Heat-related illness (HRI) in Agriculture (Part 1)

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INSTITUTE OF PUBLIC HEALTH

SCCAHS Webinar
Overview

- Heat Stress and Latino Farmworker Laborers
- Survey Findings and Crew Leader Trainings
Introduction

- Agriculture is a hazardous industry
- 1.4 to 2.1 million hired crop workers in US
- 78% of crop workers are foreign-born
- 19% of crop workers are migrant workers
- 70% of crop workers are male
- 18% of crop workers are indirect hires

<table>
<thead>
<tr>
<th>Group</th>
<th>Number</th>
<th>%</th>
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<tbody>
<tr>
<td>Mexico</td>
<td>5,239</td>
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<td>Central America</td>
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<tr>
<td>South America</td>
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<td>0.2</td>
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Data source: CDC/NIOSH; NAWS Cycles 2011-12/ 2013-14
Background

- Farmworkers at increased risk for HRI
- USDOL, 2000-2010 the highest rate of heat-related deaths were in Ag Industry
- Symptoms include headache, muscle cramps, dizziness
- Alleviate symptoms with rest, shade, hydration
- Structure of work environment as risk factor
- Importance of acclimatization
- Importance of hydration
- OSHA Heat Safety Tool

Data source: CDC/NIOSH
Excessive sweating — No sweating

Cool, pale, clammy skin — Body temperature above 103°

Nausea or vomiting — Nausea or vomiting

Rapid, weak pulse — Rapid, strong pulse

Muscle cramps — May lose consciousness

Get to a cooler, air conditioned place

CALL 9-1-1
Study Activities and Methods

Phase 1: Focus groups on heat-related occupational hazards, perceptions of risk, adaptations, and water/rest/shade (Fall/Winter 2017, South Carolina)

- Engagement of Community Partners in South Carolina (East Coast Migrant Head Start, 2 Free Clinics) to host 5 focus groups
- Focus Group Moderator and Co-Moderator facilitated groups and provided Heat Safety Tool app training

Phase 2: Crew leader recruitment and training on Heat Safety Tool app and farmworker survey (Summer/Fall 2018, Lake Park, Georgia)
“I Think the Temperature was 110 Degrees!”: Work Safety Discussions Among Hispanic Farmworkers

John S. Luque, Brian H. Bossak, Caroline B. Davila, and Jose Antonio Tovar-Aguilar

JOURNAL OF AGROMEDICINE
2019, VOL. 24, NO. 1, 15–25
https://doi.org/10.1080/1059924X.2018.1536572
## Phase 1: Focus Group Demographics
(N=29, 5 focus groups)

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<tr>
<td><strong>Sex</strong></td>
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<td>(52)</td>
</tr>
<tr>
<td>Female</td>
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<td>(48)</td>
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<tr>
<td><strong>Age</strong></td>
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<td></td>
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<td>Mean (Range)</td>
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<td><strong>Years in U.S.</strong></td>
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<td>Mean (Range)</td>
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<td><strong>Country of Origin</strong></td>
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<tr>
<td>Mexico</td>
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<td>(86)</td>
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<tr>
<td>Guatemala</td>
<td>4</td>
<td>(14)</td>
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Focus Group Discussion Themes

Farmworker Risks and Protection
◦ Inexperienced workers, need for training, use of PPE, pesticides

HRI Knowledge, Signs, Symptoms, Treatment
◦ Temperature precautions, paying attention to physical signs, use of sueros and cooling methods such as cold cloths

Water/Rest/Shade
◦ Issues of water quality, water temperature preferences, length of breaks depended on work arrangements (hourly vs. piece rate)

Access to Healthcare and Health Information
◦ Internet search to check symptoms, use of free clinics
Survey of Latino Farmworkers and Heat Safety Practices
Study Aims

• Train crew leaders to use the OSHA heat safety tool app and assess their perceptions of the usefulness of the app.

• Characterize heat safety knowledge, preventive practices, and perceptions of HRI risk among Hispanic farmworkers.
Participant Recruitment

August-October 2018

Inclusion Criteria
- Farmworker
- Ages 21 and older
Crew Leader Training

6 Crew leaders participated in OSHA Heat Safety training and on Heat Safety Tool App in April 2018 (3 males/3 females), average age 41 years

Crew leaders had experience with apps (Facebook and WhatsApp)

Crew leaders used rubric for rating app on relevance, functionality, value and privacy on scale of 1-4 (“poor” to “excellent”)

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<tr>
<th>Category</th>
<th>Average Rating</th>
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<td>Relevance</td>
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<tr>
<td>Functionality</td>
<td>3.5</td>
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<tr>
<td>Value</td>
<td>3.8</td>
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<tr>
<td>Privacy</td>
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## Results – Sociodemographics (n=101)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>% of Farmworkers</th>
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<tbody>
<tr>
<td>Age, 19-29</td>
<td>56%</td>
</tr>
<tr>
<td>Age, 30-39</td>
<td>29%</td>
</tr>
<tr>
<td>Male</td>
<td>60%</td>
</tr>
<tr>
<td>H-2A worker</td>
<td>74%</td>
</tr>
<tr>
<td>BMI in overweight or obese category</td>
<td>60%</td>
</tr>
<tr>
<td>Ability to read in Spanish “well” or “very well”</td>
<td>96%</td>
</tr>
<tr>
<td>Country of origin was Mexico</td>
<td>97%</td>
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<tr>
<td>Lived in barracks-style housing</td>
<td>70%</td>
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Work Experience

# Seasons Working in Ag
- 1
- 2
- 3 or more
Common Crops Worked in Last Week

- Tomatoes
- Cucumbers
- Sweet Potatoes
Payment Type for Work Performed

- Piece rate $0.40/box
- ≈$10.95/hour
- Piece rate and hourly
Common Work Tasks in Last Week

- Picking
- Weeding
- Planting
- Packing
HRI Knowledge and Practices

**Acclimatization**
- 58% started with a few hours of work and then increased workload
- 62% said they “always” or “usually” took breaks in the shade in the last week
- 88% said they were “very comfortable” taking a water break

**Fluid Preferences**
- 32% added something to water, like hydration salts
- 70% drank water every 30 minutes and 20% every hour
- Workers carried water bottles on belts or in pockets
- Reasons for not drinking water: 1) nausea 2) getting sick
- Water – 89%
- Gatorade – 64%
- Fruit juice – 27%
- Soda – 26%
- Energy drinks – 19%
- Coffee – 12%

**Shade and Bathroom Concerns**
- 19% said there was no toilet nearby
- 77% said shade under trees was available, but only 20% identified shade structures
HRI Adaptive Practices

Heat Stress Prevention
- 66% would drink more water
- 23% would change their work activities
- 23% would take rest breaks in the shade
- 21% would change work hours

Clothing Preferences
- Workers wore long-sleeved shirts and pants
- Workers wore hats and gloves
- 77% “rarely” or “never” wore sunglasses

Frequency of HRI
- 19% reported symptoms from working in the heat (e.g., headaches, heavy sweating, skin rash, dizziness, nausea)
- 15% reported receiving treatment for HRI

Heat Knowledge Score

- 60%
- 50%
- 40%
- 30%
- 20%
- 10%
- 0%

Low (<4)  High (4-5)
## Regression Results for Heat Safety Knowledge

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<th>B</th>
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<th>p-value</th>
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<tr>
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<td>-0.79</td>
<td>0.26</td>
<td>0.0035</td>
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<td>Male</td>
<td>REF</td>
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<tr>
<td>H-2A worker visa status</td>
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<td></td>
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<tr>
<td>Yes</td>
<td>-1.28</td>
<td>0.30</td>
<td>&lt;0.0001</td>
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<tr>
<td>No</td>
<td>REF</td>
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<tr>
<td>Level of concern regarding health being affected by working in heat</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>A little bit concerned</td>
<td>-1.21</td>
<td>0.52</td>
<td>0.0230</td>
</tr>
<tr>
<td>Not at all concerned</td>
<td>-0.77</td>
<td>0.51</td>
<td>0.1366</td>
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<tr>
<td>Very concerned</td>
<td>REF</td>
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<tr>
<td>$R^2$</td>
<td>.29</td>
<td></td>
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</tr>
<tr>
<td>$F$</td>
<td>4.98</td>
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Discussion

- App is an easy-to-use tool for crew leaders to monitor weather data and check the heat index.

- Recent study comparing weather station data with micro-environmental data in Florida recommends the OSHA app as a reliable method (Mac et al. JOEM 2018).

- **Primary finding:** farmworkers who were female, had H-2A visa status, and were “a little concerned” compared to “very concerned” about working in the heat were more likely to score **lower** on the heat safety knowledge questions.

- H-2A visa holders may be new to farmwork and have less training or experience.

- Stoecklin-Marois et al. (2013) also reported women scored lower on heat safety knowledge than men.
Recommendations

Training
• Offer annual HRI prevention training for farmworkers and supervisors, including downloading heat safety tool.
• Train workers to be able to monitor themselves and to notify supervisor for help.

Monitoring
• Provide recommendations related to HRI recognition and corrective action to reduce heat stress.
• Monitor weather conditions to protect workers from HRI using the heat safety tool app.
• Monitor workers at breaks (and mandate breaks!) and during work for low-severity signs.

Emergencies
• Require emergency medical help resources be available for workers having difficulty with HRI, especially on the hottest days of the summer.
Acknowledgements

“A society will be judged on the basis of how it treats its weakest members.”
- Pope John Paul II

Supported in part by a University of Florida Agricultural Research Center Pilot Award from the National Institute for Occupational Health and Safety [U54 OH011230].

<table>
<thead>
<tr>
<th>Study Staff</th>
<th>Collaborators</th>
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<tr>
<td>Cecila Ordaz Gudino</td>
<td>Alan Becker, PhD (FAMU)</td>
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<tr>
<td>Maria Trejo</td>
<td>J. Antonio Tovar Aguilar, PhD (FWAF)</td>
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<td>Brian H. Bossak, PhD (CofC)</td>
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<tr>
<td>Babette Brumback, PhD (UF)</td>
<td>Joseph G. Grzywacz, PhD (FSU)</td>
</tr>
<tr>
<td>Yian Guo, MS (UF)</td>
<td>Joe COMPANY, PhD (COMPANY)</td>
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Heat-related Illness (HRI) in Agriculture: Research findings and educational resources to help prevent HRI
The Problem

• From 2007-2011 in southeastern US:
  • 8,315 occupational HRI Emergency Department admissions*
  • 1,051 occupational HRI hospital admissions*
  • Approximately 16% from workers in crop agriculture*
  • 20x increase in risk of heat-related mortality as compared with other occupational groups*

The Problem

And it’s getting hotter

- Good evidence for heat stress as a contributor to acute injury and accidents.
- May contribute to productivity loss, absenteeism, and quality loss.
- #1 occupational health concern in SCCAHS needs assessment.

From Carter et al. (2014)-CH17; NCA2014
Heat-Related Illness: State of the Science St. Petersburg, FL, October 25-26, 2018

Speakers

- **Occupational Heat Stress Exposure, Assessment: Limits on Sustainable Exposures**
  - Dr. Thomas Bernard, Professor, College of Public Health, and Sunshine Education and Research Center (ERC), University of South Florida

- **Acclimatization, Decay, and Re-Acclimatization**
  - Dr. Candi Ashley, Professor, Exercise, Science, University of South Florida

- **Management & Return to Work/Activity Following Exertional Heat Illness**
  - Dr. Rebecca Lopez, Program Director, Athletic Training Professional Program, University of South Florida

- **Attending to Heat Illness & Pesticide Exposure among Farmworkers: Results from an Attention Placebo-Controlled Design**
  - Dr. Joseph Grzywacz, Chair, College of Human Sciences, Florida State University

- **The Girasoles (Sunflower) Study: Exploring the Physiologic Heat Stress Response**
  - Dr. Linda McCauley, Dean, School of Nursing, Emory University

- **Heat Illness Prevention in Athletes**
  - Dr. Eric Coris, Director, Primary Care sports Medicine, University of South Florida

- **Heat Related Illness in a Changing Climate and Demography of Florida**
  - Dr. Vasubandhu Misra, Professor, Earth, Ocean, and Atmospheric Sciences, Florida State University

- **Exertional Heat Illness: Physiology, Pathology, and Modifying Factors**
  - Dr. Michael Sawka, Professor, Biological Sciences, Georgia Tech University
Basic Themes

• Current and future climates
• Outdoor (including farmworkers) experience high levels of heat strain and heat-related illness
• Implications of exposure assessments
• Acclimatization
• Management, training and emergency response
• Directions for future efforts
Two Recommendations

• Provide training on signs and symptoms of heat disorders, and on protective practices.

• Have an emergency response plan.
  • Early recognition of heat stroke
  • Immediate, rapid, aggressive cooling
  • Emergency transport to emergency room
Directions for Future Efforts

- Interventions developed for occupations such as military and athletics have limitations in agricultural settings (safety regulations and cost).
- Training and education may be first mitigation strategy.
- SOS meeting approach was effective way to better understand the mechanisms and evaluation of HRI.
Educational Resources from SCCAHS

• State of the Science white paper
• Heat-related illness magazine insert
• Heat-related illness issue guide (English and Spanish)
• Heat-related illness informational video (English and Spanish)
• Recorded webinars on the topic of heat-related illness
State of the Science White Paper

Executive Summary

Background

Between 2000-2010, 28.6% of deaths due to heat related illness (HRI) in occupational settings occurred in six states in the Southeast. HRI is and will continue to be a major issue affecting outdoor workers. Climate models predict a 2.2°F (1.2°C) rise in temperatures in the continental United States, and that the number of days per year that achieve temperatures above 95 degrees will increase in Florida and the Southeast from 15 days per year from 1971-2000, to over 75 days per year 2041-2070. Additionally, HRI will take a toll on industry in the Southeast, with annual losses in productivity equivalent to $47 billion predicted by 2090. There is a need for collaborative, multi-disciplinary research to protect worker health and mitigate productivity losses in outdoor industries. The issue of HRI among outdoor workers, including agricultural workers, athletes, and military personnel, will continue to become more prominent. Farmworkers are particularly vulnerable, and are 20 more times more at risk of death due to HRI than other American workers. Farmworkers work long hours outdoors, are paid based on productivity rather than hourly wages, and have low political capital and fewer worker protections than many sectors of the US workforce. There is therefore a need for collaborative, multi-disciplinary research and education approach to protect worker health and mitigate productivity losses in outdoor industries.

Meeting Summary

To address this need, the Southeastern Coastal Center for Agricultural Health and Safety (SCCAHS) organized the HRI State of the Science meeting, held October 25-26, 2018. The meeting was held in St. Petersburg, Florida. The focus of the meeting was to bring together a slate of eight esteemed presenters on this topic, showcasing research at the intersections of heat related illness and climate as they relate to the health and safety of outdoor workers and farmworkers, as well as athletes and military personnel. This crosscutting, one day meeting brought together researchers from various fields to present current findings and begin the process of developing future research collaborations on this topic. Meeting attendees represented four universities, federal agencies, medical institutions, and consulting organizations.

Key Findings

Preventing HRI

The responsibility for preventing HRI lies both with organizations that employ workers, as well as with workers themselves. Many risk factors can be mitigated on both the organizational and individual level to decrease worker susceptibility to HRI.

Organizational Level

On the organizational level, employers can provide appropriate acclimatization periods, work to rest ratio, access to fluid and rehydration, and recognize, treat and manage HRI. Acclimatization refers to the period of time needed for the body to adjust to working in the heat. According to National Institute of Occupational Safety and Health, this period typically ranges from 7 to 14 days, depending on the heat exposure and acclimatization program.

Individual Level

On the individual level, workers can take steps to prevent heat-related illnesses by staying hydrated, wearing appropriate clothing, and avoiding strenuous activity during peak heat hours. It is important for workers to understand the signs and symptoms of heat illness and to know how to respond to them.

Summary

The State of the Science White Paper on Interdisciplinary Perspectives on Heat Related Illness Prevention provides a comprehensive overview of the current state of knowledge on heat-related illness prevention. The paper outlines the need for collaborative, multi-disciplinary research and education approaches to protect worker health and mitigate productivity losses in outdoor industries. The paper also highlights the importance of prevention strategies at both the organizational and individual levels. The findings from this report will be valuable for researchers, policymakers, and practitioners working to address the challenges of heat-related illness prevention.
IMPACT OF HEAT STRESS ON OUTDOOR WORKERS

The risk of heat-related death is 35 times more likely for agricultural workers than for any other occupational group.

Agricultural industry leaders in the Southeast ranked heat stress as their No. 1 occupational health concern, according to the Southeastern Coastal Center for Agricultural Health and Safety (SCCAHS).

Heat stress is common among outdoor workers and particularly among workers who plant and harvest agricultural crops. Approximately 16 percent of occupational heat-related deaths are among workers in crop agriculture. In addition to being fatal, heat stress may also contribute to loss of productivity, worker absenteeism and decline in quality of work.

SCCAHS is part of a Centers for Disease Control and Prevention (CDC) / National Institute for Occupational Safety and Health (NIOSH) Agricultural Health and Safety Initiative and is working to inform agricultural workers of the risks associated with heat stress and how to prevent heat-related illnesses.

The center recently brought together a slate of esteemed speakers on the topic of heat-related illness, showcasing research at the intersections of heat-related illness and climate change as it relates to the health and safety of outdoor workers and farmworkers, as well as athletes and military personnel. This crosscutting meeting brought together researchers from various fields to present current findings and pave the way for developing future research collaborations on these topics.

Researchers indicated that death from heat-related illness is 100 percent preventable when aggressive cooling takes place. Deaths from heat-related illness occur because of misdiagnoses, lack of care, delay of care, and immediate transport before cooling.

Three of the most common types of heat-related illness are heat cramps, heat exhaustion and heat stroke. Symptoms of heat cramps include muscle cramping, pain, thirst, sweating or fatigue. Symptoms of heat exhaustion include fainting; heavy sweating; cold clammy skin; or fast, weak pulse. Symptoms of heat stroke include body temperatures over 103 degrees; confusion; fast, strong pulse; or hot, red, dry or damp skin.

As temperatures rise, the risk of developing a heat-related illness increases.

3 WAYS TO AVOID HEAT STRESS

1. Workers should be allowed a 5-6 day acclimation period when they begin working in the heat.
2. Outdoor workers should consume about one quart, or approximately two bottles, of water every hour.
3. Workers should be encouraged to drink smaller amounts of water every 20 minutes.
Heat-Related Illness Issue Guide

WHAT RESEARCHERS KNOW ABOUT HEAT-RELATED ILLNESS

The Southeastern Coastal Center for Agricultural Health and Safety (SCCAHS) recently brought together a suite of esteemed speakers on the topics of heat-related illness, showcasing research at the intersections of heat-related illness and climate change as it relates to the health and safety of outdoor workers and farmers as well as coastal and military personnel. This crosscutting meeting brought together researchers from various fields to present current findings and pave the way for developing future research collaborations on these topics.

Death from heat-related illness is 100 percent preventable when aggressive cooling takes place. Deaths from heat-related illness occur because of illiquidity, lack of care, lack of care, and immediate transport for proper cooling. Three of the most common types of heat-related illnesses are heat cramps, heat exhaustion, and heat stroke. Symptoms of heat cramps include muscle cramping, pain, weakness, or fatigue. Symptoms of heat exhaustion include fever, heavy sweating, cold clammy skin or fast weak pulse. Symptoms of heat stroke include body temperature over 103 degrees Fahrenheit; confusion; fast, strong pulse; or hot, dry, or clammy skin. Heat-related illness is the third-leading cause of death among high school athletes.

TYPES OF HRI

CRAMPS EXHAUSTION STROKE

DEATH FROM HRI IS 100% PREVENTABLE WHEN AGGRESSIVE COOLING TAKES PLACE

HEAT-RELATED ILLNESS IS THE THIRD-LEADING CAUSE OF DEATH AMONG HIGH SCHOOL ATHLETES

QUE SABEN LOS INVESTIGADORES ACERCA DE ENFERMEDADES RELACIONADAS CON EL CALOR

El Centro Centro Sudiente para Salud y Seguridad Agrícola (CENASAS) ha reunido científicos de la Universidad de Florida, Universidad Estatal de Florida, la Universidad de la Bahía de Florida, la Universidad Emory y Universidad Tecnológica de Georgia, para llevar a cabo el estudio de las enfermedades relacionadas con el calor, en St. Petersburg, Florida, el 25 de octubre de 2018. El CENASAS aborda la agenda nacional y los necesidades de salud relacionadas con la agricultura, la pecuaria, y la silvicultura en Florida, Georgia, Alabama, Mississippi, Carolina del Sur, Carolina del Norte, Puerto Rico, y los Estados Virginicos.

Enfermedades relacionadas al calor

El Centro Centro Sudiente para Salud y Seguridad Agrícola (CENASAS) ha reunido una lista de entidades respetadas sobre el tema de las enfermedades relacionadas con el calor (ERC), trabajando en investigación relacionada con la interacción entre ERC y el clima. El clima, y su relación con el riesgo y la seguridad de los trabajadores y personal militar. Esta reunión transversal reunirá investigadores de varios campos para presentar las descubrimientos actuales y crear el camino para el desarrollo de la investigación y la colaboración sobre estos temas en el futuro.

Las muertes por ERC son 100 por ciento preventibles cuando tiene lugar un enfriamiento agresivo. Las muertes por ERC ocurren por errores en el diagnóstico, falta de cuidado, demora en el cuidado y transporte inmediato sin prensa enfriamiento. Tres de los más comunes tipos de ERC son calenturas por calor, agotamiento por calor y golpes de calor. Síntomas de las calenturas por calor incluyen calenturas musculares, dolor, sudor o fatiga. Los síntomas del agotamiento por calor incluyen fatiga, mucho sudar, piel fría, húmeda y pegajosa, o pulso débil y rápido. Los síntomas del golpe de calor incluyen temperaturas del cuerpo sobre los 103 grados (39.5 grados centígrados), confusión, pulso rápido y fuerte, o palidez, enrojecimiento, caliente y seca o húmeda.

LAS MUERTES POR ENFERMEDADES RELACIONADAS AL CALOR SON 100% PREVENIBLES CUANDO TIENE LUGAR ENFRIAMIENTO AGRESIVO

TIPOS DE ERC

CALAMBRES AGOTAMIENTO GOLPES DE CALOR

LAS ENFERMEDADES RELACIONADAS AL CALOR SON LA TERCERA CAUSA DE MUERTE ENTRE ALETAS EN LA ESCUELA SECUNDARIA
Heat-Related Illness Informational Video

- English: https://www.youtube.com/watch?v=iRFqDLWlunci
- Spanish: https://www.youtube.com/watch?v=T314mUhu-7g&t=24s
Educational Resources from SCCAHS

• All resources can be found at http://www.sccahs.org/index.php/ag-health-safety-topics/heat-stress/
  
  • *Or,* visit sccahs.org, hover mouse over Education and Training in menu bar, and click **Heat Stress**.
2019 State of the Science Meeting

• Stress and resilience among agricultural workers in vulnerable rural communities
  • Mental health stressors in agricultural workers and communities
  • Mental health stressors affecting vulnerable communities
  • Community and individual resiliency today
Questions?