EXAMINATION OF CULTURE, PLACE AND ENVIRONMENTAL HEAT STRESS ON FLUID INTAKE AND HYDRATION STATUS AMONG LATINO FARMWORKERS

by

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Agriculture is one of the most dangerous occupations in the United States, including a disproportion risk of death from heat-related illnesses (HRIs). Proper hydration mitigates HRI, yet farmworkers report not drinking water due to various pretexts. To date, no known studies have specifically focused on NC farmworker hydration status or fluid intake; therefore, the purpose of the dissertation research study was to explore how culture, place, and environmental heat stress influence fluid intake and hydration status among a sub-set of Latino farmworkers living in eastern North Carolina**.**

A community-informed, sequential exploratory mixed methods research design was conducted in July and August 2020. In Phase I we conducted focus group discussions with farmworkers to gain farmworker perceptions on their fluid intake. In Phase II we collected a cross-sectional survey, a beverage questionnaire, wet bulb globe temperatures and physiological markers of hydration status. The final convenience samples included 28 participants in Phase I and 30 participants in Phase II; all were male, migrant Latino farmworkers. Twenty-six (87%) of the final sample in Phase II also took part in Phase I, with the mean age of participants in that latter phase of 38.7 (*SD* = 8.7) years. Transcripts from the FGDs were analyzed using content

analysis. Parametric analyses using the quantitative data were performed via SPSS v.27. Qualitative and quantitative data was integrated using a meta-matrix.

From Phase I, the two major thematic findings were Absence of Protection and Freedom to Drink. Farmworkers consistently perceived extreme outdoor temperatures as the greatest barrier and reported self-care sacrifices, incomplete hydration education, and workplace water accessibility and quality issues. For Phase II, 46.7% of farmworkers' pre-shift urine specific gravity (USG) indicated dehydration, increased to 100% at post-shift, which was a significant increase across the shift, $t\ (24) = -6.765$, $p < .001$ (two-tailed). Evaluating hydrated and dehydrated groups further highlighted the importance of both time at work and heat stress to hydration status. Integration of Phase I and II data revealed congruent findings related to extreme heat, few breaks, and poor housing.

Findings of this study will support the development of interventions and support policy change to protect against farmworker HRI. It will also provide further insight into farmworker kidney health and the health effects of extreme environmental heat stress. As the nation's most trusted profession, nurses are in a great position to protect vulnerable populations. As climate change is the greatest public health this century, nurses can and should lead the call for climate and social justice and ease the burden of climate change on human health.

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by

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DEDICATION

My current and future work is dedicated to farmworkers and other vulnerable populations of the world. I would like to thank farmworkers for all they do and endure to bring food to American tables.

To my daughter, this journey is dedicated to you. I hope you will one day know that women are strong and can do anything they set their minds to. I hope to do my part to keep this planet a beautiful, healthy, and peaceful place to live for your generation.

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CHAPTER 1: INTRODUCTION

Agriculture is one of the most dangerous industries in the United States (Bureau of Labor Statistics, 2018). Fatal workplace injuries among workers in the agriculture industry commonly involve transportation, like tractor overturns; crushing injuries from equipment; other persons and animals; falls; and exposures to harmful substances or extreme environments (Bureau of Labor Statistics, 2018). Extreme environments, especially temperature-related conditions, can contribute to heat-related illnesses (HRIs). From 2000-2010, U.S. agricultural workers were 35 times more likely to die from HRIs, making agriculture the riskiest occupation for HRI death (Gubernot et al., 2015). During this period, Latino workers were at even higher risk for HRI death, with a relative risk of 3.4, compared to other agricultural workers. Approximately 870,000 farmworkers are employed in the U.S. every year and 85,000 work in North Carolina (NC), majority of whom are from Mexico and Central America, highlighting the risk for this population (Gubernot et al., 2015; Lambar & Thomas, 2019).

Death from HRIs has been a consistently higher risk for farmworkers in NC, compared to other states. Despite occupational HRI death being highly preventable, from 1992-2006, NC farmworkers had the highest annualized rate of HRI death in the country (Luginbuhl et al., 2008; National Institute for Occupational Safety and Health [NIOSH], 2016). Also, from 2000 to 2010, NC ranked 6th in the nation in HRI death rates among all workers (Gubernot et al., 2015). There was a disproportionate risk for NC farmworkers; however, on average only one death from HRI was reported yearly (Luginbuhl et al., 2008). This number was likely under reported, or under-identified and reported as death due to other co-existing conditions (Mora et al., 2017).

Farmworkers in NC frequently work long hours during the hottest time of year (Arcury et al., 2015; Kearney et al., 2016). In fact, 2019 was the hottest year ever recorded in the state and in 2020, eastern NC experienced 29 days above 32°C (90°F) in July and 16 in August (National Oceanic and Atmospheric Administration, [NOAA] 2020; Raleigh Weather Forecast Office. 2020). Factors that put farmworkers at risk for HRIs include 1) performing physically exerting tasks outside under direct sunlight, 2) working in high humidity field crops, 3) wearing heavy work clothes, and 4) irregular and infrequent access to water (Arcury, 2015; Jackson & Rosenberg, 2010; Kearney et al., 2016; Spector et al., 2015).

Heat is the leading cause of weather-related deaths, nearly double or triple the number of deaths resulting from lightening, tornadoes, hurricanes, or floods (NOAA, 2018). Illnesses caused from heat range from mild conditions, such as heat rashes and heat cramps, to more critical conditions, such as heat exhaustion and heat stroke (Centers for Disease Control and Prevention [CDC], 2019). In the general population, the reported 28-day and 2-year mortality rates from heat stroke are over 50% and 70%, respectively (Argaud et al., 2007; Hifumi et al., 2018). In NC, HRIs account for over 2,000 annual emergency department (ED) visits; the highest rates occurring in rurally isolated locations of eastern NC (Sugg et al., 2015). In NC, between 2007 and 2011, heat exhaustion accounted for over 70% of all HRI ED visits while heat stroke was the documented cause of approximately 5% (Fuhrmann et al., 2015).

Significance of the Problem

The Intergovernmental Panel on Climate Change (IPCC) calculated that the earth's averaged temperature has increased approximately 1°C (2°F) over the last 150 years (IPCC, 2018). If measures are not implemented to limit the warming of the earth, the number of people exposed to severe heat waves, occurring at least once every five years, will increase by 1.7 billion (Dosio et al., 2018). Heat waves are three or more sequential days of extremely high temperatures (Dosio et al., 2018). As a result of global warming, adverse health outcomes due to

HRI for farmworkers will likely increase. By the year 2100, the number of days per year of temperatures above 38°C (100°F) is projected to increase from 3 to 60 in the southeastern U.S. (NOAA, 2020). While that may be in the distant future, the Alliance of Nurses for Healthy Environments, is one of a number of organizations that recognizes that climate change is already affecting human health, through toxic air quality, more frequent and severe weather events, increased range and incidence of vector borne diseases and rising rates of HRIs (Anderko et al., 2017).

The HRI literature suggests farmworkers are aware heat and dehydration can cause adverse health effects. Yet the accuracy and reliability of this information is in question. Most farmworkers reported never receiving formal HRI information, though they did report knowing water to be the healthiest fluid to drink and insufficient water consumption could cause HRIs (Lam et al., 2013; Luque et al., 2019b). Lam et al. (2013) suggests there is a knowledge-practice gap regarding hydration; farmworkers are aware of the dangers but often do not act on that knowledge. Understanding what contributes to this knowledge-practice gap is important in designing and implementing interventions to prevent farmworker HRI.

Environmental and occupational factors increase farmworkers' risk for workplace injuries and impede their fluid intake. Compared to others working in agriculture, Latino farmworkers are more vulnerable to workplace injuries due to 1) minimal safety training, 2) low levels of formal education and literacy, 3) language and cultural barriers, 4) discrimination, 5) immigration-related fear, and 6) inadequate knowledge of labor rights or reluctance to speak up about unfair treatment and hazardous conditions (Arcury et al., 2015; Lambar & Thomas, 2019). Regarding fluid intake, farmworkers reported common barriers to be 1) negative reactions from superiors regarding water breaks, 2) short or no work breaks, 3) long distance to the toilet, and 4) quality and availability of the water at the worksite (Lam et al., 2013). Other occupational factors that impede fluid intake include farmworker-reported discrimination against Latinos and the imbalance between the power of agricultural system structures and farmworker agency to make self-care decisions (Snipes et al., 2017; Wadsworth et al., 2019).

Physiological markers of hydration suggest farmworkers are dehydrated on-the-job. Mix and colleagues (2018) reported that 53% of sampled farmworkers in Florida had pre-shift urine specific gravity (USG) values indicating dehydration (USG $\geq$ 1.020). More concerning is that this proportion increased to 81% post-shift. From a sample of farmworkers in California, Moyce et al. (2017) reported 64.8% of men and 52.5% of women lost more than 1.5% of their body mass over a worked shift, indicating an unhealthy loss of body fluid. According to NIOSH (2016), workers should not lose more than 1.5% body mass during a shift or the risk for HRIs increase as the body cannot compensate for heat stress. At greater than 1.5% body mass loss, heart rate and body temperature increase, and work production decreases (Greenleaf & Harrison, 1986).

Gaps in Current Farmworker HRI Literature

Several studies on the health of farmworkers in central and eastern NC have been conducted over the last ten years (Arcury et al., 2019; Furgurson et al., 2019; Kearney et al., 2014; Kinney et al., 2015; Quandt et al., 2013; Sandberg et al., 2016). During that time, authors of two studies focused on farmworker HRIs (Arcury et al., 2015; Kearney et al., 2016), with the next most recent HRI article dating back to 2010 (Jackson & Rosenberg, 2010). No known studies have had a specific focus on NC farmworker hydration status or fluid intake and environmental heat stress.

National and state policies are inadequate to protect against farmworker HRI. The existing federal worker and sanitation regulations only indirectly protect farmworkers from HRIs. Indirect regulations include inspection of migrant farmworker homes and requirements of employers to provide drinking water and toilets for employees engaged in manual, field labor. Despite indirect regulations, there are no federal or NC state-specific occupational safety and health standards that address heat injury or illness (NC Department of Labor, 2018). This study's finding will have implications for policy changes in NC.

Study Intentions and Innovation

This study addressed research priorities from leading nursing organizations; the National Institute of Nursing Research (NINR), and the Council for the Advancement of Nursing Science, with a focus on understanding health risks, improving health behaviors, and advancing global health (Grady, 2017; Henly et al., 2015). This study was also innovative through use of environmental heat stress technology and a multidisciplinary research team—additional priorities of NINR (Grady, 2017). The use of a wet bulb globe temperature (WBGT) is the preferred heat metric for HRI prevention of all occupational groups and on-site measurements are not commonly included in farmworker studies (Mac et al., 2017; Mix et al., 2018; NIOSH, 2016). A multidisciplinary team and inclusion of community members as co-investigators for the integration of local knowledge will further advance nursing science (Grady, 2017). Lastly, the use of a digital refractometer allowed for real-time on-site health information for the study participants (Heileson & Jayne, 2019).

Knowledge gained from this study could advance understanding of an emerging epidemic among Latinos agricultural workers, known as chronic kidney disease of uncertain etiology (CKDu). First discovered in Central America, and labeled 'climate change nephropathy,' young, Latino farmworkers were developing CKDu at epidemic proportions, without the presence of traditional risk factors for chronic kidney disease, such as diabetes and hypertension (Johnson et al., 2019; Roncal-Jimenez, et al., 2016). This epidemic was hypothesized to be contributed from rising outdoor temperatures, exertional activity, and chronic dehydration; therefore, is relevant to the health of farmworker populations outside of Central America, including the U.S. (Crowe et al., 2019). Many NC farmworkers migrate from Mexico and Central America and many also work in the agricultural fields in those countries.

Climate change has been described as the greatest public health threat of the 21st century and is predicted to have dramatic human health impacts, from malnutrition, extreme weather events, spread of infectious disease and complications of chronic disease (Crimmons et al., 2016; Lilienfeld et al., 2018). The populations most vulnerable to the negative health effects of climate change are likely ones who are least responsible for its development, an issue termed 'climate justice' (Lilienfeld et al., 2018). Through advocacy, education and actions as global citizens, nurses are being called to protect vulnerable populations, promote climate and social justice and ease the burden of climate change on the world's human population (Leffers & Butterfield, 2018; Lilienfeld et al., 2018; Veenema et al., 2017). As a result of climate change, the number of premature heat-related deaths in the U.S. could increase by thousands to tens of thousands of people each year by the end of the century (Crimmons et al., 2016). Knowledge about mitigation of HRIs could improve human health and save many lives.

To better understand the farmworker hydration knowledge-behavior gap, we will use a holistic focus. Rather than focusing on hydration solely as an individual behavior, we will consider both micro and macro-level factors that influence farmworker behavior. The micro-level individual characteristics and the macro-level organizational power structures will be examined regarding the concept of farmworker culture (Dixon, 2019; Yuval-Davis, 2017). Concerning place, we will explore the micro-level social relations and macro-level policy and economic structures (Neely & Nading, 2017). Environmental heat stress discussions and measurements together can provide more information about individual understanding and adaptation to heat as well as how HRI policies, or lack thereof, influence farmworker hydration (Crimmins et al., 2016; Walker et al., 2019). This study aimed to understand health disparities in HRI risk and fluid intake (Bethel et al., 2017; Brooks et al., 2017) as well as contributed to the science at the intersection of nursing and environmental health.

Theoretical Framework

Intersectionality theory was used to inform this study. Intersectionality was chosen due to its holistic nature, origins in experiences of the marginalized worker in the workplace, and ability to assist in the examination of complex interactions between social and ecological systems. The six core concepts of intersectionality are inequality, relationality, power, social context, complexity, and social justice (Collins & Bilge, 2016). Use of this theory was intended to uncover factors related to worker safety, their interrelated identities, the power imbalance at the workplace, complex effects on health behaviors, and the interplay of social justice.

The first core concept inequality, according to Collins and Bilge (2016), includes both disadvantage and privilege within socially organized hierarchies. The second core concept, relationality, relates to how class, race, gender, and other categories jointly form social inequality. Power, the third core concept, is the ability to influence the behaviors of others. Fourth, social context is the immediate physical and social setting in which people live, work, study, or play. Fifth, complexity, suggests the world, people and human experiences consist of many factors that cannot be understood singularly. Complexity further recognizes that people are positioned in the broader socio-cultural, political, and economic context, and occupy multiple demographic categories. The last concept of intersectionality—social justice—concerns the distribution of wealth, opportunities, and privileges.

Purpose of the Study

The purpose of this study was to explore how culture, place, and environmental heat stress influence fluid intake and hydration status among a subset of Latino farmworkers living in eastern North Carolina. In collaboration with staff at a federally qualified health center (FQHC), we conducted a community-informed, mixed methods research design (Creswell, 2015; Israel et al., 2013). It was community-informed by FQHC staff participating in the study design, data collection and data analysis. The study was conducted in two phases: Phase I, the qualitative component, addressed Aim I, and Phase II, the quantitative component, addressed Aim II. The study aims and research questions (RQ) were;

Aim I: Describe the factors Latino farmworkers believe influence their fluid intake.

RQ 1: How do cultural beliefs, values, and norms influence farmworker agency and fluid intake?

RQ 2: How does workplace, housing, country of origin, and rurality influence farmworkers' fluid intake?

RQ 3: What accounts for on-the-job knowledge, behaviors, and attitudes of fluid intake during environmental heat stress?

Aim II: Determine the relationship of hydration status to farmworker characteristics, behaviors, and environment. The hypothesis was: Farmworker USG would significantly increase over a worked shift and more than 50% of the sample would have USG ≥ 1.020 before work and more than 75% would have a USG ≥ 1.020 after work.

RQ 1: What is the prevalence of pre- and post-shift dehydration among farmworkers?

RQ 2: What are the associations between sociocultural factors, workplace factors, WBGT, and beverage intake with farmworker hydration status?

Operational Definitions

Fluid intake- the consumption of plain water and fluids other than water through drinking (Stanhewicz & Kenney, 2015; Stookey & Konig, 2018). In Phase I fluid intake was arrived at through textual analysis. In Phase II it was measured through the Beverage Intake Assessment Questionnaire.

Hydration status- the balance between fluid outputs and fluid inputs as measured by USG (Baron et al., 2015). In Phase II USG was measured via refractometer.

Culture- differences in sociocultural norms, about where, when, what, how, with whom, and why fluids are consumed (Stookey & Konig, 2018). In Phase I this was arrived at through textual analysis. In Phase II this was measured through a demographic survey.

Place- the physical environment, including work and home, which contribute to body water loses and differences in water intake, including water quality, perception, color, odor, taste, and access to sanitation facilities (Stookey & Konig, 2018). In Phase I place was arrived at through textual analysis. In Phase II it was measured using a demographic survey, including specific questions on workplace and housing conditions.

Environmental heat stress- environmental factors which result in an increase in heat storage in the body (NIOSH, 2016). In Phase I it was arrived at through textual analysis. In Phase II it was measured through WBGTs using a heat stress monitor.

Summary

Environmental heat stress resulting in HRI is a disproportionate morbidity and mortality risk among farmworkers in NC. While drinking water can mitigate heat stress and help prevent heat-related mortality, farmworkers reported not drinking water due to various micro and macro-level factors. This study aimed to better understand hydration and fluid intake among Latino farmworkers, using Intersectionality theory. Findings of this study suggest interventional and policy adjustments to protect against farmworker HRI. It provided further insight into CKDu and the health effects of environmental heat stress in the context of climate change.

CHAPTER 2: LITERATURE REVIEW

This chapter provides a general overview of farmworkers that live and work in North Carolina and synthesis of the literature on occupational health risks among farmworkers. Although the existing HRI and hydration literature is limited, farmworker heat exposure and hydration status will be discussed, including cultural practices, related workplace regulations and housing conditions. Inadequate occupational protections and standards are outlined, and physiological consequences of dehydration are presented. Finally, this chapter summaries the concepts of culture, place, and environmental heat stress and the Intersectionality Theory, related to farmworkers.

Farmworker Demographics

There are approximately 870,000 farmworkers in the United States every year (Bureau of Labor Statistics, 2019). They have various roles and responsibilities, including field crops, plant nurseries, livestock, and serving as graders and sorters (U.S. Department of Agriculture [DOA], 2020). They usually have the most direct contact with crops and other agriculture commodities (Lambar & Thomas, 2019). Farmworkers are commonly categorized as seasonal or migrant. A migrant farmworker is an “individual who is required to be absent from a permanent place of residence for the purpose of seeking remunerated employment in agricultural work”, while seasonal farmworkers are “individuals who are employed in temporary farm work but do not move from their permanent residence” (Migrant Clinicians Network, 2017, para. 1). Compared to other occupations, farmworkers have considerably fewer years of education, more likely to be Hispanic and less likely to be U.S. citizens (U.S. DOA, 2020). In 2019, hourly wages for farmworkers ranged from $11.13 (in Alabama, Georgia, and South Carolina) to $15.03 (in

Oregon and Washington); farmworkers in NC received, on average, $12.15 an hour (U.S. DOA, 2020).

North Carolina is one of the nation's leading employers of migrant farmworkers, with over 85,000 every year (NC Department of Commerce Workforce Solutions Agricultural Services, 2015). Farmworkers are critical to the success of the agriculture industry, a major contributor of NC's economy. The industry contributes $92.7 billion to NC's economy, more than any other NC industry (NC DOA & Consumer Services, 2020). According to the National Agricultural Workers Survey, Latinos comprise 83% of the crop worker population: 68% male, 53% uninsured and 33% live below the poverty level (U.S. Department of Labor, Employment and Training Administration, 2019). A comprehensive demographic profile of farmworkers in NC has not been conducted. Of the population that were served by NC federally qualified health centers (FQHCs), 95% reported Latino heritage, 92% were uninsured and 87% lived below the federal poverty level (Lambar & Thomas, 2019). Seventy-one percent and 29% of the NC farmworker sample reported being migrant and seasonal workers, respectively.

In NC, farmworkers usually work 10 to 12 hours per day, six days a week, and are off on Sundays (Layton, 2018). They commonly help raise tobacco, sweet potatoes and other field crops that require manual labor (Lambar & Thomas, 2019; U.S. DOA, 2021). They are less likely to work in areas that provide some shade, like orchard settings (Bethel et al., 2017; Lambar & Thomas, 2019). Especially in tobacco, farmworkers wear clothing to help reduce exposures to nicotine, pesticides, and the sun (Kearney et al., 2016; Lambar & Thomas, 2019). Farmworkers in NC have been observed wearing trash bags, rain jackets, heavy denim jeans and flannel shirts; the thickness and air impermeability of these garments interfere with convective, radiative, and evaporative heat exchange and thus increase HRI risk (Kearney et al., 2016; NIOSH, 2016; Walton et al, 2016).

Farmworker Culture

Sociocultural and environmental factors influence daily fluid intake (Stanhewicz & Kenney, 2015). Over the last eleven years, two qualitative studies have been conducted that assessed sociocultural aspects of farmworker health and hydration (Lam et al., 2013; Scherzer et al., 2010). Lam et al. (2013) conducted a participatory appraisal research study with 35 Latino farmworkers in central Washington with a goal to identify barriers to HRI prevention and treatment. Hydration barriers were discovered to be related to characteristics of the water, such as freshness, potability, location and source. The farmworkers preferred clean water over chemically treated, replenished frequently and kept away from sanitation facilities.

The second qualitative study was conducted with Latino participants in rural California, 67% of whom reported working as farmworkers (Scherzer et al., 2010). The majority of the 46 participants avoided drinking unfiltered tap water due to its poor taste, smell, and color. They believed the water in their homes' caused nausea and frequently smelled like either sewage or chlorine. Many reported giving their children Gatorade or juice over tap water. Participants spoke of a historically transmitted belief that the public tap water was unsafe.

According to NIOSH (2016) recommendations, minimal amounts of caffeine should be consumed while working, and alcoholic beverages should be avoided. Farmworkers did report drinks with high amounts of caffeine or alcohol as causes of HRI, although they admitted that soda, energy drinks, and coffee gave them energy to work faster (Lam et al., 2013). In four farmworker studies, energy drink consumption ranged from 8.6% to 21.6% while iced/hot coffee and tea consumption ranged from 4.6% to 10.7% (Bethel et al., 2017; Culp & Tonelli, 2019; Mix et al., 2018). In these studies, total quantity is not reported, therefore, making it difficult to compare to other groups of workers or people. Reported by Arcury et al. (2015), 59% of the middle-aged male farmworkers drank one to two caffeinated beverages per day (assuming 8-oz servings), an amount similar to the average American man, age 20-50, according to the National Health and Nutrition Examination Survey (Arcury et al., 2015; Drewnowski et al., 2013). Male farmworkers also have similar average alcohol consumption compared to American men; however, they reported higher rates of problem drinking (Arcury et al., 2015; Sonoma County Department of Health Services & California Human Development, 2015; Worby & Organista, 2007). Immigrant Latinos in NC report drinking alcohol to cope with increased feelings of depression and anxiety related to difficulties finding work and fear of deportation (Fleming et al., 2017).

Past and present practices of humoral medicine—the ancient tradition of balancing different humors or temperaments of the body—in Latino communities is discussed in current literature, including farmworker studies. The widespread Latino practice of balancing hot and cold elements to improve and maintain health could affect farmworker' hydration and HRI prevention behaviors (Barker et al., 2017; Foster, 1987). Farmworkers in California explained how certain fruits, salt, and self-prepared liquid solutions with added spices or electrolytes helped to restore their bodies' imbalance caused from working outside in the heat (Barker et al., 2017). In this study, dark sodas were preferred, reportedly to restore their balance while working. Farmworkers also report cold water on or in the body when it is hot outside can cause numerous body ailments from headaches to heart attacks (Lam et al., 2013; Luque et al., 2019b). In particular, the hot and cold traditional belief could be detrimental to health since rapid cooling in ice-cold water is necessary for the prevention and treatment of heat stroke (Epstein & Yanovich, 2019). Although some of the reported views from farmworkers are congruent with biomedical views, others are not; thus, further research on the sociocultural factors that influence fluid intake is warranted (Barker et al., 2017; Whalley et al., 2009).

Latino Fluid Intake

Several studies have evaluated Latino foreign-born and Latino U.S.-born beverage consumption behaviors (Brooks et al., 2017; Martinez et al., 2018; Pierce & Gonzalez, 2017; Rosinger et al., 2018). Brooks et al. (2017), using National Health and Nutrition Examination Survey data with over 8,200 participants, found racial, ethnic, and socioeconomic disparities in fluid intake among U.S. adults. White adults reported consuming, on average, 3.5 servings (600 mL) of tap water each day, while Black adults reported consuming 509 mL and Latinos reported consuming 552 mL. Lower income adults reported significantly fewer servings of tap water per day than higher income adults. Black and Latino adults also reported consuming significantly more servings of bottled water and fewer servings of other noncaloric beverages. Rosinger et al. (2018) similarly found Latino and immigrant adults consumed most of their plain water from bottled sources, using data from the National Health and Nutrition Examination Survey from 2007–2014, with over 20,000 participants. However, these researchers found Latino and immigrant adults consumed more plain water than other groups. Authors expressed concern over the added expense of bottled water and suggest structural differences might explain the disparity.

Latinos report distrust of the local tap water. Using 2013 U.S. Census Bureau's American Housing Survey, Pierce and Gonzalez (2017) found more than 90% of Americans sampled perceived their drinking water to be safe for drinking and cooking. Yet, they also found that immigrants, especially Latino immigrants, were more likely to distrust their tap water. Nearly one-third of immigrant Latinos indicated that they do not perceive their water to be safe for drinking and cooking. Native-born Latino were also the least likely ethnic group to perceive their water as safe, compared to other native-born groups.

In Latin American countries, a third of adult participants reported fluid consumptions that did not meet daily recommendations (Martinez et al., 2018). Among nearly 3,800 surveyed in Uruguay, Argentina, Mexico and Brazil, Mexican women reported the lowest total fluid intake, at 1748 mL per day. Citizens of Uruguay and Argentina had higher fluid intake than the men and women living in Mexico and Brazil. On average, plain water contributed to only 25% of all participants' fluid intake. Mexicans reported the highest sugar-sweetened beverage consumption, at 531ml/day.

Farmworker Occupational Culture

A common occupational culture practice among farmworkers is making tradeoffs between lost pay and self-care. Through focus group discussions, Wadsworth et al. (2019) found this was especially true for farmworkers in California who were paid by the piece. Piece-rate pay is the employer's choice of payment which will compensate the farmworkers by pound or piece of crop produced in a shift, instead of an hourly or salary rate (Horton, 2016). With piece-rate pay, drinking more and taking bathroom breaks will result in less pay; therefore, these farmworkers chose to consume less water (Lam et al., 2013; Wadsworth et al., 2019). Not only do farmworkers have financial goals and economic stresses leading to trade-offs in their health, farmworkers have strong desires to be viewed as "good workers" (Lambar & Thomas, 2019; Wadsworth et al., 2019). Farmworkers defined good workers as those with great endurance, productivity, and self-sufficiency. They wanted to please the employer in hopes of being asked to return to work the following day or season (Wadsworth, et al., 2019).

A primary concern is the water quality where farmworkers live and work. Bischoff et al. (2012), found 34% of sampled water from 181 farmworker camps in NC during the 2010 agricultural season failed the Total Coliform Rule (TCR) with Escherichia coli also being detected in two samples. Farmworkers in South Carolina reported bringing their own water to work due to poor quality of water (Luque et al., 2019b). Farmworkers frequently live in rural areas in housing plumbed with well-water or temporary water sources (Bischoff et al., 2012; Rosinger et al., 2018). Tap water from wells is not regulated by the EPA Safe Drinking Water Act and not tested systematically like public water systems (Rosinger et al., 2018).

Migrant farmworkers commonly live in homes provided by their employers, thus having little control over housing conditions or the other occupants of the home (Quandt et al., 2013). Referred to as migrant camps, these dwellings can include cinder-block barracks, houses, and mobile homes, clustered in one area. In Bischoff et al. (2012), over half of the inspected camps contained dwellings that housed 11 or more farmworkers. Inspectors found pest infestation in 24% of the dwellings (Bischoff et al., 2012). Poor housing conditions can also exacerbate heat stress. Lack of air-conditioning or ventilation can heighten the risk for HRIs due to the cumulative effects of heat exposure (Casa et al., 2015). A survey of housing units in 170 agricultural worker camps in NC found that more than half lacked air conditioning, and that the heat index inside the homes was often high (Quandt et al., 2013).

Occupational Health of Farmworkers

In 2015, the agricultural industry had the highest rate of fatal occupational injuries, with 570 fatal injuries for every 100,000 full-time workers. In 2018, the agricultural industry had the fourth highest mortality rate, increasing to 574/100,000 (Bureau of Labor Statistics, 2018). Persons working in agriculture face occupational risks related to dangerous machinery, physical demands, and variations in outdoor temperatures. In addition, farmworkers are exposed to pesticides, plant toxins, dusts, animal waste, and extreme noises. These serious exposures can result in cancers, infectious diseases, respiratory problems, hearing and vision disorders, and HRIs (National Council for Farmworker Health, 2018).

Overall, workplace and environmental influences can be shaped by social, political, and economic forces, as well as human-non-human interactions (Neely & Nading, 2017). Farmworkers face many workplace and environmental barriers to health. The negative forces or barriers farmworkers suggest they face with regard to hydration include poor relationships with superiors, short or no work breaks, long distance to the toilet, and employers not providing drinking water or not providing clean water (Lam et al., 2013).

Some farmers and crew leaders encourage their employees to drink water while others provide beverages to increase farmworker productivity. Investigators of a recent study of farmworkers in Iowa found water readily available and workers given ample rest periods (Culp & Tonelli, 2019). However, the authors admitted this may not be representative of Midwestern farmers as they willingly allowed the research team to observe farmworkers while working on the farms. Farmworkers in South Carolina reported that their crew leader provided beer to the farmworkers when the workday was going to be longer than normal (Luque et al., 2019b). Farmworkers in California reported that their crew leaders would give them coffee if the workers felt HRI symptoms (Barker et al., 2017).

The farmworker's relationship with their supervisor or leader made an impact on their reported water consumption. Farmworkers in Central Washington reported that they did not drink water more frequently because they did not want to upset their supervisor. In contrast, 97.5% of farmworkers in California and 95.7% of NC farmworkers felt comfortable taking a break to drink water (Kearney et al., 2016; Stoecklin-Marois et al., 2013). Whalley and colleagues (2009) found 67% of the farmworkers reported their boss did as much as possible to make their job safe, 18.5% believe the boss could do more, while 14.6% believe the boss was interested in doing the job fast and cheaply. In preventing HRIs, the power imbalance in the workplace makes it difficult for farmworkers to exercise control of their own self-care, despite the farmers reporting that they do give control to their employees (Wadsworth et al., 2019).

Breaks during the workday allow farmworkers to hydrate, rest, and use the bathroom, core behaviors in OSHA HRI-prevention program's safety message "Water. Rest. Shade." Farmworkers in central Washington described a typical workday as only drinking water during breaks or at end of the day (Lam et al., 2013). Most farmworkers in an Oregon and Washington study had at least a 30-minute break; however, over half had no additional breaks or 5 to 10-minute breaks in the mornings and afternoons (Bethel et al., 2017). Farmworkers in Washington and Florida reported no access to a toilet, 4.2% and 11% respectively (Mix et al., 2018; Spector et al., 2015). Farmworkers in Washington State with a greater than a 3-minute walk to the toilet resulted in higher odds of HRI symptoms (OR = 4.86; 95% CI = 1.18-20.06) (Spector et al., 2015).

Farmworkers in South Carolina reported that one of the most often discussed work issues was access to drinking water (Luque et al., 2019b). Some farmworkers rely on their supervisors to provide water, while others choose or needed to bring their own water from home (Fleischer et al., 2013; Lam et al., 2013; Mix et al., 2018; Stoecklin-Marois et al., 2013; Whalley et al., 2009). Under OSHA's Occupational Safety and Health Standards for Agriculture, subpart 1928.110, agricultural employers, with 11 employees or more, are required to provide a sufficient quantity of water in a readily accessible area. Despite this, between 2009 to 2018, only 88 to 97% of surveyed farmworkers in Georgia, Florida, California and North Carolina were provided clean, drinking water or beverages at work (Fleischer et al., 2013; Mix et al., 2018; Stoecklin-Marois et al., 2013; Whalley et al., 2009).

Occupational Health Standards and Policies

Through the Occupational Safety and Health Act of 1970, the National Institute for Occupational Safety and Health was established (NIOSH, 2016). This institute is responsible for conducting research and recommending occupational safety and health standards, including exposure levels. The standards on occupational heat exposure, *Criteria for a Recommended Standard: Occupational Exposure to Hot Environments*, was originally prepared in 1972 and last updated in 2016. One of the standards states "workers that have been in the heat for up to 2 hours and involved in moderate work activities [should] drink, a cup of water (about 8 oz.) every 15 to 20 minutes" and that the water should be cool (i.e., less than 15°C [59°F]) (NIOSH, 2016, p. 9). Based on this literature, farmworkers in the United States are likely not drinking enough water to meet the NIOSH standard of one cup of water every 15 to 20 minutes.

Compared to other occupations and employees, farmworker protection is markedly absent in the standards set forth from OSHA, supporting the doctrine referred to as agricultural exceptionalism (Rodman, 2016). These policies keep farmworkers uninformed and deprived of protections such as minimum wage, overtime pay, unemployment insurance, collective organizing and bargaining, and occupational health (Liebman & Augustave, 2010; Rodman, 2016). The Department of Labor in NC enforces the state's Wage and Hour Act which requires workers receive minimum wage and overtime; however, agricultural workers are specifically excluded. In NC, there are no standards requiring meal or rest periods for any workers (Rodman, 2016), key components of OSHA's "Water. Rest. Shade" for HRI-prevention. There are no federal or North Carolina state occupational safety and health regulations that specifically address heat illness (NC Department of Labor, 2018). California and Washington are the only two states with occupational safety and health regulations that specifically address outdoor environmental heat illness, both enacted in the mid-2000s (Bethel et al., 2017).

Heightened anti-immigrant rhetoric and discrimination likely has an indirect effect on farmworker fluid intake by influencing workplace safety. Using national, county-level pre-and post-2016 election surveys, Nichols et al., (2018) found higher deportation rates associated with higher reported mental health needs and lower self-rated physical health. After a five-month ethnographic study in south Texas, Snipes and colleagues (2017) concluded that the primary source of farmworkers' perceived discrimination was their employer. Those with less English proficiency and living in the U.S. for fewer years, reported stronger discrimination. Farmworkers told researchers that they would report work injuries to employees, who would either do nothing or encourage them to work through the injury. A farmworker reported being pressured to return to work only days after serious hospital admission (Snipes et al., 2017).

Physiological Effects of Heat and Hydration

Heat

Thermoregulation is controlled by the body's central nervous system, particularly the brain's hypothalamus. The hypothalamus will trigger either sweating or thermogenesis if the body moves beyond 'normal' range (NIOSH, 2016). The body can receive and exchange heat from the environment through the processes of conduction, convection, evaporation, and radiation. Evaporation cools the body when sweat changes from a liquid to a vapor (Gauer & Meyers, 2019). The speed of evaporation depends on air speed, and the water vapor pressure difference between the air and the person's wet skin (NIOSH, 2016).

According to NIOSH, heat strain is defined as the “physiological response to the heat load (external or internal) experienced by a person, in which the body attempts to increase heat loss to the environment in order to maintain a stable body temperature” (NIOSH, 2016, Glossary, p.xx). In addition, heat stress is the “net heat load to which a worker is exposed from the combined contributions of metabolic heat, environmental factors, and clothing worn which results in an increase in heat storage in the body” (NIOSH, 2016, Glossary, p.xx). When the body can no longer compensate for heat stress, the risk for HRI increases. Classic heat stroke usually affects subjects with compromised warmth-defense capabilities, such as infants and older adults, while exertional heat stroke typically occurs in healthy, young adults during high-performance activities in hot environments.

Heat-related illnesses are under-identified and under-reported (Mora et al., 2017). Heat illnesses, particularly heat stroke, can damage multiple body organs, and, thereby, lead to misdiagnosis (Mora et al., 2017). Heat stroke is frequently misdiagnosed as dehydration or heat exhaustion and can present similarly to conditions like meningitis, encephalitis, and drug intoxication (Epstein & Yanovich, 2019). Heat stroke can trigger disseminated intravascular coagulation, acute respiratory distress syndrome, myocardial infarction or trigger a serious injury or deadly fall, further complicating morbidity and mortality data (Epstein & Yanovich, 2019; Harduar-Morano & Watkins, 2017). Patients who suffered a heat stroke may die several days or weeks later, also complicating reporting (Harduar-Morano & Watkins, 2017). Although many occupational HRIs occur on farms, agricultural worker injury and death is likely underreported because farms of ten or fewer employees are exempt from OSHA investigations (Tustin et al., 2018; OSHA, 2018).

The literature on farmworker heat stress is minimal, with ten articles published in the last ten years (Arcury et al., 2015; Bethel & Harger, 2014; Culp & Tonelli, 2019; Fleischer et al., 2013; Kearney, et al., 2016; Lam et al., 2013; Mac et al., 2017; Mirabelli et al., 2010; Quandt et al., 2013; Spector et al., 2015), three of which were set in NC. Arcury et al. (2015) surveyed 101 central and eastern NC Latino male farmworkers in August 2013 about their HRI exposures, symptoms, and behaviors over the previous three months. A third (35.6%) of the participants reported heat illness while working outside. The researchers found factors associated with outdoor heat illness were working in wet clothes and shoes, harvesting and topping tobacco, and spending after-work time in an extremely hot house (Arcury et al., 2015).

A study conducted by Kearney et al. (2016) in the hottest months (August to September) in NC, found over 72% reported at least one HRI symptom over the past week and 27% experienced three or more, including 4% who reported fainting. Wearing a hat or protective gear over the face was associated with reporting three or more HRI symptoms and farmworkers denied wearing wide brim hats because that type interfered with their work in tobacco and sweet potatoes.

Mirabelli et al. (2010) conducted surveys from June and September 2009 with three hundred Latino men and women in three NC counties. Working in extreme heat was reported by 94% of the participants and 40% reported symptoms of heat illness while working in extreme heat. Heat illness was less common among H-2A workers (31% vs 56%). These workers are with the agricultural guest worker visa program, a federal and state-run program that helps farmers fill agricultural jobs. The authors did not discuss possible explanations for the difference in those that did or did not work in the visa program but the non-H-2A workers had fewer years of formal education and fewer years' experience in agriculture.

Hydration

All body systems work most efficiently when hydration levels are normal, or euhydration; the state of optimal total body water content (McDermott et al., 2017). The fluid balance within the body is the primary responsibility of the body's kidneys (Stanhewicz & Kenney, 2015). Humans, on average, ingest about 2.2 liters of fluid per day, through water and beverages and the fluids within foods. The individual daily physiological requirements for fluid depend on the individual and can vary greatly depending on factors such as, age, gender, body size, physical activity, and heat acclimation. Non-homeostatic influences of fluid intake include sociocultural and environmental stimuli, such as beverage taste, appeal, availability, timing with meals and overall drinking habits (Stanhewicz & Kenney, 2015). The Food and Nutrition Board, together with the Institute of Medicine and National Academy of Sciences recommend 2-3 liters of total daily water intake for healthy, adult women and 3-4 liters for healthy, adult men (Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, 2005).

By increasing venous return, cardiac output and cerebral tissue perfusion, proper hydration helps prevent heat cramps, heat exhaustion and heat stroke (NIOSH, 2016; Székely et al., 2015). Despite this critical physiological need for water to control heat stress, farmworkers report not drinking water due to various social and occupational reasons (Lam et al., 2013). Only three articles that specifically addressed farmworker hydration or volume depletion in the research purpose were found, all of which were quantitative designs (Bethel et al., 2017; Mix et al., 2018; Moyce et al., 2017).

Bethel et al. (2017) used two data sets collected with farmworkers in Oregon and Washington to compare their hydration and cooling practices. Using survey data, the researchers found that 78% of all the farmworkers reported drinking water at least once per hour during the previous week. During the previous week, 96% of the Washington farmworkers reported drinking water at work. The Oregon group were more likely to consume sports drinks, juice, and sodas while at work; the authors suggested this was likely due to the Oregon farmworkers' overall younger age. Washington state has HRI worker protection standards which requires HRI education, yet, even with this standard in place, only 34% of those farmworkers reported such education.

Mix and colleagues (2018) aimed, in part, to describe and investigate factors related to farmworker hydration status. Despite 98% of the 192 farmworkers in Florida reporting drinking more water at work over 80% were dehydrated according to their sampled urine. The outdoor temperature was 30° to 38°C (86° to 100°F); however, two-thirds of the sample worked inside a nursery or fernery and the temperature inside these structures was not reported. The farmworkers reported an average of 7.5 work hours during each of the three data collection days. North Carolina farmworker typically work longer days; only 11% and 16% of sampled farmworkers in NC worked less than 8 hours, according to Arcury et al. (2015) and Kearney, et al. (2016).

Finally, Moyce et al. (2017) aimed to examine the association of heat strain and volume depletion with kidney function among farmworkers in California. Volume depletion was determined by measuring the change in body mass from pre-shift to post-shift. Over 12% of the 283 farmworkers developed acute kidney injury (AKI) over a work shift. Researchers found piece-rate work was associated with 4.2 adjusted odds of AKI (95% CI 1.56 to 11.52) and heat strain was associated with 1.34 adjusted odds of AKI (95% CI 1.04 to 1.74). However, these researchers reported surprise as they did not find volume depletion to increase the odds of AKI. Moyce et al. (2017) suggested this could have resulted from California's HRI standards which require farmers to provide regular breaks to cool off and rehydrate.

No studies with a specific focus on farmworker hydration status or fluid intake have been conducted in NC. Both nationally and in NC there have been HRI studies done with farmworkers containing data specific to fluid intake (Arcury et al., 2015; Bethel et al., 2017; Culp & Tonelli, 2019; Fleischer et al., 2013; Lam et al., 2013; Mirabelli et al., 2010; Mix et al., 2018). Within these studies, different surveys were used making comparisons problematic. Two studies in NC found that 88.9% to 98% of farmworkers working outside in extremely hot weather conditions dealt with the heat by drinking more water, while 95.3% of those in Georgia did so (Arcury et al., 2015; Fleischer et al., 2013; Mirabelli et al., 2010). Among farmworkers in Oregon and Washington, over 98% consumed water at work in the previous week, while 98% of farmworkers in Florida drank more water at work, and 68.9% of farmworkers in Iowa reported only drinking water while working (Bethel et al., 2017; Culp & Tonelli, 2019; Mix et al., 2018).

Early signs and symptoms of dehydration are thirst, malaise, fatigue, headache and vomiting while late signs and symptoms are thirst, gastrointestinal cramping, heat sensations or chills (McDermott et al., 2017). The only study that collected data on farmworker's knowledge of signs and symptoms of dehydration found farmworkers in Washington knew they were dehydrated when they were thirsty, not sweating, lacked energy to work, felt nauseated or dizzy or felt their skin was looser (Lam et al., 2013). Individuals can gauge their own hydration status by monitoring their thirst, weight, void frequency and amount, and urine color (McDermott et al., 2017). Farmworkers do monitor their thirst and sweating but there is no data suggesting if farmworkers weigh themselves or monitor their urine output to gauge their own hydration. The thirst mechanism is usually not strong enough to drive someone to consume the equivalent lost in sweat. When the thirst mechanism is present the body is already in a hypo-hydrated state

(McDermott et al., 2017; NIOSH, 2016). Farmworkers mentioned drinking when thirsty but did not indicate if they drank water when not thirsty (Lam et al., 2013).

Physiological Markers of Hydration Status. Physiological markers specific to hydration status include weight, urine specific gravity (USG) and urine osmolality, serum osmolality and creatinine. Using a random time point measure of urine osmolality, Brooks et al. (2017) found the prevalence of inadequate hydration among 8,200 U.S. adults was 29.5%. Black and Latino adults had nearly 1.5 times higher risk of inadequate hydration than White adults (Brooks et al., 2017).

Researchers of two studies based in Florida and California found dehydration and acute kidney injury to be an issue among the sampled farmworkers. Physiological markers of hydration measured in farmworkers suggest approximately 50% of farmworkers were dehydrated pre-shift, 80% were dehydrated post-shift and between 12 to 33% developed an acute kidney injury (AKI) during a worked shift (Mix et al., 2018; Moyce et al., 2017). Moyce and colleagues (2017) collected weight and urine and blood specimens pre- and post-shift. Using changes in body mass, the researchers found 64% of men and 53% of women loss body mass during the shift but most did not lose more than 1.5% (Moyce et al., 2017). A loss of more than 1.5% body mass over a worked shift increases the risk for HRI. Although, the researchers caution that AKI diagnosis from only one day does not follow the criteria suggested by the Kidney Disease: Improving Global Outcomes AKI Work Group (2012). To date no physiological marker hydration study has been conducted on farmworkers in NC.

Medical monitoring concerning hydration and HRIs can include collecting heart rate, body temperature, body weight, energy expenditure estimates, and blood and urine specimens; all of which can be collected or assessed through various routes and equipment (Mac et al., 2017). There is no gold standard for hydration assessments (Villiger et al., 2018). Blood plasma osmolality (BPosm), blood plasma sodium concentration (BP[Na+]) or blood serum osmolality (BSosm) are commonly used physiological markers for determining hydration status; however, these require expensive equipment, are time-consuming, and invasive (Villiger et al., 2018). Urine osmolality is the most precise urine biomarker for hydration status (Perrier et al., 2017). It is a non-invasive method but is best measured through a 24-hour urine collection process.

Urine specific gravity (USG) is non-invasive, widely used in field work and clinical settings using reagent strips or digital refractometer (Perrier et al., 2017; Villiger et al., 2018). It is also reliable, corresponding with urine osmolality in 98.4% of 817 urine specimens (Perrier et al., 2017). Specifically, USG is a measure of the concentration of particles in the urine; therefore, can be used to evaluate hydration status and the ability of the kidneys to concentrate the urine (Laboratory Corporation of America® Holdings, 2020; Pagana & Pagana, 2018). Higher USG values indicate concentrated urine and dehydration while lower USG values indicate dilute urine and hydration (Pagana & Pagana, 2018).

Chronic Kidney Disease of Uncertain Etiology. The emerging epidemic of chronic kidney disease of uncertain etiology (CKDu) is hypothesized to be contributed from rising outdoor temperatures, exertional activity, and chronic dehydration. Also called Mesoamerican nephropathy (MeN), scientists suggest MeN/CKDu etiology is still unclear (Crowe et al., 2019). Members of the Third International Workshop on CKDu do agree the disease is multifactorial and could also be caused by agrochemicals, social and other factors (Crowe et al., 2019).

Researchers of a two-year longitudinal study with young adults from nine rural communities in northwestern Nicaragua felt the observed loss of kidney function among participants was “alarming” (Gonzalez-Quiroz et al., 2018, p. 2208). Of the men, 9.5%

experienced rapid decline despite normal baseline kidney function and 9.5% had baseline dysfunction, while 3.4% of the women experienced rapid decline. Outdoor and agricultural workers and those who lack shade during work breaks were associated with the greatest decline.

With a sample of over 4,000 Guatemalan agricultural worker participants, researchers of Dally et al. (2018) found heat extremes were associated with productivity and employment loss, especially among those with impaired kidney function. Exposures of max wet bulb globe temperature (WBGT) of 34°C (93.2°F) was associated with 1.16 tons (95% CI: -2.87, 0.54) and 0.59 tons (95% CI: -2.05, 0.87) less sugarcane cut over the next five days by workers with impaired kidney function and normal kidney function, respectively. Workers starting the season with impaired kidney function were more than twice as likely to leave the job (HR: 2.92, 95% CI: 1.88, 4.32). Heat stress was measured using WBGT, however, the data was collected from a weather station at a higher altitude than the location of the workers. Therefore, the reported temperature readings were lower, and the estimated heat impact reported is likely an underestimate.

Findings from García-Trabanino et al. (2015) and Laws et al. (2016) support the etiology hypothesis of kidney tubular injury, which along with other conditions can be caused by recurrent dehydration. With workers from El Salvador and Nicaragua, markers of dehydration and renal function worsened cross-shift. In the El Salvadoran sample, the mean USG, urine osmolality and creatinine increased, and urinary pH decreased, serum creatinine, uric acid and urea nitrogen increased, while chloride and potassium decreased (García-Trabanino et al., 2015). Novel biomarkers of kidney injury, neutrophil gelatinase-associated lipocalin (NGAL) and interleukin 18 (IL-18), increased in the Nicaraguan sample. This was especially apparent among cane cutters and irrigators versus other work roles: seeders, seed cutters, agrichemical applicators, drivers, and factory workers (Laws et al., 2016). Electrolyte solution was a protective factor (Laws et al., 2016). Central American agricultural workers reported an average intake of 3.2 liters of water intake per shift or up to 6.3 liters per day (Bodin et al., 2016; García-Trabanino et al., 2015; Laws et al., 2016).

Two articles described an intervention study involving researchers introducing interventions into farmworkers' work routines, broadly following OSHA's "Water. Rest. Shade." priorities (Bodin et al., 2016; Wegman et al., 2018). With cane workers in El Salvador, individual backpack-mounted water bladders, portable canopies to provide shaded areas, and scheduled rest periods were provided to the intervention group; 60 of the 116 participants. After the intervention, self-reported water consumption increased, symptoms of heat stress and dehydration decreased and individual production increased (Bodin et al., 2016). Eighty of those participants also agreed to have blood samples drawn for the Wegman et al. (2018) study. Cross-shift and cross-season eGFR decreased in both groups, despite the intervention, although the cross-season eGFR decrease appeared to halt after the intervention began. As the first "Water. Rest. Shade." intervention in the sugarcane industry, the authors are optimistic for the success of similar interventions in the future; however, admit that the intervention could not be fully implemented due to communication and gang-related activity in the area. They advise that the intervention was costly and time consuming and would require stakeholder commitment to be successful (Wegman et al., 2018).

Climate and Climate Change

According to NOAA, the definition of climate is the "long-term averages and variations in weather measured over a period of several decades" (n.d., para. 3). Global warming is an increase in the earth's annual averaged air temperature near the surface, over land and ocean, determined using data from thousands of instruments stationed around the world (NOAA, n.d.). Global warming is within the broader phenomenon of climate change. Climate change also refers to other observed long-term weather changes, including decreasing snow and sea ice cover, average global sea level rise and changes in precipitation patterns (Luber & Lemery, 2015; NOAA, n.d.). The rapidly changing climate is mainly due to anthropogenic causes, including greenhouse gas emissions (IPCC, 2018). When fossil fuels are burned, emissions are released and accumulate in the world's atmosphere, trapping heat (NOAA, n.d.).

Climate and North Carolina

The Coastal Plain of NC, also commonly referred to as eastern NC, covers nearly half the area of the state and consists of 41 of NC's 100 counties (NC Rural Center, 2016; State Climate Office of NC, n.d.). This area of NC usually experiences the highest temperatures and highest relative humidity levels in the state—the average daily maximum temperature at midsummer exceeds 33.3°C (92°F) in Goldsboro and Fayetteville (cities in eastern NC) (State Climate Office of NC, n.d.). The last fourteen years in NC have exceeded those norms; with the hottest average summer temperatures ever recorded (Frankson et al., 2019). Not only does the outdoor temperature increase heat stress, so does the humidity by decreasing evaporative cooling (Gauer & Meyers, 2019).

Eastern NC's 41 counties are mostly rural. Defined as an average population of 250 or less per square mile, all but three of the 41 counties are classified as rural (NC Rural Center, 2016). Using 2000-2014 U.S. Census Bureau data, compared to the citizens of central and western NC, the citizens of eastern NC are older, more diverse, and more economically disadvantaged, all of which increase this population's risk for HRIs (CDC, 2019; Cecil G. Sheps Center for Health Services Research, n.d.). By analyzing emergency department (ED) visits, Kovach et al. (2015) found rural populations in NC at higher risk for HRI than urban populations. Living in a mobile home, non-citizenship, and working in agriculture were all associated with increases in HRI visits to the local ED, factors commonly associated with NC farmworkers (Kovach et al., 2015; Quandt et al., 2013). Most HRI research has been done with populations living in urban areas due to the concern over the urban heat island effect (Kovach et al., 2015).

Farmworker Perceptions of Environmental Heat Stress and Climate Change

Perceived climate change is the communities' opinions on the long-term shift in weather patterns (Mubiru et al., 2018; Rankoana, 2018). Assessing perceptions of climate change are important because a person's adaptation to climate change depends more on their perception than the current status of the climate (Abbas et al., 2019; Niles & Mueller, 2016). Farmworkers in the U.S., because of their livelihoods, are likely aware of changes in their areas; however, there is no literature to support this (Rankoana, 2018). Perceived climate change information can also be used to design specific adaptation strategies specific to the needs of farmworkers (Bomuhangi et al., 2016).

Mitigation and adaptation raise issues of equity and justice. Many of those most vulnerable to climate change have contributed and currently contribute little to greenhouse gas emissions (IPCC, 2013). Groups identified as more vulnerable to the negative health outcomes include those with low income, some communities of color, immigrants, children and pregnant women, older adults, outdoor occupational workers, persons with disabilities, and persons with preexisting or chronic medical conditions—farmworkers are considered members of many of these groups (Crimmins et al., 2016).

Potential Theories with Vulnerable Populations

Four other theoretical frameworks were explored to study culture, place, and environmental heat stress. The Farmworker Vulnerability to Heat Hazards Framework was examined first as it conforms to the farmworker population and heat stress. It also had the potential to advance the knowledge on climate adaptation; however, the framework is focused more on the physiologic responses of the human body to environmental heat and less on social structures (Mac & McCauley, 2017).

Explored second was one with a more holistic focus, known as Vulnerable Populations Conceptual Model (Flaskerud & Winslow, 1998). It proposed that resource availability, relative risk, and health status are related through societal, environmental, and policies. This model also was closely aligned to farmworkers as a vulnerable population and with concepts of the proposed study. Yet, the model features relative risk, morbidity and mortality and these statistical concepts were not aligned with the qualitative component of this study.

Next, Social Cognitive Theory was explored due to its central concept of Reciprocal Determinism, which states a person's experiences, environment (including social context) and behavior interact (Bandura, 2004). However, it is historically a learning theory and thus less helpful in understanding micro- and macro-level factors of environmental heat stress. Lastly, the Health Belief Model was reviewed since it has been used by researchers conducting research with farmworkers on pesticide protective behaviors (Rosenstock et al., 1988; Walton et al., 2017). These authors admitted this model was insufficient for understanding health behaviors, farmworker culture and safety systems.

Intersectionality Theory

Intersectionality Theory suggests individuals' social and cultural positions and practices interact and are not separate entities (Collins & Bilge, 2016). It also suggests some people endure 'double jeopardy' as they are disadvantaged by multiple sources of oppression and power, like their race, class, gender identity, sexual orientation, and religion (Moradi & Grzanka, 2017; Olofsson et al., 2014). This theory ties with the methodological design, community-based participatory research, as they both draw on critical theory. Fluid consumption and hydration is a matter of worker safety, which is regulated through existing power structures.

Scholars within the field of nursing, particularly during the 1970s and 1980s, suggested what makes the profession unique is the holistic approach of its practitioners (Kim, 2015). Holistic health and holistic nursing both focus on the biopsychosocial and spiritual person (Dossey et al., 2016). Intersectionality Theory supports the exploration of hydration practices not as a solitary, individual behavior but having socio-cultural influence, among a traditionally marginalized population (Collins, 2015). Just like nursing considers a person an indivisible whole, Intersectionality Theory suggests individuals' social and cultural positions and practices interact and are not separate entities (Collins, 2015; Kim, 2015).

The theory was originally developed to emphasize the race and gender interplay in the violence and employment of Black women (Moradi & Grzanka, 2017). The theory has been used in studies during the 1960s and 70s to better understand discrimination, feminism, and racism (Al-Faham et al., 2019; Carbado et al., 2013). The application of Intersectionality Theory has also been expanded to advance the knowledge of privilege and oppression in the workplace of various social groups (Atewologun, 2018). Farmworkers face oppression in the workplace, from their race, nationality, and ability to speak English; therefore, an Intersectional framework will further emphasize their oppression.

Intersectionality Theory suggests people consist of multiple social identities at the micro-level intersecting with macro-level structural factors (Bowleg, 2012). The concepts of culture, place, and environmental heat stress, included in this study, align with the Intersectionality Theory. Separately, these concepts have micro and macro-level factors, while together, the concepts interact and influence the others. Place, for example, is more than simply a site, but tied to micro social relations and macro colonial, political, and economic structures (Anthias, 2012; Bowleg, 2012; Neely & Nading, 2017). The reverse is also true; locations can determine how culture is socially constructed (Yuval-Davis, 2017). This dynamic relationship between culture and place is true for immigrants; neighborhood concentration of immigrants and/or of similar ethnicities has positive and negative consequences on health, depending on the context (Viruell-Fuentes et al., 2012).

Culture is a component of Intersectionality's social context (Collins & Bilge, 2016). Culture is multi-layered and complex, with underlying power influences (Dixon, 2019; Yuval-Davis, 2017). Historically, culture had been tied with micro systems of race and demographics, but at the turn of the 20th century culture began to be studied as its own phenomenon (Yuval-Davis, 2017). Some researchers warn against continuing the use of the micro definition of culture, particularly as a homogenizing ethnic group. Doing so promotes racial and ethnic stereotypes (Viruell-Fuentes et al., 2012), thus promoting inequality, including power imbalance.

Place is more than a location on a map, but a space influenced by implicit or explicit social, political, and economic forces (Neely & Nading, 2017). A person's residence can be a source of segregation, due to its concentration of poverty, lack of resources, and exposure to environmental risks, all of which influence health and access to healthcare (Cummins et al., 2007; Viruell-Fuentes et al., 2012). In the workplace, especially in the globalized marketplace, occupational safety and health is influenced by the micro- and macro-level aspects of the country, as well as that of the workers' cultures (Stoffregen et al., 2019).

Intersectionality Theory is commonly used to study social environments but can also be used to guide studies examining the complex interactions of social and ecological systems (Thompson, 2016). Along with earth's natural forces, there are established power and social structures that control the location, quality, and quantity of drinkable water. Steeped in a deep history of human battles over natural resources, water access, use and control has been, is, and will likely be, inequitably distributed (Manganiello, 2015; Thompson, 2016).

Place is also the site for human and non-human interactions (Neely & Nading, 2017). The negative health effects of climate change are consequences of human and nature (non-human) interactions. Nature is its own force, a source of power not commonly included in Intersectionality discourse (Kaijser & Kronsell, 2014). Mitigation and adaptation to climate change aligns with social justice, power, and inequality. Groups identified as more vulnerable to the negative health outcomes of climate change are typically groups of focus in Intersectionality research—undeniably due to their position within social and power structures (Crimmins et al., 2016; Kaijser & Kronsell, 2014). Climate change also brings forth debates of materialist cultures and power over resources (Kaijser & Kronsell, 2014).

Summary

This chapter described the typical NC farmworker as male, Latino, immigrant, and a critical contributor to NC economy, who worked long hours in a dangerous occupation. NC farmworkers lived in small, hot living quarters in rural areas. Farmworkers faced oppression in the workplace, had limited protections from health and occupational polices and were frequently exposed to chemicals and environmental heat stress. Drinking more water was a common HRI-preventative intervention reported by NC farmworkers, yet fluid intake was impeded by occupational barriers. Farmworkers faced the choice of more pay and the desire to be “good workers” or the choice of self-care. Sugar-sweetened sodas and alcoholic beverages were sometimes chosen over water. Latinos in America distrusted the quality of public tap water and drinking cool water was a cultural practice. As no studies have been conducted on NC farmworker hydration status or fluid intake, this chapter focused on the ten farmworker heat stress articles published over the last ten years.

CHAPTER 3: METHODOLOGY

This chapter provides an overview of a community-informed, mixed methods study design that aimed to explore how culture, place, and environmental heat stress influence farmworker hydration. This chapter describes the study design, the researcher entrée, pilot study, and protection of participants. Next, the sample and setting are delineated, followed by data collection techniques, data management and analysis. This chapter concludes with discussion of approaches used to achieve rigor.

Study Design

A community-informed, sequential exploratory mixed methods research design was conducted in the summer of 2020 with staff at one NC federally qualified health center (FQHC). The mixed methods study contained two sequential phases: first, a qualitative data phase, and second, a quantitative data phase. In Phase I we conducted focus group discussions (FGDs) with farmworkers to gain farmworker perceptions of culture, place, and environmental heat stress on their fluid intake. In Phase II we collected a cross-sectional survey, a beverage questionnaire, wet bulb globe temperatures (WBGT) and physiological markers of hydration status. The research team was composed of the principal investigator (PI), two Latino FQHC staff, and a bilingual undergraduate student. A community-university partnership was established in 2018 while conducting a pilot study with farmworkers in this region. The director at the FQHC was involved in the pilot study and the development of this proposal and was supportive of staff participation in the mixed methods project. All members of the research team were trained in CITI modules and the study protocol.

To enhance the validity of the study's findings, a mixed methods approach was chosen to collect, analyze, and integrate multiple types of data about the same phenomenon (Creamer, 2018). Not only did this design allow us to explore the factors that affect farmworker fluid intake and hydration status, but also the how and why behind these factors. Mixed methods design also allowed us to determine the degree of relationship between fluid intake and hydration status with culture, place, and environmental heat stress. This data triangulation undoubtedly enriched the study findings.

A community-informed approach was chosen to engage community members in the research process which could lead to improved health and reduced health inequities by collaborating with the people who are most directly influenced by the problem (Israel et al., 2013). This approach also requires a commitment to action, intervention or translation of research that will benefit the community's health. Community-informed research can be transformative in communities with social and health disparities (Minkler et al., 2017; Wallerstein, & Duran, 2010; Yancey et al., 2018). Local knowledge and community members co-creating data collection, analysis and interpretation are key to addressing complex problems in situation like culture and environment (Israel et al., 2013).

We followed four of the nine principles of community-based participatory research, 1) built on the strengths and resources within the community, 2) facilitated a collaborative, equitable partnership, 3) involved a cyclic, iterative process, and 4) committed to a wider dissemination of results (Israel et al., 2013). The staff at the FQHC and their migrant and seasonal farmworker health program are resources of the farmworker community. The staff contributed their knowledge of the cultural and workplace norms, as they had previous work experience as farmworkers and established relationships with farmers and farmworkers in the area. The thoughts and ideas of FQHC staff were considered in every step of the cyclic, iterative process. The project was discussed regularly with weekly meetings among the research team.

Study results will be disseminated through academic channels and agricultural communities, in both English and Spanish.

Researcher Entrée

The PI had been a registered nurse for 11 years, lived in the study area, and had worked with farmworkers and their families in the health care setting. The PI was a member of the Alliance of Nurses for Healthy Environments and an AgriSafe Nurse Scholar and understood basic Spanish terminology. However, to actively participate, the PI completed in a 10-week online, instructor-led, Spanish language training program.

Pilot Study

In 2018, the PI began planning a pilot study with staff at a local FQHC. In partnership, the PI spent one to two days per week at the FQHC and visited homes and camps with the staff to better understand farmworker living and working conditions. The PI and FQHC staff met regularly, maintaining contact through telephone, email, and in-person. We completed a qualitative descriptive study in the summer of 2019 with eight Latino farmworkers who worked in three counties in eastern NC. Eligibility criteria included Latino farmworkers with a basic ability to converse in English and Spanish. Data were collected using semi-structured, individual interviews. Using inductive content analysis (Elo & Kyngäs, 2008), the major finding was employer control-farmworker agency which depicted the tension in worker relations. The employer controlled the breaks, work, and fluid consumption, while farmworker agency minimized self-care. The study suggested farmworker agency came at a cost, where their work ethic surpassed self-care behaviors. In the pilot study, we found weather, cultural and workplace norms and practices influenced farmworker hydration; therefore, we chose to explore these concepts further. Thus, the pilot study led to the mixed methods study.

Protection of Participants

Approval for the mixed methods study from the East Carolina University and Medical Center Institutional Review Board (Appendix A) and a letter of support from the Director of the FQHC was obtained prior to study initiation. We explained and sought signed informed consent, using English and Spanish documents (Appendix B & C). No names or PHI were collected. Farmworkers were provided with a unique ID number, recorded on a master list, by the PI only. The master list was stored separately from the data and destroyed as soon as reasonably possible. While in the field, all notes and recordings were locked in a metal notebook in the trunk of a locked car until the PI returned to the university office. Once at the office, documents were placed in a locked file cabinet in the PI's locked office.

Setting and Sample

The study took place at farmworker camps in eastern NC. The FQHC serves a six-county area in eastern NC with approximately 1,100 farms and 2,300 migrant and seasonal farmworkers working during peak harvest (U.S. Department of Agriculture, 2019; Lambar & Thomas, 2019). The FQHC outreach program provides medical assistance and educational services to farmworkers. In 2019, the FQHC established a weekly evening health clinic to accommodate the needs of farmworkers.

Sampling Strategy

In the summer of 2020, the PI and FQHC staff collaborated in the recruitment and retention of participants. First, the PI or FQHC staff received permission from the employer. Next, during the month of July, the FQHC staff traveled to farmworker camps throughout the FQHC catchment area, and recruited participants in person, using an informational flyer in English and Spanish (Appendix D & E). Inclusion criteria were men and women age greater than

18 and less than 54, self-identified as Latino heritage, English or Spanish speaking, worked primarily outdoors (>50%) 8 or more hours per week. Exclusion criteria were self-reported history of any recent illness, kidney disease, currently pregnant or use of diuretics. If the farmworker met the inclusion/exclusion criteria and was interested in participating in the qualitative, quantitative or both phases of the study, a description of their location was recorded on a paper recruitment log. This recruitment log also recorded the rate of refusal. The log was shared with the PI via phone and/or in-person. Later, the participants were informed of the data collection dates and location by delivery of an event flyer or in-person communication.

Sampling Plan: Phase I. For this phase, the initial approximation of sample size was based on information power, which is determined by examining the study aim, sample specificity, theoretical linkages, interviewer expertise and case analysis (Malterud et al., 2016). The study aim was narrow, the sample specificity was dense, the theory was predetermined, the interviewer was a novice, and case analysis suggested information power should be moderately high. Thus, a purposeful sample of four to five focus groups (6-12 participants/group) was sought (Krueger & Casey, 2015). We aimed to have two mixed-gender and two gender specific groups (all-male and all-female); therefore, approximately 24 to 60 farmworkers were sought to participate in Phase I.

Sampling Plan: Phase II. A convenience sample was planned for this phase, with a goal of 40 to 60 participants (Hertzog, 2008). Most farms in the catchment area hired between 10-40 farmworkers every season. With an anticipated participation rate of 63%, our goal was to approach 100 farmworkers, spanning two to seven farms (Mac et al., 2017). Data collection was to continue until sample size was met; however, due to the COVID-19 pandemic, the data collection period spanned fewer weeks.

Measures

In Phase II, the following measures were collected: Demographic survey, urine specific gravity; Beverage Intake Assessment Questionnaire; and wet bulb globe temperature.

Demographic Survey

Social and demographic factors included in the survey were questions of age, sex, ethnicity, country of birth and H-2A status. These were particularly important for a study guided by the Intersectionality framework as we aimed to understand how these identities influenced hydration (Collins, 2015). Questions on the type of housing (e.g. house, trailer, barrack), type of work conditions (e.g. distance to toilet, frequency of water consumption, type of crop, etc.) and work experience (e.g. years of agricultural experience, etc.) were also included. Level of English-speaking proficiency was self-reported using a 3-point Likert scale. The survey questions were developed in English, translated to Spanish, and translated back to English for comparison (Chen & Boore, 2010). Our survey (Appendix F & G) was adapted from previous farmworker HRI studies (Fleischer et al., 2013; Mac et al., 2017).

Urine Specific Gravity

There is no gold standard for hydration assessments, yet hydration status can be measured in various ways (Villiger et al., 2018). Blood plasma osmolality, plasma sodium concentration or blood serum osmolality are commonly used physiological markers for determining hydration status; however, these require expensive equipment, are time-consuming, and invasive (Villiger et al., 2018). Urine osmolality is the most precise urine biomarker for hydration status (Perrier et al., 2017). It is a non-invasive method but is best measured through a 24-hour urine collection process (Perrier et al., 2017). Urine specific gravity was the chosen measurement for hydration status in this study because it is non-invasive, is widely used in the field and clinical settings and can be quickly assessed using a digital refractometer (Perrier et al., 2017; Villiger et al., 2018). It is also reliable, corresponding with urine osmolality in 98.4% of 817 urine specimens (Perrier et al., 2017).

Urine specific gravity (USG) was assessed using a digital refractometer: The Palm Abbe model PA202X-093. This refractometer reports USG to four decimal places, with a validated interval of 1.0020–1.0300 (Wyness, et al., 2016). The digital display eliminates subjective interpretation of results observed with manual refractometry. It can accurately calculate the USG with a minimum quantity of 60 microliters. Linearity of Palm Abbe, with osmolality, and solute score, was verified with observed error of ≤ 0.1% (Wyness et al., 2016). This model of refractometer is automatically temperature compensated for aqueous solutions (MISCO Refractometer, 2014).

Reagent strips were used to record protein, ketones, blood, and glucose which could alter USG results (Pagana & Pagana, 2018). In healthy adults, dense solutes, such as glucose, are not normally present in urine. However, if present the dense solutes will falsely inflate the USG readings (Greenberg, 2018). Moderate quantities of protein (1-7.5 g/L or 100-750mg/dL) may cause elevated USG readings (Siemens Healthcare Diagnostics Inc., 2019). The strips are sensitive to air exposure; therefore, the team used an unopened bottle and immediately closed the bottle after removing each reagent strip. The pH of the urine was examined because alkaline urine can cause falsely low USG results (Siemens Healthcare Diagnostics Inc., 2019).

Beverage Intake Assessment Questionnaire

Fluid intake was assessed using the 32-item Beverage Intake Assessment Questionnaire (BIAQ) (Appendix H). The questionnaire, developed in Spanish, questions fluid consumption over the last month, including type and quantity of beverage, and frequency and timing of intake.

The BIAQ was validated in a sample of Spanish-speaking adults from a randomized controlled trial evaluating an obesity intervention program (Ferreira-Pêgo et al., 2016). Using the Bland-Altman analysis, the BIAQ was found to have relative validity; total daily beverage fluid intake was negatively associated with urine osmolality (-0.65), and positively associated (0.22) with BMI and total energy intake (R^2: 0.20; $p < 0.001$). The BIAQ was also found to have good repeatability; no significant differences were found in the fluid consumption at baseline, six months, or one-year (Ferreira-Pêgo et al., 2016). The demographic survey and BIAQ were estimated to take 20 minutes to complete per participant.

Wet Bulb Globe Temperature

The environmental heat exposures was assessed by a heat stress monitor, which recorded the wet bulb globe temperatures (WBGTs) (NIOSH, 2016). The WBGT is a measure of the heat stress in direct sunlight, accounting for temperature, humidity, wind speed, sun angle and cloud cover, unlike heat index, which is calculated for shady areas (National Weather Service, 2020). Compared to the OSHA-NIOSH Heat Safety Tool application, WBGT outperformed the tool in assessing occupational risk to heat stress in agricultural settings (Dillane & Balanay, 2020). We used the QUESTemp° 34 (3M, Oconomowoc, WI) heat stress monitor. Comparing six portable WBGT thermometers, the QUESTemp° 34 (MAE = 0.24°C, RMSE = 0.44°C, MBE = –0.64%) demonstrated the least error in relation to the reference standard over three different sessions, in moderate and high HRI risk environmental conditions (Cooper et al., 2017). Description and photographs of the monitor can be found at https://www.tsi.com/.

The American Conference of Governmental Industrial Hygienists (ACGIH, 2019) recommends the use of the screening criteria for Threshold Limit Values (TLVs®) to help prevent occupational HRIs. The screening criteria provides recommendations for WBGT exposure limits based on work/rest cycle and workload. The worksite's current WBGT should be compared to the screening criteria WBGT to determine if it exceeds the recommended limits. The workplace WBGT should be adjusted if the workers wear clothing like double-layer woven clothes or polypropylene coveralls.

On the day of data collection, some of the participants reported wearing polypropylene coveralls for two hours at the beginning of the shift; therefore, per ACGIH (2019) recommendations, 0.5°C was added to the corresponding hourly WBGT measurements collected from the heat stress monitor. All participants worked in tobacco on the data collection date; so, a moderate metabolic rate was assumed (ACGIH, 2019; Dillane & Balanay, 2020). The TLVs® were adjusted according to work/rest periods; work was considered 75%-100% and adjusted for short breaks (50-75%) or longer breaks (0-25% or 25%-50%). Hourly mean WBGT indices were compared to the TLVs® to determine if the study participants exceeded the exposure limit recommendations during the work shift (ACGIH, 2019; Dillane & Balanay, 2020).

Data Collection

Due to the COVID-19 pandemic in the summer of 2020, the data collection period was delayed and spanned fewer weeks than originally planned. The research team followed steps to minimize personnel density, allow distancing, and reduce the chances for transmission by following CDC, state, and university requirements during both phases. The research team completed the NIEHS courses: Protecting Yourself from COVID-19 in the Workplace and the OSHA Guidelines for COVID-19 prior to data collection. The research team completed the COVID-19 Screening form individually with each potential participant, the day before and the day of data collection. The research team wore masks and remained six feet away from participants and each other. Hand sanitizer was available and used frequently. The focus groups and urine specimen processing took place within large rooms, allowing for distancing. Gloves were always used while collecting data and cleaning/disinfecting. The research team cleaned and disinfected all non-disposable equipment and furniture used at the research site. This was done with an EPA-registered household disinfectant and the PI followed the CDC Guidance: 6 Steps for Safe & Effective Disinfectant Use. Disposable items (gauze, pipettes, reagent strips, specimen containers, cooler) were placed in a plastic bag, tied, and deposited in garbage cans, off-site. Team members did not travel in the same vehicles together.

Despite the pandemic, data collection still occurred during the hottest months of the year in NC, June through September. Phase I, the qualitative phase, took place during the months of June and July 2020. Phase II, the quantitative phase, was conducted in August 2020.

Data Collection, Phase I

Four focus group discussions (FGDs) were conducted to provide insights into diverse opinions and behavioral norms of farmworkers (Krueger & Casey, 2015). Each focus group was comprised of five to nine participants, for a total of 28 in all four groups. Focus groups allow for rich interaction, understanding of a shared culture and permits a power shift from investigator to participants. Focus group discussions were appropriate for this study because sensitive information was not asked, and we sought to capture diverse opinions. The goal for each FGD was to gain perspectives on how culture, place, and environmental heat influenced fluid intake.

To conduct the FGDs, the PI and FQHC staff traveled to the farmworker camps. Before the FGD began the participants were greeted and informed consent was collected. The consent was read aloud or given to participants to read, as preferred. A time for questions was offered. The research team emphasized the voluntary nature of the research and that the participants could leave the group at any time without recourse to their employment, health care, or immigration status. Each focus group had one moderator (PI) and one bilingual co-moderator (FQHC staff or undergraduate student). The FGD guide included semi-structured questions in English and Spanish, developed from the pilot study and the current literature (Appendix I & J). The questions were pilot tested with one FQHC Latino staff member and revised for clarity (former farmworker). On the day of the FGD, participants completed the demographic survey, labeled with their unique ID number. Staff from the FQHC read the survey aloud and recorded responses on paper or gave to the participants to read and complete, as preferred. The FGDs were audio recorded, in the preferred language, with the permission of participants.

Dominant voices must be considered when designing focus groups, as they may overpower others (Krueger & Casey, 2015). This was managed by tactfully shifting the focus to others, ensuring the value of all participants. Participants were encouraged to maintain confidentiality of what was shared during the FGDs but were cautioned that it could not be assured (Raby, 2010). Incentives of a $25 gift card were offered to the participants at the end of the FGD.

Data Collection, Phase II

A total of 32 participants signed informed consent for the phase of the study. This was 87% of the participants from Phase I. The PI, student and FQHC staff collected physiological markers and survey and questionnaire data from the participants at specified time points. The PI measured WBGT in the fields where these farmworkers labored. The FQHC staff and student were instructed by the PI in standard operating procedures for data collection and given documents detailing the procedures. To accurately perform and record the refractometer readings, the manufacturer's instructions were followed (Appendix K). The goal was to sample ten (±2) participants on each of four to five days, for a total of 40 participants. We planned to sample participants over consecutive days, during the first two weeks of August. The PI, student and FQHC staff traveled to farmworker camps the evening before the selected day of data collection. Signed informed consent was collected, as described in Phase I. The *Clean Catch Urine Sample: Educational Handout* (Appendix L), available in Spanish and English, was provided and explained (The Ohio State University Medical Center, Mount Carmel Health System, Ohio Health and Nationwide Children's Hospital, 2009). Sterile specimen containers and castile soap towelettes were given to each participant, the night before the research team arrived at the camp for specimen collection. The containers were labeled with the participant's unique ID number.

Between 5-6:30 AM the next morning, participants collected their first morning void urine specimen (pre-shift) in a sterile specimen container (McDermott et al., 2017). The participants placed their filled urine specimen cups in an enclosed, disposable cooler, left the previous night by the research team. The PI, student and the FQHC staff arrived at the farmworker camp, also between 5-6:30 AM. Before each urinalysis, the PI calibrated the refractometer using distilled water. Calibration verifies the baseline or zero-set reading (MISCO Refractometer, 2014). All urine specimens were analyzed within two hours of specimen collection (Laboratory Corporation of America® Holdings, 2020). The corresponding USG and results of reagent strips were read and recorded. Remaining urine was flushed down a toilet at the farmworker camp immediately after assessment.

Once urine collection and analysis were complete, the PI traveled to the designated field where the farmworkers spent most of their day working. The QUESTemp° 34 was set up at the edge of the field, on a tripod, 3.5 feet above the ground (TSI Incorporated, 2018). The thermometer data logged the WBGT every 1 minute and provided hourly mean WBGT indices.

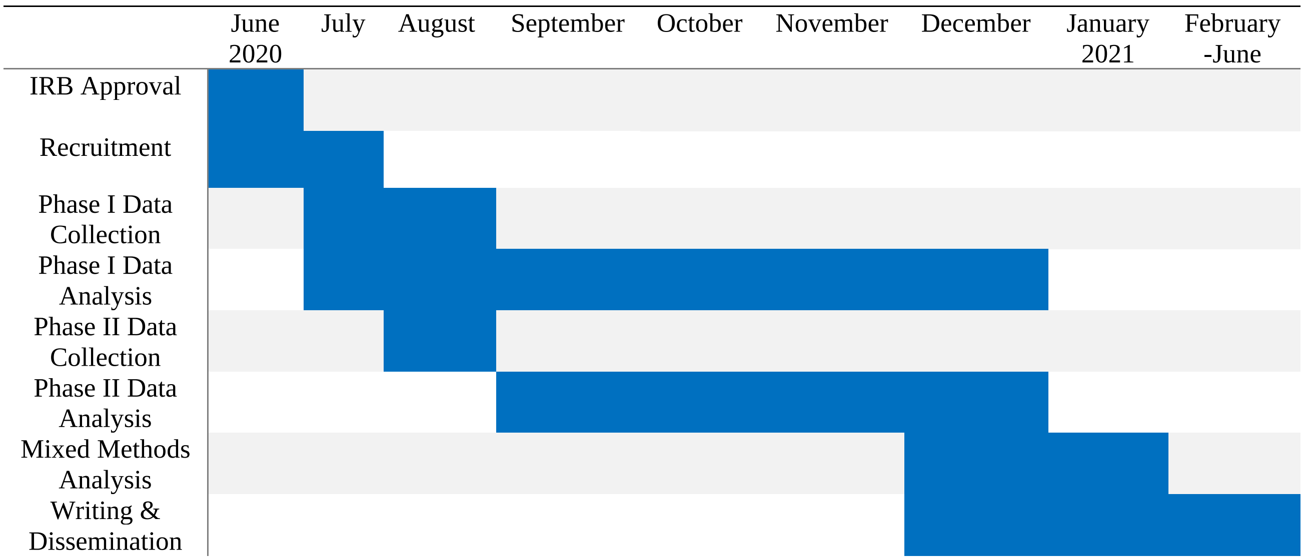
The PI travelled back to the field to collect the QUESTemp° 34 at the end of the worked shift, between 2-5:30 PM. After that, at approximately 2:15-5:45 PM on the same day, the PI returned to the camp, provided a second sterile specimen container to participants to collect a post-shift clean catch urine specimen. The same USG analysis process was followed, as above. Immediately following the post-shift collection, the results of the pre- and post-shift USG tests and reagent strips were provided to the participants. Participants who had abnormal results were referred to local health clinics for follow-up care.

At a time convenient for the participant, either the night of data collection or the Sunday following urine specimen collection, the research team returned to the farmworker camp. The PI, student or a FQHC staff read or provided the demographic survey (if not already completed in Phase I) and the Beverage Intake Assessment Questionnaire to each participant and responses were recorded on the corresponding paper document. Once completed, each participant was offered a $25 gift card.

Research logs, field notes, the PI's reflective notes, codebook memos and analysis memos were collected as appropriate throughout the project. Research logs documented the progress of the study design, starting with the first meeting with the FQHC staff. The log also included details about recruitment and retention of participants, conversations with farmers, county metrics concerning the COVID-19 pandemic and the details of the data collection process. Field notes described observations and general conversations at the farmworker camps. A small pocket notebook was used to quickly write down phrases from participants and research team members, which were later expanded on and stored in a Word document. The PI's reflexive notes included speculation, discussion of context during the study phases. The codebook memos contained the progression of codes while the analysis memos described the data integration process. Notes were recorded chronologically, and effort was made to record the notes as soon after the observation or event happened. Notes were reviewed weekly to assess progress and throughout the analysis stage.

Figure 1

Study timeline



Data Management and Analysis

In the qualitative phase, the goal was to translate and transcribe the audio recording into English within one week of each focus group date, using Microsoft Word. Naturalized transcripts were prepared jointly by the PI and bilingual member of the research team. The transcripts were validated for accuracy by the PI (De Chesnay, 2015). A participant profile was created to understand the context of each focus group. Also, matrixes were developed and edited numerous times. Matrixes were organized by the research aims and then matched with Intersectionality theory concepts.

In the quantitative phase, all survey data, physiological markers, and the records of WBGT index were labeled with the participant's unique ID number. The data was later transferred to a SPSS file for cleaning and coding. All data files, for Phase I and Phase II, were saved to an encrypted university protected computer and will be stored for six years.

Data Analysis

The mixed methods analysis was done sequentially. The qualitative data was analyzed first and then the quantitative data was analyzed. After, we integrated the data and analyzed using a meta-matrix.

Data Analysis, Phase I. Content analysis was the chosen data analysis method (Bernard et al., 2017). It is a method used to explore explicit and covert meanings within text, with close ties to grounded theory. Content analysis was chosen due to the lack of literature on farmworker hydration (Bengtsson, 2016). We started with a set of pre-identified concepts (deductive coding) and expanded on these to include other concepts that are determined during coding process (inductive coding) (Bernard, 2011). Whole transcripts were selected as the unit of analysis. Beginning with the first focus group transcript, the PI and a qualitative nurse scientist independently read the transcripts multiple times, taking care that each transcript was reviewed with similar frequency.

During the deductive coding process, the PI coded the transcripts with the concepts from the Intersectionality framework and the findings from our pilot study. Data that did not fit the pre-identified concepts were analyzed inductively. During the inductive coding process, open coding included In Vivo and descriptive coding and occurred through an iterative process (Corbin & Strauss, 2008). The PI recorded the progression in a codebook. Disagreements during the coding process were resolved by discussion. A case-by-variable matrix was used to compare the frequency of the codes within each FGD transcript. Themes were developed from categorization and relationships.

Major ideas were grouped into three initial categories labeled Thankful for Job, Farmworker Norms and Housing/Rurality. Within the Thankful for Job category were the sub-categories of High heat/Humidity; Freedom Conundrum; Short, Infrequent Breaks; Farm Bureau Education; and Crop Work. During research discussions, the Thankful for Job category was recategorized to Acceptance of Hazards, the Housing/Rurality category that focused on farmworkers' lack of agency and poor housing was recategorized to Workplace Oppression. Further categorization and linking of relationships led to the final two major themes.

Research team data analysis meetings occurred weekly to biweekly. The FQHC staff brought the emic (insider) viewpoint. The goal for our final round of coding was 80% interrater reliability (Creswell & Poth, 2018). The data analysis was to be completed within six months following completion of FGDs (Jackson, 2008). Clear instructions and positive and supportive atmosphere were used to improve research team member participation.

Particularly important when conducting qualitative studies is reflexivity. Researchers should consider their own bias, interpretations or lens that may influence perceptions of the data or how the findings are written (Creswell & Poth, 2018). The PI has conducted one farmworker research study which may minimize bias, but the PI's understanding of the farmworker literature may increase bias. Keeping reflective notes to record biases and changes in understandings between research team members was especially important since the study was informed by Intersectionality theory (Duran & Jones, 2019).

Data Analysis, Phase II. Data analysis was conducted using SPSS (version 27.0; SPSS Inc. Chicago, IL). An alpha level of 0.05 was selected, an acceptable risk for Type I errors and appropriate for the sample size. First, a codebook of the variable definitions and labels and descriptions of the coding responses was prepared. Table 1 shows the independent variables that were included in analysis and the corresponding levels of measurement (continuous, categorical, or ordinal). Next, data was entered into SPSS and then checked for errors. Descriptive analysis provided frequencies, means, standard deviations (*SD*), including the outcomes of the beverage questionnaire and pre- and post-shift USG levels, stratified by age.

Table 1

Independent Variables Included in Data Analysis, Phase II

Demographic	Continuous	Categorical	Ordinal
Age	x		
Level of Education			x
Workplace	Continuous	Categorical	Ordinal
Years Worked in Agriculture	x		
Weeks Worked this Year	x		
Days Worked per Week	x		
Average Hours Worked per Day	x		
Hours Worked on Data Collection Day	x		
Worked in Sweet Potatoes		x	
Wore Poly Coveralls on Data Collection Day		x	
Toilet >3 minutes away/ ≤3 minutes away		x	
Fluid Intake	Continuous	Categorical	Ordinal
Water Intake per Day	x		
Juice Intake per Day	x		
Soda Intake per Day	x		
Beer & Other Alcohol Intake per Day	x		
Gatorade Intake per Day	x		
Other Fluid Intake per Day	x		
Sugar Sweetened Beverage Intake per Day	x		
Total Fluid Intake per Day	x		
Environmental Heat Stress	Continuous	Categorical	Ordinal
Maximum WBGT on Data Collection Day	x		
Numbers of Hours on Data Collection Day Spent Working Above the TLVs®	x		
Percent of Data Collection Day Spent Working Above the TLVs®	x		

Normality was determined by reviewing the 5% trimmed mean, the skewness, kurtosis, Kolmogorov-Smirnov statistic, histograms, Q-Q plots, and boxplots. The pairwise exclusion was applied for missing data. Pearson's correlation was used to examine the associations between cultural and place factors, beverage intake, WBGT with the dependent variable of hydration status (USG). Preliminary analyses were done to ensure no violation of the assumptions of normality, linearity, and homoscedasticity. The National Athletic Trainers' Association guidelines was used to categorize urine specimens; considering USG less than 1.020 as euhydrated, 1.020 to 1.029 as dehydrated, and equal to or more than 1.030 as significantly dehydrated (Casa et al., 2015).

Independent sample t-tests were conducted to compare the pre- or post-shift USG mean score of two different categorical groups. One group was hydrated (< 1.020) and another group was dehydrated (≥ 1.020), based on the National Athletic Trainers' Association guidelines. To examine the impact of decreased kidney function as a person ages, age was grouped into those <40 and those ≥40. As explained by NIOSH's (2016) *Criteria for a Recommended Standard: Occupational Exposure to Hot Environments* low caffeine consumption does not increase the risk for HRI; therefore, up to one cup of coffee or three sodas per day is considered safe. With this, servings of caffeine were determined using the BIAQ data (sodas, coffee, energy drinks, etc.) and the sample was categorized into High Caffeine Intake (equivalent of > 1 cup of coffee or 3 sodas) vs Low Caffeine Intake (≤ 1 cup of coffee or 3 sodas).

Data Integration and Interpretation

Integration of the qualitative and quantitative data involved comparing similar constructs found in the qualitative and quantitative data, including 1) reported behaviors, collected via group discussions and individual surveys, 2) measures of hydration (USG) and environmental heat stress (WBGT), and 3) the research team's reflexive notes. A case-by-variable meta-matrix was used to view the findings simultaneously, to validate the findings across the qualitative and quantitative data (Miles & Huberman, 1994). The themes and subthemes from Phase I were placed within the columns, then Phase II data was placed next to the corresponding theme from Phase I. By comparing the columns, the integration data findings were placed in the third column, supported by literature and reflexive notes, as appropriate. Possible inconsistencies between the data sets were iteratively discussed by the research team.

Potential Problems and Alternative Strategies

The challenges of conducting research with vulnerable populations, such as farmworkers, for research purposes must be considered; long work hours, cultural and language differences, and farmer cooperation cannot be underestimated (Farquhar et al., 2014). Farmworkers in eastern NC usually work 10-12 hours per day, six days a week (Layton, 2018). Confirmed by our pilot study, we planned to improve farmworker recruitment by adjusting recruiting and FGD to evenings and weekends. The greatest number of farmworkers in NC are present from May through September; therefore, the data collection period was planned for these months. Due to cultural and language differences, it was crucial to develop a sense of trust between the farmworkers and the researchers. The FQHC outreach staff, referred to as *promotores*(*as*) in farmworker research literature, were vital to establishing trust and study success due to pre-established relationships with the farmworkers and farmers (Moyce, 2016; Nebeker & López-Arenas, 2016). This was also confirmed by our pilot study.

Another challenge to conducting research with farmworkers is farmer/employer cooperation. Some researchers have received permission from the farm owner or the farm labor contractor for data collection during work hours while others ask participants to meet at another location outside of work hours (Mac et al., 2017; Moyce et al., 2017). Multiple factors influence this decision, including the workers' concerns for loss of employment, interference with wages and employer's concern for retribution (Farquhar et al., 2014). We sought employer cooperation, which was facilitated through established relationships between FQHC staff and farmers. We aimed to improve employer cooperation by including early and transparent communication between PI and farmer; however, the COVID-19 pandemic delayed our timeline. Three NC Cooperative Extension agents assisted with locating potential employers who hired people within our inclusion criteria. We did not seek farmworkers that lived off-site from their employer's property, but this may be necessary for future studies.

Rigor

Trustworthiness was addressed using the criteria of credibility, dependability, transferability, and confirmability (Guba & Lincoln, 1994). Credibility was achieved through prolonged engagement in the field, from 2018 to 2021, and verbatim transcription of audio recordings. It was also addressed with member checking. This occurred upon the conclusion of the FGD; the moderator summarized each question, and solicited participants agreement, additions, or clarifications (Krueger & Casey, 2015). Dependability was attended through 1) clear descriptions of the selection and characteristics of the participants and the data analysis process and 2) inclusion of participant quotations. Transferability was supported through description of the data collection and analyses processes. Confirmability was addressed through reflexivity and data and analyst triangulation. The research team participated in weekly or bi-weekly debriefing meetings throughout the study timeline. Any inquiries or disagreements were discussed until a consensus was reached. Data triangulation was achieved through incorporation of fieldnotes and memos with focus group data and quantitative measures.

Summary

With a community-informed, mixed methods research design, we explored how culture, place, and environmental heat stress influenced fluid intake and hydration status among Latino farmworkers living in eastern NC. Phase I included FGDs while in Phase II we collected physiological markers and survey data from the participants. Phase I data was analyzed using content analysis while Phase II included descriptive and correlation statistics. Several ethical considerations, accommodations for rigor, and alternate strategies while conducting research with a vulnerable population were included in our study plan.

CHAPTER 4: CULTURE, PLACE AND ENVIRONMENTAL HEAT STRESS ON FLUID INTAKE: PERCEPTIONS FROM FARMWORKERS LIVING IN EASTERN NORTH CAROLINA

Abstract

Objective: To elicit Latino farmworker perceptions on their fluid intake and heat stress.

Methods: A qualitative descriptive, community-informed research design, guided by Intersectionality theory, was conducted in summer 2020. In partnership with staff at one federally qualified health center, focus group discussions were held on four camps in eastern North Carolina. A total of 28 Latino farmworker between ages 23 and 53 (Age_M 39) participated in one of four focus groups. Using content analysis, two themes and subthemes were identified.

Results: The two major themes were Absence of Protection and Freedom to Drink. Absence of Protection was represented by two sub-themes; (1a) Intense Climate Considerations; and (1b) Workplace Exploitation. Freedom to Drink was represented by two sub-themes; (2a) Distance and Distaste; and (2b) Culture of Farm Work. Farmworkers consistently perceived extreme outdoor temperatures as the greatest hydration barrier and reported self-care sacrifices to meet workplace demands, incomplete hydration education, and workplace water accessibility and quality issues.

Conclusion: Findings highlight how farmworker fluid intake is mediated through work and influenced by multiple interlocking social categories and power systems. This study may support development and implementation of interventions that drive policy change to protect against farmworker HRI and promote farmworker hydration. Nurses and other health care professionals could practice climate justice, focusing on the vulnerable populations of the world, as the burden of climate change continues to alter health and daily life.

Introduction

Environmental heat stress resulting in heat-related illness (HRI) is a disproportionate occupational hazard for farmworkers. From 2000 to 2010, persons working in the agricultural industry were 35 times more likely to die from HRIs than other occupations. During this period, Latino agriculture workers were even more vulnerable, with a relative risk of 3.4 for HRI deaths (Gubernot et al., 2015). This is a critical concern for clinicians in North Carolina (NC) as 95% of farmworkers are Latino migrant workers from Mexico and Central America (Lambar & Thomas, 2019).

According to the National Aeronautics and Space Administration (NASA, 2021), 2016 and 2020 tied for the world's hottest years on record. The year 2019 was the hottest ever recorded in NC (National Oceanic and Atmospheric Administration, [NOAA] 2020). Over the last five NC summers, the number of emergency department visits for HRIs peaked in 2018, with 4,593 (NC Department of Health and Human Services, 2021). Environmental heat stress concerns the surrounding environmental factors which result in an increase in heat storage in the body (National Institute for Occupational Safety and Health [NIOSH], 2016). As a result of climate change and global warming, the environmental heat stress experienced by agricultural workers in NC is at record levels and outdoor temperatures are expected to continue to rise. By the year 2100, the number of days per year of temperatures above 38˚C (100°F) is projected to increase from 3 to 60 days/year in the southeastern U.S (NOAA, 2020).

While drinking water can manage heat stress and mitigate heat-related mortality, farmworkers report not drinking water due to various social and occupational pretexts. In studies of physiological markers among Latino farmworkers in California and Florida 80% sampled were dehydrated post-shift and more than 12% developed an acute kidney injury over a work shift (Mix et al., 2018; Moyce et al., 2017). To date, no known studies have specifically focused on fluid intake among NC farmworkers.

Background

There are approximately 870,000 farmworkers in the United States every year (Bureau of Labor Statistics, 2019). According to the National Agricultural Workers Survey, Latinos comprise 83% of the crop worker population: 68% male, 53% uninsured, and 33% live below the poverty level (U.S. Department of Labor, Employment and Training Administration, 2019). North Carolina is one of the nation’s leading employers of migrant farmworkers, with over 85,000 annually (NC Department of Commerce Workforce Solutions Agricultural Services, 2015). Farmworkers are critical to the success of the agriculture industry, which contributes more to NC’s economy than any other industry (NC DOA & Consumer Services, 2020).

A typical work schedule for NC farmworkers is 10 to 12 hours a day, six days a week (Layton, 2018). They commonly work in tobacco and sweet potato fields as these crops require manual labor (Lambar & Thomas, 2019). They usually work in open fields, without shade trees. Farmworkers in NC have been observed wearing trash bags, rain jackets, and heavy and thick clothing to reduce exposures to nicotine, pesticides, and the sun (Kearney et al., 2016; Lambar & Thomas, 2019). The thickness and air impermeability of these clothing choices increase HRI risk by interfering with convective, radiative, and evaporative heat exchange (Kearney et al., 2016; NIOSH, 2016; Walton et al, 2016).

Demographic data of farmworkers in NC is limited. Of 48,090 farmworkers and family members served by the NC federally qualified health centers (FQHCs), 75% were men, 95% were of Latino heritage, 92% were uninsured, and 87% lived below the federal poverty level (Lambar & Thomas, 2019). These indicators are all higher in comparison to the national farmworker population (U.S. Department of Labor, Employment and Training Administration, 2019). Further, the vast majority (71%) reported being migrant farmworkers, rather than seasonal workers, who move to harvest different crops up and down the east coast (Lambar & Thomas, 2019).

Currently, 25% of those hired to fill temporary farmworker jobs in NC are H-2A workers (Ferriss, 2020). The H-2A visa program, run by federal and state agencies, helps farmers employ foreign workers for temporary agricultural jobs, usually vacant due to harsh working conditions and a lack of willingness by US-born residents to fill or maintain that employment (Clemens, 2013; U.S. Department of Agriculture [DOA], 2020). North Carolina remains a top state in the nation in the number of H-2A visas processed every year.

Intersectionality Theory

This study was informed by Intersectionality theory (Collins & Bilge, 2016; Crenshaw, 1989*)*, a holistic representation of the marginalized worker bounded by social and ecological systems. The theory, originally developed to emphasize the interplay of race and gender in the violence and employment of Black women, contains six core concepts: inequality, relationality, power, social context, complexity, and social justice (Collins & Bilge, 2016). The concepts of Intersectionality theory are highly relevant to the vulnerability of Latino farmworkers. A power imbalance exists in their workplace, which creates complex effects on their self-care behaviors, such as drinking water. Groups identified as more vulnerable to the negative health outcomes of climate change are typically groups of focus in Intersectionality research—undeniably due to their position within social and power structures (Crimmins et al., 2016; Kaijser & Kronsell, 2014). This theory has been used with studies involving vulnerable populations affected by climate change, including community members who experienced a wildfire event and among smallholder farmers in disaster-prone and food-scarce regions (Khoza et al., 2019; Walker et al. 2020; Wood et al., 2021).

Fluid intake is a complex and dynamic behavior. Daily fluid intake is influenced by multiple homeostatic (i.e. age and physical activity) and non-homeostatic factors (i.e. sociocultural and environmental stimuli) (Stanhewicz & Kenney, 2015). Thus, homeostatic factors and non-homeostatic factors should be considered together in addressing hydration and fluid intake. To evaluate both micro and macro systems that influence farmworker hydration; concepts from Intersectionality theory guided the study. The micro system of individual social identities and the macro system of organizational power structures were examined within farmworker culture. Within the farmworker workplace, the micro-level social identities and relations and the macro-level political and economic structures in the workplace were explored.

Micro- and Macro-level Factors

Farmworkers, compared to other workers, are noticeably exempt in many policies, regulations and standards set forth by federal and state agencies. The Occupational Safety and Health Administration (OSHA), is the federal agency that ensures safe and healthful working conditions. When farmworkers are left out of protective standards, this doctrine is referred to as agricultural exceptionalism (Rodman, 2016; Rodman et al., 2016). These policies keep farmworkers uninformed and deprived of protections such as minimum wage, overtime pay, unemployment insurance, collective bargaining, and occupational safety and health (Liebman & Augustave, 2010; Rodman et al., 2016). The Department of Labor in NC enforces the state’s Wage and Hour Act which requires workers receive minimum wage and overtime; however, agricultural workers are specifically excluded in this act. In NC, there are no standards requiring meal or rest periods for any workers (Rodman, 2016).

For NC workers, there are no federal or state occupational safety and health regulations that specifically address heat illness (NC Department of Labor, 2018). California, Minnesota, and Washington are the three states with such regulations (Heat Illness Prevention in Outdoor Places of Employment, 2006; Indoor Ventilation and Temperature in Places of Employment, 2014; Outdoor Heat Exposure, 2003). California’s heat illness prevention law is the most comprehensive and requires employers to (a) train all employees and supervisors about heat illness prevention; (b) allow and encourage employees to drink at least 1 quart of water per hour; (c) provide shade for cool-down breaks; and (d) establish a written heat stress prevention plan. In addition, if temperatures are above 35°C (95°F), workers must be allowed 10-minute paid breaks every two hours. Minnesota’s standard only protects workers against extreme indoor temperatures.

In 2011, OSHA launched their heat illness prevention campaign (OSHA, 2021). The campaign’s safety message was ‘Water. Rest. Shade’, as basic yet critical strategies to protect workers from heat illness. Specifically, these strategies include adequate water intake, periodic rest from work, and breaks in shaded areas. Farmworkers report macro-level barriers to ‘Water. Rest. Shade.’ strategies at work. According to findings from a qualitative study by Lam et al. (2013) farmworkers in Washington state reported (a) short or no work breaks; (b) long distance to bathroom facilities; and (c) poor quality drinking water. Those farmworkers also perceived poor relationships with employers as barriers to fluid intake.

Poor relationships with employers and other macro-level factors influence farmworker occupational safety. The imbalance between the power of agribusiness structures and farmworker agency, including employer-to-farmworker discrimination, impedes farmworker self-care decisions (Snipes et al., 2017; Wadsworth et al., 2019). A qualitative descriptive pilot study with farmworkers in eastern NC also found tensions in employer-worker relations (Mizelle & Larson, 2020). In-depth interviews with eight Latino farmworkers suggested the employer controlled the breaks, work, and fluid consumption, while farmworker agency minimized self-care. The work ethic of the farmworkers also superseded their self-care behaviors.

Micro-level factors influencing hydration involve individual, cultural characteristics and practices and social relationships in the workplace. Lam et al. (2013) reported farmworkers had personal knowledge that water was a healthy choice at work, while alcohol and caffeine should be avoided; however, their reported behaviors did not always match this knowledge. Lam and colleagues suggested a knowledge-practice gap in relation to hydration; farmworkers were aware of the risk for HRI but used alcohol to help quench thirst and caffeine to increase productivity. Understanding what contributes to this knowledge-practice gap is important in designing and implementing interventions to prevent farmworker HRI.

Occupational Vulnerability

Many studies on the general health (Arcury et al., 2019; Furgurson et al., 2019; Kinney et al., 2015) and more specifically occupational health of farmworkers (Kearney et al., 2014; Kearney et al., 2016; Quandt et al., 2013; Sandberg et al., 2016) in central and eastern NC have been published in the last several years. Three studies have focused on adult farmworker HRIs in NC (Arcury et al., 2015; Mirabelli et al., 2010; Kearney et al., 2016). From these studies it was reported that many farmworkers experience symptoms of HRI while working outdoors. Of the study participants, over 36%, 40% and 72%, respectively, reported symptoms of HRI. The researchers found many factors to be associated with outdoor heat illness, but the findings were not consistent among the studies. Working in wet clothes and shoes, working in tobacco, and spending after-work time in an extremely hot house (Arcury et al., 2015); wearing a hat or protective gear over the face (Kearney et al., 2016); and working with the H-2A visa program (Mirabelli et al., 2010) were found to be associated with HRI symptoms. In these studies, little information was gathered about water and hydration practices. Most participants (88.9% and 98%) from two studies reported drinking more water to protect from HRI (Arcury et al., 2015; Mirabelli et al., 2010).

Farmworkers are disproportionately vulnerable to heat-related morbidity and mortality. Agricultural exceptionalism and lack of HRI protective policies are examples of power systems impacting farmworker health outcomes. While adequate water intake in critical to controlling heat stress, the specific influences on NC farmworker fluid intake has not been studied, yet, farmworkers are currently working in the hottest recorded period in history. This study was conducted to fill that literature gap by conducting focus group discussions (FGDs) among a subset of farmworkers in eastern NC. This article describes the first phase of a larger community-informed, mixed methods study. In this phase, we examined the sociocultural factors Latino farmworkers believe influence their fluid intake.

Methods

Design

A community-informed qualitative descriptive study was conducted in partnership with staff at one FQHC that serves farmworkers in six counties. This design was chosen to engage community members in the research process which could lead to improved health and reduced health inequities (Israel et al., 2013). In 2018, the PI began working with the FQHC director and two outreach staff on a pilot study. The FQHC staff are members of the local community and familiar with farm work. The research team was composed of the principal investigator (PI), two Latino FQHC staff, and a bilingual undergraduate nursing student. Staff from the FQHC provided local or emic knowledge, while the PI contributed the etic orientation; a synthesis of emic-etic knowledge brings about a new understanding of the phenomenon of interest (Israel et al., 2013). The research questions for this study were 1) How do cultural beliefs, values, and norms influence farmworker agency and fluid intake? 2) How does workplace, housing, country of origin, and rurality influence farmworkers' fluid intake? and 3) What accounts for on-the-job knowledge, behaviors, and attitudes of fluid intake during environmental heat stress?

The university review board approved all study procedures. A letter of support was obtained from the Director of the FQHC and the PI received permission from local farmers who employed farmworkers eligible for the study. The research team collected signed informed consent from the participants. The consent form was read aloud, and all questions were answered. The voluntary nature of their participation was explained; that they could leave the focus group at any time with no penalty. Participants were identified by a unique ID number for data tracking. The study was conducted during the COVID-19 pandemic and the PI established a COVID-19 Research Safety Plan and followed CDC, state, and university requirements during both phases.

Setting

The study was conducted on farmworker camps in eastern NC during July and August of 2020. The FQHC service area has approximately 1,100 farms and 2,300 migrant and seasonal farmworkers working during peak harvest (U.S. DOA, 2019; Lambar & Thomas, 2019). Of the ten employers approached, four agreed to allow the researcher team to recruit farmworkers. The research team traveled to the four farmworker camps and recruited participants in person, using an informational flyer.

The participants worked in three counties and the farmworker camps were in two of those counties, which are among the most economically disadvantaged counties in NC. In this region of NC, approximately 20% to 24% of the total population live in poverty and the unemployment rates are higher than the state average (University of Wisconsin Population Health Institute, 2021; U.S. Census Bureau, 2021). In 2020, eastern NC experienced 29 days above 32°C (90°F) in July and 16 in August (Raleigh Weather Forecast Office. 2020).

Sample

The initial approximation of sample size was based on information power, which is determined by examining the study aim, sample specificity, theoretical linkages, interviewer expertise and case analysis (Malterud et al., 2016). The study aim was narrow, the sample specificity was dense, the theory was predetermined, the interviewer was a novice, and case analysis suggested information power should be moderately high. Thus, a purposeful sample of four to five focus groups (6-12 participants/group) was sought (Krueger & Casey, 2015; Malterud et al., 2016). Four focus groups were sufficient to reach 95% code saturation using procedures outlined by Hennink and colleagues (2019).

We invited a total of 32 farmworkers to participate in the study: 28 agreed, resulting in an 87.5% acceptance rate. Inclusion and exclusion criteria were men and women between ages 18 and 54, self-identified as Latino, English or Spanish speaking, worked primarily outdoors (>50%) 8 or more hours per week, with no self-reported history of recent illness, kidney disease, use of diuretics, or currently pregnant. The 28 participants were then scheduled to participate in one of four focus groups held at their camp the following week. All participants were men between the ages 23 and 53. The range of years in farm work was 4-26 years. Most had a primary school education (6^{th} grade); however, one was college-educated. Table 2 displays participant profiles of each focus group.

Table 2

Focus Group Participant Profile (4 Focus Groups: N=28 Participants)

	FG 1 *n* = 5 f (%)	FG 2 *n* = 9 f (%)	FG 3 *n* = 8 f (%)	FG 4 *n* = 6 f (%)
Age				
18-30	2 (40)	3 (33.3)	1 (12.5)	1[a] (16.7[a])
31-45	2 (40)	3 (33.3)	3 (37.5)	3[a] (50[a])
46-54	1 (20)	3 (33.3)	4 (50)	1[a] (16.7[a])
Highest level of education				
Elementary school	3 (60)	2 (22.2)	2 (25)	1[a] (16.7[a])
Middle school	—	3 (33.3)	5 (62.5)	3[a] (50[a])
High school or more	1 (20)	4 (44.4)	1 (12.5)	1[a] (16.7[a])
Current home				
Mobile home	5 (100)	9 (100)	—	—
House	—	—	8 (100)	—
Barrack	—	—	—	6 (100)
Amount of time worked in agriculture in the United States				
< 5 years	—	1 (11.1)	—	1[a] (16.7[a])
5-14 years	5 (100)	5 (55.6)	4 (50)	2[a] (33.3[a])
15 or more years	—	3 (33.3)	4 (50)	2[a] (33.3[a])
Current crop/s				
Tobacco	5 (100)	9 (100)	8 (100)	6 (100)
Sweet potatoes	1 (20)	—	—	—
Cotton	—	—	2 (25)	—
Cucumbers	—	—	—	6 (100)

Note. FG=Focus Group
[a]Demographic data missing from one participant

Data Collection

Data collection occurred during the hottest months of the year in NC: July and August. Focus group discussions (FGD) were sought to provide insight into diverse opinions and behavioral norms and allow for rich interaction, understanding of a shared culture and permits a power shift from investigator to participants (Krueger & Casey, 2015). To conduct the FGDs, the PI and members of the research team traveled to farmworker camps. Participants completed a demographic survey before the FGD, labeled with their unique ID number. One moderator (PI) and one bilingual co-moderator (FQHC staff or the student) facilitated each group. A semi-structured interview guide based on the literature, the pilot study, and project objectives was developed and translated from English to Spanish. The questions were pilot tested and revised with feedback from one of the Latino research team members, a former farmworker. Focus groups were conducted in the farmworkers' language of preference; in which was Spanish. The PI asked the questions in Spanish, which were supplemented or clarified by one of the bilingual research team members. The FGD were audio recorded with the permission of participants. The four FGDs were held for 39 to 66 minutes, with an average interview time of 56 minutes. At the conclusion of the FGD, a summary was read aloud to the group and participants either agreed or clarified items in the summary (Krueger & Casey, 2015). Incentives of a $25 gift card were then given to the participants.

Data Management and Analysis

Audio recordings and notes were translated and transcribed into English within two weeks following each focus group. Naturalized transcripts were prepared jointly by the PI and bilingual team members and validated for accuracy by the PI (De Chesnay, 2015). Beginning with the first focus group transcript, the PI read the transcripts multiple times, taking care that each transcript was reviewed with similar frequency.

A codebook was generated following regular discussions with the PI's dissertation chair, occurring weekly to biweekly. While coding for Intersectionality the interrater reliability was 86% (Creswell & Poth, 2018). In keeping with a community-informed approach, the FQHC staff were engaged in data analyses and interpretation. An audit trail was maintained through research logs, field notes, memos, and reflective notes.

First level coding included In Vivo and descriptive coding, which occurred through an iterative process (Miles et al., 2020). In Vivo coding moved to descriptive coding in some cases;

for example, “Stomach doesn’t feel very good, when you drink something cold, walking, working in the heat” was descriptively coded as Hot/Cold Balance. Next, a matrix was created to align with each research question and matched with the research concepts of culture, place, and environmental heat stress. Finally, concepts from the Intersectionality theory were compiled into a case-by-variable matrix to compare the frequency of the codes within each FGD transcript.

Whole transcripts were selected as the unit of analysis. To explore the “explicit and covert meanings” in the FGD text, content analysis was selected as the data analysis method for this study (Bernard et al., 2017, p. 243). We started with a set of pre-identified concepts (deductive coding), including concepts from the Intersectionality theory and the pilot study. Then we expanded on these to include other concepts that were determined during the coding process (inductive coding) (Bernard, 2011).

Rigor

Rigor, or trustworthiness, was addressed through credibility, dependability, transferability, and confirmability (Guba & Lincoln, 1994). Credibility was achieved through verbatim transcription of audio recordings and member checking (Krueger & Casey, 2015). Dependability was attended to by (a) clear descriptions of the selection and characteristics of the participants; (b) transparency of the data management and analytic processes; and (c) inclusion of exemplar quotations. Transferability was supported through description of the setting, data collection process, and inclusion of the cultural and social contexts of the study. Confirmability was addressed through reflexivity and data and analyst triangulation. A reflective journal was kept to record biases that were uncovered during research discussions. Analyst triangulation was achieved by listening to the perspectives of multiple team members. These perspectives were especially important as we were conducting studies informed by the Intersectionality theory

(Duran & Jones, 2019). The PI's limited experience working with the farmworker culture may have decreased bias, but a comprehensive understanding of the farmworker literature may have increased bias.

Results

Two major themes were identified, Absence of Protection and Freedom to Drink. The first theme, Absence of Protection, was represented by two sub-themes; (a) Intense Climate Considerations; and (b) Workplace Exploitation. The second theme, Freedom to Drink was represented by two sub-themes; (a) Distance and Distaste; and (b) Culture of Farm Work.

Absence of Protection

The theme, Absence of Protection, described the inadequate health standards and norms of the agricultural industry. The absence of protection focused on two conditions at work: Intense Climate Considerations and Workplace Exploitation. The farmworkers continued to work in extreme environmental heat with few breaks and long work hours. The farmworkers described being powerless and exploited, stemming from their employer's inconsistent occupational policy compliance and payment practices.

Intense Climate Considerations. Lack of federal or state occupational safety and health regulations regarding heat stress was a hydration barrier for the farmworkers. This was evident in the farmworkers' limited personal knowledge and workplace practices regarding heat stress prevention and policy. When asked about water intake during extreme heat one participant replied "No there's not any rules for consuming water. Just whenever you need some you are going to consume. Being the climate how it is, no matter." Participants were rarely allowed longer or more frequent breaks during periods of extreme heat. Participants from one focus group recalled leaving the field due to extreme heat only once during the 2020 season. More ice or more water was reported as the usual interventions on extremely hot days. One participant mentioned OSHA by name and compared Virginia’s rules to other states as more “distinct.” None expressed any awareness or understanding about federal regulations regarding environmental heat stress or climate change policy.

Environmental heat stress was consistently perceived as the greatest hydration barrier across all four focus groups. One participant stated, “the heat does a lot of damage and at night you have nightmares.” This was confirmed by another participant, “yes, dreams, nightmares (sueños, pesadillas).” Days were described as “super-hot (super caliente)” and farmworkers recognized that they had to drink more water at work than other workers. Extreme temperatures were experienced outdoors, in the fields, as well as indoors, in tobacco barns.

Farmworkers also reported other adverse occupational health exposures or “damages,” such as humidity, nicotine, and pesticides. They spoke of their “fight” against these exposures that “attack” them daily. The humidity from the ground, off the crops and after it rains caused greater thirst among farmworkers. Those who worked in tobacco reported that the tobacco let off heat and the height of the crop blocked the cooling effects of the wind, which increased their need for water. Intersectionality theory’s core concept of Inequality was prominent within the subtheme of Intense Climate Considerations. Farmworkers are exposed to more occupational hazards and are protected less due to existence of agricultural exceptionalism and lack of HRI policy.

Workplace Exploitation. Exploitation in the workplace, most prominent in the lack of occupational education and powerlessness created from agricultural norms, contributed to inadequate water intake. Yet, farmworkers do not directly express powerlessness related to their water intake. In fact, each group reported an equivalent of “everything is peaceful,” and “we are very comfortable here." Participants rarely complained about their job. Exploitation was identified through field notes and reports from the FQHC research team members.

Farmworkers reported outdated and incomplete education from the NC Growers Association. Farmworkers shared how they watched the same three-hour video every year, in route or once they arrive in NC. One worker believed it was the same video for the last 20 years. They recalled the video indicating to drink "when they are thirsty" and "to have water nearby" but did not specify a frequency or quantity.

Farmworker personal knowledge on how water and beverage intake affect the body was limited and varied. When discussing water and health, discussions focused on necessity; "water is life," without it "there is no existence" and comparing humans' needs as water to plants and gas to a motor. In half of the focus groups, at least one participant reported kidney pain while working. To cure kidney pain, some farmworkers felt drinking sodas helped their pain while some felt sodas worsened the pain. One group believed drinking two liters of water per day is the recommended amount during hot days while another could explain how urine color darkened as a person became more dehydrated.

Agricultural norms that exploited farmworkers and were a barrier to hydration included the piece-rate payment system, tensions in employer-farmworker relations and the H-2A program. Piece-rate is a payment system which compensates farmworkers by the pieces picked in a shift (Horton, 2016). While harvesting sweet potatoes, farmworkers reported being paid 50 cents per filled 35-pound bucket. This payment system encourages farmworkers to take fewer breaks; "to not lose time, you also harm the body, to fill more buckets." Farmworkers also drank less water when working in sweet potatoes. One farmworker admitted,

> You can't [drink a lot of water] because you won't be able to bend over as much. When it's time to stop you take a little sip and that's it because if not and you fill yourself up you feel like it will come out your nostrils.

Although staying hydrated while working in the sweet potato crop was difficult due to the payment system, farmworkers did not believe heat stress was a barrier. In NC, the sweet potato harvest occurs from September through November. Farmworkers reported less extreme temperature (but still warm); therefore, less need for fluid intake. While harvesting the sweet potatoes crop was described as cool but fast work, time spent in the tobacco fields was considered hot but slow work. Farmworkers spent the hotter months (June through August) in the tobacco crop but could work at a slower pace with "more freedom" to drink water.

In the past, with previous employers, farmworker admitted to heightened tensions in employer-farmworker relations. They reported that they would be fired if they complained or didn't work hard while on the job. Participants described a farmer who fired an entire group of workers because one person was being lazy; however, the farmworkers reported this one worker was feeling ill at the time. Others reported past experiences of asking their neighbors for water since there was none at work or it was inaccessible. Participants described a past employer as racist and "didn't care if any of us drank water at all, he wanted his earnings to stretch." Current employers were the exception. The farmworkers did not report poor relationships with their current employers. When asked about language differences between the employer and the farmworkers, the workers did not perceive that influenced their water intake. Most farmworkers in this sample spoke Spanish, with very little English. Despite this, they felt they could adequately communicate with their employer through non-verbal behaviors, translator telephone apps, or a member of the crew that knew more English.

Farmworkers reported multiple problems in payment. Farmworkers were supposed to receive reimbursement for travel from their home destination (i.e. Mexico) to North Carolina. One FQHC staff confirmed how the NC Growers Association is supposed to collect money from the farmers to reimburse farmworkers for their travel expenses. Yet, some farmworkers reported not receiving this reimbursement. Farmworkers also reported not receiving the number of hours of employment stipulated by their work visa. For this reason, they considered breaking their contracts, but if they do, they would not be allowed to reapply for a farmworker position with the NC Growers Association for six years. Field notes also verified that farmworkers were commonly on-call to work long hours most days of the week and had little personal or leisure time.

Intersectionality theory's concept of Power was the most prominent concept throughout the study findings, especially in the subtheme of Workplace Exploitation. Power systems relevant to farmworker fluid intake included economic systems influencing farmer and farmworker income; migration systems creating power imbalance between employer and migrant employee; and political systems controlling policy. The farmworker identities that were found to have an impact on their hydration were that of migrant, lower economic class, and employee. These identities overlap, providing examples of Relationality, another Intersectionality theory concept.

Freedom to Drink

The second theme, Freedom to Drink, described the contradictions farmworkers perceived in their freedom to drink water despite water accessibility issues. Some farmworkers stated, "we are never in need for water at work." Regardless of this perception, farmworkers also reported water being available but not accessible. The poor water quality was problematic for about half of farmworkers, in that the taste and smell was often repulsive, stemming from poor sanitation and housing.

Distance and Distaste. Some farmworkers reported being provided a sufficient quantity of water while at work. One participant noted “No matter the type of work we are doing, he [the crew leader] always goes back to get [us] water. As soon as you’re out, he goes and gets water, you are never without water.” Farmworkers reported drinking between 1-6 Liters (average 3L) per day, drinking every 10-60 minutes (average, every 15 minutes). Some reported being hydrated at work helped them feel healthy while one participant noted when he doesn’t drink water at work; “I return to home and I feel fatigued, I go to the bathroom and it’s hard.”

Despite this perceived quantity, water could be inaccessible, too far away from the worksite or farmworkers would choose to consume beverages other than water. Water was usually stored in large orange water coolers at the end of long crop rows or in vehicles parked at the edge of fields. Farmworkers usually left the water at the edge of the fields and did not bring water bottles with them into the field. They chose to do this because of the higher risk of contaminating their water with pesticides or other chemicals from the crops. One farmworker explained,

> We have to take care to not drink water with dirty hands because…the chemicals can make us sick (mareado) or vomit. Sometimes we have to take a swallow, then spit it out, now we can drink it. The dust of the chemical gathers here around the mouth. If we don’t do this, we will get sick. (FG#4)

Distance to water access was further suppressed by infrequent and irregular breaks for water intake. Farmworkers reported being allowed three employer-permitted breaks, over an 8 to 12-hour workday: a morning and afternoon break lasting between 5-15 minutes and a 30-minute lunch break. To compensate for short, infrequent breaks, farmworkers gulped water quickly to maintain hydration. As a result of gulping water, farmworkers experienced adverse gastrointestinal symptoms like pain and nausea, which decreased their desire to hydrate. One farmworker explained, “and even though your stomach is full of water, your mouth gets really dry and you still want to go drink more water, even though you feel full.”

Although employer-permitted breaks were infrequent, unscheduled breaks were allowed. Farmworkers felt they could quickly take unscheduled breaks to drink water and then return to work. A participant stated, “even if we are not finished in the row” or “are [on] top of a machine…you can stop and go get water.” Participants did not feel pressured to only drink during the scheduled breaks.

Farmworkers reported the water, either at the worksite or where they lived, had poor taste or appearance. Specifically, they reported water being yellow or moldy. Taste was reported as the most important quality of drinking water and some chose to buy bottled water instead of drinking the water at work. Workers perceived well water as a barrier to hydration. Many had worked in multiple locations throughout NC and the U.S.; they consistently reported the drinking water in eastern NC to be worse than other areas. The director of the FQHC admits that many local citizens do not drink the public, tap water, and instead drink bottled water. Another participant was aware that the quality of water at their homes is tested before they arrive to the camps and “they (the NC Grower’s Association) tell us if we consume the [tap] water it is safe for us.”

While working in NC, farmworkers reported greater availability and accessibility to beverages compared to their native home. Due to a higher income in the U.S. living in Mexico, farmworkers bought more beverages than when they are in Mexico. Farmworkers consumed more soda and beer but also purchased beverages such as sports and energy drinks; "a lot of things we consume here, we don't there [Mexico] like Monster and Gatorade."

Other beverages, especially sodas, were preferred to water. Specifically, they reported liking the taste of sodas, such as, Coca-Cola®. Farmworkers remarked that the taste of the water took "away from the flavor of my food." This meant that the water diminished the flavor of their food. When asked about alcohol consumption, some drank beer at the end of the day, to help with pain from sore muscles accrued during work and to help them sleep.

Culture of Farm Work. Daily life of a farmworker involved employer-provided housing. Based on field notes, farmworkers lived in small, crowded homes in rural areas. Farmworkers reported poor workplace sanitation and housing and unpleasant characteristics of the water (i.e. taste, smell, etc.). In reference to sanitation, the employer-provided portable bathrooms in the fields were either too hot or too unsanitary to use. Field notes identified the presence of one portable bathroom about 250 yards from the current worksite.

Participants in all focus groups reported poor housing as a barrier to hydration. They lived five to six people per mobile home or eight within a small house: sharing one or two bathrooms. The lack of window screens encouraged the presence of insects while some reported infestations of roaches in their homes in the past. Few had air-conditioning and outdoor garbage dumpsters were overflowing. Farmworker camps were noted to be within 15 minutes of small convenience stores. They did not have consistent transportation, but this nor the location of the camps was perceived as a barrier to water consumption.

Farmworkers reported cultural preferences for cool water and would, at times, refuse ice or warm water. Most farmworkers reported practicing humoral medicine, a Latino belief of balancing hot and cold elements to maintain health (Barker et al., 2017). While working in the heat, farmworkers indicated they would not drink ice water because of the potential for bodily pain or a “heat shock (choque de calor).” Farmworkers also did not consume warm or hot water as this worsened the taste.

This subtheme aligns with Intersectionality theory’s core concept of social justice as housing and sanitation were substandard. Social context, another concept of Intersectionality theory, was a prominent within the subtheme of Distance and Distaste and Culture of Farm Work. The fluid intake of farmworkers could vary greatly depending on their social context, particularly the area’s climate and water quality, access to beverages and workplace culture.

This study aimed to explore how culture, place, and environmental heat stress influenced farmworker fluid intake. Environmental heat stress was perceived as the greater barrier to fluid intake. Farmworkers did not perceive major workplace barriers to fluid intake, though contradictions were uncovered which surfaced as self-care sacrifices to meet workplace demands, incomplete hydration education, and water accessibility and water quality issues. The influence of farming and farmworker culture on fluid intake included unpleasant bathrooms and poor housing.

Discussion

This qualitative descriptive study provided a greater understanding of farmworker perceptions of culture, place, and environmental heat stress on their fluid intake, specifically water. These findings were framed by Intersectionality theory, highlighting how fluid intake, mediated through work, intersects with multiple interlocking social categories and power systems. Unique to this study was the perception of microclimates within the tobacco crop that increased their need for water consumption, highlighting the unique hydration needs of this population.

The gulping of water and the resulting physical complaints from a full stomach, is a finding only briefly mentioned in one other farmworker study. Two studies reporting on child farmworkers (n=30) in NC reported stomach pains and shortness of breath after gulping water; as a result, participants limited or avoided water intake (Arnold et al., 2020). The most recent recommended standard from NIOSH (2016) states that workers should drink 1 cup of cool water every 15 minutes while working, equaling 0.5 to 1 quart per hour, depending on the wet bulb globe temperature (WBGT) index and workload. Although the farmworkers were not aware of the NIOSH standard, they did report drinking as often as the standard recommended. It is unclear why they also reported the need to drink large amounts of water at once. It is possible farmworkers are overestimating their intake frequency or providing a socially acceptable answer. Gulping water could suggest farmworkers need alternate means, besides fluid intake, for cooling their bodies during times of high heat (i.e. longer breaks in shaded areas).

Farmworkers expressed powerlessness over self-care, stemming from power systems imposed by their employer or the H-2A visa program. The theme Absence of Protection suggested that farmworkers complied with the lack of standards and norms of agribusiness employers, and rarely complained about their job conditions or lack of these protections. This was likely so that they could retain employment. Our finding was congruent with the ‘good worker’ attribute, described by Wadsworth et al. (2019). California farmworkers made tradeoffs between a strong work ethic, lost pay, and self-care. This was especially true for farmworkers who were paid by the piece, or piece-rate. Also like our findings, farmworkers avoided drinking more water and taking bathroom breaks because they would receive less pay (Lam et al., 2013; Wadsworth et al., 2019). Farmworkers described good workers as those with great endurance, productivity, and self-sufficiency; a desire to please the employer (Wadsworth et al., 2019).

Participants in our study were also likely sacrificing self-care for fear of jeopardizing their 'good worker' positionality. One FQHC research team member verified this and further explained that the COVID-19 pandemic may have exacerbated the 'good worker' trait as farmworkers were even more grateful to be employed than in past years.

Hinson and Bradley (2017) report that many working-class people experience exploitation and powerlessness. However, scholars support that Latino migrant workers are more vulnerable to exploitation than other workers. Termed *superexploitation*, scholars have suggested that Latino migrants will work harder for less pay and are less likely to challenge authority (Heyman, 1998; Horton, 2016). In Mexico, agriculture workers earn between $10-16 per day, while farmworkers in the U. S. make between $11-15 per hour (The Regents of the University of California, Davis, 2018; U.S. DOA, 2020).

Our study confirmed that occupational policies intended to protect farmworkers are lacking, including policies that impact fluid intake. Most concerning are the short and infrequent breaks that farmworkers receive, as they work many hours a day in intense outdoor temperatures. Breaks during the workday should allow farmworkers to rest, hydrate and use the bathroom, core behaviors in OSHA HRI-prevention program's safety message 'Water. Rest. Shade.' Vega-Arroyo et al. (2019) conducted a HRI study during the summer months in California with 259 farmworkers and no participants, on their study day, reported HRI symptoms. With that, the authors suggested that California regulations, implemented by the study farms, protected the workers. Participants in that study, like our study, perceived a freedom to drink at any time throughout the workday. However, in Washington State, farmworkers reported they usually drank water only during breaks or at end of the workday (Lam et al., 2013). While most farmworkers in our study reported three breaks during a 12-hour day, over half of Oregon and

Washington fruit farmworkers had only a 30-minute lunch break and no additional breaks (Bethel et al., 2017). Bethel et al. (2017) did not report how many hours these workers worked on a typical day.

Not only are occupational policies lacking, our study also confirmed that some occupational hydration policies are poorly enforced. Under OSHA's Occupational Safety and Health Standards for Agriculture, subpart 1928.110, agricultural employers, with 11 employees or more, are required to provide sufficient quantity of water in a readily accessible area. Although participants insisted that employers provided sufficient quantities of water, it was not always accessible.

We also found similar barriers to fluid intake consumption as noted by Lam et al. (2013), although participants in our study did not report poor relations with their current employers, but rather poor relations with previous employers. Specifically, Lam et al. (2013) reported that farmworkers did not drink water more frequently because they did not want to upset their supervisor. Yet, in other studies, California and NC farmworkers reported feeling comfortable taking a break to drink water (Kearney et al., 2016; Stoecklin-Marois et al., 2013). In 2009, 67% of NC farmworkers reported their boss does as much as possible to make the job safe, while others believed the boss was more interested in doing the job fast and cheaply (Whalley et al., 2009). In preventing HRIs, the power imbalance in the workplace makes it difficult for farmworkers to exercise control of their own self-care, despite the farmers reporting that they do give control to their employees (Wadsworth et al., 2019).

The H-2A visa program requires that employers pay for housing for all H-2A farmworkers and that the housing must meet US Department of Labor (DOL) safety standards regarding sanitation, water, toilets, laundry, and pest control. Our study found housing as a hydration barrier for H-2A workers, particularly the quality of drinking water coming from the faucets within the homes. The Migrant Housing Act of North Carolina (1989) requires inspection of farmworker housing and enforcement of water quality and water sanitation standards. Bischoff et al. (2012) found 31% of sampled water from camps with H-2A workers failed the Total Coliform Rule (TCR), failing to meet NC Department of Labor (NCDOL) standards. The existing regulations at the time did not ensure water safety requirements and is concerning because the percent of the farmworkers with the H-2A visa program in the U.S. and NC is an increasing practice among agribusiness.

Little is known about the hydration status or fluid intake differences between H-2A and non-H-2A workers; however, literature suggests there are HRI discrepancies between these two groups. Mirabelli et al. (2010) surveyed farmworkers in three NC counties, found heat illness was less common among H-2A workers than non-H-2A workers (31% vs. 56%), yet HRI-preventative strategies (i.e. resting in the shade, adjusting work hours) were more common among non-H-2A workers. The authors did not explain this but the non-H-2A workers had fewer years of formal education and fewer years' experience in agriculture. Luque et al. (2019a) found non-H-2A farmworkers working along the Florida-Georgia border had significantly higher HRI knowledge scores than H-2A workers. However, Whalley et al. (2009) reported NC farmworkers with H-2A visas practiced more pesticide safety behaviors, as well as experienced better housing conditions, than non-H-2A workers. Whalley et al. suggested H-2A workers lived in better conditions because the program requires state inspections of intended H-2A housing.

After investigations, the US DOL's Office of Inspector General (2020) reported, in November of 2020, about vulnerabilities in four foreign labor certification programs, including H-2A. One vulnerability of the program is that employers are not complying with the conditions of employment, leaving the H-2A program susceptible to fraud. Investigators identified various employers that did not uphold one or more of the items included on the H-2A application. Examples included failing to pay H-2A workers' transportation expenses, retaining H-2A workers' passports and visas, dilapidated and trash-strewn housing with rodents, no hot water for showers or working fire extinguishers.

A finding unique to this study was the perception of microclimates within the tobacco crop that increased their need for water. Tall, dense crops, like tobacco, can block the wind, which decreases evaporation speed; thereby, increasing heat stress (NIOSH, 2016; Papadavid & Toulios, 2018). Most farmworker studies estimate environmental heat stress through regional weather station measurements; few farmworker studies have reported microclimate (the area immediately surrounding the worker) measurements experienced by the farmworker (Mac et al., 2019; Mitchell et al., 2017). Although no actual farmworkers were observed, Dillane and Balanay (2020) determined a heat stress monitor outperformed the OSHA-NIOSH heat stress application for smart phones in assessing occupational risk to heat stress in an agricultural setting in NC.

Limitations

Due to the COVID-19 pandemic in the summer of 2020, data collection was delayed and shortened. We intended to provide perspective on both men and women and migrant and seasonal workers; however, our sample was limited to male migrant farmworkers working with the H-2A visa program. Still, the sample included diverse age range and educational level. The convenience sample of farmworkers were from one geographic region of the state; thus, findings would not be generalizable to other regions. Sample bias was likely due to the limitation of farmer permission and the positive perspective from farmworkers due to the COVID-19 pandemic. Sample bias likely led to more positive farmworker perceptions on any negative workplace influences on hydration. Therefore, results should be interpreted with caution.

Conclusion and Implications for Policy and Research

Farmworkers are essential to the NC economy and as agricultural workers they are critical for maintaining the food production and distribution process to households across the U.S. Yet, many are faced with adverse health outcomes by working in extreme weather conditions and living in substandard housing. Despite the farmworkers in this study experiencing workplace exploitation, farmworkers did not complain and were appreciative to have a job. Nonetheless these workers deserve the equitable housing, sanitation, and occupational health protections as other workers.

Farmworkers are a vulnerable population with disproportionately at risk for HRI death. Occupational health policies are inadequately protecting them from HRIs and possibly other unknown condition, such as CKDu. Regular training opportunities for farmworkers and crew leaders are recommended to stress the importance of HRI prevention. As farmworkers perceive heat as the greatest hydration barrier, more HRI prevention interventions and policies are necessary, including more frequent rest periods. However, interventions to prevent HRI and promote hydration will need to consider Latino farmworkers economic vulnerabilities as well as their hesitance to speak out about occupational health hazards. Improvements to the H-2A program, public water systems, and the farmworker-employer relationship could also improve farmworker hydration. More research is needed on how housing and contract status affects farmworker hydration, especially among non-H-2A farmworkers. By combining observation and physiological measurements of HRI and hydration status, researchers can further understand fluid intake behaviors and hydration status among farmworkers.

Climate change has been described as the greatest public health threat of this century and is predicted to have dramatic human health impacts, from dehydration, more frequent extreme weather events, increased spread of infectious disease and complications of chronic disease (Crimmons et al., 2016; Lilienfeld et al., 2018). Farmworkers are on "the front lines of climate change," according to authors Kearney and Garzon (2020, p. 311). They urge NC policymakers to recognize the increased HRI risk farmworkers currently face and strengthen laws to protect these workers. The Alliance of Nurses for Healthy Environments has partnered with several other nursing and healthcare organizations in supporting a Nursing Collaborative on Climate Change and Health which aims to elevate nursing leadership in addressing climate change, including policy and mitigation strategies. Through advocacy, education and global citizenship, nurses are called to protect vulnerable populations, promote climate and social justice and ease the burden of climate change on the world's human population (Leffers & Butterfield, 2018; Lilienfeld et al., 2018; Veenema et al., 2017).

CHAPTER 5: FACTORS INFLUENCING FLUID INTAKE AND HYDRATION STATUS AMONG EASTERN NORTH CAROLINA FARMWORKERS: A MIXED METHODS STUDY

Abstract

Objective: To determine the relationship of hydration status to farmworker characteristics, behaviors, and environment.

Methods: A community-informed, mixed methods research design, guided by Intersectionality theory, was conducted in partnership with staff at one federally qualified health center. We recruited Latino farmworkers at camps in eastern North Carolina in the summer of 2020. In Phase I, focus group were held and in Phase II, demographics, beverage inventory, wet bulb globe temperatures in the field, and urine specimens were collected. Content analysis was used for qualitative data and parametric analyses were performed with the quantitative data. Mixed methods integration was done using a meta-matrix.

Results: The sample in Phase I was 28 and in Phase II was 30 farmworkers. All participants were male, migrant Latinos. From Phase I, the two major thematic findings were Absence of Protection and Freedom to Drink. For Phase II, 46.7% of farmworkers' pre-shift urine specific gravity indicated dehydration, increased to 100% at post-shift, which was a significant increase across the shift, $t\ (24) = -6.765$, $p < .001$ (two-tailed). Integration of Phase I and II data revealed congruent findings related to extreme heat, few breaks, and poor housing.

Conclusion: Farmworkers are dehydrated at work, placing them at higher risk for heat-related illness. The Alliance of Nurses for Healthy Environments could lead the effort to promote farmworker hydration and kidney health, in collaboration Growers Associations, FQHC staff and university faculty. These collaborations could propose national policy related to water, rest and shade.

Introduction

Trends in data across two decades depict agricultural workers in the United States (U.S.) being 35 times more likely to die from heat-related illnesses (HRIs). This places agriculture as one of the most dangerous occupations (Gubernot et al., 2015). During this period, Latino farmworkers were at even higher risk for HRI death, with a relative risk of 3.4, compared to other agricultural workers (Gubernot et al., 2015). Further, these trends highlight the risk for farmworkers in North Carolina (NC) with 95% identifying as Latino; most often coming from Mexico and Central America (Lambar & Thomas, 2019). Farmworkers in NC have experienced disproportionate fatality from HRIs compared to farmworkers in other states. Despite occupational HRI death being highly preventable, from 1992-2006, NC had the highest annualized rate of HRI death among farmworkers in the country and from 2000 to 2010 the 6th highest for HRIs deaths rates among all workers (Gubernot et al., 2015; Luginbuhl et al., 2008; National Institute for Occupational Safety and Health [NIOSH], 2016).

According to NIOSH, heat stress is the "net heat load to which a worker is exposed from the combined contributions of metabolic heat, environmental factors, and clothing worn which results in an increase in heat storage in the body" (NIOSH, 2016, Glossary p.xx). When the body can no longer compensate for heat stress, the risk for HRIs increases (NIOSH, 2016). Environmental heat stress is the heat load from the indoor or outdoor environmental temperatures in which workers are exposed. As a result of global warming and climate change, outdoor environmental heat stress in NC is at record levels. According to the National Aeronautics and Space Administration (NASA, 2021), 2016 and 2020 tied for the earth's hottest years on record. In NC, the hottest year was 2019 (National Oceanic and Atmospheric Administration, 2020).

Heat rash, heat cramps, heat exhaustion and heat stroke are all types of HRIs. The most severe, heat stroke, occurs when a core body temperature of 40.5°C (105°F) triggers a systemic response leading to multiorgan failure and death (Gauer & Meyers, 2019). Heat stroke increases potential for severe injuries and deadly falls and can cause internal bleeding, respiratory failure, and myocardial infarction (Epstein & Yanovich, 2019). Rhabdomyolysis, which is associated with heat stress, can lead to deadly heart arrythmias, seizures, kidney damage or kidney failure. While less is known about the long-term effects from heat stress, heat stress can contribute to chronic disorders of the heart, kidneys, and liver (NIOSH, 2016).

Proper hydration increases venous return, cardiac output and cerebral tissue perfusion mitigating HRI (NIOSH, 2016). Despite this critical physiological need for water to control heat stress, farmworkers report not drinking water due to various social and occupational pretexts. Social pretexts include a preference for caffeinated beverages to increase work pace and the cultural practice of avoiding ice cold or warm water on hot days (Lam et al., 2013). Occupational pretexts were short or no work breaks, long distance to the toilet, poor quality drinking water provided by employer, and piece-rate pay (Barker et al., 2017; Lam et al., 2013; Luque et al., 2019). Piece-rate pay is the employer's choice of payment which will compensate the farmworkers by pound or piece of crop produced in a shift, instead of an hourly rate or salary rate (Horton, 2016). With piece-rate pay, drinking more leads to taking more bathroom breaks which results in less pay; therefore, these farmworkers chose to consume less water (Lam et al., 2013; Wadsworth et al., 2019). To date no physiological hydration measurement studies have been conducted with farmworkers in NC. In this article, we aimed to determine the relationship between hydration status and farmworker characteristics, behaviors, and the environment.

Background

Water is essential to life and for preventing HRIs. Body systems work most efficiently when hydration levels are in a state of euhydration, defined as optimal total body water content (McDermott et al., 2017). The renal system is primarily responsible for the fluid balance within the body (Stanhewicz & Kenney, 2015). Particularly concerning to agricultural workers is an emerging epidemic known as chronic kidney disease of uncertain etiology (CKDu). This form of chronic kidney disease (CKD), mostly occurring in young male, agricultural workers, who did not have typical conditions like hypertension and diabetes mellitus that might lead to CKD (Johnson et al., 2019; Roncal-Jimenez, et al., 2016). This epidemic is hypothesized to be occurring among farmworkers due to rising outdoor temperatures, exertional activity, and chronic dehydration (Crowe et al., 2019). Yet, the science is still unclear.

North Carolina is one of the nation's leading employers of migrant and seasonal farmworkers, with about 85,000 workers per year (Tutor Marcom et al., 2020). Farmworkers in NC usually work 60 to 72 hours per week, under direct sunlight, in tobacco and other field crops that require manual labor (Lambar & Thomas, 2019; Layton, 2018). Farmworkers who labor in tobacco wear thick or impermeable clothing to help reduce chemical and sun exposure. Although protective, this type of clothing can increase the risk for HRI (Kearney et al., 2016; NIOSH, 2016; Walton et al, 2016).

A comprehensive demographic profile of farmworkers in NC has not been conducted. The best available demographic information on farmworkers in NC is from the federally qualified health centers (FQHCs), federally funded clinics across the country that serve the health and social needs of underinsured and uninsured community members. In NC, there are 39 FQHCs working to serve migrant and seasonal farmworkers across the state. Of 48,090 served in

2017, 75% were men, 95% were Latino, 92% were uninsured, and 87% lived below the federal poverty level (Lambar & Thomas, 2019). Compared to the national average, there are more male farmworkers in NC, more without health insurance and more living below the federal poverty level (U.S. Department of Labor, Employment and Training Administration, 2019).

Researchers who studied HRI phenomena reported that many NC farmworkers experience symptoms of HRI while working outdoors. Arcury et al. (2015), Mirabelli et al. (2010), and Kearney et al. (2016) respectively found 35%, 40% and 72% of farmworkers experienced HRI symptoms. Common factors associated with HRI were not found among the three studies but included working in wet clothes, working in tobacco, spending time in poorly ventilated housing, and wearing personal protective equipment. Mirabelli and colleagues (2010) found HRI symptoms to be more common among workers with the agricultural guest worker visa program, also called H-2A workers. Arcury et al. (2015) did inquire about alcoholic and caffeinated beverage consumption, which they found not to be associated with HRI symptoms.

Analysis of physiological markers of hydration can assess occupational and overall health of farmworkers yet few such studies have been done (Mix et al., 2018; Moyce et al., 2017; Vega-Arroyo et al., 2019). By measuring changes in body mass and the specific gravity of urine specimens, researchers of US-based farmworker studies have measured farmworker hydration in Florida and California. Measuring USG with a refractometer, Mix and colleagues (2018) found 50% of sampled farmworkers in Florida were dehydrated pre-shift, 80% were dehydrated post-shift. This was despite 98% of the sample reporting drinking more water while working. The outdoor heat index was reported to be 31.7°C (89°F); however, two-thirds of the sample worked inside a nursery or fernery and the indoor temperatures were not measured. The farmworkers labored about 7.5 hours during each of the three data collection days, which was fewer hours than the HRI studies in NC (Arcury et al., 2015; Kearney, et al., 2016; Mix et al., 2018).

Measuring pre- and post-shift body mass among farmworkers in California, Moyce et al., (2017) found 64% of men and 53% of women loss body mass during a work shift but only about 15% and 3% lost more than 1.5% body mass, an indicator of dehydration. More than 12% of the 283 participants developed acute kidney injury (AKI) across a work shift. Researchers found piece-rate work and heat strain was associated with 4.2 (95% CI 1.56 to 11.52) and 1.34 (95% CI 1.04 to 1.74) adjusted odds ratio of AKI. These researchers did not find volume depletion increased the odds of AKI, as expected. Moyce and colleagues explained that due to California's unique HRI standards farmers are required to provide regular breaks for farmworkers to cool off and rehydrate.

There are no federal occupational safety and health regulations that specifically address outdoor heat-related illness. California and Washington are the only two states with state standards for heat illness prevention in outdoor environments (Heat Illness Prevention in Outdoor Places of Employment, 2006; Outdoor Heat Exposure, 2003). Among other requirements, the most recent version of California's heat illness prevention law requires employers to encourage employees to drink at least one quart per hour and provide shade and breaks. Specifically, if temperatures are above 35°C (95°F), workers must be allowed 10-minute paid breaks every two hours (Heat Illness Prevention in Outdoor Places of Employment, 2006).

Vega-Arroyo et al. (2019) conducted an HRI study in California with 259 farmworkers. They, too, collected pre- and post-shift body mass and found approximately 14% of farmworkers lost enough body mass to be considered dehydrated. If the workers had an elevated maximal core body temperature during the shift, they were more likely to become dehydrated than those who did not (58.8% vs 41.2%, $P = 0.03$). None of the participants reported HRI symptoms. Again, the authors suggested that California heat regulations, implemented by the study farms, protected the workers from HRI.

Farmworkers have dangerous jobs, including the disproportionate risk for heat-related morbidity and mortality. This study was conducted to by determine the relationship between of hydration status and key characteristics, behavior, and environmental temperatures among a subset of farmworkers in eastern NC. The effect of environmental heat stress on farmworker hydration status is also not known but is pertinent as they are currently working in the hottest recorded period in the history of NC and the world.

Methods

Study Design

A community-informed, sequential exploratory mixed methods research design was conducted in partnership with staff at one FQHC. A community-informed approach added the emic (insider) perspective to this study and a mixed method design was chosen to enhance validity through triangulation (Creamer, 2018; Minkler et al., 2017). This sequential exploratory design is characterized by an initial qualitative phase followed by a quantitative phase. We chose sequential exploratory to gain detailed knowledge on the study phenomenon of fluid intake and hydration status.

In Phase I we conducted focus group discussions (FGDs) with farmworkers to gain their perceptions of culture, place, and environmental heat stress on fluid intake. The research questions for Phase I were 1) How do cultural beliefs, values, and norms influence farmworker agency and fluid intake, 2) How does workplace, housing, country of origin, and rurality influence farmworkers' fluid intake, and 3) What accounts for on-the-job knowledge, behaviors, and attitudes of fluid intake during environmental heat stress. In Phase II we collected demographic data, a beverage questionnaire, temperature in the field and physiological markers. The research questions for Phase II were 1) What is the prevalence of pre- and post-shift dehydration among farmworkers? and 2) What are the associations between social factors, occupational factors, WBGT and fluid intake with farmworker hydration status?

The research team was composed of the principal investigator (PI), two Latino FQHC staff, and a bilingual student. The FQHC staff are members of the local community and familiar with farm work. A partnership between PI and FQHC began in 2018 with a pilot study. The study was conducted during the COVID-19 pandemic. The PI established a COVID-19 Research Safety Plan and followed CDC, state, and university requirements during both phases. All members of the research team completed OSHA training modules. The university institutional review board approved the study.

Setting

The study site was four farmworker camps in eastern NC. Approximately 1,100 farms and 2,300 migrant and seasonal farmworkers work in the six-county FQHC service area during peak harvest (U.S. Department of Agriculture, 2019; Lambar & Thomas, 2019). Of the ten employers approached, four gave the research team permission to conduct research on their farm. Data collection occurred during July and August, the hottest months of the year in NC. During that summer, 29 days were recorded with temperatures above 32°C (90°F) in July and 16 in August (Raleigh Weather Forecast Office, 2020).

Sample

In Phase I, 28 Latino farmworkers, with a mean age of 39, agreed to participate. In Phase II we invited 43, and 32 agreed to participate, resulting in a 74% acceptance rate. Of the 32 participants in Phase II, one farmworker did not provide urine specimens and one’s specimen was excluded due to glucosuria, resulting in a final convenience sample of 30. Twenty-six (87%) of the final sample in Phase II also took part in Phase I. Inclusion criteria were men and women age greater than 18 and less than 54, self-identified as Latino heritage, English or Spanish speaking, worked primarily outdoors (>50%) 8 or more hours per week. Exclusion criteria were self-reported history of any recent illness, kidney disease, currently pregnant or use of diuretics.

Data Collection

In July and August 2020, four focus group discussions (FGDs) were conducted to elicit insights into diverse opinions and behavioral norms of farmworkers (Krueger & Casey, 2015). Each focus group was comprised of five to nine participants, for a total of 28 farmworkers in all four groups. Each focus group had one moderator (PI) and one bilingual co-moderator (FQHC staff or undergraduate student). The FGD guide included semi-structured questions in English and Spanish.

The quantitative phase was conducted in early August of 2020. The following measures were collected: physiological markers; demographic survey, Beverage Intake Assessment Questionnaire; and WBGT. Participants were sampled at their farmworker camps, on one of four days in a sequential five-day period. The research team traveled to farmworker camps the evening before the selected day of data collection. The team collected signed informed consent, read the consent form aloud and answered any questions. The voluntary nature of study participation was explained; that participants could leave the study at any time with no penalty. Each participant was given a unique ID number. While in the field, all documents were locked and secured until returned to a locked university office.

Physiological Markers. Using reagent strips, we assessed for protein, ketones, blood, and glucose which could alter urine specific gravity (USG) results (Pagana & Pagana, 2018).

Specimens with trace glucose levels and higher, and protein 2+ and higher were excluded from the analysis. Alkaline urine can cause low USG results, but no specimens in this study were alkalotic. Urine specific gravity was the key measurement selected for hydration status in this study because it is quick, non-invasive, reliable, and widely used in the field and clinical settings (Perrier et al., 2017; Villiger et al., 2018). Urine specimens were measured with a digital refractometer, the Palm Abbe model PA202X-093, to determine the USG. This refractometer model has a validated USG measurement interval of 1.0020–1.0300 and the linearity with osmolality and solute score, was verified with observed error of ≤ 0.1% (Wyness et al., 2016).

A standard operating procedure detailed the data collection procedures, including how to accurately perform the refractometer readings according to the manufacturer's instructions. The participants were educated on how to properly collect a clean catch urine specimen. Sterile specimen containers and castile soap towelettes were given to each participant, and the containers were labeled with the participant's ID number. Pre-shift, participants collected their first morning void urine specimen and participants placed in an enclosed, disposable cooler left by the research team. The PI arrived to camp in the morning, calibrated the refractometer before (and between) each USG reading and analyzed all urine specimens according to protocol, within 1.5-2 hours of specimen collection (2020 Laboratory Corporation of America® Holdings and Lexi-Comp Inc., 2020; MISCO Refractometer, 2014).

The PI returned to the camp at the end of the workday (post-shift) to collect a second clean catch urine specimen. The same USG analysis process was followed. The corresponding USG and results of reagent strips were read, recorded, and explained to participants on-site. Participants who had abnormal results were referred to local health clinics for follow-up care. Guidelines of the National Athletic Trainers' Association were used to categorize urine specimens; considering USG less than 1.020 as euhydrated, 1.020 to 1.029 as dehydrated, and equal to or more than 1.030 as significantly dehydrated (Casa et al., 2015).

Demographic survey. Developed by the research team, social and demographic factors included in the survey were questions of age, sex, ethnicity, country of birth and level of education. Self-reported level of English-speaking proficiency was measured using a 3-point Likert scale. Workplace factors included H-2A status, type of housing, type of work conditions (e.g. distance to toilet, frequency of water consumption, type of crop, etc.) and work experience were included. The survey questions were developed in English, translated to Spanish, and translated back to English for comparison, with edits from the Latino research team member (Chen & Boore, 2009).

Beverage Intake Assessment Questionnaire (BIAQ). Fluid intake was assessed using the 32-item BIAQ. The BIAQ, validated in a sample of Spanish-speaking adults, questions fluid consumption over the last month, including type and quantity of beverage, and frequency and timing of intake. The demographic survey and the BIAQ were collected either the night of data collection, the following Sunday, or on the FGD date if the farmworker participated in Phase I. The research team read the demographic survey and the BIAQ to each participant, taking about 20 minutes per participant to complete. Reponses were recorded on the corresponding paper document. All survey data were labeled with the participant's ID number. Once completed, each participant was offered a $25 gift card.

The average daily fluid intake from beverages was estimated based on servings of each type of beverage (Ferreira-Pêgo, 2016). The BIAQ items included tap water and bottled water, which was grouped into the category labeled Water. Fruit and vegetable juices were grouped into Juices. The category labeled Other included whole milk, semi-skimmed milk, skimmed milk, drinking yogurt, milkshakes, vegetable drinks, soups, jellies and sorbets, espresso (sweetened and unsweetened [S/UNS]), white coffee (S/UNS), tea (S/UNS), other infusions (S/UNS), non-alcoholic beer, meal replacement shakes and other beverages. The Beer and Other Alcohol category included beer, wine, sprits, and mixed alcoholic drinks, although consumption other than beer was rarely reported by the study participants. Sports drinks/isotonics was labeled Sports Drink. Total Fluid intake was calculated using the sum of all categories, listed above. Farmworkers could choose if they consumed the water or beverages on a daily, weekly or ‘never or almost never’ basis. Items consumed on a weekly basis were included but divided to provide a daily average. Fluids marked as ‘never or almost never’ were not included.

Wet Bulb Globe Temperature (WBGT). The WBGT is the preferred measure of environmental heat stress in all occupational groups (NIOSH, 2016). It accounts for temperature, humidity, wind speed, sun angle and cloud cover (National Weather Service, 2020). We used the QUESTemp° 34 (3M, Oconomowoc, WI) heat stress monitor, which has demonstrated the least error in relation to the reference standard (Cooper et al., 2017). The environmental heat stress indices included were Mean WBGT, Maximum WBGT, number of hours spent working above the Threshold Limit Values (TLVs®), and percent of day working above the TLVs®. The mean and maximum WBGT were measured and recorded by a heat stress monitor.

Once pre-shift urine collection and analysis were complete, the PI traveled to the designated field where the farmworkers worked that day. Direct WBGT readings of the participants’ work environments were collected by setting the QUESTemp° 34 at the edge of the field, on a tripod, 3.5 feet above the ground (TSI Incorporated, 2018). The thermometer data logged the WBGT every 1 minute. The QUESTemp° 34 remained in the field until the end of the worked shift, in early or late afternoon.

The worksite's current WBGT was compared to the American Conference of Governmental Industrial Hygienists' (ACGIH, 2019) Threshold Limit Values (TLVs®), which provides recommended limits for workplace heat exposure. The workplace WBGT was adjusted as some participants reported wearing polypropylene coveralls for two hours at the beginning of the shift; therefore, per ACGIH (2019) recommendations, 0.5°C was added to the corresponding hourly WBGT measurements collected from the heat stress monitor. On the day of data collection participants worked in tobacco; therefore, a moderate metabolic rate was assumed (ACGIH, 2019; Dillane & Balanay, 2020). The TLVs® were adjusted according to work/rest periods. Work was considered 75%-100% and adjusted for short breaks (50-75%) or longer breaks (0-25% or 25%-50%). Hourly mean WBGT indices were compared to the TLVs® to determine if the study participants exceeded the exposure limit recommendations during the work shift (ACGIH, 2019; Dillane & Balanay, 2020).

Data Management & Analysis

In Phase I, whole transcripts were selected as the unit of analysis. To explore the "explicit and covert meanings" in the text, content analysis was selected as the analytic technique for this study (Bernard et al., 2017, p. 243). We started with a set of pre-identified concepts (deductive coding), including concepts from the Intersectionality theory and the pilot study. Then we expanded on these to include other concepts that were determined during coding process (inductive coding) (Bernard, 2011). All data was stored on an encrypted university protected computer and kept in the locked office of the PI. Research team data analysis meetings occurred weekly to biweekly. Research logs, field notes, the PI's reflective notes, codebook memos and analysis memos were collected as appropriate throughout the project.

In Phase II, a codebook of the variable definitions and labels and descriptions of the coding responses was prepared. Next, the data was transferred to SPSS v.27 for cleaning and coding. The variables not included in the analysis were male, Latino, married, H-2A workers, migrants, foreign-born, worked in the tobacco, spoke little English, reported drinking water every 15-20 minutes, and received hydration information.

After removing outliers, the dependent variables of pre- and post-shift USG were normally distributed; therefore, parametric analyses were done. Descriptive statistics provided frequencies, means, standard deviations (*SD*), including the outcomes of the pre- and post-shift USG levels, demographic survey and the BIAQ and the heat stress indices. An alpha level of 0.05 was chosen. Pearson's product correlation coefficient was used to examine the associations between demographic factors, workplace factors, fluid intake, and WBGT with the dependent variable of hydration status (USG). The strength of the relationship was determined using Cohen's (1988) guidelines. A correlation coefficient (r) of .10 to .29 was considered a weak or small association; r =.30 - .49 was considered moderate and r = .50 - 1.0 as strong or large. Partial correlations were also performed to control for age.

Statistical techniques utilized to compare groups included paired-sample t-tests, independent-samples t-tests and one-way between-groups ANOVA. Paired sample t-test was used to compare the mean USG scores from pre- to post-shift. Independent sample t-tests were conducted to compare the USG mean scores of those hydrated and dehydrated groups, younger versus older groups, and high caffeine consumption compared to low. Other groups analyzed using independent sample t-tests were those who drank alcoholic beverages compared to those who did not; drank sports drink compared to those who did not; wore poly coveralls on data collection day compared to those who did not; toilet > 3 minutes away compared to $\leq$ 3 minutes away; and worked in sweet potatoes compared to those who did not. One-way between-groups ANOVA with post-hoc tests was conducted to tell if there was a significant difference is pre- and post-shift USG across three the levels of education. The final analysis included 30 pre-shift USG specimens and 25 post-shift specimens. Of the post-shift specimens, one was excluded due the presence of 2+ protein, one was missing, and three were outliers.

Data Integration and Interpretation

Integration of the qualitative and quantitative data involved comparing 1) reported behaviors, collected via group discussions and individual surveys, 2) physiological measure of hydration (USG) and 3) the research team's reflexive notes. Qualitative data and quantitative data were placed in a case-by-variable meta-matrix. The matrix was used to view the findings simultaneously, to validate the findings across the qualitative and quantitative data (Miles & Huberman, 1994).

Results

In Phase I the sample included 28 Latino farmworkers who participated in four focus group discussions. The two major thematic findings were Absence of Protection and Freedom to Drink. The first major theme, Absence of Protection, was represented by two sub-themes: 1) Intense Climate Considerations and 2) Workplace Exploitation. The second major theme, Freedom to Drink, was represented by two sub-themes: 1) Distance and Distaste and 2) the Culture of Farm Work. When asked about barriers to fluid intake while working, farmworkers consistently perceived extreme outdoor temperatures as the greatest barrier. Through further discussion, they did report self-care sacrifices, incomplete hydration education, and workplace water accessibility and quality issues. Farmworkers choose beverages, usually sugary beverages, over water. Field notes and FGDs verified tensions in employer-farmworker relations, and farmworker exploitation through the piece-rate payment system and the H-2A visa program.

In Phase II, the sample included 30 Latino male farmworkers, who were married (90%) and worked in tobacco (100%) with a mean age of 38.7 (*SD* = 8.7) years (Table 3). Most of the farmworkers reported a middle school education and an average of 12.7 (*SD* = 5.6) years of agricultural work in the U.S. All the participants were foreign-born migrant workers who had H-2A visas. While participants lived in two counties, they worked in three counties in eastern NC, working 10.5 (*SD* =3.1) weeks so far that year, 5.9 (*SD* = .6) days during an average week and 10.3 (*SD* = 1.2) hours on a typical workday. On the day of data collection, the farmworkers logged 7.9 (*SD* = 2.7) hours, less than a typical workday, because of rain. All workers were paid by the hour instead of piece-rate pay. Most (86.2%) reported receiving education in 2020 on staying hydrated while working and almost all (96.7%) reported they drank water every 15 to 20 minutes.

There was significant increase in USG from pre-shift (M = 1.020, SD = .005) to post-shift (M = 1.026, SD = .003), t (24) = -6.765, p < .001 (two-tailed). Using paired pre-and post-shift data, 100% of participants' USG measurements increased over the shift, with a mean increase of 0.007 [0.005, 0.009]. The eta squared statistic (.656) indicated a large effect size. Approximately 46.7% of farmworkers' pre-shift USG indicated dehydration, increasing to 100% at post-shift (Table 4). No farmworkers were considered significantly dehydrated pre-shift, however, 8% of the sample were at post-shift.

Table 3

Farmworker Characteristics, Phase I (n=30)

Demographic Characteristics	Mean ± SD	*n* (%)
Age, years	38.7 ± 8.7	
Marital status		
Single		2 (6.7)
Married		27 (90)
Divorced		1 (3.3)
Highest level of education		
Elementary school		11 (36.7)
Middle school		11 (36.7)
High school or more		8 (26.7)
Current home		
Mobile home		18 (60)
House		7 (23.3)
Barrack		5 (16.7)
English speaking ability		
Little, if any		28 (93.3)
Intermediate		2 (6.7)
Proficient		–
Years working in agriculture in the United States	12.7 ± 5.6	
Workplace Characteristics	**Mean ± SD**	***n* (%)**
Weeks worked this year[a]	10.5[a] ± 3.1[a]	
Days worked per week	5.9 ± .6	
Average hours worked per day	10.3 ± 1.2	
Hours worked on data collection day	7.8 ± 2.7	
Current crop/s		
Tobacco		30 (100)
Sweet potatoes		7 (23.3)
Cotton		2 (6.7)
Cucumbers		5 (16.7)
Received training this year on staying hydrated at work[a]		
Yes		25[a] (86.2) [a]
No		5[a] (16.7) [a]
Drinks water every 15 minutes while working		
Yes		29 (96.7)
No		1 (3.4)
Wears double-layer woven clothes while working		
Yes		–
No		30 (100)
Wear polypropylene coveralls while working		
Yes		12 (40)
No		18 (60)
Distance to toilet at work		
Greater than a 3-minute walk		15 (50)
A 3-minute walk or less		15 (50)

[a]Data missing from one participant

Table 4

Farmworker Hydration Status

	USG < 1.020 *n* (%)	USG 1.020 – 1.029 *n* (%)	USG ≥ 1.030 *n* (%)
Pre-shift (n=30)	16 (53.3)	14 (46.7)	—
Post-shift (n=25)	—	23 (92)	2 (8)

Note. USG=Urine Specific Gravity

The farmworkers reported almost four liters of fluid intake on an average day (Table 5). This includes 2.5 liters of water, about one serving of juice, one can of soda, less than one can of beer or equivalent of alcoholic beverages, half a serving of sports drink, and more than one serving of Other fluids. The commonly consumed fluids within the Other category included soup, gelatin, and milk. Of the farmworkers' daily fluid intake, about 770 ml (or two servings) was sugar-sweetened beverages (SSB).

Timing of fluid consumption was collected from 27 farmworkers; three did not complete this section. From the data available, water was consumed during the day but rarely before or after the shift. Water consumption while working was estimated to be 0.2 liters/hour (L/hr) (Water Intake/Average Hours Worked Per Day). Total fluid consumption per hour while working is estimated to be 0.35L (Total Fluid Intake-Beer & Other Alcohol Intake/Average Hours Worked Per Day). Juice was commonly consumed in the morning, soda during breaks and at lunch, and beer, if consumed, was done in the evening hours.

The mean WBGT on the four collection days was 29.1°C (84.4°F, *SD* = .979) and the mean maximum WBGT was 33.9°C (93°F, *SD* = .459). The farmworkers spent between 2 to 7.5 hours of their day working in conditions above the TLVs®, which was 50% to 100% of their workday. Table 6 displayed the hourly WBGT experienced by the farmworkers, per data collection day and depicts the time during the day that the WBGT farmworkers labored in

Table 5

Average Farmworker Fluid Intake (mL) Per Day (n=27[a])

Beverage type	Mean ± SD
Water	2448 (2091)
Juice	252 (333)
Soda	454 (288)
Beer and other alcohol	229 (328)
Sports drink	138 (237)
Other	419 (549)
Sugar-sweetened[b]	769 (680)
Total fluid	3929 (2446)

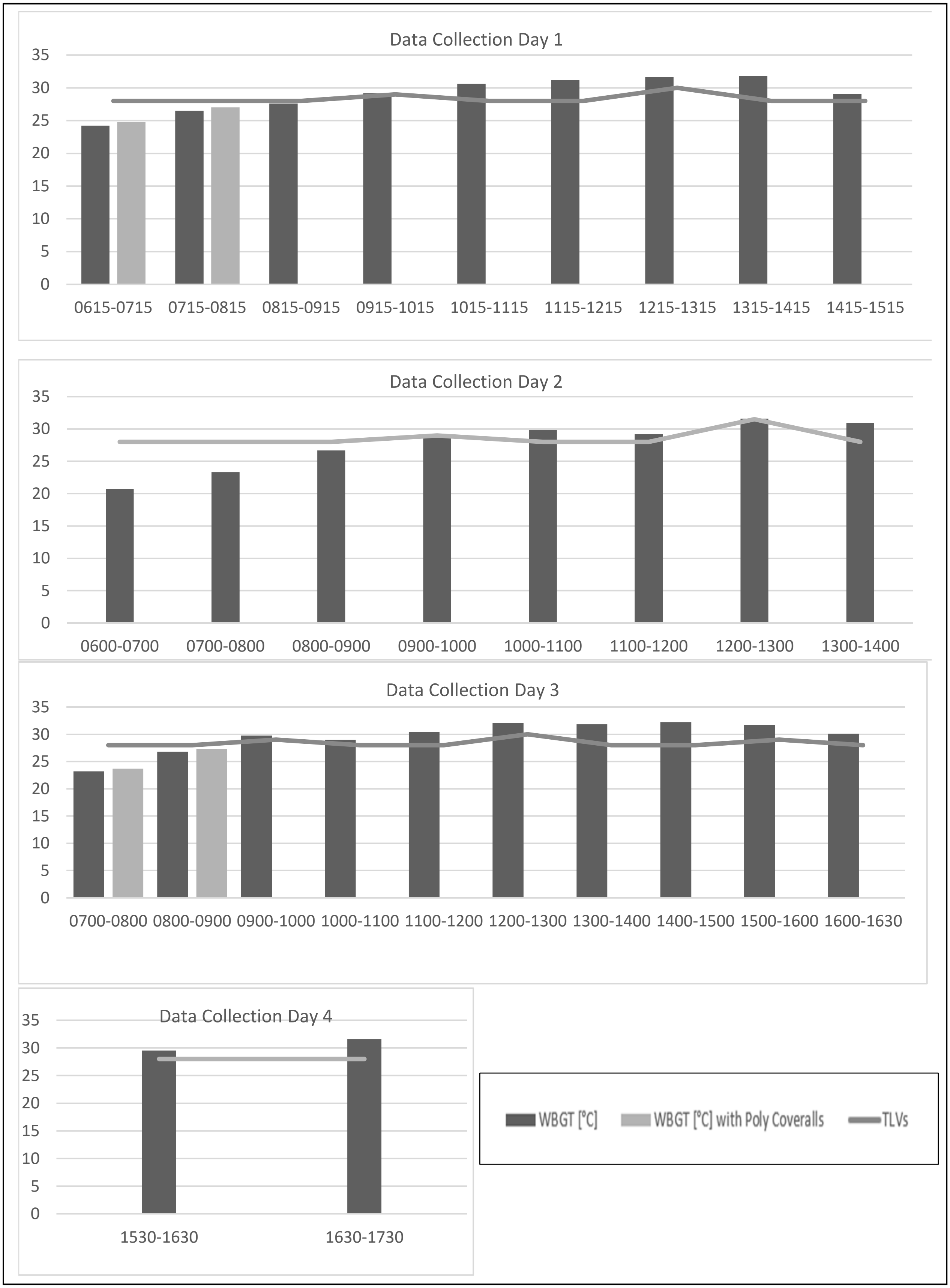
[a]Data missing from three participants
[b]Defined as soda (regular, not sugar-free), fruitades, sports drinks, energy drinks, sweetened waters, and coffee and tea beverages with added sugars, but exclude 100% natural fruit juice, per U.S. Department of Agriculture (2015); therefore, is a subset of the total fluid intake

exceeded the TLVs®. On data collection day 1, 2 and 3 the farmworkers had surpassed the TLVs® by 9:00 am (day 1 and 2) or 10:00 AM (day 3) and continued to work above the TLVs® for the remainder of the shifts. They were permitted 15-minute breaks at 09:00 AM and 3:00 PM and a 30 to 60-minute lunch break. Farmworkers on data collection day 4 worked two hours in the evening with no break.

Three correlations were found between the dependent variables and independent variables; the correlating independent variables were related to time and heat stress. There was a strong, positive correlation between the average hours worked per day and post-shift USG, r = .64, n = 25, p < .01; as the number of hours worked on a typical workday increased, the post-shift USG levels increased. Controlling for age had very little effect on the strength of the relationship between these two variables, r = .65, p < .001. The actual number of hours worked on data collection day and pre-shift USG, r = .15, n = 30, p = .44, or post-shift, r = .29, n = 25, p = .16, did not correlate. There were moderate, positive correlations between weeks worked this year, r = .45, n = 24, p < .05, and hours spent working above the TLVs®, r = .43, n = 25, p < .05,

Table 6

Hourly WBGT Experienced by Farmworkers on Four Days in a Month Compared to TLVs®



with post-shift USG. Controlling for age had very little effect on the strength of the relationships; r = .46, p = .029 and r = .43, p = .038.

Evaluating hydrated and dehydrated groups further highlighted the importance of both time and heat stress to hydration status. Of those already dehydrated in the morning, average days worked per week, r = .61, n = 12, p < .05, average hours worked per day, r =.74, n = 12, p < .01, and hours worked on data collection day, r = .71, n = 12, p < .01, correlated with post-shift USG. Of those already dehydrated in the morning, all four environmental heat stress indices also correlated with post-shift USG. As the mean WBGT, r = .72, n = 12, p < .01, maximum WBGT, r = .66, n = 12, p < .05, number of TLVs® hours, r = .71, n = 12, p < .05, and percent of TLVs® hours on data collection day, r = .71, n = 12, p < .05, increased so did post-shift USG.

Assessing younger (< 40 years) and older age groups, more relationships between independent variables and pre-shift USG were identified, but only in the younger age group. Of those <40, work in sweet potatoes r = .66, n = 15, p < .01, and hours spent working above the TLVs®, r = .58, n = 15, p < .01) correlated with pre-shift USG. This suggests working in sweet potatoes and more hours spent in extreme heat is related to a less hydrated state in the morning.

Finally, the pre-shift and post-shift means of categorical groups were compared. There was a significant difference in pre-shift USG for those that worked in the sweet potato crop (M = 1.023, SD = .003) and those that did not (M = 1.019, SD = .005; t (28) = -2.079, p = .047, two-tailed). No significant differences were found between a) those that did and did not drink beer and other alcohol, b) sports drink, c) high or low caffeine intake, d) wore or did not wear poly coveralls, or e) toilet distance.

Integration of Phase I and II data revealed congruent findings related to extreme heat, few breaks and poor housing (Table 7). In Phase I, heat was consistently perceived as the greatest hydration barrier. In Phase II, there was a moderate, positive correlation between the hours spent working above the TLVs® and post-shift USG. In Phases I and II, there were congruent data related to water breaks. Farmworkers reported infrequent breaks in Phase I and the WBGT data in Phase II suggests breaks were not permitted enough to stay within the recommended TLVs®. Congruent data from both phases suggests unofficial water breaks were allowed. Housing having an impact on farmworker hydration is a congruent finding across both phases. Farmworkers described poor housing in the FGDs. That coupled with the long workdays and high prevalence of pre-shift dehydration discovered in Phase II could suggest re-hydration before or after work, in farmworker housing, may be inadequate.

Table 7

Integration of Mixed Methods Data

Themes/subthemes	Clinical Indicators	Integration
Theme 1: Absence of Protection		
Sub-theme 1a: Intense Climate Considerations	Mean WBGT, 29.1°C (84.4°F, *SD* = .979) Mean maximum WBGT, 33.9°C (93°F, *SD* = .459). Time spent working above TLVs®, 50-100%	More breaks would permit safer work in higher WBGT environments
Sub-theme 1b: Workplace Exploitation	Pre-shift USG indicated dehydration, 46.7% Post-shift USG indicated dehydration, 100%	Current workplace norms do not support farmworker hydration
Theme 2: Freedom to Drink		
Sub-theme 2a: Distance and Distaste	Water intake, Total fluid intake; 1 cup/hr, 1.5 cups/hr Drank water every 15 minutes at work, 96.7%	Farmworkers are not consuming enough to meet NIOSH recommendations; with moderate work in an environment with a WBGT of 26°-32°C (78.8°-89.6°F), workers should consume ≥ 3 cups of fluid/hr (NIOSH, 2016)
Sub-theme 2b: Culture of Farm Work	Pre-shift USG indicated dehydration, 46.7% Mean hours worked per day, 10.3 (*SD* = 1.2)	Long workdays, poor sanitation & water quality may contribute to pre-shift dehydration

Note. WBGT=Wet bulb globe temperature. TLVs®=Threshold Limit Values from American Conference of Governmental Industrial Hygienists [ACGIH®]. (2019). Heat stress and strain. In *2019 TLVs® and BEIs® (pp. 239-248)*. ACGIH® Signature Publications. USG=Urine Specific Gravity. hr=hour. National Institute for Occupational Safety and Health [NIOSH]. (2016). *Occupational exposure to heat and hot environments: Revised criteria 2016*. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. https://www.cdc.gov/niosh/docs/2016-106/default.html.

Discussion

This was the first NC farmworker study to collect physiological markers of hydration status and measure the microclimate WBGT experienced by farmworkers. Farmworkers' hydration status deteriorated significantly over a worked shift. About half of the sample started the shift dehydrated and by the end of the day all farmworkers were considered dehydrated or severely dehydrated. By measuring the WBGT, we determined farmworkers spent most or all shift working above the recommended limits for workplace heat exposure.

The percentage of farmworkers with dehydration pre- and post-shift was like farmworkers in Florida (Mix et al., 2018) but higher than the farmworkers who participated in the California studies (Moyce et al., 2017; Vega-Arroyo et al., 2019). Compared to other occupational groups who experienced equivalent environmental heat stress (~29°C, 84.2°F), construction workers in Egypt and in Japan had comparable USG results (El-Shafei et al., 2018; Ueno et al., 2018). While indoor and outdoor workers across Europe had similar pre-shift dehydration prevalence, Piil et al. (2018) found agricultural workers to be the only occupational group whose hydration status worsened over the shift. The authors hypothesized that this was due to limited access and availability of fluids compared to the other occupational groups (Piil et al., 2018). A sub-theme in the qualitative phase of our study, Distance and Distaste, supported the finding of limited access and availability of water during the workday. Although employers provided enough water, the water was often inaccessible or was of poor quality.

Researchers who conducted studies with farmworkers working in CKDu hotspots reported varied dehydration prevalence. Among farmworkers in El Salvador, with hotter but shorter workdays than reported in our study, a fluid intake of 0.8 L/hr was enough to maintain hydration status pre- and post-shift (García-Trabanino et al., 2015). The USG of farmworkers in

Nicaragua indicated about 18% were severely dehydrated (≥1.030) in the morning following a workday, despite fluid intake consumption of 0.8 L/hr (Wesseling et al., 2016). Participants in our study consumed about half the hourly intake compared to the El Salvadoran and Nicaraguan farmworkers and 8% of the sample were severely dehydrated post-shift.

Occupational factors related to time and environmental heat stress correlated with higher USG, particularly post-shift results. Time at work is suggestive of dehydration in this farmworker sample. The longer they worked on an average day and the later in the season positively correlated with increased post-shift USG. This, coupled with the high percentage of workers already dehydrated pre-shift, suggests re-hydration from day to day may be inadequate. Due to long workdays, particularly if fatigue sets in from many weeks of work, farmworkers do not have the time and/or energy to rehydrate.

Recurrent dehydration, even minor, can cause irreversible kidney damage and is hypothesized to be the cause of CKDu (Polo et al., 2020). Dehydration triggers inflammation and injury cascades; vasopressin and aldose reductase-fructokinase pathways are triggered resulting in tubular injury, which is thought to be compounded by rehydration with sugar-sweetened beverages (García-Arroyo et al., 2016). Frequent consumption of sugar sweetened beverages is associated with kidney disease, as well as weight gain, type 2 diabetes, and heart disease (Malik & Hu, 2019). Our qualitative data suggests farmworkers prefer drinking sugar-sweetened beverages over water, yet they understand the basic connection between water intake and kidney function.

The *Criteria for a Recommended Standard: Occupational Exposure to Hot Environments* from NIOSH (2016) has specific recommendations on the amount of water workers should consume during outdoor labor. For farmworkers performing at a moderate metabolic rate in an environment with a WBGT 26°- 32°C (78.8°-89.6°F), workers should consume at least three 8-ounce cups of fluid every hour. All but one participant (96.8%) reported drinking water every 15-20 minutes, which meets this standard. Our demographic survey did not specify quantity, only if they drank water every 15 minutes. However, results from the BIAQ suggests the workers are not drinking enough to meet the standard. They reported almost four liters of fluid intake per day, or 16 cups; however, even if this amount of fluid was strictly consumed during the work shift it would only meet the standard for a little over five hours.

A correlation between higher measures of environmental heat stress and higher USG was not a surprising finding in Phase II as extreme environment heat was a prominent theme in Phase I. An unexpected finding was the time of day that the workers exceeded the TLVs. Three of the groups worked longer shifts, about 6:30 AM to 3:30 PM, yet exceeded the TLVs® around 9:30 in the morning. An administrative control, recommended by NIOSH (2016), is to alter work schedules to avoid the heat of the afternoon. However, our data suggests this recommendation may not be completely effective in reducing HRI risk for these farmworkers.

We found that those that worked in sweet potatoes had significantly higher pre-shift USG. Sweet potatoes are usually harvested in late August to November in NC, so the participants were likely cultivating or weeding the crop, instead of more physically demanding task of harvesting, at the time of data collection. From the qualitative data, farmworkers reported receiving piece-rate pay while harvesting the crop which encourages them to take fewer breaks to earn more money. Farmworkers also drank less water when harvesting sweet potatoes because constant bending over created stomach pain if the worker gulped water. Since the workers were not receiving piece-rate pay at the time of data collection, we cannot conclude that this was related to pre-shift dehydration.

It is not unreasonable to consider NC farmworkers to be at risk for CKDu. While CKDu has been documented in agricultural workers in the harsher climates of Central America, new hot spots have been reported in Mexico and possibly the western U.S. (Wegman et al., 2015). Also, many NC farmworkers migrate from Mexico and Central America and work in the agricultural fields in those countries.

Limitations

Several limitations exist in this study. First, a convenience sample of farmworkers participated who were from one geographic region of the state. Thus, findings would not be generalizable to other regions. The sample was limited to male, foreign-born farmworkers on the H-2A visa program. This limited analysis of diverse social and occupational factors on farmworker hydration. Due to the COVID-19 pandemic, the data collection period for this study was delayed and occurred over fewer weeks. Finally, employers who were more willing to allow a research team to work with farmworkers might also have biased this sample. If these employers were more likely to follow hydration standards, then is it possible this sample was more hydrated than what could truly be expected in a NC farmworker population.

Implications for Nursing Research, Practice and Education

Nursing research in climate science is limited despite nursing's historical interest in clean air, water, and healthy environments. There are numerous and complex ways climate change is affecting human health; therefore, multiple experts from various nursing specialties will be needed to advance the science. Specific to farmworker hydration, further studies should be conducted in NC, including collection of physiological markers of hydration status and kidney function among larger farmworker samples.

In addition to current practice, FQHC staff can disseminate health information through colorful, visually appealing infographics on pre- and post-shift hydration. Farmworker hydration education should emphasize hydrating before and after shift and not just during. Staff from FQHCs should teach farmworkers to drink water every 15 minutes while working and specifically consume one cup at each interval. Targeted information on long-term protective kidney behaviors, like avoiding dehydration, mild or worse, and sugar-sweetened beverages, should likewise be included. Community nurses and healthcare providers could also encourage farmworkers to get regular health screenings, including to have blood and urine collected to test kidney function. Local FQHCs could coordinate screenings at farmworker workplaces or camps, as NC farmworkers report transportation as one of the top three barriers to healthcare (Lambar & Thomas, 2019).

The Alliance of Nurses for Healthy Environments could partner with other stakeholders, like Growers Associations, FQHC staff and university faculty to educate farmers and farmworkers on the effects of dehydration and environmental heat stress on kidney health. Local FQHCs should work with employers to develop administrative controls to provide more rest and water breaks and to keep clean, high-quality water accessible at all times. Employers should know that environmental heat stress limits can be met in the morning hours. With that, cooling and hydration practices may be a higher priority intervention than avoidance of work in the afternoon hours.

Through education, nurses and other healthcare professionals can build their competency to deliver specialized health care for outdoor workers in the rapidly changing climate. The AgriSafe Network provides courses and webinars on occupational agricultural health and CleanMed conferences bring together national leaders in healthcare sustainability. Climate change concepts are slowly being integrated into nursing undergraduate, graduate, and practice education and can be potentiated by nurses' individual and responsible acts as global citizens.

Conclusion

Horton (2016) describes the illness, injury, and illegality among California farmworkers in her classic book, *They Leave Their Kidneys in the Fields.* Her ethnographic approach demonstrates how social, political, and occupational factors produce dehydration, chronic diseases and HRI in farmworkers. Our study contributed to the knowledge of social, political, and occupational factors influencing NC farmworker hydration. As farmworkers continue to be a vulnerable population, an approach on local and global levels is needed to protect these workers from HRIs and kidney disease and to promote hydration.

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APPENDIX A: UMCIRB APPROVAL LETTER

IRB Approval Letter

EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board
4N-64 Brody Medical Sciences Building· Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office **252-744-2914** · Fax **252-744-2284** · **rede.ecu.edu/umcirb/**

Notification of Initial Approval: Expedited

From: Biomedical IRB
To: Elizabeth Mizelle
CC: Kim Larson
Date: 6/26/2020
Re: UMCIRB 20-001259
Culture, Place and Environmental Heat Stress on Farmworker Hydration Status

I am pleased to inform you that your Expedited Application was approved. Approval of the study and any consent form(s) occurred on 6/25/2020. The research study is eligible for review under expedited category # 3,6,7. The Chairperson (or designee) deemed this study no more than minimal risk.

As the Principal Investigator you are explicitly responsible for the conduct of all aspects of this study and must adhere to all reporting requirements for the study. Your responsibilities include but are not limited to:

1. Ensuring changes to the approved research (including the UMCIRB approved consent document) are initiated only after UMCIRB review and approval except when necessary to eliminate an apparent immediate hazard to the participant. All changes (e.g. a change in procedure, number of participants, personnel, study locations, new recruitment materials, study instruments, etc.) must be prospectively reviewed and approved by the UMCIRB before they are implemented;

2. Where informed consent has not been waived by the UMCIRB, ensuring that only valid versions of the UMCIRB approved, date-stamped informed consent document(s) are used for obtaining informed consent (consent documents with the IRB approval date stamp are found under the Documents tab in the ePIRATE study workspace);

3. Promptly reporting to the UMCIRB all unanticipated problems involving risks to participants and others;

4. Submission of a final report application to the UMICRB prior to the expected end date provided in the IRB application in order to document human research activity has ended and to provide a timepoint in which to base document retention; and

5. Submission of an amendment to extend the expected end date if the study is not expected to be completed by that date. The amendment should be submitted 30 days prior to the UMCIRB approved expected end date or as soon as the Investigator is aware that the study will not be completed by that date.

The approval includes the following items:

Name	Description
Beverage Intake Assessment Questionnaire forms.docx	Surveys and Questionnaires
CHAPTER THREE 6-21.docx	Study Protocol or Grant Application
Clean Catch Urine Sample education English and Spanish.docx	Other Medical Procedures/Considerations
Demographic Survey english.docx	Data Collection Sheet
Demographic Survey spanish 5-9.docx	Surveys and Questionnaires
Demographic Survey.docx	Surveys and Questionnaires
Focus Group Interview Guide 5-8 final.docx	Interview/Focus Group Scripts/Questions
Latino Farmworkers Recruitment Flyer english 6-24.docx	Recruitment Documents/Scripts
Latino Farmworkers Recruitment Flyer spanish 6-22.docx	Recruitment Documents/Scripts
Master List.docx	Additional Items
Mizelle Farmworker Hydration Status 2020 Informed-Consent-No-More-Than-Minimal-Risk english 6-21 spanish.doc	Translated Consent Document
Mizelle Farmworker Hydration Status 2020 Informed-Consent-No-More-Than-Minimal-Risk english 6-21.doc	Consent Forms
Recruitment Log 5-9.docx	Additional Items
Refractometer Manufacturer_s Instructions.docx	Additional Items

For research studies where a waiver or alteration of HIPAA Authorization has been approved, the IRB states that each of the waiver criteria in 45 CFR 164.512(i)(1)(i)(A) and (2)(i) through (v) have been met. Additionally, the elements of PHI to be collected as described in items 1 and 2 of the Application for Waiver of Authorization have been determined to be the minimal necessary for the specified research.

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

APPENDIX B: INFORMED CONSENT ENGLISH

Informed Consent English

Informed Consent to Participate in Research

Information to consider before taking part in research that has no more than minimal risk.

Title of Research Study: An Exploration of How Culture, Place and Environmental Heat Stress Influence Fluid Intake and Hydration Status Among a Sub-Set of Latino Farmworkers Living in Eastern North Carolina

Principal Investigator: Elizabeth Mizelle
Institution, Department or Division: East Carolina College of Nursing Department of Nursing Science
Address: 3185L Health Sciences Building Greenville, NC 27858
Telephone #: 252-744-6518

Faculty Advisor: Kim Larson
Institution, Department or Division: East Carolina College of Nursing Department of Nursing Science
Address: 3135 Health Sciences Building Greenville, NC 27858
Telephone #: 252- 744-6527

Researchers at East Carolina University (ECU) study issues related to society, health problems, environmental problems, behavior problems and the human condition. To do this, we need the help of volunteers who are willing to take part in research.

Why am I being invited to take part in this research?

The purpose of this research is to learn more about farmworkers' hydration behaviors (drinking water and other fluids) and hydration status (how hydrated your body is). You are being invited to take part in this research because you are a farmworker, man or woman, age 18-54, who currently works at least 8 hours per week in eastern North Carolina. You should work greater than 50% of the time outdoors, identify as Latino or Hispanic, and speak English or Spanish. The decision to take part in this research is yours to make. By doing this research, we hope to learn how culture, place and environment influence farmworker hydration. If you volunteer to take part in this research, you will be one of about 100 people to do so.

Are there reasons I should not take part in this research?

You understand that you should not volunteer for this study if you are under 18 or over 54 years of age, had a recent illness, been told you have kidney disease, are currently pregnant or using diuretics. You should also not take part in this research if you are allergic to Castile soap towelettes or coconut.

What other choices do I have if I do not take part in this research?
You can choose not to participate.

Where is the research going to take place and how long will it last?
This research study will have two phases. Phase 1 will include group discussions among farmworkers. You will be asked to contribute to the conversation during one group discussion. Group discussions will be in held at farmworker camps or homes, in a place that farmworkers choose; for example, the communal kitchen area, a picnic table outside. The total amount of time you will be asked to volunteer for this phase of the study is 60 to 120 minutes.

Phase 2 will include collection of urine samples, weather measurements and completion of surveys. You will be asked to collect a sample of your first urine when you first wake up, in a specimen cup. That same day, a weather monitor may be set up in a field where you work. After returning from work, you will be asked to provide a second urine sample. We will use a small machine and strips to test the urine, but we will not keep your urine samples for later testing. A few days after the urine collection, we will return and ask you survey questions. The survey questions will be asked in a private location, if you choose. The total amount of time you will be asked to volunteer for this phase of the study is 60 minutes.

What will I be asked to do?
You will be asked to do the following:

- At a date and time convenient for you, we will ask these questions during the discussions;
    - We are interested in what you drink at work. Can you describe what you drink on a typical workday?
    - We are also interested in how much you drink. Can you explain what effects the amount of water you drink every day? (sodas, beer, etc., too)
    - We are also interested in when you drink. Can you discuss how often you would get a break to drink fluids? Are there "official" water breaks or do you drink when you choose? (grower/crew leader mandated);
    - How does the place or location (work site) where you work influence the fluids that you drink? Can you explain?
    - How does the place or location where you live (house, trailer or camp) influence what you drink? (Probe: Does the distance of your home from other people or places matter?
    - When it comes to drinking water, do you think it matters if you are from the United States or from Mexico, or another country? If so, can you explain?
    - We are interested in honoring your beliefs. Are there any that you would like for us to know about your beliefs about water? About beverages? (Probe: Many people believe it is important to balance hot/cold, how do you feel about that?)
    - What is the most important thing to you about the water you drink? And the beverages you drink?
    - Does the language you speak effect your water intake? If so, can you explain?
    - What do you know about drinking water and hot weather? What do you do that is different when you feel extreme heat and humidity?
    - Is there anything else you would like to add?
- The group discussions will be audio recorded. The discussions will help us learn about farmworker drinking behaviors, from multiple people.

- In Phase 2, the survey questions include:
  - How old are you?
  - Are you male or female?
  - Do you identify as Latino?
  - What is your marital status?
  - Were you born in the United States?
  - Do you have an H2A visa this season?
  - Did you move away from your home in order to work in agriculture this season?
  - What is your level of education?
  - Where do you currently live?
  - What would you say is your level of English-speaking ability?
  - How many years have you worked in agriculture in the United States?
  - How many weeks have you spent working in agriculture this season?
  - How many days have you worked this week?
  - How many hours have your worked per day this week?
  - What work task did you perform?
  - What is the most common crop you worked in?
  - What is your type of pay?
  - Have you been trained at work about staying hydrated, this season?
  - Do you drink water every 15-20 minutes?
  - Describe the clothes that you wore today
  - Did you wear double-layer woven clothes?
  - Did you wear polypropylene coveralls?
  - How far was the toilet from where you were working?
  - Was the research protocol acceptable?
  - Was the research protocol burdensome?
  - How much water do you drink and when?
  - What beverages do you drink and when?
- In Phase 2, the survey questions will be done to learn more about you as a person and your drinking behaviors.
- The urine samples will be tested to see how hydrated you are. The strips will be used to see if sugar or protein is in your urine.

What might I experience if I take part in the research?
We don't know of any risks (the chance of harm) associated with this research. Any risks that may occur with this research are no more than what you would experience in everyday life. We don't know if you will benefit from taking part in this study. There may not be any personal benefit to you, but the information gained by doing this research may help others in the future.

Will I be paid for taking part in this research?
We will be able to pay you for the time you volunteer while being in this study. You will receive a $25 gift card for Phase 1 and a $25 gift card for Phase 2.

Will it cost me to take part in this research?
It will not cost you any money to be part of the research.

Who will know that I took part in this research and learn personal information about me?

ECU and the people and organizations listed below may know that you took part in this research and may see information about you that is normally kept private. With your permission, these people may use your private information to do this research:

- The University & Medical Center Institutional Review Board (UMCIRB) and its staff have responsibility for overseeing your welfare during this research and may need to see research records that identify you.

How will you keep the information you collect about me secure? How long will you keep it?
Audio recordings, completed surveys and any written documents will be kept in a locked metal notebook in a locked vehicle until the materials are returned to East Carolina University campus. Once returned to campus, the documents and recordings will be locked in a file cabinet in the PI's locked office, where it will be stored for 6 years. Your name or any other identifiable information will not appear on any documents nor will this information be recorded in the audio recording or any paper documents. Your documents will be labeled with a unique ID number.

Transcripts (written copies) of the audio recordings will be made on Word documents and the results of the urine samples and surveys will be saved on software. All research data will be saved to an encrypted university protected computer, which will also be stored for 6 years. The computer is password protected and stored in ECU College of Nursing, 3185L Health Sciences Building. Only the PI, the PI's faculty advisor, Dr. Kim Larson, an ECU faculty member, Dr. Greg Kearney and two staff from a local health center will have access to the research documents.

The results of this research project may be made public and information quoted in professional journals and meetings. If quotes from you are used in professional journals or meetings, your name will not be used. When it comes time to destroy the files, tapes will be destroyed, and files will be permanently deleted.

What if I decide I don't want to continue in this research?

You can stop at any time after it has already started. There will be no consequences if you stop and you will not be criticized. You will not lose any benefits that you normally receive.

Who should I contact if I have questions?

The people conducting this study will be able to answer any questions concerning this research, now or in the future. You may contact the Principal Investigator at (252) 744-6518, Monday through Friday 8:00 AM to 5:00 PM

If you have questions about your rights as someone taking part in research, you may call the Office of Research Integrity & Compliance (ORIC) at phone number 252-744-2914 (days, 8:00 am-5:00 pm). If you would like to report a complaint or concern about this research study, you may call the Director for Human Research Protections, at 252-744-2914.

Is there anything else I should know?

The following research results will be provided to you: urine specific gravity and presence of ketones, glucose and proteins (proteins and sugar) in the pre-shift and post-shift urine samples. These results will be shared with you at the end of the workday that you provide urine samples. A nurse will explain the results to you. Participants who have abnormal results will be referred to local health clinics for follow-up care.

Your information or biospecimens collected as part of the research, even if identifiers are removed, will not be used or distributed for future studies.

Will I receive anything for the use of my private identifiable information or identifiable biospecimens?
If the research conducted on your private identifiable information or identifiable biospecimens leads to a commercially valuable product, you will not be eligible for any of the profits either because it will be impossible to identify the information or biospecimen that led to the product or because you are transferring ownership of that sample.

Will my identifiable biospecimen be used for whole genome sequencing?
Whole genome sequencing is the process of determining the complete DNA sequence of an individual at a single time. However, further analysis must usually be performed to provide any biological or medical meaning of this sequence. For this research, whole genome sequencing will not occur.

I have decided I want to take part in this research. What should I do now?
The person obtaining informed consent will ask you to read the following and if you agree, you should sign this form:

- I have read (or had read to me) all of the above information.
- I have had an opportunity to ask questions about things in this research I did not understand and have received satisfactory answers.
- I know that I can stop taking part in this study at any time.
- By signing this informed consent form, I am not giving up any of my rights.
- I have been given a copy of this consent document, and it is mine to keep.

____

Participant's Name (PRINT) **Signature** **Date**

Person Obtaining Informed Consent: I have conducted the initial informed consent process. I have orally reviewed the contents of the consent document with the person who has signed above and answered all of the person's questions about the research.

____

Person Obtaining Consent (PRINT) **Signature** **Date**

APPENDIX C: INFORMED CONSENT SPANISH

Informed Consent Spanish

Consentimiento Informado para Participar en la Investigación

Información a considerar antes de participar en una investigación que no tiene más que un riesgo mínimo.

Título del Estudio de Investigación: Una Exploración de Cómo la Cultura, el Lugar y el Estrés Ambiental Influyen en la Ingesta de Líquidos y el Estado de Hidratación Entre un Subconjunto de Trabajadores Agrícolas Latinos Que Viven en el Este de Carolina del Norte

Investigador principal: Elizabeth Mizelle
Institución, Departamento o División: East Carolina College of Nursing Department of Nursing Science
Dirección: 3185L Health Sciences Building Greenville, NC 27858
Teléfono: 252-744-6518

Asesora de la facultad: Kim Larson
Institution, Department or Division: East Carolina College of Nursing Department of Nursing Science
Address: 3135 Health Sciences Building Greenville, NC 27858
Teléfono: 252- 744-6527

Investigadores de la East Carolina University (ECU) estudian temas relacionados con la sociedad, problemas de salud, problemas ambientales, problemas de comportamiento y la condición humana. Para hacer esto, necesitamos la ayuda de voluntarios que estén dispuestos a participar en la investigación.

¿Por qué me invitan a participar en esta investigación?

El propósito de esta investigación es aprender más sobre los comportamientos de hidratación de los trabajadores agrícolas (agua potable y otros líquidos) y el estado de hidratación (qué tan hidratado está su cuerpo). Usted está siendo invitado a participar en esta investigación porque es un trabajador agrícola, hombre o mujer, de entre 18 y 54 años, que actualmente trabaja al menos 8 horas por semana en el este de Carolina del Norte. Debe trabajar más del 50% del tiempo al aire libre, identificarse como latino o hispano y hablar inglés o español. La decisión de participar en esta investigación es suya. Al hacer esta investigación, esperamos aprender cómo la cultura, el lugar y el medio ambiente influyen en la hidratación de los trabajadores agrícolas. Si se ofrece como voluntario para participar en esta investigación, será una de las aproximadamente 100 personas que lo harán.

¿Hay razones por las que no debería participar en esta investigación?

Usted comprende que no debe ser voluntario para este estudio si es menor de 18 años o mayor de 54 años, ha tenido una enfermedad reciente, le han dicho que tiene una enfermedad renal, está actualmente embarazada o está usando diuréticos. Tampoco debe participar en esta investigación si es alérgico a las toallitas de jabón de Castilla o al coco.

¿Qué otras opciones tengo si no participo en esta investigación?

Puedes elegir no participar.

¿Dónde se llevará a cabo la investigación y cuánto durará?

Este estudio de investigación tendrá dos fases. La Fase 1 incluirá discusiones grupales entre los trabajadores agrícolas. Se le pedirá que contribuya a la conversación durante una discusión grupal. Las discusiones grupales se llevarán a cabo en campamentos de trabajadores agrícolas u hogares, en un lugar que los trabajadores agrícolas elijan; por ejemplo, el área de cocina comunitaria, una mesa de picnic afuera. La cantidad total de tiempo que se le pedirá que sea voluntario para esta fase del estudio es de 60 a 120 minutos.

La fase 2 incluirá la recolección de muestras de orina, mediciones climáticas y la realización de encuestas. Se le pedirá que recolecte una muestra de su primera orina cuando se despierte por primera vez, en una copa de muestra. Ese mismo día, se puede configurar un monitor meteorológico en un campo donde trabaje. Después de regresar del trabajo, se le pedirá que proporcione una segunda muestra de orina. Usaremos una pequeña máquina y tiras para analizar la orina, pero no guardaremos sus muestras de orina para pruebas posteriores. Unos días después de la recolección de orina, volveremos y le haremos preguntas de la encuesta. Las preguntas de la encuesta se realizarán en un lugar privado, si lo desea. El tiempo total que se le pedirá que sea voluntario para esta fase del estudio es de 60 minutos.

¿Qué se me pedirá que haga?

Se le pedirá que haga lo siguiente:

- En una fecha y hora convenientes para usted, haremos estas preguntas durante las discusiones;
- Estamos interesados en lo que bebes en el trabajo. ¿Puedes describir lo que bebes en un día laboral típico?
- También nos interesa cuánto bebes. ¿Puedes explicar qué efectos tiene la cantidad de agua que bebes todos los días? (refrescos, cerveza, etc., también)
- También nos interesa cuándo bebe. ¿Puede hablar con qué frecuencia tomaría un descanso para beber líquidos? ¿Hay descansos de agua "oficiales" o bebes cuando eliges? (mandatario del productor / líder de la tripulación);
- ¿Cómo influye el lugar o ubicación (lugar de trabajo) donde trabaja en los líquidos que bebe? ¿Puedes explicar?
- ¿Cómo influye el lugar o lugar donde vives (casa, casa rodante o campamento) en lo que bebes? (Sondeo: ¿Importa la distancia de su hogar a otras personas o lugares?
- Cuando se trata de agua potable, ¿crees que es importante si eres de los Estados Unidos o de México u otro país? Si es así, ¿puedes explicarlo?
- Estamos interesados en honrar sus creencias. ¿Hay alguna que le gustaría que sepamos sobre sus creencias sobre el agua? ¿Sobre las bebidas? (Sondeo: muchas personas creen que es importante equilibrar frío / calor, ¿cómo se siente al respecto?)
- ¿Qué es lo más importante para ti sobre el agua que bebes? ¿Y las bebidas que bebes?
- ¿El idioma que habla afecta su consumo de agua? Si es así, ¿puedes explicarlo?
- ¿Qué sabes sobre el agua potable y el clima cálido? ¿Qué haces que es diferente cuando sientes calor y humedad extremos?
- ¿Hay algo más que le gustaría agregar?
- Las discusiones grupales serán grabadas en audio. Las discusiones nos ayudarán a aprender sobre los comportamientos de bebida de los trabajadores agrícolas, de varias personas.

- En la Fase 2, las preguntas de la encuesta incluyen:
- ¿Cuántos años tienes?
- ¿Es usted hombre o mujer?

- ¿Te identificas como Latino/a?
- ¿Cuál es tu estado civil?
- ¿Naciste en los Estados Unidos?
- ¿Tiene una visa H2A esta temporada?
- ¿Te mudaste de tu casa para trabajar en la agricultura esta temporada?
- ¿Cuál es tu nivel de educación?
- ¿Dónde vives actualmente?
- ¿Cuál dirías que es tu nivel de habilidad para hablar inglés?
- ¿Cuántos años ha trabajado en agricultura en los Estados Unidos?
- ¿Cuántas semanas has pasado trabajando en agricultura esta temporada?
- ¿Cuántos días has trabajado esta semana?
- ¿Cuántas horas has trabajado por día esta semana?
- ¿Qué tarea de trabajo realizó?
- ¿Cuál es el cultivo más común en el que trabajó?
- ¿Cuál es su tipo de pago?
- ¿Te han entrenado en el trabajo para mantenerte hidratado esta temporada?
- ¿Bebes agua cada 15-20 minutos?
- Describe la ropa que llevabas hoy
- ¿Usaste ropa tejida de doble capa?
- ¿Llevabas overoles de polipropileno?
- ¿A qué distancia estaba el baño de donde estabas trabajando?
- ¿Fue aceptable el protocolo de investigación?
- ¿Fue engorroso el protocolo de investigación?
- ¿Cuánta agua bebes y cuándo?
- ¿Qué bebidas tomas y cuándo?
- En la Fase 2, las preguntas de la encuesta se realizarán para aprender más sobre usted como persona y sus comportamientos de bebida.
- Las muestras de orina se analizarán para ver qué tan hidratado está. Las tiras se usarán para ver si hay azúcar o proteínas en la orina.

¿Qué podría experimentar si participo en la investigación?

No sabemos de ningún riesgo (la posibilidad de daño) asociado con esta investigación. Cualquier riesgo que pueda ocurrir con esta investigación no es más de lo que experimentaría en la vida cotidiana. No sabemos si se beneficiará de participar en este estudio. Puede que no haya ningún beneficio personal para usted, pero la información obtenida al hacer esta investigación puede ayudar a otros en el futuro.

¿Me pagarán por participar en esta investigación?

Podremos pagarle el tiempo que sea voluntario mientras esté en este estudio. Recibirá una tarjeta de regalo de $ 25 para la Fase 1 y una tarjeta de regalo de $ 25 para la Fase 2.

¿Me costará participar en esta investigación?

No le costará dinero ser parte de la investigación.

¿Quién sabrá que participé en esta investigación y conoceré información personal sobre mí?

La ECU y las personas y organizaciones enumeradas a continuación pueden saber que usted participó en esta investigación y pueden ver información sobre usted que normalmente se mantiene privada. Con su permiso, estas personas pueden usar su información privada para hacer esta investigación:

- University & Medical Center Institutional Review Board (UMCIRB) y su personal tiene la responsabilidad de supervisar su bienestar durante esta investigación y es posible que necesite ver registros de investigación que lo identifiquen.

¿Cómo mantendrá segura la información que recopila sobre mí? ¿Cuánto tiempo lo guardarás?

Las grabaciones de audio, las encuestas completadas y cualquier documento escrito se guardarán en un cuaderno de metal cerrado con llave en un vehículo cerrado hasta que los materiales sean devueltos al campus de la East Carolina University. Una vez que regresen al campus, los documentos y las grabaciones se guardarán en un archivador en la oficina cerrada del PI, donde se guardarán durante 6 años. Su nombre o cualquier otra información identificable no aparecerá en ningún documento ni esta información se grabará en la grabación de audio ni en ningún documento en papel. Sus documentos serán etiquetados con un número de identificación único.

Las transcripciones (copias escritas) de las grabaciones de audio se realizarán en documentos de Word y los resultados de las muestras de orina y las encuestas se guardarán en el software. Todos los datos de la investigación se guardarán en una computadora encriptada protegida de la universidad, que también se almacenará durante 6 años. La computadora está protegida con contraseña y almacenada en la ECU College of Nursing, 3185L Health Sciences Building. Solo el PI, el asesor de la facultad del PI, el Dr. Kim Larson, un miembro de la facultad de la ECU, el Dr. Greg Kearney y dos miembros del personal de un centro de salud local tendrán acceso a los documentos de investigación.

Los resultados de este proyecto de investigación pueden hacerse públicos y la información puede citarse en revistas y reuniones profesionales. Si se utilizan citas suyas en revistas o reuniones profesionales, no se utilizará su nombre. Cuando llegue el momento de destruir los archivos, las cintas serán destruidas y los archivos serán eliminados permanentemente.

¿Qué sucede si decido que no quiero continuar en esta investigación?

Puede detenerse en cualquier momento después de que ya haya comenzado. No habrá consecuencias si se detiene y no será criticado. No perderá ningún beneficio que normalmente recibe.

¿A quién debo contactar si tengo preguntas?

Las personas que realicen este estudio podrán responder cualquier pregunta relacionada con esta investigación, ahora o en el futuro. Puede comunicarse con el investigador principal al (252) 744-6518, de lunes a viernes de 8:00 a.m. a 5:00 p.m.

Si tiene preguntas sobre sus derechos como alguien que participa en la investigación, puede llamar a la Office of Research Integrity & Compliance (ORIC) al número de teléfono 252-744-2914 (días, de 8:00 a.m. a 5:00 p.m.). Si desea informar una queja o inquietud sobre este estudio de investigación, puede llamar al Director for Human Research Protections, al 252-744-2914.

¿Hay algo más que deba saber?

Se le proporcionarán los siguientes resultados de investigación: gravedad específica de orina y presencia de cetonas, glucosa y proteínas (proteínas y azúcar) en las muestras de orina antes y después del turno. Estos resultados se compartirán con usted al final de la jornada laboral en que proporcione muestras de orina. Una enfermera le explicará los resultados. Los participantes que tengan resultados anormales serán remitidos a clínicas de salud locales para recibir atención de seguimiento.

Su información o muestras biológicas recopiladas como parte de la investigación, incluso si se eliminan los identificadores, no se utilizarán ni distribuirán para futuros estudios.

¿Recibiré algo por el uso de mi información de identificación privada o bioespecificaciones identificables?
Si la investigación realizada sobre su información de identificación privada o muestras biológicas identificables conduce a un producto comercialmente valioso, no será elegible para ninguna de las ganancias ya sea porque será imposible identificar la información o la muestra biológica que condujo al producto o porque usted es transfiriendo la propiedad de esa muestra.

¿Se usará mi bioespecie identificable para la secuenciación del genoma completo?
La secuenciación del genoma completo es el proceso de determinar la secuencia completa de ADN de un individuo a la vez. Sin embargo, generalmente se deben realizar análisis adicionales para proporcionar cualquier significado biológico o médico de esta secuencia. Para esta investigación, no se producirá la secuenciación del genoma completo.

He decidido que quiero participar en esta investigación. ¿Qué debería hacer ahora?
La persona que obtenga el consentimiento informado le pedirá que lea lo siguiente y, si está de acuerdo, debe firmar este formulario:

- He leído (o me había leído) toda la información anterior.
- He tenido la oportunidad de hacer preguntas sobre cosas en esta investigación que no entendí y he recibido respuestas satisfactorias.
- Sé que puedo dejar de participar en este estudio en cualquier momento.
- Al firmar este formulario de consentimiento informado, no renuncio a ninguno de mis derechos.
- Me han dado una copia de este documento de consentimiento, y es mío conservarlo.

____

Nombre del participante (IMPRIMIR) **Firma** **Fecha**

Persona que obtiene el consentimiento informado: He llevado a cabo el proceso inicial de consentimiento informado. Revisé oralmente el contenido del documento de consentimiento con la persona que firmó anteriormente y respondí todas las preguntas de la persona sobre la investigación.

____

Persona que obtiene el consentimiento (IMPRIMIR) **Firma** **Fecha**

APPENDIX D: RECRUITMENT FLYER ENGLISH

Recruitment Flyer English

We are inviting you to participate in a research study for

Latino Farmworkers

The purpose of the study is to learn what influences farmworker fluid intake and hydration. There will be two phases. The first phase is group discussions. The second phase is surveys and urine collections.

We are looking for participants that:
-Work 8 or more hours per week, work mostly outside, are 18 to 54 years old and speak English or Spanish
- Please do not participate if you are recently ill, have kidney disease, are currently pregnant or use diuretics

You will be given a $25 gift card for Phase 1 and a $25 gift card for Phase 2

If you are interested, contact Elizabeth Mizelle, a nursing professor at East Carolina University, (919)795-2321, mizelleel15@ecu.edu

APPENDIX E: RECRUITMENT FLYER SPANISH

Recruitment Flyer Spanish

Estamos invitándole a participar en una investigación para

GRANJEROS LATINOS

El propósito del estudio es aprender qué influye en la ingesta de líquidos y la hidratación de los trabajadores agrícolas. Habrá dos fases. La primera fase son las discusiones grupales. La segunda fase son encuestas y recolecciones de orina.

Buscamos participantes que:
-Trabajan 8 o mas horas por semana, trabajan al aire libre, entre 18 y 54 anos, y hablan Ingles o Español
- No antecedentes de enfermedad reciente, enfermedad renal, actualmente embarazada o usando diuréticos

Recibirá una tarjeta de regalo de $25 para la Fase 1 y una tarjeta de regalo de $25 para la Fase 2

Si está interesado(a), comuníquese con Brayan Madero (252) 642-4188, o Vanessa Rodriguez, (252) 370-8915
La investigación es con una profesora de Enfermería en la Universidad de East Carolina, Elizabeth Mizelle, mizelleel15@ecu.edu

APPENDIX F: DEMOGRAPHIC SURVEY ENGLISH

Demographic Survey English

Farmworker Hydration Demographic Survey

This should be completed in reference to the day you provided urine samples.

1) How old are you? _____________ years old

2) Are you male or female?
   ________Male
   ________Female

3) Do you identify as Latino?
   ________Yes
   ________No

4) What is your marital status?
   ________Single
   ________Married
   ________Divorced
   ________Widowed

5) Were you born in the United States?
   ________Yes
   ________No
   If no, list country of birth ______________________

6) Do you have an H2A visa this season?
   ________Yes
   ________No

7) Did you move away from your home in order to work in agriculture this season?
   ________Yes
   ________No

8) What is your level of education?
   ________Some middle school
   ________Some high school
   ________High school graduate
   ________Some college or more

9) Where do you currently live?
   ________In a house
   ________In a trailer

_______In barrack-style housing

10) What would you say is your level of English-speaking ability?

_______Little, if any
_______Intermediate
_______Proficient

11) How many years have you worked in agriculture in the United States? __________ years

12) How many weeks have you spent working in agriculture this season? _________ weeks

13) How many days have you worked this week? ________ days

14) How many hours have your worked per day this week? _________ hours

15) What work task did you perform? Please list____________________________________

16) What is the most common crop you worked in?

_______ Cotton
_______ Tobacco
_______ Sweet Potatoes
_______ Cucumbers
_______ Other

17) What is your type of pay?

_______ By the hour
_______ Piece-rate

18) Have you been trained at work about staying hydrated, this season?

_______Yes
_______No

19) Do you drink water every 15-20 minutes?

_______Yes
_______No

20) Describe the clothes that you wore today__________________________________

21) Did you wear double-layer woven clothes?

_______Yes
_______No

22) Did you wear polypropylene coveralls?

_______Yes
_______No

23) How far was the toilet from where you were working?

_______Greater than a 3-minute walk
_______ A 3-minute walk or less

24) Was the research protocol acceptable?

________Yes

________No

If no, please explain ____

25) Was the research protocol burdensome?

________Yes

________No

If no, please explain____

APPENDIX G: DEMOGRAPHIC SURVEY SPANISH

Demographic Survey Spanish

Encuesta Demográfica de Hidratación de Trabajadores Agrícolas

1. ¿Cuantos años tienes? _____________

2. ¿Es usted hombre o mujer?
   _______ Hombre
   _______ Mujer

3. ¿Te identificas como Latino/a?
   _______ Si
   _______ No

4. ¿Cuál es tu estado civil?
   _______ Soltero
   _______ Casado
   _______ Divorciado
   _______ Viudo

5. ¿Naciste en los Estados Unidos?
   _______ Si
   _______ No
   Si no, indique el país de nacimiento_____________________________________

6. ¿Tiene una visa H2A esta temporada?
   _______ Si
   _______ No

7. ¿Te mudaste de tu casa para trabajar en la agricultura esta temporada?
   _______ Si
   _______ No

8. ¿Cuál es tu nivel de educación?
   _______ Escuela primaria
   _______ Escuela secundaria
   _______ Preparatoria o bachillerato
   _______ Universidad

9. ¿Dónde vives actualmente?
   _______ En una casa
   _______ En un trailer
   _______ En viviendas tipo barraca

10. ¿Cuál dirías que es tu nivel de habilidad para hablar inglés?
_______ Poco o nada
_______ Intermedio
_______ Competente

11. ¿Cuántos años ha trabajado en agricultura en los Estados Unidos?
__________ anos

12. ¿Cuántas semanas has pasado trabajando en agricultura esta temporada?
_________ semanas

13. ¿Cuántos días sueles trabajar por semana?________ dias

14. ¿Cuántas horas sueles trabajar cada día? _________ horas

15. ¿Qué tarea de trabajo realizó? Plantación, cosecha….? _____________________

16. ¿Cuál es el cultivo más común en el que trabajó?
_______ Algodón
_______ Tabaco
_______ Camotes
_______ Pepinos
_______ Otra

17. ¿Cuál es su tipo de pago?
_______ Por la hora
_______ Precio por pieza

18. ¿Te han entrenado en el trabajo para mantenerte hidratado esta temporada?
_______ Si
_______ No

19. ¿Bebes agua cada 15-20 minutos?
_______ Si
_______ No

20. Describe la ropa que llevabas hoy__________________________________

21. ¿Usaste ropa tejida de doble capa?
_______ Si
_______ No

22. ¿Llevabas overoles de polipropileno?
_______ Si
_______ No

23. ¿A qué distancia estaba el baño de donde estabas trabajando?

_______ Más de 3 minutos a pie

_______ Una caminata de 3 minutos o menos

24. ¿Fue aceptable el protocolo de investigación?

_______ Si

_______ No

Si no, por favor explique_____________________________________

25. ¿Fue engorroso el protocolo de investigación?

_______ Si

_______ No

En caso afirmativo, por favor explique______________________________

APPENDIX H: BEVERAGE INTAKE ASSESSMENT QUESTIONNAIRE

Beverage Intake Assessment Questionnaire, in English and Spanish

predimed plus

SPANISH BEVERAGE INTAKE ASSESSMENT QUESTIONNAIRE

Centre	Participant	Visit	Date

Instructions:
Please indicate your answer for your consumption last month.
For each type of beverage consumed, indicate the number of times per day or per week, and with an "X" the moment of the day that you consumed it.
For example, if you drank 2 glasses of wine per week with lunch, mark "lunch" in the "moment of the day" column and put a 2 in "per week" column. If a drink is consumed every day, for example water, indicate how many times "per day" you consumed it. For example: 6 times a day.
Do not take into account the liquids used in the kitchen or in other culinary preparations, such as sauce or homemade dessert.
If you drink coffee with milk, mark it in the category "coffee with milk" and not in the dairy categories.

TYPE OF BEVERAGE		FREQUENCY OF CONSUMPTION											
		TIMES			MOMENT OF THE DAY								
		RARELY OR NEVER	PER WEEK	PER DAY	BEFORE BREAKFAST	BREAKFAST	BETWEEN BREAKFAST AND LUNCH	LUNCH	BTEWEEN LUNCH AND DINNER	DINNER	AFTER DINNER	DURING NIGHT
Tap water	200 cc											
Bottled water (sparkling/ still)	200 cc											
Natural fruit juices	200 cc											
Bottled fruit juices	200 cc											
Natural vegetable juices (*gazpacho*, tomato, etc.)	200 cc											
Bottled vegetable juices (*gazpacho*, tomato, etc.)	200 cc											
Whole milk	200 cc											
Semi-skimmed milk	200 cc											
Skimmed milk	200 cc											
Drinking yogurt	100 cc											
	200 cc											
Milkshakes	200 cc											
Vegetable drinks (soy, oat, almond, etc.)	200 cc											
Soups	200 cc											
Jellies and sorbets	120 cc											
Sugar sweetened beverages	200 cc											
	330 cc											
Artificially sweetened beverages	330 cc											
	200 cc											
Espresso (sweetened)	30-50 cc											
Espresso (unsweetened or sugar-free)	30-50 cc											
White coffee (sweetened)	125 cc											
White coffee (unsweetened or sugar-free)	125 cc											
Tea (sweetened)	200 cc											
Tea (unsweetened or sugar-free)	200 cc											
Other infusions (sweetened)	200 cc											
Other infusions (unsweetened or sugar-free)	200 cc											
Beer	200 cc											
	330 cc											
Non-alcoholic beer	330 cc											
	200 cc											
Wine, champagne	120 cc											
High alcoholic content beverages (whisky, rum, vodka, gin)	50 cc											
Mixed alcoholic drinks (cocktails, gin tonic, *piña colada*, etc.)	200 cc											
Energy drinks (Red Bull, Burn, etc.)	200 cc											
Sport/ Isotonic drinks	200 cc											
	330 cc											
Meal replacement shakes	200 cc											
Other drinks:												

CUESTIONARIO DE VALORACIÓN DE INGESTA DE BEBIDAS

Nodo	Participante	Visita	Fecha

Instrucciones:

Por favor indique su respuesta haciendo referencia al mes pasado.
Por cada tipo de bebida consumida, marque con un número la cantidad de veces al día o a la semana, y con una "X" el momento en que la consumió.
Por ejemplo, si usted bebió 2 vasos de vino por semana, marque el número 2 en "a la semana" situado en la columna "veces". Si se trata de una bebida que consume todos los días, por ejemplo agua, indique cuantas veces la consume en la columna "al día" (por ejemplo: 6 veces al día).
No cuente los líquidos utilizados en la cocina o en otras preparaciones culinarias, como por ejemplo al preparar una salsa o un postre casero.
Si consume el café con leche, márquelo en la categoría de bebidas "café con leche" y no en las categorías de leche.

TIPO DE BEBIDA		FRECUENCIA DE CONSUMO											
		VECES			MOMENTO								
		NUNCA O CASI NUNCA	A LA SEMANA	AL DÍA	ANTES DEL DESAYUNO	CON EL DESAYUNO	ENTRE DESAYUNO Y COMIDA	CON LA COMIDA	ENTRE COMIDA Y CENA	CON LA CENA	DESPUES DE LA CENA	DURANTE LA NOCHE
Agua de grifo	200 cc												
Agua embotellada (con/ sin gas)	200 cc												
Zumos naturales de frutas	200 cc												
Zumos envasados de frutas	200 cc												
Zumos vegetales naturales (gazpacho, de tomate, etc.)	200 cc												
Zumos vegetales envasados (gazpacho, de tomate, etc.)	200 cc												
Leche entera	200 cc												
Leche semidesnatada	200 cc												
Leche desnatada	200 cc												
Lácteos bebibles	100 cc												
	200 cc												
Batidos lácteos	200 cc												
Bebidas vegetales (bebida de soja, almendras, avena, etc.)	200 cc												
Sopas y caldos	200 cc												
Sorbetes, gelatinas	120 cc												
Refrescos	200 cc												
	330 cc												
Refrescos Light /Zero	330 cc												
	200 cc												
Café sólo o cortado (con azúcar)	30-50 cc												
Café sólo o cortado (sin azúcar, con/sin edulcorante)	30-50 cc												
Café con leche o americano (con azúcar)	125 cc												
Café con leche o americano (sin azúcar, con/sin edulcorante)	125 cc												
Té (con azúcar)	200 cc												
Té sin azúcar (sin azúcar, con/sin edulcorante)	200 cc												
Otras infusiones (con azúcar)	200 cc												
Otras infusiones (sin azúcar, con/sin edulcorante)	200 cc												
Cerveza, Sidra	200 cc												
	330 cc												
Cerveza sin alcohol o Light	330 cc												
	200 cc												
Vino (tinto, rosado o blanco), cava	120 cc												
Bebidas alcohólicas de alta graduación (whisky, ron, vodka, ginebra)	50 cc												
Bebidas alcohólicas combinadas (cubata, gin-tonic, piña colada, cócteles, etc.)	200 cc												
Bebidas energéticas (*Red Bull*, *Burn*, etc.)	200 cc												
Bebidas para deportistas/ isotónicas	200 cc												
	330 cc												
Batidos sustitutivos de comidas/ híper proteicos	200 cc												
Otros (especifique):													

APPENDIX I: INTERVIEW GUIDE ENGLISH

Semi-structured Interview Guide English

Farmworker Hydration Focus Group Interview Guide

Thank you for being a part of this group. My name is _________________________ and I am from East Carolina University. I will be your moderator for today's group. This is ______________, who will also be a moderator for today's group. My colleague, __________________, is here to take notes, run the tape recorder, and help the session run smoothly.

We are trying to understand what farmworkers in eastern North Carolina think about their health and working outside in hot weather. And we really want to learn from you.

Our talking will be recorded in audio to make sure our written notes are exactly what you say. It does not matter who says what; we only care what ***is*** said. All recorded information is confidential, and **no one will know who said what.** Just as you did not need to give your real name when signing in or on your name tag, your name will not be used in any way.

Notes will also be taken during our talk today. We will not be writing your name next to what you said, only what *was* said. Does anyone have worries or concerns about the audio taping or the notes being taken for this session?

Informed Consent: You choose to take part in this group – it was voluntary. Before we begin, we will hand out a consent form for each of you to read, if you still want to take part in our talk. Do any of you have any questions about taking part in this group?

If anyone says she/he wants to leave: That is fine you have decided you do not want to take part, please pick up your things and leave the room. We do appreciate that you were interested.

Guidelines/Ground Rules: We want to go over a few guidelines or rules before we start:

1. What you say in this room stays in this room. So please feel comfortable speaking openly with us.
2. We want you to do the talking and we want to hear from everyone. So, we may call on you if you haven't spoken.
3. Your contribution is voluntary, and you can stop at any time.
4. Today we hope to get your thoughts on what you know about drinking water. Once you leave this group, please do not tell what a certain person said with anyone who was not in this group.
5. There are no wrong answers to any of the questions we have for you today. Please let everyone speak and respect everyone's ideas, even if it is different from your own.
6. We can only state and explain the question.
7. Say what **you believe.** It doesn't matter whether anyone agrees with you. It does not matter what we think.
8. Sometimes we might ask you a follow-up question to make sure ***we*** understand what you have said. Or, we might ask that you give an example of something you might describe or say.

<u>Key Questions (45-60 minutes)</u>

Begin session with going around the table letting everyone say what their favorite food is; this is so everyone has an initial opportunity to say something.

RQ3

1. We are interested in **what** you drink at work. Can you describe what you drink on a typical workday?
2. We are also interested in **how much** you drink. Can you explain what affects the amount of water you drink every day? (sodas, beer, etc., too)
3. We are also interested in **when** you drink. Can you discuss how often you would get a break to drink fluids? Are there “official” water breaks or do you drink when you choose? (grower/crew leader mandated);

RQ2

4. How does the place or location (work site) where you work influence the fluids that you drink? Can you explain?
5. How does the place or location where you live (house, trailer or camp) influence what you drink? (Probe: Does the distance of your home from other people or places matter?
6. When it comes to drinking water, do you think it matters if you are from the United States or from Mexico, or another country? If so, can you explain?

RQ1

7. We are interested in honoring your beliefs. Are there any that you would like for us to know about your beliefs about water? About beverages? (Probe: Many people believe it is important to balance hot/cold, how do you feel about that?)
8. What is the most important thing to you about the water you drink? And the beverages you drink?
9. Does the language you speak effect your water intake? If so, can you explain?

RQ3

10. What do you know about drinking water and hot weather? What do you do that is different when you feel extreme heat and humidity?
11. Is there anything else you would like to add?

If time allows, ask the following;

1. How is a day working in tobacco fields different than working in sweet potatoes?
2. When you are working, where are fluids for drinking stored? Who is responsible for bringing, moving, and refilling fluids for drinking?
3. Are there times during the growing/harvesting season that you have more time or less time to drink water? If so, can you explain this.
4. Describe how long and how often your breaks are in more detail.

APPENDIX J: INTERVIEW GUIDE SPANISH

Semi-structured Interview Guide Spanish

Farmworker Hydration Focus Group Interview Guide- Spanish

Gracias por ser parte de este grupo. Mi nombre es ________________
Y soy de la Universidad de East Carolina. Seré tu moderador para el grupo de hoy. Esto es ______________, quien también será un moderador para el grupo de hoy. Mi colega, _________________, está aquí para tomar notas, ejecutar la grabadora y ayudar a que la sesión funcione sin problemas.

Estamos tratando de entender qué piensan los trabajadores agrícolas en el este de Carolina del Norte acerca de su salud y de trabajar afuera cuando hace calor. Y realmente queremos aprender de ti.

Nuestra conversación se grabará en audio para asegurarnos de que nuestras notas escritas sean exactamente lo que usted dice. No importa quién dice qué; solo nos importa lo que se dice. Toda la información registrada es confidencial, y nadie sabrá quién dijo qué. Del mismo modo que no necesitaba dar su nombre real al iniciar sesión o en su etiqueta de nombre, su nombre no se utilizará de ninguna manera.
(no name tags, just ask them which names to use and record)

También se tomarán notas durante nuestra charla de hoy. No escribiremos su nombre junto a lo que dijo, solo lo que se dijo. ¿Alguien tiene preocupaciones o inquietudes sobre la grabación de audio o las notas que se toman para esta sesión?

Consentimiento informado: Eliges participar en este grupo, fue voluntario. Antes de comenzar, entregaremos un formulario de consentimiento para que cada uno de ustedes lo lea, si aún desea participar en nuestra charla. ¿Alguno de ustedes tiene alguna pregunta acerca de participar en este grupo?

```
If someone decides not to participate: Está bien que hayas decidido que no
quieres participar, recoge tus cosas y sal de la habitación. Agradecemos
que haya estado interesado.
```

Pautas / reglas básicas: queremos repasar algunas pautas o reglas antes de comenzar:

1. Lo que dices en esta sala se queda en esta sala. Así que siéntete cómodo hablando abiertamente con nosotros.
2. Queremos que hable y queremos saber de todos. Por lo tanto, podemos llamarlo si no ha hablado.
3. Su contribución es voluntaria y puede dejar de hacerlo en cualquier momento.
4. Hoy esperamos tener su opinión sobre lo que sabe sobre el agua potable. Una vez que abandone este grupo, no diga lo que dijo cierta persona con alguien que no estaba en este grupo.
5. No hay respuestas incorrectas a ninguna de las preguntas que tenemos para usted hoy. Permita que todos hablen y respeten las ideas de todos, incluso si son diferentes a las suyas.
6. Solo podemos plantear y explicar la pregunta.
7. Di lo que crees. No importa si alguien está de acuerdo contigo. No importa lo que pensemos.

8. A veces podemos hacerle una pregunta de seguimiento para asegurarnos de que entendemos lo que ha dicho. O podríamos pedirle que dé un ejemplo de algo que podría describir o decir.

Preguntas clave

Comencemos por todas diciendo su comida favorita

1. Estamos interesados en lo que bebes en el trabajo. ¿Puedes describir lo que bebes en un día laboral típico?
2. También nos interesa cuánto bebes. ¿Puedes explicar qué efectos tiene la cantidad de agua que bebes todos los días? (refrescos, cerveza, etc., también)
3. También nos interesa cuándo bebes. ¿Puede hablar con qué frecuencia tomaría un descanso para tomar líquidos? ¿Hay descansos de agua "oficiales" o bebes cuando eliges? (mandatario del productor / líder de la tripulación);

4. Cómo influye el lugar o ubicación (lugar de trabajo) donde trabaja en los líquidos que bebe? ¿Puedes explicar?
5. 5. ¿Cómo influye el lugar o lugar donde vives (casa, casa rodante o campamento) en lo que bebes? (Sondeo: ¿Importa la distancia de su hogar a otras personas o lugares?
6. 6. Cuando se trata de agua potable, ¿crees que es importante si eres de los Estados Unidos o de México u otro país? Si es así, ¿puedes explicar?

7. Estamos interesados en honrar sus creencias. ¿Hay alguna que le gustaría que sepamos sobre sus creencias sobre el agua? Sobre las bebidas? (Sondeo: muchas personas creen que es importante equilibrar frío / calor, ¿cómo se siente al respecto?)
8. ¿Qué es lo más importante para ti sobre el agua que bebes? ¿Y las bebidas que bebes?
9. ¿El idioma que habla afecta su consumo de agua? Si es así, ¿puedes explicar?

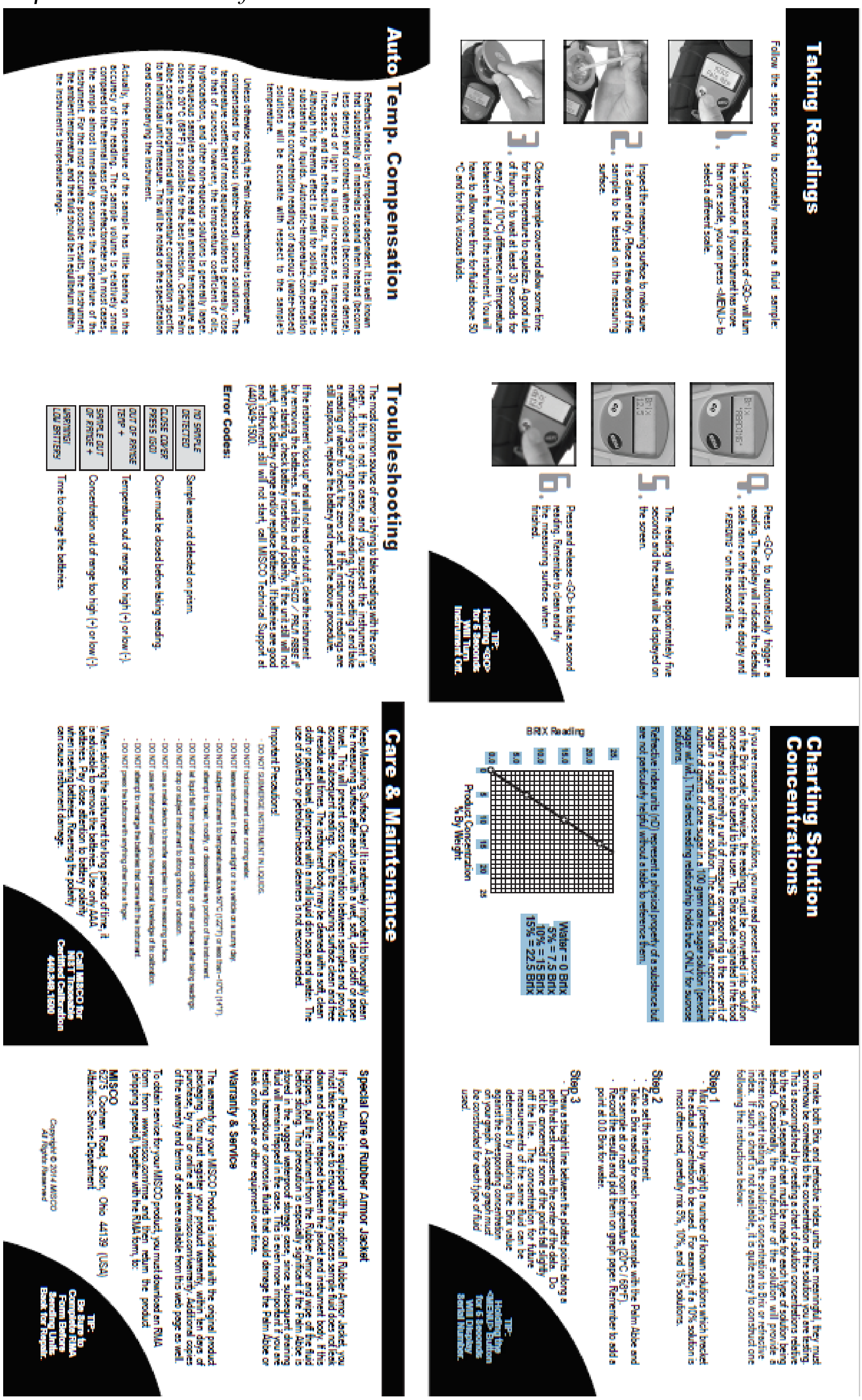
10. What do you know about drinking water and hot weather? What do you do that is different when you feel extreme heat and humidity?
11. Is there anything else you would like to add?

Si el tiempo lo permite, pregunte lo siguiente;

1. ¿En qué se diferencia un día de trabajo en los campos de tabaco a trabajar en camote?
2. Cuando trabaja, ¿dónde se almacenan los líquidos para beber? ¿Quién es responsable de traer, mover y rellenar líquidos para beber?
3. ¿Hay momentos durante la temporada de crecimiento / cosecha en los que tiene más tiempo o menos tiempo para beber agua? Si es así, ¿puedes explicar esto?
4. Describa cuánto tiempo y con qué frecuencia son sus descansos con más detalle.
5. ¿Ha influido Corona Virus en su consumo de agua?

APPENDIX K: REFRACTOMETER MANUFACTURER’S INSTRUCTIONS

Refractometer Manufacturer’s Instructions


Taking Readings

Follow the steps below to accurately measure a fluid sample:

1. A single press and release of <GO> will turn the instrument on. If your instrument has more than one scale, you can press <MENU> to select a different scale.

4. Press <GO> to automatically trigger a reading. The display will indicate the default scale name on the first line of the display and "READING" on the second line.

5. The reading will take approximately five seconds and the result will be displayed on the screen.

Charting Solution Concentrations

Auto Temp. Compensation

Troubleshooting

Error Codes:

Care & Maintenance

Special Care of Rubber Armor Jacket

Warranty & Service

APPENDIX L: CLEAN CATACH URINE SAMPLE EDUCATIONAL HANDOUT

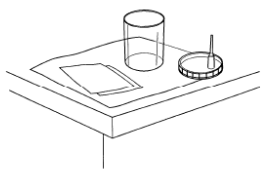
Clean Catch Urine Sample: Educational Handout

Urine Sample – Male (Clean Catch)

This test is done to check for bladder or urinary tract infection. Follow these steps:

1. Wash your hands with soap and water. Rinse and dry your hands well.

2. Use the urine sample kit. The kit includes a cup and 2 wipes.
3. Put a clean paper towel or cloth on a place you can reach from the toilet.
4. Open the wipes and place them on the towel.
5. If there is a sticker on the top of the cup lid, do not remove it. There is a sharp point under it.
6. Take the lid off the cup. Put the lid flat side down next to the wipes. Do not touch the inside of the cup or lid.



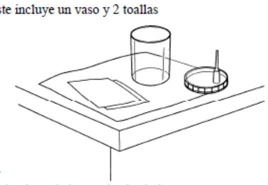
7. Pull back on the fold of skin around the tip of your penis if you are not circumcised.

Muestra de orina en el hombre (muestra no contaminada)

Este examen se hace para detectar una infección vesical o urinaria. Siga estos pasos:

1. Lávese las manos con agua y jabón, enjuáguelas y séquelas bien.

2. Use un kit para muestra de orina. Éste incluye un vaso y 2 toallas húmedas.
3. Coloque una toalla de papel o un paño limpio en un lugar que pueda alcanzar desde el inodoro.
4. Abra las toallas húmedas y colóquelas sobre la toalla de papel.
5. Si hay un adhesivo en la parte superior de la tapa del vaso, no lo quite. Hay una punta afilada debajo.



6. Quite la tapa del vaso. Coloque el lado plano de la tapa hacia abajo cerca de las toallas húmedas. No toque el interior del vaso ni de la tapa.
7. Deslice hacia atrás el pliegue de piel alrededor de la punta del pene si no está circuncidado.

8. Wash the end of your penis with a wipe. Throw the wipe away.
9. Wash your penis with the second wipe. Throw the wipe away.
10. Pick up the cup.
11. Start to urinate a small amount into the toilet.
12. Put the cup into the urine stream. Collect the urine in the cup until it is about half full.
13. Put the lid tightly on the cup. Be careful not to touch the inside of the cup or lid.
14. Wash your hands.
15. If you are in the hospital, give the sample to the staff. If you are home, put the cup in a plastic bag. Put the bag in the refrigerator. Take it to the lab or doctor's office as directed.

Test results are sent to your doctor. Your doctor will share the results with you.

Talk to your doctor or nurse if you have any questions or concerns.

8. Limpie el extremo del pene con una toalla húmeda. Tire la toalla
9. Limpie el extremo del pene con la segunda toalla. Tire la toalla.
10. Tome el vaso.
11. Comience orinando una pequeña cantidad en el inodoro.
12. Coloque el vaso bajo el flujo de orina. Llene el vaso con orina hasta la mitad.
13. Coloque y apriete bien la tapa del vaso. Tenga cuidado de no tocar el interior del vaso ni de la tapa.
14. Lávese las manos.
15. Si está en el hospital, entregue la muestra al personal. Si está en casa, coloque el vaso en una bolsa plástica. Deje la bolsa en el refrigerador. Llévela al laboratorio o a la consulta del médico según se le indicó.

Los resultados del examen se le envían a su médico. Su médico le comunicará los resultados.

Hable con su médico o enfermera si tiene alguna pregunta o duda.