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The Most Important Thing is to Know What to Wear When Working in the Sun

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ABSTRACT

Objective: Crop workers face increasingly hot working conditions. Wearing light-colored, single-layer breathable clothing and wide-brimmed hats, on top of having water, rest, and shade, can reduce the risk of heat illness among crop workers. Clothing preferences and limited access may prevent crop workers from wearing optimal work apparel. However, little is known about crop workers' workplace clothing preferences or their clothing acquisition barriers (e.g., access to retailers, cost). This qualitative study aimed to document Spanish-speaking crop workers' ideal work clothing and understand the primary barriers that prevent them from wearing clothing that reduces heat-related illness risk.

Methods: Four focus groups were conducted in Spanish on vegetable farms in Colorado during August and September 2023. Two researchers thematically analyzed qualitative focus group data.

Results: There were 54 Spanish-speaking crop workers who participated in focus groups during August and September 2023. Findings show participants know which work clothing options protect from heat-related illnesses. Participants purchased their work clothes primarily at second-hand stores. They preferred clothes made of light but durable materials and complete pieces that cover the head, neck, and trunk with long sleeves and pants that facilitate movement. Barriers to wearing worker-defined ideal clothing described include costs and the difficulty in finding the specific style of clothing at their preferred retail outlets. Participants described an interest in partnering with employers to purchase ideal clothing to prevent heat-related illness.

Conclusion: Spanish-speaking crop workers have a clear understanding of ideal work clothing and the link between clothing and heat illnesses prevention. However, based on thematic analysis of focus groups with crop workers in Colorado, cost and access to ideal clothing are the biggest barriers. Strategies that facilitate access to appropriate clothing for working in hot environments and involvement of employers in apparel choice are potential methods to promote worker safety and reduce the risk of heat-related illnesses among agricultural farmworkers.

KEYWORDS

Clothing; farmworkers; heat-related illness

Introduction

Between 2000 and 2021, there were at least 795 fatalities in the U.S. due to occupational heat exposure.^{1,2} Approximately 24% of deaths attributable to heat exposure in this timeframe occurred in workers in the agricultural, forestry, and fishing sector.^{1,3} Increases in average temperature and number of extreme heat events are expected to increase the risk of heat-related mortality.^{4,5} Outdoor workers, such as agricultural workers whose work is primarily conducted during the warm summer months, are among the most at risk.^{1,3,6}

Strategies for the prevention of heat-related illness in the workplace are well defined. Specifically, consumption of cool water and implementation of

rest breaks, especially in the shade, are best practice for reducing personal risk. Workplace administrative practices like acclimatization programs and annual worker training are also well established.^{7–9}

While no federal regulatory standard currently exists, in July 2024 the U.S. Department of Labor published a proposed rule: "Heat Injury and Illness Prevention in Outdoor and Indoor Work Settings". If enacted, the rule would require agricultural employers to develop an injury and illness prevention plan to control heat hazards in workplaces affected by excessive heat.¹⁰ Under the proposed rule, employers must have an acclimatization plan, evaluate heat risks and provide drinking water and rest when heat increases

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risks to workers. In workplaces where employees wear vapor-impermeable clothing, such as when applying certain pesticides, the proposed rule would require employers to evaluate heat stress hazards and implement policies and procedures to protect employees while wearing these clothing.

In the absence of a federal standard, several states have enacted local laws or rules that address heat illness prevention in the workplace. In particular, the law enacted in Colorado in May 2022 requires agricultural employers to provide annual worker training on safety procedures to prevent heat illness, cool water, shade, and additional rest breaks in increased risk conditions (e.g., in extreme heat, during long workdays, while wearing personal protective equipment [PPE] like respirators and chemical-resistant aprons, etc.).¹¹ Aside from addressing the additional risk posed by the donning of PPE, current occupational safety standards do not specify basic workwear apparel requirements.

Agricultural workers' clothing and heat

Studies have shown that wearing light-colored, single-layer, breathable clothing, and wide-brimmed hats may reduce the risk of heat illness among field workers.^{12,13} Additionally, there are defined elevated risks for wearing vapor-impermeable materials and multiple layers of woven textiles due to their interference with sweat evaporation, the body's natural cooling mechanism.⁸ However, field-based studies have struggled to tease out the specific effects of everyday work clothing on workers' internal temperature.¹² This suggests that the most effective interventions for reducing risk must consider and intervene on the complex interplay between environmental conditions, hydration, and work load.

People working in agriculture report a higher-than-average use of and preference for long-sleeved shirts and hats.^{14–17} A study of pear farmers in Korea found men selected work clothing for its comfort, while women selected work clothing for its work efficiency benefit.¹⁸ A study of field workers in California found women were more likely than men to wear tight clothing, sweatshirts, and cotton pants.¹⁹ A study of farmworkers in

Korea likewise found women to wear more layers.²⁰ Farm workers in North Carolina reported wearing long-sleeves as a means of sun protection.²¹

Though self-reported adherence to recommended clothing guidelines is high, non-adherence is also reported.^{16,22} Known non-adherence has been attributed to perceived misalignment between recommended clothing function and specific worker preferences for clothing that facilitates work efficiency (e.g., wearing baseball hats instead of wide-brimmed hats because the latter interfere with the ability to complete work tasks).^{14,18} Farmworkers have also named weight-loss benefit and prevention of dust and chemical exposures as motivations for wearing dark-colored, thick, or tight clothing.²² Overall, this highlights the complexity of the gap that exists between agriculture worker awareness of clothing recommendations and the practice of wearing recommended clothing. Specifically, non-adherence does not necessarily imply ignorance of the benefit of use; instead, other barriers and preferences have a greater impact on what clothing is worn.

The complexity in the human-clothing relationship may also impact the awareness-practice gap. The word “comfort” has been ubiquitously used to describe the idyllic state of being that is facilitated by the wear of clothing.^{23,24} Because comfort is a subjective state of being, with highly individualized opinions and preferences, it is nearly impossible to define what a comfortable garment is for any given person, environment, and/or situation.^{23–25} To further complicate the understanding of clothing comfort, the design of a garment involves several factors that may predict comfort, such as size and fabric. Within each of these factor person- and garment-based categories, a set of complex and often contradictory variables exist. For example, clothing fit is an important aspect of clothing comfort that involves objective measures such as the quantitative amount of wearing ease as well as subjective measures such as consumer preferences. These objective and subjective measures can often contradict each other. For example, when offered the objectively correct size of clothing based on measurements, many male wearers will subjectively

prefer to wear the next size up for a looser garment fit.²⁶

As summarized, the previous research on farmworkers' clothing demonstrates the potential for clothing to serve as both a protective and risk factor for heat illness. Based on prior studies, it is clear that clothing preferences impact work practices related to clothing. However, there is a gap in understanding of other important factors, such as workers' access to recommended work clothing, which contribute to the awareness-practice gap.

Study purpose

This study used a qualitative approach to begin to address the gaps in the existing literature on the role of work clothing as a potential protecting factor against heat illness among agricultural workers. It had two primary exploratory aims. Specifically, the study aimed to better understand:

- (1) Spanish-speaking crop workers' preferred or ideal work clothes. This aim included an exploration of work clothing preferences overall as well as clothing-related strategies to adapt to hot work environments.
- (2) Key factors that influence the clothing that Spanish-speaking crop workers wear to work in general and in hot working conditions. This aim included an investigation into the barriers Spanish-speaking crop workers experience that limit their ability to wear the ideal clothes to prevent heat related illness (light-colored, loose clothing).

This project was conducted in response to a request by a regional agricultural industry association. The research team worked with farm owners in this association during the two previous growing seasons, providing compliance assistance with local heat illness prevention regulations. Leaders in the association desired to address heat illness prevention beyond those measures required by law (water, shade, breaks, training, emergency response) to understand how clothing impacts heat illness risk among their employees. Growers held perceptions that field workers did not often wear the recommended light-colored, light-weight,

loose fitting clothing. They wished to develop workplace interventions to help workers wear ideal clothing. As a first step towards developing such interventions, growers sought to understand their workers' current practices in selecting and purchasing their clothing. In particular, they wanted to learn if workers were aware of recommended clothing practices and if they experience access barriers, like high cost or inability to find suitable clothing at their preferred retailers. This formative evaluation would direct employers towards an intervention to target the most appropriate barrier.

Methods

Participants, procedures, and data collection

Participants included Spanish-speaking workers on crop farms in Colorado. The participating farms and workers were recruited from active members of the industry group. Permission was obtained from two unrelated farms to visit and recruit farm employees to participate in the focus groups. Workers who agreed to participate in the focus groups were offered \$25 cash in compensation for their time. Refreshments were provided.

All focus groups were conducted in Spanish at the conclusion of a full workday in late-August and early-September 2023. Focus groups were held on property owned by the farm at either the employer-provided employee housing or at the packing facility. Participants were sorted into groups by gender, since previous research suggests men and women differ in their clothing preferences and choices.^{18–20}

Five overarching questions were asked of participants, with follow-up questions asked as needed to generate more detailed responses (see Appendix). For two sessions at Farm A, the focus group included one facilitator who led the conversation, one co-facilitator who asked follow-up questions and took written notes, and a third facilitator who just took detailed written notes. All facilitators were bilingual. Due to constraints on their time, which limited their availability, participants at Farm B asked for sessions to run concurrently instead of consecutively. Thus, consenting participants were split into two groups, by

gender. With only two bilingual facilitators available, each facilitator had to manage all roles in their session: asking questions, follow-up, and taking detailed written notes. While not ideal for collecting detailed notes, the facilitators determined there was greater value in completing both sessions at Farm B, even at limited notetaker capacity, to ensure both men and women were able to participate. To reinforce commitment to anonymity and encourage honest dialogue in all four sessions, no audio or video recordings were collected.

Written notes were recorded in both Spanish and English, based on the notetaker's preference. Notes included summaries of participant comments and, when possible, direct quotations. Notes and quotations recorded in Spanish were translated by the notetaker into English before being shared with two English-speaking research team members for thematic analysis.

Data analysis

Thematic analysis of the qualitative data from the focus groups was conducted using the approach outlined by Braun and Clarke.²⁷ Specifically, two coders from the research team became familiar with the qualitative data by reading the detailed focus group notes several times. Then the coders generated initial codes throughout the data, and those codes were reviewed for potential themes that were then defined and refined. Finally, the primary author related the themes with illustrative quotes back to the study's aims during manuscript preparation. Thematic analysis provides a structured yet flexible framework for analyzing qualitative data that supports rigorous qualitative analysis because it uses multiple coders to enhance reliability, provides descriptions of themes, and supports themes with excerpts from the qualitative data.²⁷

This project was reviewed and approved by the University Institutional Review Board.

Results

There were 54 Spanish-speaking agricultural workers from two large vegetable farms in Colorado who participated in the focus groups. A total of four focus groups were conducted in Spanish, with the number of participants in each group ranging from 5 to 30. Participants included male ($n = 47$) and female ($n = 7$) workers involved in production and harvest of leafy greens, herbs, cabbage, corn, and onions. Information shared during the sessions revealed that participants included workers residing permanently in Colorado and workers with guest visas who reside outside the U.S. for a portion of the year. Table 1 summarizes the makeup of each focus group.

Ideal clothing preferences

Overall crop workers described that their ideal work clothing would be made of lightweight, light-colored, thin, breathable materials. Workers described how they would prefer clothes that are light in color, but not white, so that it does not show stains. Clothing would provide full coverage of the skin from the sun, including long sleeves, long pants, hoods, and/or hats. Some workers also preferred face coverage for additional protection. The workers described ideal work clothing that aligned with best practices for clothing to prevent heat illness.

Factors and barriers impacting wearing ideal clothing in hot temperatures

The primary factors influencing work clothing choice for workers and barriers to wearing ideal clothing to prevent heat illness are listed as key thematic findings, along with illustrative quotes, in Table 2. These factors informed the workers' daily clothing decision-making and included the weather, work tasks, clothing comfort and durability, clothing care and availability, and employers'

Table 1. Focus group session composition and participant details.

Farm	Date	Participant Cropping System at Time of Focus Group	Gender	No. of Participants
Farm A	08/23/23	Mixed Vegetables	Men	5
Farm A	08/23/23	Mixed Vegetables	Men	12
Farm B	09/22/23	Onions	Men	30
Farm B	09/22/23	Onions	Women	7

Table 2. Summary of thematic findings from four focus groups of crop workers in Colorado.

Theme	Illustrative Quote, Translated into English
Ideal clothing	"We really like to wear clothes that are light, that are not tight so we can move better. If we can wear light colored clothes it is better, although sometimes we avoid them because they get dirty very easily." (Male participant)
Daily selection	"When they tell us the day before where we are going to be, we can choose what to wear depending on whether there is going to be dew, or if we are going to be in places where our clothes can get stained, but it will always include long-sleeved clothing and a sweater." (Male participant)
Price	"I never wear new clothes to work. Work clothes in work clothing stores are expensive and the obligations we have with our children prevent us from buying expensive things." (Female participant)
Durability	"The most important thing is to find clothes that can last us all season." (Male participant)
Comfort	"Sometimes we tie a hoodie around our waist to prevent our colleagues from looking at our buttocks when we bend down." (Female participant)
Clothing cleanliness and care	"When we find something that is very useful to us and we like for work, we try to take better care of it. We have clothes that we have been wearing for almost 3 years." (Female participant)
Clothing procurement	"Sometimes the prices can be high, but many of us go to second-hand stores to buy clothes. Nobody buys the most expensive clothes because they are for work, so we look for the best at an affordable price." (Male participant)
Employers' roles	"Any support from the company with the clothing would be welcome." (Male participant)

roles in providing work clothing. Of these factors, workers described cost as the most influential. Workers preferred not to spend a lot of money on clothes.

Daily selection

Workers described how they make the daily decision of what to wear the night before work. Workers made their clothing choice based on weather, environmental factors (e.g., dew), work tasks (e.g., pesticide application), and location. Workers said they are informed on these conditions using weather apps on their own mobile devices and/or communication from their supervisors. Workers described how they are not able to change clothes during the day, so their chosen outfit for each day must meet the myriad of conditions and tasks they may face. One noted exception was for pesticide application, where an exposure incident requires the exposed worker to immediately shower and change clothes for personal safety.

Price and availability

Workers described the biggest barriers to wearing their ideal clothing (lightweight, breathable) as the price of this clothing and its availability in the stores where they shop and in the right size. Though the desire for low-cost clothing was not extensively explored in the focus groups, women mentioned prioritizing spending on children rather than work clothing.

Durability

Durability, not being easily damaged during work, was described as the second most influential factor after cost. Workers preferred clothes that were highly durable, meaning they would "hold up" to the work. One mark of good durability was clothing that could be worn and washed many times over the whole work season, preferably lasting even longer. There was some disagreement among workers on the value of durability, with a minority recognizing durability comes at the expense of breathability.

Comfort

Workers described the comfort of their clothes as a key consideration. In particular, they described the importance of comfort in the context of being cool, staying dry, having unrestricted movements (for men), and not being in pain (specifically related to footwear). Women described seeking tight fitting clothes, particularly for pants (like athletic leggings), to prevent their underwear and buttocks from being visible during stooping tasks.

Clothing cleanliness and care

Workers described that it was important to them to wear freshly washed clothing every day. All workers had access to washing machines and regularly washed and cared for their clothing. Workers noted though wearing light colors can keep them cooler, light-colored clothing (particularly white) becomes more visibly dirty and is difficult to clean. Workers stated when their clothing became worn out, they threw it away. They

also described work clothing as not important enough to necessitate extra care; however, they deemed some specialty gear (e.g., hats with neck covers that last for several seasons) important enough for diligent care.

Clothing procurement

Workers described sourcing clothes primarily in the U.S. near their workplace from secondhand outlets (e.g., thrift stores, garage sales). A minority of workers expressed preference to buy new clothes but still from discount retailers like Target, Walmart, and Ross. These workers said they found new clothes more durable than secondhand clothes.

Employers' role

At both farms, employers facilitated access to some specialized clothing (e.g., work gloves, hats with neck protection), either by providing it outright or through cost-sharing. Crop workers felt their employers were responsible for providing specialized clothing, specifically water-proof materials for combating dew present on crops during early morning harvest. Support from employers to access clothing was encouraged from workers.

Discussion

This qualitative study aimed to understand Spanish-speaking crop workers' preferred work clothes and the key factors that influence the clothing workers wear to work in general and in hot working conditions. In addition to exploring these current practices, this study also sought to define workers' ideal work apparel and identify the barriers to wearing this most ideal clothing. In addressing these aims, the study explored how preference, cost, and access shape what agricultural workers wear to work. The findings contribute information and context for agricultural organizations and producers considering providing optimal clothing to workers, elucidating if workers would wear provided clothing.

Crop workers described their ideal clothing as lightweight, breathable, and non-restrictive. They would most like to wear these kinds of clothes in styles with long-sleeves, long-pants, hats, and hoods such that their clothing protects their skin

from the sun. This worker-defined ideal apparel is in line with recommended best practices for heat illness prevention.

The most salient barriers to wearing their ideal clothing include costs and access. Because workers' top preference is to purchase low-cost clothing, they shop at second-hand or discount retail stores where specialized outdoor clothing is difficult to find. Workers also had a preference for durability, which means purchasing thicker garments like denim and sweatshirts. These garments have the benefit of standing up to rough outdoor working conditions. Purchasing durable garments, ones that last the whole season, is another way of reducing cost. These barriers and preferences may be driving workers to purchase and wear less ideal clothes like denim, sweatshirts, and dark colors, as observed by farm owners.

Workers subjectively believe the textile durability and lack of visible garment staining associated with heavy, dark-colored garments are a more comfortable and idyllic wearing experience than the textile breathability and heat dissipation of lightweight, light-colored garments. These findings reinforce the complexity of the human-clothing relationship in that subjective comfort dominates, despite the objective benefits of the later type of apparel.^{23–25}

Women in particular named preferences around forced modesty that are a barrier to ideal clothing. The specific use of multiple layers and tight layers were mentioned as efforts to keep their buttocks and underwear covered, especially during stooping tasks.

While clothing is regularly machine washed, workers did not wish to spend the additional time required to thoroughly remove stains from light-colored clothing. Workers also expressed the desire to show up to work each day feeling fresh and clean. These preferences may influence clothing color choices, specifically towards darker colors that do not readily show dirt.

Finally, employers were seen as a potential access bridge to workers' ideal clothing, helping workers gain access to and/or reduce the cost of their ideal clothing. There was a prevailing attitude that employers have the responsibility to provide workers with specialized gear, particularly for working in wet environments. Workers seemed

eager to wear and care for employer-provided apparel, especially if they were given the opportunity to provide input and direct employers to options they would find most comfortable and useful. This interest from employees suggests an additional cost burden of a warming climate that may be borne by employers.

Strengths and limitations

This study has several important limitations. The focus groups were established out of convenience on only two vegetable farms, and all were conducted in Spanish. The preferences and barriers noted may not be broadly generalizable to workers in other sectors of agriculture, farmworkers outside of Colorado, or workers of non-Latino origins. In particular, there may be other clothing-specific needs or unique working conditions that shape the clothing preferences and barriers to live-stock workers.

The methods of this study did not follow strict focus group methodology. One session had a large number of participants ($n = 30$), which is larger than the recommended number of focus group participants and limited the ability of all participants to fully contribute to the discussion. Additionally, to protect the identities and safety of agricultural workers who participated in the study, we did not audio record the focus groups. Instead, we relied on detailed notes taken at each meeting by a bilingual research team member. Moreover, the research team did not have an opportunity to ask participants for additional explanation, narrative examples, or probe deeper into themes that emerged as researchers do when using other qualitative methods, such as one-on-one interviews or repeated interactions. In particular, the use of online shopping platforms was not explored. Other worker characteristics that may impact clothing preferences and heat adaptive behaviors, such as age and experience in agricultural work, were not explored.

Despite these limitations, the study has several important strengths. First, this study centers the voice, awareness, and preferences of Spanish-speaking agricultural workers in the discussion of work clothing. Given the subjective nature of the human-clothing relationship, hearing directly

from workers helps researchers, professionals, and employers understand the complex human-clothing environment, preferences, and behaviors that are causing workers to dress in seemingly non-recommended clothing. This study also documents current shopping practices of agriculture workers, which are not included in other published explorations of clothing in agricultural occupational safety and health literature.

Secondly, aside from standards provided by the American Conference of Governmental Industrial Hygienists,⁸ there are no standards around agricultural work clothing and minimal PPE standards for work clothing. This research highlights the need for more details and nuanced understanding of how clothing may improve safety and may help other researchers and professionals understand how and why they need to craft these standards.

Future research

Given that clothing can be both a protective and exacerbating factor for agricultural workers as they face an increasing risk of heat-related illness, future research should continue to explore the barriers and facilitators to specific apparel use and, especially, acquisition. Much of this work involves transdisciplinary collaboration between researchers in agricultural safety and health and apparel design, textiles, and merchandising. This includes exploration of themes generated here, including availability of sizing for non-Anglo Saxon body types for women, shopping preference and practices among agricultural workers, and exploring worker distinctions between PPE, specialized gear, and everyday workwear. Incorporating constructs from consumer behavior literature – such as defining product, consumer, and use and purchase situational characteristics via product importance²⁸—may elucidate additional insights on the complexity of factors that influence what workers buy and wear.

The act of wearing clothing is subjective and experiential, and as such, differences may exist between what individuals think they would wear and what they would actually wear. Therefore, future research should utilize methods that gather rich information on experiences and perceptions (e.g., focus groups) and

information on practical use and implementation (e.g., wear tests).

Additionally, given study participants' interest in their employers' potential role in ordering or supporting bulk clothing purchases, future research should seek to better understand agricultural employers' perspectives on providing work clothing or a uniform for their employees. Given the direct financial cost of provision of clothing, this research should be coupled with direct or indirect measurements of financial benefit to the employer, such as worker productivity and/or impact on safety culture.

Conclusion

Findings from a series of focus groups with crop workers in Colorado elucidated psychological, physiological, economic, and environmental factors that influence their choice of clothing worn to work. Workers defined their ideal clothing as clothing that aligned with standard best practice clothing: lightweight, light-colored, thin, breathable materials. They knew these clothes are best to wear in hot working conditions. However, competing priorities of clothing durability, cleanliness, cost, and access can help explain the apparent gap that exists between worker's awareness of ideal clothing for hot environments and the practice of regularly wearing this clothing. Of note, this study found workers preferred to purchase clothing in-person from secondhand or discount stores, which was a perceived barrier to finding ideal clothing and in an ideal size. Future research is needed to identify the most salient facilitators of ideal clothing acquisition and use, particularly the role of employers in overcoming access barriers.

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