Ohio Farmworkers and Heat-Related Illness Prevention

A Focused Ethnography

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Objective: The aim of the study is to understand farmworkers' knowledge of heat-related illness prevention and behavioral and cultural factors related to heat-related illness (HRI) prevention. **Methods:** The theory of planned behavior and an ethnographic study design were used. Data collection consisted of observations and interviews. Recorded interviews were conducted with participants and transcribed verbatim. Transcribed interviews were analyzed using thematic analysis. **Results:** Overall, 14 interviews were conducted, and four themes emerged: acquisition and interpretation, perception, interoception, and action. Other findings included an insufficiency of formal training and the absence of knowledge of a protocol for acclimatization. **Conclusions:** Better education and training are needed in this occupation, especially regarding acclimatization. Occupational health professionals must lead efforts to develop HRI plans and measures to ensure acclimatization protocols are adopted in the workforce.

Keywords: farmworkers, underserved population, occupational health, heat-related illness, prevention

LEARNING OUTCOMES

At the end of reading this article, the reader will be able to:

- Describe the impact of heat-related illness on Ohio farmworkers and the importance of prevention measures.
- Identify key themes that should be considered when creating strategies to prevent HRI among Ohio farmworkers.
- Identify several areas in which Ohio's farmworkers lack knowledge and proper practices to prevent HRI, which could be used to develop targeted strategies to mitigate these risks.

Heat is to blame for 436 work-related deaths between 2011 and 2023 in the United States.[1] The majority of these deaths happen within the first few days of working.[2] Climate change is expected to increase the number of hot days, and heat waves are predicted to increase in intensity and duration.[3] Heat-related illness (HRI) and death remain problems that, without mitigation, will only worsen from the effects of climate change. Negative outcomes from heat stress can be seen once the body reaches 100.4°F.[4] Heat stress has been found to increase the risk of accidents due to fatigue, increase the risk of cardiac arrest, and severely compromise the immune system.[5] Heatstroke is a life-threatening medical emergency that results from hyperthermia associated with a core body temperature above 104°F.[6] Some of the most at-risk populations for exertional HRI include agricultural workers, athletes, firefighters, military personnel, and factory workers.[7] Farmworkers have some of the highest risk of death from HRI. When compared to all occupations, farmworkers have a 35% increased risk of death from heat.[8] While there are no federal regulations or heat standards, Occupational Safety and Health Administration has issued a Notice of Proposed Rulemaking for Heat Injury and Illness Prevention in Outdoor and Indoor Work Settings.[9] The proposed rule would mandate that employers develop a plan to assess and mitigate heat-related hazards in the workplace and provide clear guidance on employer responsibilities and the necessary actions for protecting employees.[9]

US farms are essential; not only do they produce food for our tables, but they also play an important part in the economy. There are around 2 million farms in the US, many of which are operated by families and individuals.[10] Family-owned farms and ranches produce 86% of S agricultural products, and around 25% are novice farmers.[10] On average, one farm produces food for about 166 people; however, with the global population set to increase to 9.8 billion by 2050, farmers worldwide will have to make about 70% more food.[10,11] Despite their efforts, farmers and ranchers only receive roughly 8 cents per dollar spent on food.[10]

The US agricultural workforce is made up of farmers, their families, and hired workers.[12] The occupation of hired farmworkers is varied, encompassing a range of tasks such as fieldwork, nursery work, livestock handling, inspection, and management.[12] Though hired farmworkers are becoming more settled and less migrant, many are foreign-born, mostly originating from Mexico and Central America.[12] Farm work is a crucial occupation but comes with health and safety risks and low compensation even with years of experience.[13] For example, the average hourly wage for farmworkers is $13.59, despite these workers having an average of 18 years of farm experience.[13] Farmwork is physically demanding, and the very nature of farmwork requires workers to work during the hottest months of the year. Farmworker vulnerability is increased as many lack authorization to work in the US, limiting their access to health care and workplace protections.[12,13] Additionally, farmworkers are aging; between 2008 and 2018, their average age increased by 5 years to age 38.[12]

Ohio is home to roughly 76,900 farms, with about 90% operated by individuals or families.[12] Midwestern states are far from the

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Funding sources: Ashley Edgerly was funded by the American Association of Occupational Health Nurses and Medique Products' new researcher grant. Ashley Edgerly was supported by the National Institute for Occupational Safety and Health through the University of Cincinnati Education and Research Center (no. T42OH008432). This dissertation project designs and preparation was not influenced by the funders.
Conflicts of interest: None declared.
Authors' contributions: A E. did the conceptualization, methodology, literature search, analysis, and original draft preparation. A.E. and G.G. did the analysis and B.H. was available for discrepancies. G.G., B.H., and A.B. did the writing, review, and editing. All authors approved the published version of the manuscript. We adhered to the Standards for Reporting Qualitative Research (EQUATOR Network reporting guidelines).
Ethical considerations and disclosures: Ethical approval for human subjects' research was received from the University of Cincinnati Institutional Review Board on March 28, 2022. IRBID: 2022-0216.
Supplemental digital contents are available for this article. Direct URL citation appears in the printed text and is provided in the HTML and PDF versions of this article on the journal's Web site (www.joem.org).
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DOI: 10.1097/JOM.0000000000003230

hottest; however, they are not without risk from HRI. In the past, heat waves have proven to be deadly in Ohio. During a 1999 heat wave in the Midwestern and Eastern United States, Ohio recorded among the highest frequency of heat-related deaths.[14] In a report by Climate Central on states' preparedness for climate change, Ohio received an F on extreme heat as it is among several states with an above-average threat level but is below average on preparedness compared to other states.[15] Furthermore, by 2050, Ohio is projected to see 30 dangerous heat days a year and has taken minimal action regarding vulnerability assessments, adaptation plans, or resilience action.[15] Moreover, farmworkers account for more workers' compensation claims for HRI than any other occupation.[16]

The higher incidence and increased risk of death from HRI for farmworkers necessitate research in this area and population. To the best of our knowledge, there are no ethnographic studies focused on HRI in farmworkers, and very few studies have used qualitative methods. Lam et al[9] used focus groups to help identify barriers to the prevention and treatment of HRI in Latino farmworkers. There also have been few studies focused on farmworkers in midwestern states. To our knowledge, the only study to date on farmworkers focused on hydration and symptoms.[17] Therefore, to add to the current body of literature, an ethnographic research design was used to assist in gaining a comprehensive view of the area of focus from the Ohio farmworkers' point of view.

METHODS

Study Design

This study used an ethnographic design during the summer of 2022 to explore the culture of Ohio farmworkers in relation to HRI and prevention. The P.I. worked in the field alongside farmworkers to have experiences similar to the group members and made observations to understand what was happening naturally. Semistructured interviews were conducted following the observation phase with 10 farmworkers and four other potentially affected community members. Institutional review board approval was granted before the initiation of study procedures. Participants were compensated for participating in semistructured interviews with a $20 Visa gift card. The P.I. conducted the interviews. This work was completed as part of dissertation research.[18] We adhered to Standards for Reporting Qualitative Research (SRQR) guidelines (EQUATOR Network reporting guidelines) (Supplemental Digital Content, http://links.lww.com/JOM/B711).[19]

Procedures

Setting and Sample

This study was conducted on a small farm in Ohio. The farm owner agreed for this study to occur on their farm. Convenience sampling was used due to the historical difficulty in accessing this population. Farmworkers and other potentially affected community members were recruited in person, through the use of referrals, calls or emails to organizations, and flyers. Criteria for farmworker participation were reading and speaking in English or Spanish, being 18 years or older, and working full- or part-time doing outdoor farm work in Ohio. There were no exclusion criteria. Other potentially affected community members include those who work directly or indirectly with farmworkers such as farm owners, health care workers, and employees at agriculturally focused organizations such as the Ohio Department of Agriculture. Inclusion criteria for other potentially affected community members were being 18 years of age or older and working directly or indirectly with Ohio farmworkers who were at risk of HRI.

Procedures for the Observation Phase

The P.I. spent several months working alongside farmworkers, making covert observations and taking field notes to gain a sense of the environment from an emic perspective. Field notes included such observations as clothing worn at work, access to and use of shade and water, and average frequency and length of breaks. Daily temperatures were included in the observation tool. Temperatures were collected using National Weather Service data for the location of the farm. Only observations visible to a person walking by the farm were documented.

Procedures for the Interview Phase

Farmworkers were asked if they would like to participate in an interview at the end of the observation phase. It was communicated to participants that their input was sought because they were experts in farmwork, and their knowledge and input into the research on HRI in farmworkers is important. After consent was obtained, farmworkers were asked open-ended questions about their personal experiences, knowledge, and beliefs regarding HRI and HRI prevention measures to gain understanding from an etic perspective. The P.I. worked alongside many of the participants interviewed and developed a previous rapport with them. However, some were recruited through flyers and referrals. Still, before each interview, the reasons for the research were explained to all participants as part of the consent process.

Interview questions were developed using the literature and the theory of planned behavior as a framework. Data were also collected on participants' demographic and personal experience with HRI. Interviews took place at the participants' chosen setting and several by telephone. Interviews were audio-recorded and transcribed verbatim.

Semistructured interviews with other potentially affected community members who have experience working with farmworkers and HRI prevention also were conducted. Farm owners, public health officials, and other persons, such as those working with the county extension programs, were sought for interviews. Three farm owners and one human resource representative participated. Interviews were modified from farmworkers' interviews and were used to triangulate the data and increase trustworthiness. Similar to farmworker interviews, these interviews took place in the participants' chosen setting, with several being via telephone. Each interview was audio-recorded and transcribed verbatim.

Data Analysis

In total, 14 interviews were conducted. Transcribed data were analyzed using Braun and Clarke's[20] recommendations for thematic analysis. First, we were familiarized with the data through the process of interviewing and transcribing. While transcribing the recorded interviews, the P.I. listened to the audio recordings multiple times to ensure accuracy. Next, two researchers began the process of coding, which was done line by line to extract relevant data after reading the transcripts multiple times. Data then were combined into relevant codes. Codes were reviewed to ensure that relevant data matched each code, and then codes were sorted into themes. We reviewed the themes to ensure that the codes fit in each theme and then began naming and defining them. During the thematic analysis process, a third researcher was on hand to serve as a tiebreaker in case of any discrepancies. Themes then were further reviewed to see how and if they fit with the theory of planned behavior. Field notes were used to triangulate data from the semistructured interviews.[21]

RESULTS

In total, there were 14 interview participants. Ten participants were farmworkers. Four participants were community members who have ties with farmworkers at risk for HRI and could be potentially affected through this research. These other potentially affected community members comprised three farm owners and one human resource representative. The average age of farmworkers was 49.6 years, and the average age of other potentially affected community members was 48.5 years. Farmworkers worked an average of 42.7 hours weekly and had an average of 29 years of experience. Other potentially

affected community members had an average of 22.8 years of experience. Of the farmworkers, 80% were males. Farmworkers self-reported their race and ethnicity: 40% identified as White, 40% identified as Hispanic, and 20% did not respond. Three of the other potentially affected community members were White males and one was a White female. All of the participants spoke English; however, 40% of farmworkers spoke English as a second language, with Spanish being their native language. Workers reported duties consisted of fieldwork such as planting and harvesting, mowing, running and fixing machinery, feeding animals, and a combination of these. See Table 1 for a visual representation of participant sociodemographic data. Two of the three farm owners reported doing farm labor alongside workers. The P.I. worked on the farm during the months of June and July of 2022. During this time, daily high temperatures ranged from 75°F–95°F and the average daily high was 87°F.

None of the workers reported having specific on-the-job training; only one of the other potentially affected community members discussed on-the-job training during interviews. However, all participants had some knowledge of HRI signs and discussed their use of prevention. Acclimatization was the only prevention measure specifically asked about during the interview, and none of the participants had a specific plan or reported receiving education or training about acclimatization. Participants discussed acclimatization from an intuitive or instinctual viewpoint or with assumptions that people are "immune." Twelve of 14 participants reported an experience with HRI that involved themselves or others. Table 2 reports the following four themes and their subthemes: (1) acquisition and interpretation, (2) perception, (3) interoception, and (4) action.

TABLE 2. Themes and Subthemes From the Interview Findings

Themes	Subthemes
Acquisition and interpretation	a. Education and training
	b. Beliefs
	c. Personal experience
Interoception	a. Listening to your body
	b. The limit
	c. Acclimatization
Perception	a. Attitudes toward prevention
	b. Work norms
	c. Control
Action	a. Personal protective equipment (PPE)
	b. Shade
	c. Breaks
	d. Decrease body temperature
	e. Hydration
	f. Antiprevention
	g. Lifestyle behaviors and home remedies

Acquisition and Interpretation

The first theme is acquisition and interpretation. Acquisition is defined as how one acquires knowledge, and interpretation is how one processes it. This theme encompasses the process by which farmworkers and other potentially affected community members acquire knowledge about HRI and prevention and how that knowledge is perceived and understood. This theme is represented by the following three subthemes: *education and training, beliefs*, and *personal experience*. They encompass farmworkers' reports of learning and processing of HRI and prevention knowledge. These antecedents influence attitudes, subjective norms, and perceived behavioral control and are important to understand when developing an intervention targeted at change.[21,22]

The subtheme *education and training* encompassed workers and other potentially affected community members reporting what they know about HRI and prevention and their reports of where they gained this knowledge. For example, when asked what they have been taught about HRI, Javier (farmworker) responded, "Some people say don't take too long on the sun." Workers also reported not having education or training or being unsure of training or what they know. One worker reported that they had never been taught. Jose (farmworker) reported "I ain't never told 'bout, just hearing there from my, you know, keep yourself hydrated pretty much." While none of the workers reported specific instances of on-the-job training or education received

TABLE 1. Sociodemographic Characteristics of the Interview Respondents

	Farmworkers		Other Potentially Affected Persons	
Sociodemographic Variables	**n (%)**	**M (SD)**	**n (%)**	**M (SD)**
Biological sex				
Male	8 (80)		3 (75)	
Female	2 (20)		1 (25)	
Age (years)		49.6 (15.8)		48.5 (14.1)
30–40	4 (40)		1 (25)	
40–50	1 (10)		1 (25)	
50–60	1 (10)		1 (25)	
Over 60	4 (40)		1 (25)	
Race/ethnicity				
Caucasian	4 (40)		4 (100)	
Hispanic	4 (40)		0 (0)	
Other response	2 (20)		0 (0)	
Hours worked per week		42.7 (16.4)		nd
Less than 30	1 (10)		nd	
30–40	5 (50)		nd	
41–50	2 (20)		nd	
Over 50	2 (20)		nd	
Years of experience		29 (14.6)		22.8 (18.4)
10–20	3		3	
21–30	4		0	
31–40	0		0	
41–50	3		1	

nd, no data.

from a supervisor, one potentially affected community member reported that orientation consisted of HRI training videos. Jason (human resource representative) reported, "that video would talk about types of clothing that are important, you know lighter colors that reflects on versus darker colors that absorb it" and "they do get into a little bit of the uhm telltale signs of heatstroke."

While farmworkers and other potentially affected community members reported knowing about HRI, there were some misconceptions in their knowledge regarding sun safety and humidity. Eight workers appeared to confuse HRI with sun safety when asked what they knew about HRI. For example, sunscreen was reported as a method for preventing HRI. Marlin Man (farm owner) reported, "Well, with me, my heat-related illness has a lot of it has to do just with sun damage." Three of these eight workers talked about skin cancer. Rosa (farmworker) reported, "it causes skin cancer." Three workers expressed that humidity was protective against HRI. For example, Marlin Man (farm owner) stated that "I don't think there's as many heat-related issues in the humidity."

The subtheme of *personal experience* consisted of participants' reports of having a personal experience with HRI for themselves or others. Twelve of 14 (86%) participants in our study reported an experience with HRI that involved themselves or others. Seven out of the 12 who reported having a personal experience reported accounts of HRI and reported symptoms that were of the more serious forms, heat exhaustion and heat stroke. For example, Will (farmworker) stated, "I got dizzy and vomited." Jose (farmworker) talked about his experience as an observer of HRI, "They just got real cold and cold sweats and turned pale." Hector stated he "Just like got lightheaded. Felt real weak. I wasn't sweating and kinda was getting more dizzy by the second" and reported "lying down in the back of like a semitrailer in the shade that was like cooled off like the aluminum floor was cool." Then stated he "went back to work. I felt a little bit better. I wouldn't say I was like 100 percent, but I was good enough to go back out." Raymond (farmworker) reported when he was 16, he "fainted before" and "my father had put me inside the tractor. With a tractor had A.C. [air conditioning], so you know I went in there to cool down and got better and started working again." Participants also report on actions taken during an event of HRI. For example, Kristen (farmworker) reported that when her little brother had a heatstroke, they "put him in cold water to revive him." During the P.I.'s time working on the farm, no incidents of HRI were witnessed or experienced by the P.I.

The subtheme *beliefs* encompasses participants' interpretations surrounding HRI and symptoms. Beliefs can be influenced by factors such as knowledge, culture, or emotions. Many participants expressed beliefs and assumptions about HRI. Four participants' responses showed that they understood that HRI is dangerous and can occur in a short amount of time. David (farmworker) stated, "Well, I know it-it's scary." Will (farmworker) stated, "I know it comes on quick. People ignore it." However, some statements illustrate that participants had misconceptions about HRI. Will (farmworker) stated that "It's bad when you stop sweating."

Many beliefs seem to be rooted in truth. Will (farmworker) stated, "You should keep your shirt on, you know, guys that take it off, you know, that's the worst thing you could do, you know, you want the water near your surface of your skin so it can evaporate to cool you down." Jay (H.R. rep) said, "It's probably a bigger issue than-than we even know."

Interoception

The second theme is Interoception. Interoception is still being defined and studied as a construct, predominantly in neuroscience and psychology.[23] Chen et al's[23] definition fits closely with this theme: "Interoception includes the processes by which an organism senses, interprets, integrates, and regulates signals from within itself."(p4) This theme is represented by three subthemes having to do with when participants sense or ignore cues for taking preventive measures such as resting or slowing down. These subthemes are *listening to your body, the limit,* and *acclimatization.*

The subtheme, *listening to your body*, encompasses participants' subjective reports of body cues of how they felt, which let them know when to use preventions like breaks or drinking water. These included general statements of feelings, such as David's (farmworker) statement, "If it got too hot, you know, go to the shade." Raymond (farmworker) reported, "You just start adapting to what you need to do in order to feel some type of way." Jason reported, "Yeah, I think the natural uhm instinct of self-preservation is to get yourself out of that situation." Some participants had more specific reports of bodily cues. David (farmworker) reported, "I've had to stop during the day and take a break, because the uh-uh yeah, feeling overheated, or not being able to cool down my body fast enough."

The subtheme, *the limit*, encompasses participants' reports of going beyond what their bodies could physically endure regarding HRI. Emma (farm owner) reported that she's had "experiences where I've kind of overdone it, you know, and I get dizzy if I try to like stand up too quickly or things like that."

The subtheme*, acclimatization*, encompasses participants' reports on how they built their tolerance to working in the heat and their knowledge of acclimatization. There are recommended guidelines for acclimatization[4]; however, acclimatization in this analysis is represented by participants' responses of articulating more toward instincts, "feelings", and physical senses rather than a guideline or parameters for building a tolerance to working in the heat. Five participants had reports of just getting used to it. For example, Will (farmworker) reported, "You just go with it." Similarly, Rosa (farmworker) said, "you just get used to it." While others hold preconceived notions that themselves or others are somehow insusceptible. For example, José (farmworker) reported he is "immune." Javier (farmworker) reported that "my family, we all, used to working on da, on hot weather." Jay (farm owner) reported, "So you get used to it, but never really a formal protocol for doing that."

Perception

The third theme is Perception. Perception is the way in which a person understands or interprets something. This theme is represented by several subthemes: *attitudes toward prevention measures, work norms*, and *control*. Attitude toward a behavior is the extent to which an individual holds a positive or negative assessment of the behavior in question and is formed from behavioral beliefs.[21] An example of this is the attitude that "it's good to work hard" comes from the belief that a strong work ethic is a valuable trait. Subjective norm is a social factor influenced by a person's perceived social pressure about performing the behavior.[21] Control beliefs inform perceived behavioral control and are based on factors that increase or reduce the perceived difficulty of performing the behavior.[21] Individuals' perceived control over a behavior increases in relation to their belief in the ability to perform it related to factors such as access to resources and opportunities and it decreases in relation to the anticipation of obstacles or impediments.[21] For example, if someone believes their concerns at work will not be listened to and taken seriously, then they may feel they don't have the ability to change negative situations at work.

The subtheme, *attitudes towards prevention measures*, encompasses participants' evaluations of HRI prevention measures that are either negative or positive. For example, Will (farmworker) stated, "I see people driving around and like they go to the air-conditioned car to the air-conditioned wherever they're going out, and then they go to the air-conditioned house. Oh, it's so hot out. Like, how do you know you were never outside, you know?" He then added, "No, they're just wimps." Marlin Man (farm owner) expressed negative attitudes toward water stating, "I see people all the time, carrying around

water bottles all the time. Sometimes I wonder if this isn't a little exaggerated."

The subtheme work norms encompass participant reports of what they see as normal in regard to work and prevention. Hector (farmworker) reported that, "Everybody usually wears like the sun hat of different forms, whether it's like a straw or the thing that protects your neck. Um, long sleeves, everybody kind of typically follows suit. Once you see one guy doing it, everybody else starts doing it." Rosa stated, "That's all you see out there. Everybody with long sleeves and big hats." While working on the farm, the P.I. observed that most workers wore long sleeves, hats, and long pants. Many times workers were observed wearing hot dark colored material. For example, one worker was observed on several occasions picking produce in the field wearing a black long-sleeved sweatshirt with a hood on their head.

The subtheme of *control* encompasses participants' descriptions of times when they report having control or having no control regarding using HRI prevention measures. This includes beliefs about the circumstances and other factors that they feel enable, reduce, or prevent their ability to use HRI prevention measures. Some reports from participants include feelings of control. Will (farmworker) stated, "They have water here, and you can get it any time" and "I can stop working any time." Beam (farmworker) reported, "I'm not under a lot of pressure; if I, if I'm where I'm hot, I just go break." Other times participants report having no control. Javier (farmworker) stated, "You gotta work whenever they tell you, you gotta work." Raymond (farmworker) reported that "a bad boss or something like that" could keep people from using preventative measures and further explained that a bad boss was "Somebody that wants you to work, you know, get the, you get the-the job done. Uh it doesn't matter how long it takes, it's get it done, no break or nothing, they, 'cause they're greedy." The P.I. observed that workers worked on their own time at the farm, and no one appeared rushed; however, there was not a set schedule, and the crops and the weather often dictated duties. For example, workers were pulled from normal duties, such as working in the market or mowing, to help pick corn as it was needed that day. In June 2022, a heat wave caused unseasonably warm temperatures and near-record highs. This heat wave was seen across the Ohio and Tennessee Valley from June 12–16, with temperatures recorded between 92–95°F and heat index values up to 120°F.[24] Weather data for the area near the farm reported the hottest day was 95°F with an average high of 84.6°F.[20] The P.I. observed the farm owner send several outdoor workers home early due to the heat. Workers were observed coming and going on the farm at their own schedules.

Action

Farmworkers and other potentially affected community members discussed the actions they took to prevent HRI. This fourth theme, Action, was represented by several subthemes related to the prevention measures they take and recommend that others take to prevent HRI. The subthemes included *personal protective equipment (PPE), shade, breaks, decrease body temperature, hydration, antiprevention,* and *lifestyle behaviors and home remedies.*

PPE encompasses participants' reports of using PPE to prevent HRI. PPE included the use of clothing, hats, and sunscreen. David (farmworker) stated, "I wear a hat, uh, quite often." Hector reported, "Really wearing like light colors, long sleeves to keep sun off." The P.I. observed workers wearing long sleeves; however, they were not always wearing light-colored clothing, and on many occasions, workers were seen wearing black and other dark colors. The P.I. observed the frequent use of hats, and all the outdoor workers wore hats daily, including the P.I.

Shade encompasses participants' reports of using shade to prevent HRI. Will (farmworker) reported, "Try to be in the shade as much as you can." Jason (H.R. rep) also reported providing shade, "We provide them with a company van so that that provides, you know, shade and they can sit and take their breaks there." Problems with a lack of shade were reported. For example, Emma (farm owner) stated, "Unfortunately, the fields don't have like much shade directly in them." The P.I. witnessed farmworkers' use of a company van to transport themselves around the farm, and it was always parked within a few feet of where workers were picking.

Breaks encompass participants' reports of using breaks to prevent HRI. Javier (farmworker) reported, "We'll take a half an hour." David (farmworker) reported, "They take a break at 10 [am] and of course, then have lunch and then take another break around 3 [pm] or so." The P.I. witnessed workers taking breaks as they needed and did not witness reporting it to the farm owner. The P.I. did witness a worker leaving early due to the heat after reporting this to the farm owners. On the first day, the farm owner reported to the P.I. that they could take a break whenever they needed. The building where workers are offered breaks is in the market and air-conditioned.

Decrease body temperature encompasses participants' reports of decreasing their body temperature or "cooling off" to prevent HRI. Participants' quotes include the various ways they accomplished cooling off. For example, Jose (farmworker) reported the use of "a vehicle or something that has some type of A.C." Rosa stated, "You sweat, it makes you cool." The P.I. also witnessed workers sitting inside of air-conditioned vehicles as well as going into the air-conditioned building for a break.

Hydration encompasses participants' reports of using hydration to prevent HRI. Javier stated to prevent HRI, "Drink a lot of water." The P.I. kept an insulated water bottle with her while working on the farm. On several occasions, the P.I. forgot her water bottle, but bottled water was available in refrigerators for workers. The P.I. only noted other workers drinking water on two separate occasions, but because workers are often working in separate areas, this was difficult to observe.

Antiprevention encompasses participants' reports of beliefs and actions surrounding HRI and HRI prevention that are false, according to experts. One participant reported the use of beer to help prevent HRI. Javier (farmworker) stated that "it [beer] helps to relax and give you more energy." Will (farmworker) discussed things you shouldn't do if you want to prevent HRI which he called "Antiprevention," and he explained that "Drinking coffee, alcohol, you know, those are both going to do the opposite effect." The P.I. did not observe any alcohol use; however, early morning coffee consumption was observed.

Lifestyle behaviors and home remedies encompass participants' reports of measures they took to prevent HRI that fall outside of the normal recommendations and things they do in their everyday life. For example, Will (farmworker) reported the use of "magnesium spray" for his leg cramps.

DISCUSSION

This study sought to explore the culture of Ohio farmworkers concerning HRI and prevention and to understand the factors associated with the use of prevention measures in this population. It is necessary to understand HRI and prevention from the perspective of farmworkers. Not only can you not fully understand something [farmwork] that you have never done yourself, there are hidden cultural aspects in the workplace that cannot often be seen from an outside perspective.

While workers in Ohio and other midwestern states are at risk for HRI, it was evidenced by our findings they lack the necessary protections, education, and training. It was concerning that no workers reported formal or on-the-job training on HRI, and only one other potentially affected community member reported that HRI training is included in education for workers. However, all of the participants were able to report some signs and symptoms of HRI and appropriate prevention measures. The lack of reported education and training but showing knowledge of HRI and prevention suggests that workers are learning some of what they need to know, possibly from on-the-job experience. This is consistent with the current body of literature as it has

been reported that there is a need for better education and training for farmworkers and a significant need for first aid-related training for HRI.[25] Mandatory training should be a priority as it can reduce the morbidity and mortality from HRI. Mandatory heat training programs have been successful in decreasing HRI in municipal outdoor workers.[26]

Many participants in our study reported experiencing HRI symptoms that are associated with more serious forms of HRI. In a cross-sectional study of 158 farmworkers, 72% of the participants in their study reported having at least one HRI symptom in the previous week.[27] In our study, we used semistructured interviews and only asked participants if they had ever experienced or witnessed HRI; whereas the cross-sectional study used a survey asking participants to mark which symptoms they experienced therefore, it is possible that HRI could have been more frequent and participants may not have been aware of more minor symptoms.

The results of our study suggest that workers perform prevention measures based on how they feel, which could explain high rates of symptoms as well as more severe symptoms. HRI symptoms are not always avoidable; minor symptoms like thirst could lead to larger problems when workers are unaware of the steps they need to take once symptoms arise. Because heat exhaustion and heat stroke can quickly turn deadly, knowledge should not rely on informal training or personal experience. Instead, knowledge and training should come from leading authorities such as National Institute for Occupational Safety and Health.[4] More research is needed to understand the factors that are associated with farmworkers' decisions to use prevention measures.

Our study found some potentially hazardous misconceptions, such as the belief that cooling someone quickly was bad. This is consistent with the literature as it has been reported that workers believed it was bad to cool someone experiencing HRI quickly.[25] This is a dangerous belief that can lead to mortality. Understanding that these ideas exist is important for mitigating negative outcomes and could be used to help tailor educational materials. Health science librarians collaborated with community workers to develop resources, including educational materials tailored for farmworkers, videos to assist community health workers in honing their online health information retrieval skills, and webinars to introduce these resources.[28] Occupational health professionals should partner with community members to develop resources and tailor them to the specific needs of farmworkers related to HRI.

The theme of Interoception is especially important. Internal sensation, "how we feel," is often instinctive and plays a role in behavior. This is not something typically considered in occupational health research; however, it should be explored. For example, workers may listen to their bodies to know when to stop, and others may go past what they can handle. Although there are guidelines for acclimatization, workers and farm owners did not have specific policies, rules, or guides; instead, they talked about acclimatization in the sense of instinct and listening to their bodies.[4] Similarly, it has been reported that the primary strategy for wildland firefighters to mitigate the build-up of excess body heat was self-regulation of work/rest.[29] Acclimatization schedules must be implemented into the workforce to prevent unnecessary HRI and death. Beyond these schedules, workers need to have the ability to self-regulate to control HRI and need encouragement to stay within what their bodies can handle. They should be encouraged to listen to their body and not surpass their "limit." More research is needed to understand how farmworkers acclimatize and learn what farm owners and workers know about formal acclimatization. Moreover, workers should not be forced to rely on just listening to their bodies to prevent HRI. Wearable technology that monitors for and reports heat stress data, such as the Zephyr bioharness device, is available and used in other populations.[30] Steps need to be taken to assist in adopting lifesaving technology for farmworkers.

In our study, we found several negative attitudes toward prevention measures. The cause for such attitudes is unknown; however, they may be related to machoism. It has been previously reported that machoism is a problem within farmworker populations and it could contribute to workers being expected to push through HRI symptoms such as being dizzy.[25] Although these things are not directly correlated, these attitudes and beliefs can be dangerous when part of work culture norms. While the *norms* found in our study tended to be positive, as workers mostly reported using prevention measures and seeing others doing the same, it has been recommended that a culture of safety be developed on farms so that reporting HRI symptoms is not viewed negatively.[17] Positive norms can be beneficial to creating a culture of safety at work and should be reinforced by both owners and workers. Control has a considerable impact on behaviors. When farmworkers feel unable to perform prevention measures successfully or easily, they are not likely to try. In our study, farmworkers expressed both feelings of control and having no control in our study. Attitudes, norms, and perceived control are important factors in workplace safety. Implementing behavior-based safety interventions based on these constructs has been shown to improve the safe behavior of industry supervisors.[31] Similarly, by understanding these constructs through the lens of farmworkers, HRI prevention interventions could be developed for farm owners or supervisors.

In this study, participants discussed the ways they prevented HRI. However, participants also reported a lack of access to shade, forgetting water, and use of prevention that may worsen HRI, such as alcohol. According to the literature, there are many barriers to farmworkers' use of prevention measures, such as withholding fluids, because they cannot easily access a restroom.[32] Recognizing the barriers to HRI, such as those found in this study, like forgetting water or lacking shade in the field, can be used to develop ways to overcome them. For example, farmworkers can use the buddy system to help them remember to use prevention measures, monitor for HRI, and use portable sources of shade and hydration. Water and bathrooms should always be accessible. If they cannot be made portable, farms should attempt to provide quick access, such as by vehicles. Hydration with electrolytes should be included for any work done over 2 hours, especially when heavy sweating is expected.[4] Cooling measures on a farm could be more difficult; however, the use of cooling garments or wetted garments is recommended.[33] Additionally, misters or a cold room where employees can go during breaks or even when they feel it is needed are recommended. Farms should try to have portable shade and take advantage of natural resources such as trees.

Limitations

Several limitations exist for this study. Interviews were semistructured; therefore, participants were not asked the exact questions in the same order. At times, participants did not elaborate on certain topics or constructs; however, the P.I. did not probe deeply to prevent a Hawthorne effect. This study consisted of a small number of participants, most of whom came from the same small family farm and may not be generalizable to all farmworkers in Ohio. Flyers were used to attempt to gain access to workers from various locations. Farmworkers are historically difficult to access.[8] One farm, where an interview with an H.R. rep occurred, stated they would allow workers to be interviewed but stopped responding to emails. Recruitment also consisted of emails and phone calls to other farms, but they either did not respond or denied access to workers and declined to give interviews. Several attempts were made to clinics that care for farmworkers and migrant workers to better understand health care professionals' knowledge, beliefs, and attitudes toward HRI, but no responses were received. Another limitation was the potential for a lack of full and honest disclosure due to fear of repercussions for discussing work issues. To minimize this risk, participants were asked to choose pseudonyms, which were used instead of real names on the transcripts. The farm owners were not told who participated in the interviews or provided any details about individual responses by participants.

CONCLUSIONS

It is easy to take for granted the effort and hard work that goes into food production when we can easily walk into a grocery store or order food online. However, it is important not to overlook the health and safety of those who work tirelessly to provide us with such necessities. Our research has identified key themes that should be considered when creating strategies to prevent HRI among farmworkers. Furthermore, our findings indicate a lack of formal training and an absence of knowledge regarding acclimatization protocols, which are crucial prevention strategies that could potentially save lives. Ohio farmworkers face many safety risks working in a physically demanding setting for very little compensation. HRI, when not addressed, produces preventable morbidity and mortality. We must continue to support and prioritize the health and well-being of those who work in our agricultural industry.

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