Climate Change, Heat Stress and Worker Health

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Learning Objectives

• Understand how climate change, specifically increased ambient temperature, is impacting vulnerable workers.

• Learn the direct and indirect impact of heat exposure on worker health.

• Discover the results of a successful employer-based occupational heat-related illness (HRI) prevention program.
Climate Change and Increased Ambient Temperature
Heat Stress, A Global Phenomenon

In 138 years of NOAA data, 2009 to 2019 was the hottest decade on record.

Higher ambient temperatures

• More air pollution
• Increased UV radiation
• More weather extremes
• Increase in vector-borne diseases
Increased Ambient Temperature

We can expect to see:

• Extended hot seasons
• More days over 90 degrees
• Added heat waves, in both:
  • Duration
  • Frequency
Heat Stress and its Impact on Workers

“Every year, thousands of workers become sick from occupational heat exposure, and some are fatally injured. These illnesses and fatalities are preventable.”

- OSHA
Heat Stress and its Impact on Workers

Heat stress/strain:
heat load >> cooling

Contributors to a high net heat load:
• Environment
• Metabolic heat/physical activity
• Clothing, personal protective equipment (PPE)
• Individual factors

Cooling
Evaporation through sweating is a key moderating factor. But...
• Only a liter an hour of water can be absorbed by drinking
• Sweating is not effective when relative humidity exceeds 75%
# Heat Stress and its Impact on Workers

## Direct Effects of Heat Stress

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><strong>Heat Syncope</strong></td>
<td>Dehydrated or poorly acclimatized individuals develop peripheral vessel dilation, diminished blood flow to the brain, and faint</td>
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<tr>
<td><strong>Heat Cramps</strong></td>
<td>Excessive sweating resulting in muscle cramps or spasms</td>
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<tr>
<td><strong>Heat Exhaustion</strong></td>
<td>Increased core body temperature, decreased cardiac output</td>
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<tr>
<td><strong>Heat Injury</strong></td>
<td>Rhabdomyolysis, acute renal injury, disseminated intravascular coagulation, acute liver failure, increased core body temperature</td>
</tr>
<tr>
<td><strong>Heat Stroke</strong></td>
<td>Multisystem failure, central nervous system dysfunction, high core body temperature</td>
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</tbody>
</table>
Heat stroke is a medical emergency.

- Body can no longer regulate temperature
- Any delay in treatment increases risk of permanent illness and death
Heat Stress and its Impact on Workers
Other Health Effects of Heat Stress

- **Exacerbation of co-morbidities**: Cardiovascular, renal, pulmonary disease and diabetes
- **Mental health**: Aggression, anxiety, depression, exacerbation of mental illness
- **Renal disease**: Acute renal injury, renal failure, chronic kidney disease

Heat Stress and its Impact on Workers
Indirect Effects of Heat Stress

The effects of heat stress impact the entire company through:

- Dizziness
- Sweaty palms
- Fogged safety glasses
- Slowed reaction time
- Distracted by discomfort
- Agitation
- Fatigue
- Cognitive impairment
- Heat related illness and fatalities
- Exacerbation of co-morbidities
- Higher incidence of burns
- Accidents
Heat Stress: Risk Factors
Heat Stress: Risk Factors
Thermal Environment

• Air temperature
• Humidity
• Air movement
• Radiant heat from the sun and other sources
Heat Stress: Risk Factors
Job Specific

Work Demands
• Duration of heat exposure
• Physical requirements
• New workers and workers returning from extended absence

PPE & Clothing Requirements
• Respirators
• Impermeable PPE
• Uniforms

Heat Stress: Risk Factors

Individual

- Age
- Obesity
- Prior HRI
- Pregnant women
- Co-morbidities: heart disease, diabetes, lung disease and kidney disease
- Poor physical fitness
- Alcohol or drugs
- Medications
- Acute illnesses causing dehydration
- Skin conditions

Heat Stress Prevention Programs
Heat Stress Prevention Program
Hierarchy of Controls

- Engineering controls
  - Cool the environment
- Administrative controls
  - Water, rest periods
  - Acclimatization program
  - Training
  - First aid and emergency response procedures
  - Buddy system
- Medical monitoring and surveillance
- Thermal considerations for PPE and clothing
Heat Stress Prevention Program
Engineering Controls

Engineering Controls
• Air conditioning/shade
• Ventilation
• Cooling fans
• Reflective shields

“Employers’ failure to support acclimatization appears to be the most common deficiency and the factor most clearly associated with death.”
Heat Stress Prevention Program
NIOSH’s Recommended Acclimatization Plan

**Gradual Exposure to Heat**
Increase exposure time in hot environmental conditions over a 7-14 day period depending on environmental and individual risk factors.

For new workers, no more than 20% on day 1 and no more than 20% increase on each additional day.
Heat Stress Prevention Program
Heat Acclimation Physiology

- 2 hours/day of heat exposure needed
- Sweating: earlier onset, greater production and lower electrolyte concentration
- Stabilization of circulation
- Decreased heart rate, lower core temperature with activity

OSHA-NIOSH Heat Safety Tool

The OSHA-NIOSH Heat Safety Tool is an application designed to help workers in hot environments by calculating the heat index and providing real-time updates on heat-related conditions. The tool uses current temperature and humidity data to determine the heat index, which takes into account the combined effect of temperature and humidity. This helps in assessing the risk of heat-related illnesses and providing recommendations for workplace safety.

Key features of the OSHA-NIOSH Heat Safety Tool include:

- **Heat Index**: Calculates the apparent temperature in the environment, considering both temperature and humidity.
- **Hourly Index**: Provides a daily heat index forecast for different hours of the day.
- **Precautions**: Offers guidelines for workers to protect themselves from heat-related illnesses.
- **First Aid**: Informs about signs and symptoms of Heat Stroke and Heat Exhaustion, along with appropriate first aid measures.

The tool is available on both iOS and Android platforms, making it accessible to a wide range of users. It is an essential tool for workplaces, particularly in industries where employees are exposed to high temperatures and humidity, such as construction, agriculture, and transportation.

**Precautions**

- **Heat Stroke**: Symptoms include:
  - High body temperature (104°F or higher).
  - Rapid breathing, rapid heartbeat.
  - Confusion, dizziness, or unusual behavior.
- **Heat Exhaustion**: Symptoms include:
  - Dehydration,
  - Weakness, cold clammy skin,
  - Heavy sweating,
  - Faintness, nausea.

**First Aid**

- Keep the person cool by:
  - Removing excess clothing,
  - Sponging with cool water,
  - Fan cooling air over the person.
- If the person is unable to cool down, move them to a cooler environment.
- If the person is unable to cool down, begin CPR if trained.

**Watching Out for Heat-related Illness**

- Check for heat-related illness in coworkers.
- If possible, provide shade and water.
- Take frequent breaks in cooler locations.
- Use fans or cooling systems.
- Provide shade for workers.
- Drink plenty of water and cool drinks.
- Avoid strenuous activity during heat waves.

This tool is a valuable resource for employers to ensure the safety of their employees working in hot environments, helping to prevent heat-related illnesses and injuries.
Heat Stress Prevention Program
Personal Protective Equipment and Clothing

Preventive PPE considerations:
• Water-cooled garments
• Air-cooled garments
• Cooling vests
• Wetted overgarments

Clothing recommendations:
• Loose fitting
• Light colored
• Light-weight
• Long sleeved
  • Sun protection
  • Environment > body temperatures
Heat Stress Prevention Program
Medical Monitoring and Surveillance

Goals:
• Early identification of risk factors that may increase the risk of heat-related illness and signs or symptoms that may be related to heat-related illness for the prevention of adverse outcomes

Medical Opinion:
• Whether the worker has any medical conditions that would increase the health risk of exposure to heat in the work environment.
• Whether the worker is physically fit for the work required by the job
• Recommendations for reducing the worker’s risk for heat-related illness
Impact of a Heat-related Illness Prevention Program

Outcomes of a Heat Stress Awareness Program on Heat-Related Illness in Outdoor Municipal Workers

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Impact of a Heat-related Illness Prevention Program
Outcomes of Heat Stress Awareness Program

Based on exposed workers’ responses to questionnaire screening for heat-related illness risk factors

All workers and workers with no identified increased risk:
• Training: heat stress prevention, HRI first aid, emergency response procedures
• Acclimatization plan

Workers at higher risk for heat illness:
• Medical monitoring with RN and/or,
• Medical monitoring exam with physician
• Individualized HRI prevention training

Workers at highest risk to self or others in hot environment:
Restricted from work in hot environments
• Requested health condition addressed by personal physician/specialist
• Once at-risk condition controlled, acclimatization plan to return to work
• Periodic rechecks through hot season offered

Median Costs per Illness: Before and After

Median cost incurred per illness reduced by 50% after program implemented compared to the prior 2 years $p=.0009$

Impact of a Heat-related Illness Prevention Program
Heat-related Illnesses: Before & After Heat Stress Awareness Program*

Heat-related Illness/1000 population

Year
Heat-Related Illness/1000 population

27 24 30 15 18 15 3 0 0

HSAP* introduced

Key Takeaways

• Heat-related illnesses and fatalities are preventable.
• Research supports heat illness prevention programs’ effectiveness in reducing heat-related illness and associated workers’ compensation costs.
• Prepare now to address heat exposure to preserve the health and safety of your vulnerable patients.
Resources

Mental Health

www.climatepsychiatry.org/toolkits

- educational material for mental health providers about heat impacts focusing particularly on our psychiatric population
- guidelines/tips for patients or family/caregivers during extreme heat.

CDC/NIOSH

https://www.cdc.gov/niosh/topics/heatstress/

OSHA

http://www.osha.gov/dts/osta/otm/otm_iii/otm_iii_4.html
https://www.osha.gov/SLTC/heatillness/heat_index/pdfs/all_in_one.pdf
Thank you!