provide these services throughout the state. NCFHP workers are bilingual, outreach experts and community educators who have worked long-term with farmworker populations. This type of commitment builds trust within the farmworker community that can be wary of detection due to undocumented status. The NCFHP workers spend several hours each
week during the agricultural season visiting farmworker camps. Outreach is typically performed during the afternoon and nighttime after the work day is over. During these encounters, teams of NCFHP employees provide case management and health education lessons which often take several hours of work.

When outreach workers contact farmworker camps, they perform a health needs assessment for each worker at the campsite. The farmworkers who agree to an assessment sign a standard patient consent form that recognizes *Fhases* as an appropriate method of sharing of patient data for the purpose of care under HIPAA. *Fhases* is the electronic medical records system that the NCFHP uses to collect and share farmworker data across medical sites. Each farmworker who signs this form receives a unique identification number that is logged into *Fhases* after outreach workers perform the health needs assessment. These individuals are considered to have received enabling services. If these farmworkers receive any enabling services including referrals, transportation, or education lessons, this is documented into *Fhases* under the farmworker’s unique identification number.

NCFHP outreach workers provide referrals and transportation to NCHFP funded medical appointments for farmworkers who request medical attention. The individual must be identified as a farmworker and be connected with NCFHP outreach providers in order to receive medical services. Through contracting with the Bureau of Public Health, the NCFHP helps pay for primary care from a variety of providers at their 11 sites in North Carolina. The NCFHP has access to detailed clinical data from these sites which includes birth data, gender, campsite, migrant status, and age. The clinics are staffed by physicians, nurses, physician’s assistants, and
nurse practitioners who make the diagnosis and appropriate ICD-9 codes are entered into *Fhases* after each clinic visit.

The data used in this cross-sectional study is de-identified enabling and medical information from the *Fhases* database. This data includes farmworker demographic information such as age, migrant status, and ethnicity. Other demographic information including gender and campsite were removed from data analysis to protect farmworker identity. Every patient in the database has received enabling services of some sort. The data thus includes records of which particular education lesson an individual received. The NCFHP provides educational talks on a variety of topics including pesticides, heat illness, green tobacco sickness, nutrition, diabetes, hypertension, and behavioral health. In order to keep the education talks relevant to the medical data used, the study only identifies if individuals received education on hypertension, diabetes, pesticide exposure, and back pain and health.

Medical data were provided if farmworkers were seen at one of the NCFHP funded medical appointments. The medical data includes the 4 most prevalent ICD-9 diagnoses in the *Fhases* database: hypertension, diabetes, back pain, and dermatitis. Only a proportion of all farmworkers who received enabling services used medical services.

Estimates of farmworker prevalence in North Carolina are from the Employment Security Commission estimates.
Study Population

Included Sample

Enabling *Phases* data was retrieved from the 11 sites that are funded by the NCFHP over the 2013 calendar year. These sites include the Ashe Memorial Hospital, Robeson Health Care Corporation, Good Samaritan Clinic, North Carolina Farmworkers Project, Pender County Health Department, Piedmont Health Services, Rural Health Group, Surry County Health and Nutrition Center, Toe Rover Health District, Vecinos, Inc., and Wake County Human Services.

Medical data was only retrieved from 8 of the 11 sites. Robeson Health Care Corporation data was not available. While Robeson Health Care Corporation sees a significant amount of farmworker patients, they maintain their own internal medical database and do not use *Phases*. The NCFHP offers enabling service funding to Piedmont Health Services and Rural Health Group, however it does not offer medical funding to these locations as they receive their own grant from the Bureau of Primary Care. Therefore enabling data from these sites is included in the analysis but medical data is not.

The individuals in the data set are both farmworkers and their dependents which include spouses and dependent elders. In order to limit data analysis to full-time farmworkers alone, individuals in the database younger than 18 years old were excluded from the study. There is evidence that Latino youth begin working in tobacco as early as age 13. However the pediatric and adolescent populations are not as likely to be involved in full-time farm work that can lead to illness and injury associated with long-term, agricultural labor. Adults over 18 in the dataset may be a farmworker dependent and not be directly involved in full-time farm work either, however this is less likely. Therefore all individuals over 17 were included in the analysis.
**Study variables of interest**

Every farmworker who received enabling services was given a specific identification number. One outcome of interest was a visit to medical provider. Medical care visit was treated as a dichotomous variable and coded as either 0: “no medical visit” or 1: “medical visit.”

The other health outcomes for this cross-sectional study investigate the most prevalent ICD-9 diagnoses in FHASES. These are hypertension, back pain, diabetes, and dermatitis. These variables were analyzed as dichotomous variables and coded as either 0 or 1. “Dermatitis” does not have its own ICD-9 code rather codes for “acute dermatitis due to solar radiation,” “chemical dermatitis not elsewhere classified,” “atopic dermatitis,” “chronic solar dermatitis not elsewhere classified,” “contact dermatitis and other eczema,” “contact dermatitis of eyelid,” “dermatitis due to plants,” “dermatitis factitia,” dermatitis not elsewhere classified,” and “dermatitis not otherwise specified” were grouped together into a dermatitis diagnosis-related group.

Covariates included farmworker demographic information such as migrant status and age. Migrant status was defined either migrant or seasonal and treated as a dichotomous variable.

**Data analysis**

Prevalence of medical visits and of specific health outcomes was performed using univariate analysis. T-tests were used to analyze relationships between medical visits, health outcomes and age. Chi-squared and linear regression tests were used to analyze differences in health outcomes between migrant and seasonal workers. There was no missing data from the set. Patients under age 18 were dropped from the dataset however baseline demographic information
was analyzed from excluded individuals to explore health outcome and health utilization
differences between pediatric/adolescents and adult farmworkers.

Enabling data was collected from all 11 NCFHP health sites while medical data was
collected from only 8 NCFHP sites. Therefore the dataset includes significantly more patients
who received enabling services than those that received medical care. By definition, if there is no
medical data provided then the farmworker who received enabling services is assumed to have
never received a NCFHP funded medical appointment. Calculating the prevalence of
farmworkers who utilize medical services by using the prevalence of medical visits amongst
those who receive enabling services would underreport the overall uptake of medical services.
Therefore to calculate farmworker health care utilization, the enabling patients from the sites for
where medical patient data was not included was subtracted from the total enabling patient
number. That is:

\[
\text{Prevalence of farmworker medical visits} = \frac{(\text{Total # medical patients from 8 NCFHP sites that gave medical data})}{((\text{Total # enabling patients from all 11 NCFHP sites}) - (\text{# of enabling patients from the 3 NCFHP sites where medical data was not provided}))}
\]

Data analysis was performed using STATA (version 10.1, College Station, TX) statistical
software program. All statistical testing was two-sided with the level of significance set at
\(p<0.05\). This study was approved by the Biomedical Institutional Review Board of the University
of North Carolina at Chapel Hill (Chapel Hill, NC).
Results

Sample population

Farmworkers included in the analysis (n=5,406) were 73.6% migratory, 26.4% seasonal, and 96.3% self-identified as Latino. Their average age was 35.0 years with a range of 18-90. Older individuals (over 65 years) who may not be full-time farmworkers were included in the study because it is not certain when farmworkers stop working as full-time farmworkers and there were only 32 individuals over 65 years, with a cumulative prevalence of 0.5%. The average age excluding participants ages 66-90 years was 34.8.

Study participants who were excluded from the analysis because they were under 18 years (n=907) were on average 7.1 years old with a range of 0-17. They were 32.0% migratory, 68.0% seasonal, and 97.6% were identified as Latino. Baseline characteristic information between excluded and included individuals is shown in Table 1.

Primary outcomes

NCFHP sites that provided both enabling and medical data showed that 47.2% of farmworkers received medical services over the course of the 2013 agricultural year (n=1236). The average age of those who received medical care was 35.2 years, which was not significantly different than the age of those who did not receive medical care (p = 0.46). Of those who received medical care, 65% were migrant workers and 35% were seasonal workers.

Hypertension was diagnosed in 4.2% of farmworkers (n =111). Farmworkers with hypertension comprised 9.0% of clinic visits in NCFHP funded medical visits. The average age of a farmworker with hypertension was 45 years (±10). The average age of farmworkers without
hypertension was 35 years (±11). Advanced age was correlated with a hypertension diagnosis (p < 0.01). Of the 111 workers diagnosed with hypertension, 65% were migrant workers and 35% were seasonal workers.

A diagnosis of diabetes was prevalent amongst 3.9% of all farmworkers (n=102) and 8.3% amongst all medical visits. The average age of farmworkers with diabetes was 46 years (±10). The average age of those without diabetes was 35 years (±11). Advanced age was correlated with having diabetes (p < 0.01). Of 102 workers diagnosed with diabetes, 47% were migrant workers and 53% were seasonal workers. Individuals with hypertension also had an increased odds of having diabetes with an adjusted OR=18.89 (95% CI 11.50-31.03) after adjusting for age.

A clinic visit for dermatitis was prevalent amongst 1.1% of farmworkers (n=28) and comprised 2.3% of medical visits. The average age of farmworkers with a diagnosis of dermatitis was 36 years (±12). Migrant and seasonal workers made up 71% and 29% of dermatitis diagnoses respectively.

A diagnosis of back pain was made among 4.7% of migrant and seasonal farmworkers (n=123). Back pain was diagnosed during 10.0% of medical visits. The average age of farmworkers with a diagnosis of back pain was 33 years (±9). Of the 123 workers diagnosed with back pain, 76% were migrant workers and 24% were seasonal workers. Neither diagnoses of back pain nor dermatitis were associated with increased age.
Comparison of migrant and seasonal farmworkers

The average age of migrant and seasonal farmworkers was 34 (±10) and 37 (±11) respectively. Seasonal farmworkers were on average significantly older than migrant farmworkers (p<0.01).

Of migrant and seasonal workers, 20% (n = 808) and 30% (n = 428) respectively accessed medical services in 2013. Logistic regression showed that seasonal workers had increased odds of utilizing health care than migrant workers with an unadjusted OR = 1.68 (95% CI 1.46-1.93). After accounting for age, the adjusted OR = 1.69 (95% CI 1.46-1.93). Details of the calculations are in Table 3.

Focusing on specific health outcomes, 1.8% migrant farmworkers (n=72) and 2.7% of seasonal workers had hypertension (n=39). The unadjusted OR showed that seasonal workers had greater odds of having a diagnosis of hypertension than migrant workers with an OR = 1.52 (95% CI 1.00-2.29). However after adjusting for age and diabetes it was no longer significant, (p=0.71). Of migrant and seasonal farmworkers, 1.21% (n=48) and 3.78% (n=54) respectively had diabetes. Seasonal workers had a greater odds of having a diagnosis of diabetes than migrant farmworkers with an unadjusted OR = 3.22 (95% CI 2.12-4.87). After adjusting the co-variates of age and hypertension, the adjusted OR = 2.56 (95% CI 1.68-3.92). There was no association between migratory status and either a dermatitis or back pain diagnosis. Details of the calculations are in Table 4.
Secondary outcomes: outreach and education

All 6,343 individuals in the database received enabling services which included health education. Of all farmworkers and their dependents, 32% received education on hypertension (n = 1,731), 5.1% received education on diabetes (n = 275), 84% received education on pesticide safety (n = 4,537), and 10% received education back pain and safety (n = 564).

Of migrant and seasonal farmworkers, 36% and 21% received hypertension education, 4.3% and 7.3% received diabetes education, 86% and 77% received pesticide training, and 9.9% and 12% received back pain and safety training, respectively. Migrant workers had a greater odds of receiving hypertension, pesticide, and back pain and safety training (p<0.01). Seasonal workers had a greater odds of receiving diabetes education (p<0.01).

Of patients with a diagnosis of hypertension and diabetes, 24% and 32% received education on the respective disease. Of those patients who had diagnosis of back pain or dermatitis, 72% and 79% received counseling on the subject. It is not known whether this counseling happened before or after their medical visits. There is no association between receiving back pain or pesticide education and subsequent medical diagnoses of back pain or dermatitis.

Discussion

Summary of findings

This study sought to increase the understanding of health care utilization and health outcomes of migrant and seasonal farmworkers in North Carolina. The results show that almost half of the farmworker population uses medical services over the course of an agricultural year.
The most common diagnoses were back pain, hypertension, and diabetes. Migrant workers had almost twice as many clinic visits as did seasonal workers, which is no surprise as migrant workers made up 74% of the North Carolina farmworker population.

Adult seasonal workers were significantly older than migrant workers and had almost two times the odds of seeking medical services than migrant workers. Additionally seasonal workers were three times as likely as having a diagnosis of diabetes than migrant workers. The reasons for these findings are multiple. Seasonal farmworkers may be able to sustain a life of farmwork at a later age because they have permanent residence in the United States and do not have to endure the hardships of a migratory lifestyle. As an older population, seasonal farmworkers will have higher prevalence of chronic diseases which leads to higher health care utilization. The alternative reasoning is that migratory workers are less likely to seek health care services and those with health care needs go undetected. Migration leads to less familiarity with local health care resources, less acculturation and comfort with the American medical system, and potentially less ability to speak English because they do not have permanent residence in the United States. Therefore it may be that seasonal workers do not have a higher prevalence of diabetes, rather diabetes is diagnosed at a higher rate than in migrant workers because seasonal workers are more willing to seek health care services.

This point is significant because NCFHP outreach workers have noticed an increase in the proportion of migrant workers within North Carolina. In 2010 there were 58,400 migrant workers in North Carolina and in 2013 there were 59,771; this is 70.2% and 71.6% of the statewide farmworker population respectively. The NCFHP infers that this is happening because of increased unreliability of employment due to mechanization and an increased use of
subcontracted labor.\(^1\) If this population continues to grow, more education must be provided to the migrant population to inform them of the resources available to them through the NCFHP.

**Previous Literature: Health Care Utilization**

Previous research has shown that 71% of farmworkers are migratory and 94% are Latino in North Carolina.\(^1\) Of farmworkers and their dependents, children ages 0-17 make up 16% of the population.\(^1\) These values are all comparable to the demographic data in the study sample. In 2013 among all North Carolina migrant farmworker agencies, 40,871 farmworkers accessed enabling and medical services out of a total population estimate of 83,516 (49%), which is similar to the health care utilization value in the study.\(^7\)

Literature on farmworkers nationwide demonstrates drastically lower levels of health care utilization amongst farmworkers. For example, a 2000 national study found that only 20% of migrant and seasonal farmworkers reported using any healthcare services in the preceding 2 years.\(^{37}\) The discrepancy between national numbers of health care utilization and those found in the study could be due to the unique and dedicated support to farmworker care in North Carolina. Most nationwide health centers that provide services to farmworkers serve not only farmworkers but other low-income populations as well. These types of clinics receive general health center grants but often do not receive funding specifically to support needs of farmworkers. In 2002, only 125 of the nation’s 843 federally funded health centers received funds specifically to target farmworker needs.\(^{37}\)

The NCFHP and other North Carolina Independent migrant health centers receive 330 migrant health funding from the Bureau of Primary Health Care, Health Resources and Services Administration. Migrant clinics can apply through the U.S. Public Health Services section 330
for funding to serve migratory and seasonal agricultural workers. This type of specific farmworker funding allows the NCFHP to perform special services such as offer health education, case management services including transportation, interpretation, and referral to clinics, as well as fund local primary care at local clinics. When asking North Carolina farmworkers what barriers to care they have experienced, 24% cited language, 12% cited transportation, 12% cited cost, 5% cited work scheduled, and 5% cited hours. The NCFHP and their outreach workers have tried to address these concerns as well as hold evening and/or weekend clinics and offer sliding scale clinic fees to help accommodate farmworker schedules and wages.

*Previous Literature: Health Care Outcomes*

Research on farmworker skin conditions in North Carolina have mostly been longitudinal surveillance studies conducted at farmworker camps rather than collecting data at clinics. The data is primarily obtained through self-report and one study showed that 95% of farmworkers reported a skin problem within the last 7 days on the interview. However studies that focused on dermatologic related quality of life showed small effects and that most conditions were banal and chronic. This fits with the results of the study because despite high prevalence of self-reported skin disease in these studies, small effect on quality of life will lead to low rates of medical care utilization.

In a cross-sectional survey of musculoskeletal health and safety among North Carolina migrant and seasonal farmworkers, 40% of 300 farmworkers reported elevated musculoskeletal discomfort at the time of interview. Another survey taken by the Binational Farmworker Health Survey which samples nationwide farmworkers reported that 27% of current workers reported at
least one injury during their working lifetime.\textsuperscript{35} The prevalence of both self-reported skin-related and musculoskeletal disease seems high compared to the low health care utilization seen for these two conditions in the study (1.1\% for dermatitis and 4.7\% for back pain). We do not have quality of life scores for the studies on musculoskeletal health. However if they are similar to the values seen in the dermatology studies, low rates of health care utilization are not surprising when considering that farmworkers may not want to sacrifice a days’ worth of pay to seek treatment.

There have not been any cross-sectional analyses of chronic illnesses amongst farmworkers in North Carolina. Previous data on chronic disease are based on clinic data or self-reported diagnoses of farmworkers in other states.\textsuperscript{35} One study that looked at hypertension prevalence from clinic data in New York reported that between 6.8-1.8\% had a diagnosis of hypertension between 2003-05.\textsuperscript{40} One study in Texas and another in New Mexico found that 21\% and 25\% of farmworkers self-reported a diagnosis of hypertension.\textsuperscript{41,42}

The Bureau of Primary Care reports that North Carolina migrant clinics served 1,456 diabetic patients in 2013. Still there are no studies on diabetes prevalence amongst North Carolina farmworkers. The study referenced above from New York, using clinic data, reported prevalence rates of 1.9-4.3\% between 2003-05.\textsuperscript{40} The studies in Texas and New Mexico using self-reported data showed diabetes prevalence rates as high as 22.6\% and 16.1\% respectively.\textsuperscript{41,42}

The chronic disease prevalence rates from the New York study is very similar to the rates found in this study. By no coincidence, both studies used clinic-based data. The self-reported rates from the studies in Texas and New Mexico report substantially higher rates of chronic disease. This self-reported data may be subject to over-reporting, recall bias, and are
generalizable to southwestern United States. However it indicates that the true values of chronic
disease amongst farmworkers in North Carolina are certainly higher than the values reported,
likely due to unwillingness to access health care or not being aware of the services offered to
them. This means that there are many farmworkers currently working under strenuous conditions
who have unmanaged chronic illness which could have catastrophic medical consequences.

**Limitations**

The results of this study should be considered in light of its limitations. Using clinic data
has an inherent bias in that it only represents those farmworkers who access health care. Clinic
based estimates of disease prevalence are going to be significantly lower than true values. This
limitation is especially true amongst farmworkers who seek care at lower rates than the general
population. Unfortunately many farmworkers refrain from seeking medical attention even
when needed due to cultural, linguistic, financial, and logistical reasons.

The NCFHP data source in particular may further underrepresent the prevalence of
disease and health care utilization. NCFHP outreach workers will refer patients to whatever care
is most appropriate, which in some cases may not be a NCFHP funded clinic. For example,
health outreach workers generally cover several counties and are based at a health center in one
of those counties. If that worker travels to a neighboring county to provide farmworker enabling
services and a farmworker needs medical services, it may be true that there is a closer medical
facility with sliding scale that accepts farmworkers. Although this clinic may not be funded by
the NCFHP, it is more convenient for the farmworker. Because the NCFHP does not pay for that
encounter, it does not capture that medical data (although it will capture the enabling encounter
data). Additionally, the dataset does not include medical data from 3 NCFHP sites: Piedmont
Health Services, Rural Health Group, and Robeson Health Care Corporation. However appropriate adjustments were made described in the Methods section to calculate health care utilization prevalence rates.

Individuals in the data set under 18 years old were excluded from the study because the focus was on full-time farmworker employees and health issues unique to this population. Although farmwork labor can begin during adolescent years, not all adolescents participate full-time and those that work are less likely to endure the injuries associated with long-term agricultural labor. Excluding this population could potentially underreport the number of farmworkers and health care utilization data. However only 8.0% of clinic visits (n=108) were from individuals under 18.

Similarly, all adults over 17 were included in the data and the age values ranged from 18-90. Although individuals at the higher age ranges (75-90) are most likely dependents of farmworkers (parents, relatives) rather than full-time farmworkers, it is unclear at what age farmworkers retire. It can be inferred that the age of retirement is higher than the Social Security full retirement age of 65 years old due to financial pressures to continue working later in life. Therefore all individuals over 18 were included in the study. Including this population could potentially overestimate health care utilization and disease prevalence. However only 0.51% (n=32) of the data set were over 65 and is unlikely that exclusion of this population would substantially change the results. Lastly, a cross-sectional analysis does not indicate causality only association.
Conclusions and opportunities for further research

One of several aims of the Affordable Care Acts is to expand medical insurance coverage to millions of previously uninsured Americans. It will be interesting to see how this affects farmworkers and their ability to access health care. Although North Carolina has currently declined to expand Medicaid coverage to those within 133% of the Federal Poverty Level, legally present farmworkers which include H2A workers will be required to purchase individual insurance from the exchanges. Additionally, some farmworkers will be offered health insurance through their employers. Large employers with more than 50 employees will be required to offer affordable insurance to their employees or face a financial penalty. Smaller businesses with less than 50 employees can shop on the insurance exchange. As the ACA continues to evolve, the NCFHP and other farmworker support organizations should provide ACA navigators to help farmworkers understand new health care consumer options. Increased knowledge about available resources will hopefully persuade farmworkers to access health services when medically necessary.

However undocumented farmworkers will still not be able to purchase insurance in the United States. The National Agricultural Workers Survey (NAWS) from 2007-09 shows that 48% of farmworkers do not have proper documentation to work in the United States which is a very significant percentage. Therefore grass-roots efforts must still be undertaken to educate farmworkers on health care options and to expand migrant health facilities with affordable treatments. NCFHP outreach coordinators have realized that there is an overall decline in rural service providers, especially in specialty services like mental and dental health, who are willing to accept low Medicaid reimbursements. Additionally, Charity Care is becoming less common
and co-payments are increasing which results in higher financial burden for farmworkers.\textsuperscript{1} Independent of insurance coverage, health care services need to be made more affordable for this population to encourage appropriate health care utilization. The ACA has allotted $11 billion dedicated to community health center programs which hopefully will create sufficient medical services to support a growing farmworker population.\textsuperscript{43}

In terms of further research on farmworker health outcomes, there needs to be more cross-sectional analyses of the prevalence of chronic diseases to understand disease burden. This research could include mass blood pressure screenings and A1C checks amongst farmworkers at campsites. Concerning findings should result in referral to one of the NCFHP funded clinics for follow-up and disease management. Knowing this information and who amongst the farmworkers have particular chronic illnesses could help NCFHP target enabling services and education lessons to those who could benefit from the information.

\textit{Acknowledgements}

I would like to thank the North Carolina Farmworker Health Program for their support and guidance in this project. I would like to specifically thank Mary Rockers and Maria Ruatto of the NCFHP for helping me organize the data and focus my study. Also, I would like to thank Dr. Anthony Viera and Dr. Gayle Thomas for proofreading and editing my work.
### Table 1

<table>
<thead>
<tr>
<th>Participant characteristics</th>
<th>Included participants</th>
<th>Excluded participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (in years)</td>
<td>Mean (sd) [range]</td>
<td>35.03 (10.69) [18-90]</td>
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<tr>
<td>Latino</td>
<td>no. (%)</td>
<td>5405 (97.6)</td>
</tr>
<tr>
<td>Migrant</td>
<td>no. (%)</td>
<td>3978 (73.6)</td>
</tr>
<tr>
<td>Seasonal</td>
<td>no. (%)</td>
<td>1427 (26.4)</td>
</tr>
</tbody>
</table>

*Table 1.* Baseline demographic characteristics between included participants and excluded participants. Individuals were excluded if they were under 18 years old.
Table 2. Baseline characteristics between migrant and seasonal farmworkers.  
1. Only included p-values if was significant (p <0.05).
Table 3. Test of association between seasonal workers and health care visits.

1. Adjusted for age

<table>
<thead>
<tr>
<th></th>
<th>OR (unadjusted)</th>
<th>OR (adjusted)</th>
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<tr>
<td>Seasonal workers vs. migrant workers and health care utilization</td>
<td>1.68 (1.46-1.93)</td>
<td>1.69 (1.46-1.93)</td>
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</tbody>
</table>
Table 4. Test of association between seasonal workers and diabetes diagnosis.
1. Adjusted for age, hypertension, back pain and dermatitis.
2. Adjusted only for age and hypertension.

<table>
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<tr>
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<th>OR (unadjusted)</th>
<th>OR (gold)¹</th>
<th>OR (adjusted)²</th>
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<tbody>
<tr>
<td>Seasonal workers vs. migrant workers and diabetes diagnosis</td>
<td>3.22 (2.12-4.87)</td>
<td>2.61 (1.71-4.00)</td>
<td>2.56 (1.68-3.92)</td>
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</tbody>
</table>

Table 4
References


