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Hydration and Cooling Practices Among Farmworkers in Oregon and Washington

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Abstract

Objectives—Although recommendations for preventing occupational heat-related illness among farmworkers include hydration and cooling practices, the extent to which these recommendations are universally practiced is unknown. The objective of this analysis was to compare hydration and cooling practices between farmworkers in Oregon and Washington.

Methods—A survey was administered to a purposive sample of Oregon and Washington farmworkers. Data collected included demographics, work history and current work practices, hydration practices, access and use of cooling measures, and headwear and clothing worn.

Results—Oregon farmworkers were more likely than those in Washington to consume beverages containing sugar and/or caffeine. Workers in Oregon more frequently reported using various cooling measures compared with workers in Washington. Availability of cooling measures also varied between the two states.

Conclusions—These results highlight the large variability between workers in two states regarding access to and use of methods to stay cool while working in the heat.

Keywords

Cooling practices; farmworker; heat-related illness; hydration

Introduction

Outdoor workers have been identified as a population with increased vulnerability to climate-sensitive health outcomes such as heat-related illnesses (HRI).[1] HRIs include heat rash, heat syncope, heat cramps, heat exhaustion, and heat stroke, which can be fatal. Farmworkers are at particularly high risk, as their work tasks involve heavy exertion in an outdoor setting. Although deaths from working in extreme heat are rare, the annual heat-related fatality rate among outdoor crop workers from 1992 to 2006 was 0.39 deaths per 100,000 crop workers, compared with 0.02 deaths per 100,000 workers in all occupations.[2]

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Rates of nonfatal HRI among farmworkers are difficult to estimate. However, in separate studies, researchers in Georgia, North Carolina, Oregon, and Washington have estimated the prevalence of HRI among convenience samples of outdoor farmworkers ranging from 33% to 79%.[3–8]

Numerous studies examining HRI in athletic and military settings have formed the basis for guidance for preventing HRI in the workplace. However, the unique nature of the agricultural setting renders many of the recommendations difficult to follow. Much of the work is conducted outdoors during warm summer months, is physically demanding, and driven by market forces. In addition, payment methods by the piece provide little incentive to stop working. Practical, culturally appropriate prevention strategies that are likely to be effective in agricultural settings have been suggested, but it is not known to what extent these recommendations are universally practiced. Culp et al.[9] and Jackson and Rosenberg[10] developed specific preventive strategies targeting hydration (e.g., availability and frequency), rest periods (e.g., frequency and location), clothing (e.g., light and breathable), and worker education and employer education (including acclimatization).

In 2008, the Washington State Department of Labor and Industries agriculture heat rule (WAC 296-307-097), which is intended to protect employees from outdoor heat exposure, went into effect.[11] The requirements apply to outdoor work environments from May 1 through September 30, when employees are exposed to outdoor heat at or above specific temperature thresholds that vary according to the type of clothing or personal protective equipment employees are required to wear. When clothing-specific temperature thresholds are exceeded, employers must include an outdoor heat exposure safety program in their written accident prevention program and encourage employees to frequently consume potable water or other acceptable beverages to ensure hydration. Specifically, employers must ensure that sufficient quantities of potable water are accessible to employees at all times and that all employees have the opportunity to drink at least 1 quart of drinking water per hour. In addition, supervisors and employees must receive training related to working in hot conditions prior to outdoor work that exceeds temperature thresholds. Oregon does not currently have a rule specifically addressing outdoor work in hot conditions. The objective of the study was to describe and compare hydration and cooling practices between farmworkers in Oregon and Washington, states that do and do not have an outdoor heat rule mandating certain hydration and cooling provisions.

Methods

Measures

The study utilized data from two recent studies examining HRI and HRI risk factors among farmworkers in Oregon and Washington.[5,7] Surveys to identify risk factors for HRI were administered to two nonrandom, purposive samples of farmworkers in Oregon and Washington. Researchers in the two states jointly developed a core set of questions adapted from existing validated surveys, when possible, that were administered in each state. The core questions assessed basic demographics, work history, and current work activities over the previous week, including crops worked with, main job task, work environment/location, availability and length of breaks, and payment type (by piece or by hour). To assess

hydration practices, core questions included frequency of water consumption, beverages consumed, and time to walk to water sources. Cooling practices included availability and use of shade structure, trees, fans, rest stations, buildings on the farm operation with air conditioning, cars/trucks with air conditioning, misters, wet hats and bandanas, wet clothing, water from a spigot or hose, and jumping into a river or canal. Headwear and clothing worn, HRI training received, HRI concern level, and acclimatization during the current season were also assessed. Questions were developed in English and then translated into Spanish by bilingual and bicultural project staff members.

Data collection

Methods for data collection among Oregon farmworkers have been described elsewhere.[5] Briefly, bilingual research staff recruited participants in conjunction with education and outreach staff from a local community health center that was conducting health education and outreach to four migrant camps near Cornelius, Oregon. Eligible participants were adults engaged in outdoor crop work at the time of the interview and were able to speak English or Spanish. After obtaining verbal informed consent, bilingual interviewers conducted personal interviews of 100 farmworkers during July and August 2013. The interviews lasted approximately 30 minutes. Workers in Oregon were directly hired by owners/operators and lived in the migrant camps. Participants received $20 for their participation. Methods for data collection among Washington farmworkers have been described elsewhere.[7] Briefly, bilingual and bicultural research staff members recruited participants in coordination with growers and supervisors in central and eastern Washington during July and August 2013. Eligible participants were adults engaged in outdoor summer crop work in central or eastern Washington. After obtaining informed consent, participants completed surveys on touchscreen tablets with research staff available to answer questions and assist. Among participants in Washington, 90% reported reading very/fairly well in Spanish (and 27% in English). A Spanish version of the survey was available with written questions and answer choices as well as audio of both. Participants were given headphones so they could hear the questions, if requested. Project staff were available to assist when requested. Workers in Washington were directly hired by owners/operators and lived in their own residences. Participants received $10 for their participation. Researchers received approval from the Oregon State University and University of Washington institutional review boards, respectively, prior to initiating data collection.

Statistical analysis

The two data sets were merged and imported into Stata for cleaning, coding, labeling, and statistical analysis (release 13.0; StataCorp, College Station, TX, USA). Univariate analyses of all variables were conducted to describe the overall study population. Chi-square and Fisher's exact tests were used to compare prevalence of characteristics between participants in Oregon and Washington. Fisher-Freeman-Halton exact test was used to compare prevalence when the contingency table was larger than 2 × 2.

Results

Overall, 197 participants' responses were included in the analyses (100 in Oregon and 97 in Washington). Participants in the two states were mostly male (56%), Latino (99%), foreign-born (95%), did not complete more than primary school education (60%), and lived in the United States all year (89%) (Table 1). The mean age of participants in Oregon was nearly 9 years less than the mean age of participants in Washington. Participants in the two states differed in the percent that worked ≥10 seasons (38% and 49% in Oregon and Washington, respectively), in payment type (76% and 50% by piece in Oregon and Washington, respectively), crops working with, main job site, and main job task. All Oregon participants worked in blueberries in addition to 46% working with other berries, mostly harvesting in fields, whereas participants in Washington worked mostly with tree fruit in orchards. In Oregon, daily maximum temperatures on data collection days ranged from 66°F to 92°F (mean: 83°F, median: 84°F) with low humidity. In Washington, daily maximum temperatures on data collection days ranged from 81°F to 96°F (mean: 89°F, median: 90°F) with low humidity.

Although nearly all (99%) participants consumed water at work the previous week, participants in Oregon were more likely than participants in Washington to consume soda (65% vs. 31%), sports drinks (69% vs. 23%), juice (41% vs. 8%), hot coffee or tea (18% vs. 3%), and iced coffee or tea (8% vs. 1%) (Table 2). When we examined the absence of cooling measures available to workers, we found that a greater percentage of participants in Oregon reported that no cooling measures were available at work compared with participants in Washington (40% vs. 5%). When we examined the presence of specific cooling measures available to workers in the two states, we found that workers in Oregon more frequently reported the presence of shade structures (29% vs. 5%) and rest stations (19% vs. 8%), whereas workers in Washington more often reported access to shade from trees (92% vs. 47%). When we examined which cooling measures were actually used by workers in the two states, we found that workers in Oregon more frequently reported using the following cooling measures, compared with workers in Washington: shade structures (26% vs. 6%), rest stations (19% vs. 6%), cars with air conditioning (14% vs. 3%), wet clothes (40% vs. 2%), and a hose (14% vs. 2%). Of workers in Oregon, 27% reported not using any cooling measures at work during the previous week compared with 3% of Washington workers.

Workers in Oregon were more likely than workers in Washington to report wearing a baseball cap (94% vs. 76%), bandana (75% vs. 26%), and a sweatshirt hood (63% vs. 16%). Workers in Washington were more likely to not wear light-colored shirts than workers in Oregon (24% vs. 6%). Overall, 44% of participants reported ever receiving HRI-related training, with large differences between workers in Oregon (54%) and Washington (34%). Workers in Oregon (48.3%) more often reported gradually increasing the number of hours worked at the start of the season (i.e., acclimatization) than workers in Washington (34.4%), although the difference was not statistically significant. Overall, 17% of workers were "very" concerned about HRI, with no significant difference between the two states.

Discussion

This study is the first to compare hydration and cooling practices in agricultural workers working in states with and without outdoor heat rules. Although nearly all workers reported drinking water at work during the previous week, only 78% of workers across the two states reported drinking water at least once per hour during the previous week. Nearly half of all workers reported consuming soda at work during the previous week, with a significantly higher proportion of Oregon workers reporting soda consumption. This finding may be due to a younger group of workers participating in Oregon. Yet, the United States Occupational Safety and Health Administration (OSHA) recommends consuming 1 quart of potable water per hour and to refrain from soda. In addition, 40% of workers in Oregon reported that their employers did not provide cooling measures at work, such as shade structures, fans, and rest stations, compared with only 5% of workers in Washington. However, nearly 92% of workers in Washington reported trees as a cooling measure available at work, likely because the Washington participants were working in orchard settings. Washington State's outdoor heat rule does not have specific provisions for access to shade; however, the only other state with an outdoor heat rule does have such a specific shade provision.[11,12]

Although the Washington State's outdoor heat rule calls for employee HRI training, only 34% of workers reported receiving such training, compared with 48% of workers in Oregon. Two previous studies in California and Georgia reported results of HRI training received by workers.[4,13] Stoecklin-Marois et al.,[13] who interviewed 474 farmworkers in California, and Fleischer et al.,[4] who interviewed 405 farmworkers in Georgia, reported that 92% and 24% of participants, respectively, received HRI training. The California Heat Illness Prevention Regulation states that effective training should be provided to all employees (supervisory and nonsupervisory) "before the employee begins work that should reasonably be anticipated to result in exposure to the risk of heat illness."[14] Subsequent guidance from the California Division of Occupational Safety and Health indicated that training should be provided when the employee is hired, with refresher training as needed. These results suggest that there is substantial variability in HRI training across the United States. Further investigation is needed to determine the extent to which workers are receiving HRI training. As many farmworkers are exposed to heat hazards as well as pesticides, the findings regarding trainings received can be framed in the context of pesticide training required by the US Environmental Protection Agency's Worker Protection Standard (WPS). Although compliance with the WPS training requirement has not been fully evaluated, results from studies in California, North Carolina, and Texas show the percentage of workers ever receiving pesticide training ranging from 35.2% to 76.8%.[15–18]

Our study is subject to several limitations. First, different methods of data collection were used in Oregon and Washington, which could have led to information bias. Participants in Washington completed a self-administered survey on touchscreen tablets at the worksite, whereas participants in Oregon completed a personal interview administered by research staff at the housing facility. Participants have been shown to provide more positive and socially desirable responses and to underreport sensitive issues during personal interviews compared with self-administered surveys.[19] However, we expect the information bias to be minimal, since the information collected was not sensitive. Second, participants were

recruited differently in the two states—via outreach workers in Oregon and via employers and supervisors in Washington. Participants in Oregon may have felt less inhibited and provided more accurate responses. Next, the conditions in which participants in the two states worked were vastly different. Specifically, participants in Washington primarily picked tree fruit in orchard settings, which provided a natural form of shade, whereas participants in Oregon primarily harvested blueberries with little shade. In addition, the environmental conditions varied between the study sites in the two states. These differences may impact access to cooling measures, the types of cooling measures used, and frequency of water consumption; however, we expect little impact on items such as types of drinks consumed, HRI trainings received, and concern level. Lastly, caution is advised in using these results to evaluate the outdoor heat rule in Washington, as data were collected from a small number of participants and sites using nonrandom sampling methods.

These results highlight the large variability among and between workers in two Pacific Northwest states in access to and use of methods to stay cool while working in the heat. Basic hydration and cooling recommendations appear to be practiced to varying degrees, and differences may reflect differences in work and work environments. Future work should aim to elucidate the reasons for these differences and to reduce disparities in HRI risk.

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Table 1

Demographic and work characteristics among study participants, Oregon and Washington, 2013.

Characteristic	Overall (*N* = 197)	Oregon (*n* = 100)	Washington (*n* = 97)	*P* value
Age; mean (SD)	36.0 (12.1)	31.8 (10.1)	40.4 (12.6)	<.001
Male gender; % (*n*)	56.4 (111)	60.0 (60)	52.6 (51)	.294
Latino; % (*n*)	99.0 (194)	99.0 (98)	99.0 (96)	.988
Foreign-born; % (*n*)	94.9 (186)	97.0 (96)	92.8 (90)	.183
Years living in US >10; % (*n*)	57.7 (112)	44.3 (43)	71.1 (69)	<.001
Lives in US all year; % (*n*)	89.3 (176)	86.0 (86)	92.8 (90)	.123
Education; % (*n*)				.500
Completed primary or less	59.9 (115)	63.0 (63)	56.5 (52)	
Part/Completed middle/Part of high school	24.5 (47)	21.0 (21)	28.3 (26)	
≥High school	15.6 (30)	16.0 (16)	15.2 (14)	
Number seasons worked in agriculture; % (*n*)				.022
0–2	13.9 (27)	9.2 (9)	18.8 (18)	
3–5	23.2 (45)	29.6 (29)	16.7 (16)	
6–9	19.6 (38)	23.5 (23)	15.6 (15)	
≥10	43.3 (84)	37.8 (37)	49.0 (47)	
Number days worked previous 7 days; mean (SD)	5.6 (1.4)	6.3 (0.96)	4.9 (1.5)	<.001
Payment type for current job; % (*n*)				<.001
Per hour	37.3 (72)	24.0 (23)	50.5 (49)	
Per piece	62.7 (121)	76.0 (73)	49.5 (48)	
Crops worked with previous 7 days; % (*n*)				
Tree fruit	44.2 (87)	3.0 (3)	86.6 (84)	<.001
Other fruit	7.1 (14)	4.0 (4)	10.3 (10)	.101
Blueberries	52.8 (104)	100.0 (100)	4.1 (4)	<.001
Other berries	23.4 (46)	46.0 (46)	0.0 (0)	<.001
Hops	2.5 (5)	1.0 (1)	2.5 (5)	.207
Grapes	2.0 (4)	2.0 (2)	2.0 (4)	1.000
Vegetables	1.5 (3)	2.0 (2)	1.0 (1)	1.000
Other crop	7.2 (7)	7.0 (7)	7.2 (7)	.953
Main job task previous 7 days; % (*n*)				<.001
Pruning/Thinning	14.3 (28)	1.0 (1)	27.8 (27)	
Weeding	2.6 (5)	0.0 (0)	5.2 (5)	
Harvesting crops	66.5 (127)	84.9 (84)	44.3 (43)	
Sorting/Packing	5.1 (10)	1.0 (1)	9.3 (9)	
Other job	11.0 (21)	8.5 (8)	13.4 (13)	
Main work site last week; % (*n*)				<.001
Orchard	48.7 (96)	13.0 (13)	85.6 (83)	
Field	50.3 (99)	86.0 (86)	13.4 (13)	
Tractor	1.0 (2)	1.0 (1)	1.0 (1)	

Table 2

Hydration and access to cooling resources among study participants, Oregon and Washington, 2013.

Characteristic	Overall (*N* = 197)	Oregon (*n* = 100)	Washington (*n* = 97)	*P* value
Usual morning break length				<.001
No break	10.2 (20)	11.0 (11)	9.3 (9)	
5–10 minutes	31.0 (61)	47.0 (47)	14.4 (14)	
15 minutes	51.3 (101)	37.0 (37)	66.0 (64)	
30 minutes	4.6 (9)	4.0 (4)	5.2 (5)	
Other amount of time	3.1 (6)	1.0 (1)	5.2 (5)	
Usual lunch break length				<.001
No break	1.5 (3)	3.0 (3)	0.0 (0)	
15 minutes	9.6 (19)	17.0 (17)	2.1 (2)	
≥30 minutes	84.8 (167)	73.0 (73)	96.9 (94)	
Other amount of time	4.1 (8)	7.0 (7)	1.0 (1)	
Usual afternoon break length				<.001
No break	28.4 (55)	19.4 (19)	37.5 (36)	
5–10 minutes	29.9 (58)	48.0 (47)	11.5 (11)	
15 minutes	36.1 (70)	26.5 (8)	45.8 (44)	
30 minutes	3.6 (7)	4.1 (4)	3.1 (3)	
Other amount of time	2.1 (4)	2.0 (2)	2.1 (2)	
Drank water at least once per hour previous week at work; % (*n*)	78.1 (153)	73.0 (73)	83.3 (80)	.081
Drinks consumed previous week at work; % (*n*)				
Water	98.5 (194)	100.0 (100)	96.9 (94)	.117
Sports drink	46.2 (91)	69.0 (69)	22.7 (22)	<.001
Energy drink	8.6 (17)	11.0 (11)	6.2 (6)	.229
Juice	24.9 (49)	41.0 (41)	8.3 (8)	<.001
Iced coffee or tea	4.6 (9)	8.0 (8)	1.0 (1)	.035
Hot coffee or tea	10.7 (21)	18.0 (18)	3.1 (3)	.001
Soda	48.2 (95)	65.0 (65)	30.9 (30)	<.001
Other drink	2.0 (4)	3.0 (3)	1.0 (1)	.621
Time to water source <3 minutes away; % (*n*)	81.1 (159)	76.0 (76)	86.5 (83)	.061
Time to toilet <3 minutes away; % (*n*)	64.4 (125)	63.3 (62)	65.6 (63)	.731
Cooling measures available at work; % (*n*)				
Shade structures	17.3 (34)	29.0 (29)	5.2 (5)	<.001
Trees	69.0 (136)	47.0 (47)	91.8 (89)	<.001
Fans	1.5 (3)	2.0 (2)	1.0 (1)	1.000
Rest stations	13.7 (27)	19.0 (19)	8.3 (8)	.028
Building with air conditioning	1.5 (3)	1.0 (1)	2.1 (2)	.617
Other	1.5 (3)	3.0 (3)	0.0 (0)	.246
No cooling measures available	22.8 (45)	40.0 (40)	5.2 (5)	.001
Cooling measures used at work previous week; % (*n*)				
Shade structures	16.2 (32)	26.0 (26)	6.2 (6)	<.001

Characteristic	Overall (*N* = 197)	Oregon (*n* = 100)	Washington (*n* = 97)	*P* value
Trees	69.0 (136)	47.0 (47)	91.8 (89)	<.001
Fans	3.1 (6)	4.0 (4)	2.1 (2)	.683
Rest stations	12.7 (25)	19.0 (19)	6.2 (6)	.007
Building with air conditioning	0.5 (1)	1.0 (1)	0.0 (0)	1.000
Car with air conditioning	8.6 (17)	14.0 (14)	3.1 (3)	.009
Mister	1.5 (3)	3.0 (3)	0.0 (0)	.246
Wet clothes	21.3 (42)	40.0 (40)	2.1 (2)	<.001
Hose	8.1 (16)	14.0 (14)	2.1 (2)	.003
Jump in river or canal	0.5 (1)	0.0 (0)	1.0 (1)	.492
Other	5.1 (10)	10.0 (10)	0.0 (0)	.002
No cooling measures used	15.2 (30)	27.0 (27)	3.1 (3)	<.001
Headwear usually worn at work previous week; % (*n*)				
Baseball cap	85.3 (168)	94.0 (94)	76.3 (74)	<.001
Wide-brimmed hat	21.8 (43)	21.0 (21)	22.7 (22)	.775
Other hat	1.0 (2)	2.0 (2)	0.0 (0)	.498
Bandana	50.8 (100)	75.0 (75)	25.8 (25)	<.001
Hood from hooded sweatshirt	39.6 (78)	63.0 (63)	15.5 (15)	<.001
Clothing usually worn at work previous week; % (*n*)				
No light-colored shirt (vs. light-colored shirt)	14.7 (29)	6.0 (6)	23.7 (23)	<.001
Received HRI training previous year; % (*n*)	44.0 (84)	54.2 (52)	33.7 (32)	.004
Gradually increased no. hours worked at start of season; % (*n*)	41.1 (76)	48.3 (43)	34.4 (33)	.054
“Very” or “somewhat” concerned about HRI; % (*n*)	67.0 (130)	63.9 (62)	70.1 (68)	.360