

# Heat related Injury and Illness



GREAT LAKES CENTER FOR  
**FARMWORKER**  
HEALTH AND WELLBEING

**I** ILLINOIS

**UIC** UNIVERSITY OF  
ILLINOIS CHICAGO

Illinois Extension

farmdoc

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# Acknowledgement

*The University of Illinois at Chicago stands on the original homelands of the Miami, Three Fire Peoples - the Bodewadmi, Ojibwe, and Odawa, who have been stewards of this land for generations. Illinois is also home to a diverse Native community of more than 75,000 tribal citizens, many of whom live in the Chicago area.*





## HEALTH

# Poor regulatory safeguards leave farmworkers suffocating in the face of increasing heat waves

Mónica Cordero, Investigate Midwest, and Eva Tesfaye, Harvest Public Media

Associated Press

Published 6:03 a.m. CT Aug. 25, 2023 | Updated 6:05 a.m. CT Aug. 25, 2023

Juan Peña, 28, has worked in the fields since childhood, often exposing his body to extreme heat like the wave hitting the Midwest this week.

The heat can cause such deep pain in his whole body that he just wants to lie down, he said. It sucks his desire to work, as his body tells him he can't take another hot day on the job. On those days, his only motivation to get out of bed is to earn dollars to send to his 10-month-old baby in Mexico.

Farmworkers, such as Peña and the crew he leads in Iowa, are unprotected against heat-related illnesses. They are 35 times more likely to die from heat exposure than workers in other sectors, according to the [National Institutes of Health](#), and the



Juan Peña (seated at left) takes a break with other farmworkers in a field in southeastern Iowa on July 20. Their crew leader (standing) said summers have gotten hotter over the years. *Sky Chadde, Investigate Midwest*

# The Hidden Toll of Agriculture

## *Farmworkers' Struggle with Heat Stress and Inadequate Safeguards*

- Farmworkers are especially vulnerable to heat stress due to the strenuous nature of their work, performed primarily outdoors, with a high workload, long duration of work
- They are induced to work under duress
  - Often paid by the pound rather than by the hour (aka Piece-rate),
  - Low job decision latitude
  - Poor safety climate
- No federal OSHA heat standard (only a few states have one)



# Contents

- Climate
- Heat related Injury (HRI)
  - How do you identify and treat?
  - How Bad is it?
- How do you prevent it?



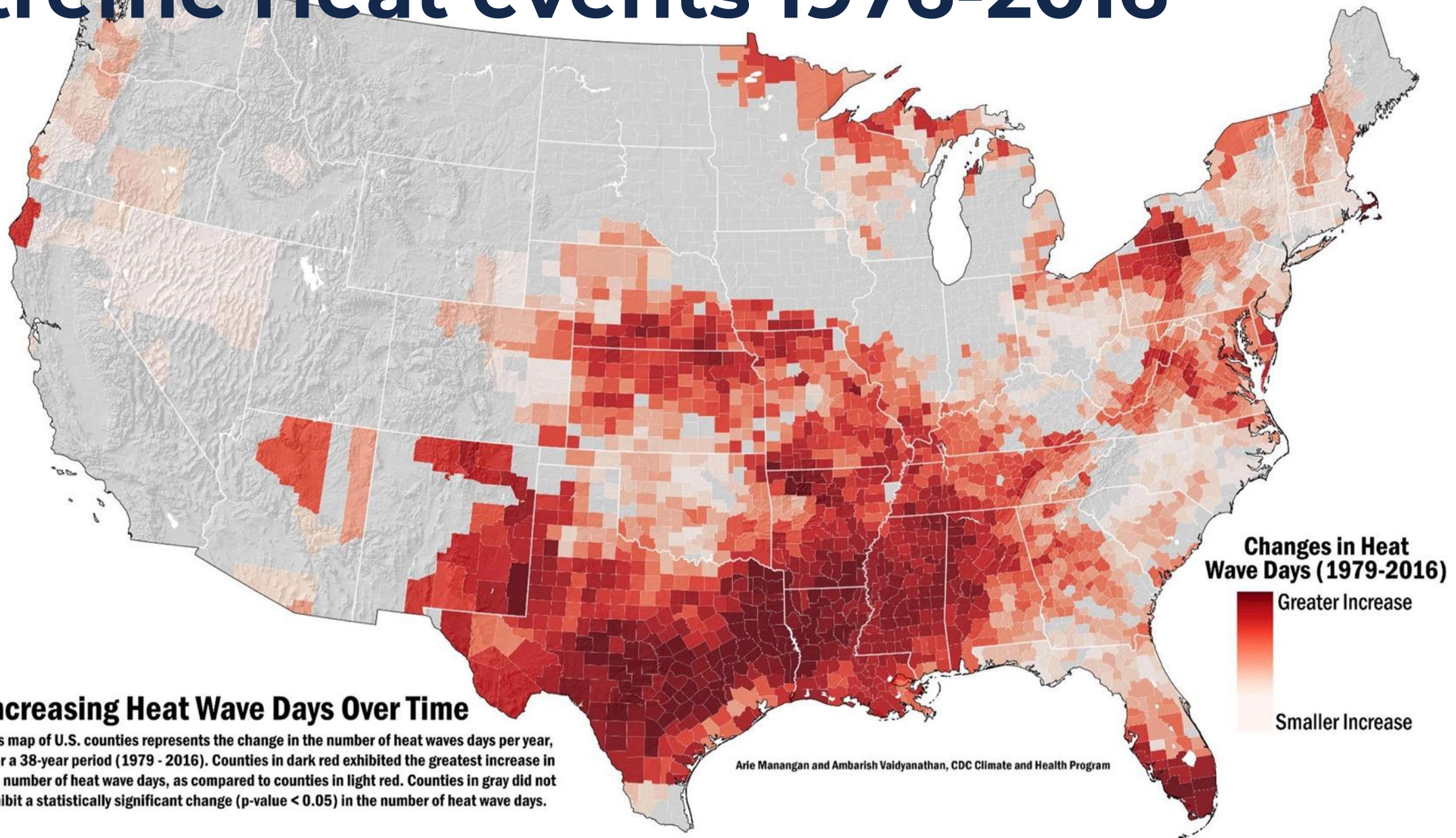


# Climate





# Extreme Heat events 1976-2016



## Increasing Heat Wave Days Over Time

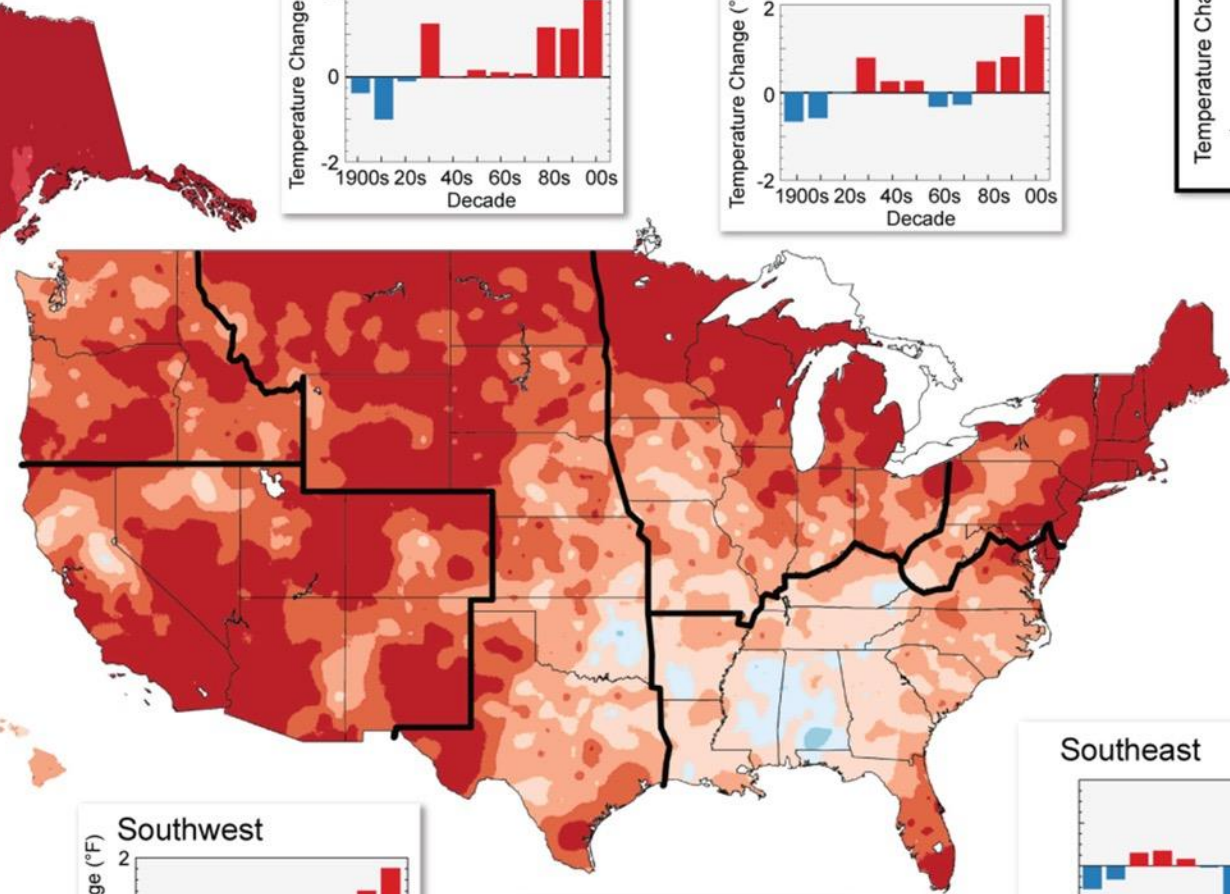
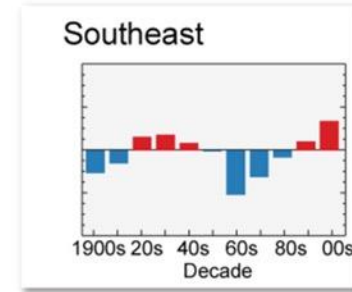
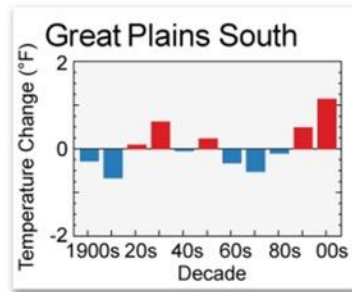
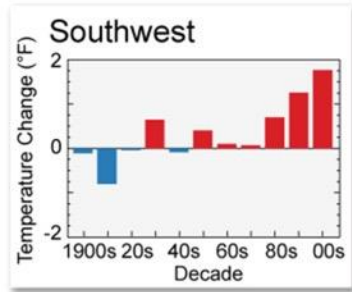
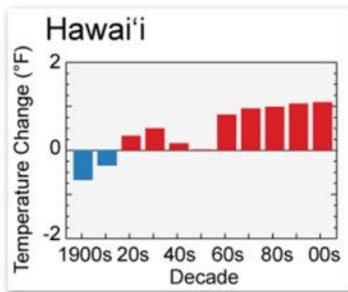
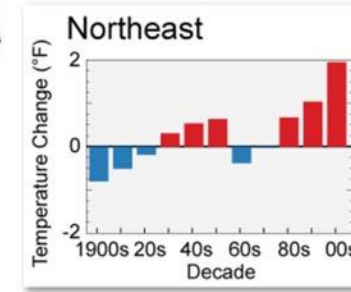
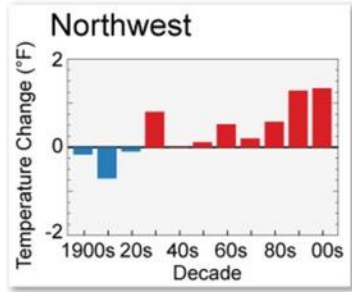
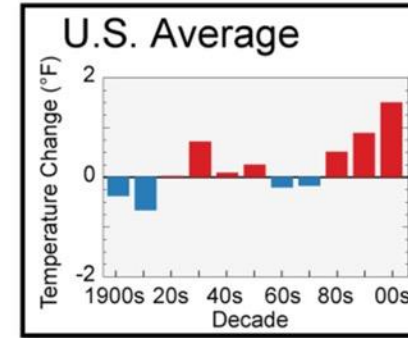
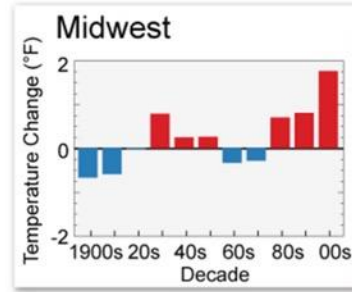
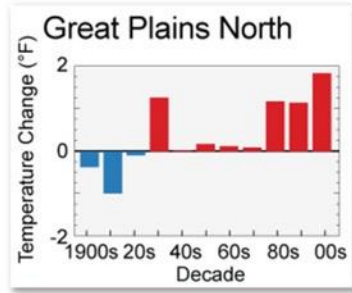
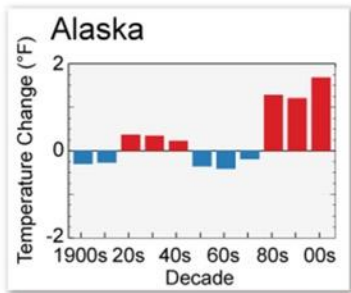
This map of U.S. counties represents the change in the number of heat waves days per year, over a 38-year period (1979 - 2016). Counties in dark red exhibited the greatest increase in the number of heat wave days, as compared to counties in light red. Counties in gray did not exhibit a statistically significant change (p-value < 0.05) in the number of heat wave days.

Arie Manangan and Ambarish Vaidyanathan, CDC Climate and Health Program

<https://storymaps.arcgis.com/stories/8654cd23dc114cabbf8abaa7f00ffb>



# Observed US temperature change



| Temperature Change (°F) |              |
|-------------------------|--------------|
|                         | > 1.5        |
|                         | 1.0 to 1.5   |
|                         | 0.5 to 1.0   |
|                         | 0.0 to 1.0   |
|                         | -0.5 to 0.0  |
|                         | -1.0 to -0.5 |
|                         | -1.5 to -1.0 |
|                         | < -1.5       |

[ncics.org/report-landing-page/nca3-data](http://ncics.org/report-landing-page/nca3-data)



# Climate Change will make farmworkers' risk of heat stress worse

- Heat waves and increased temperatures
- Air pollutants
- UV radiation
- Extreme weather events
- Vector-borne and zoonotic disease

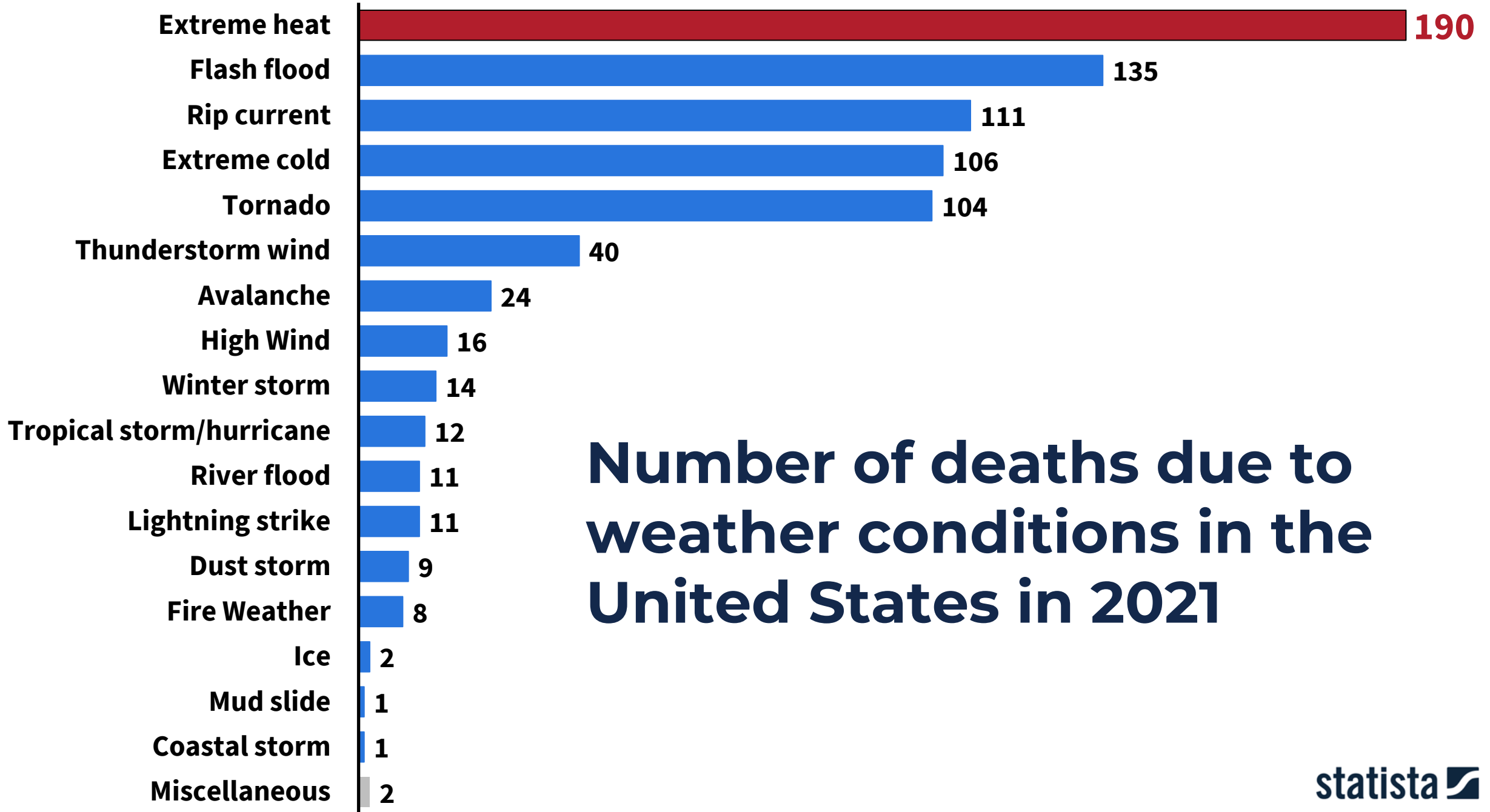




# Illinois changes in Ambient temperature

- 2022: Third warmest summer (June-August) on record for the U.S.
- Illinois: Past decade (2010-2019) vs. prior four decades (1970-2009)
  - 4%+ increase in summer days with max temperatures over 76°F





# Number of deaths due to weather conditions in the United States in 2021

Source(s): National Oceanic and Atmospheric Administration; US National Weather Service



# Heat Related Illness

*How do we Identify  
and treat it*



# Heat Illness



**Heat  
Rash**



**Heat  
Cramps**



**Heat  
Syncope**



**Heat  
Exhaustion**



**Heat  
Stroke**



# Heat Rash

*Also known as miliaria or prickly heat, is a skin condition caused by blocked sweat ducts*

- Cluster red bumps
- Neck, chest, folds skin
- Risk factors include:
  - Overheating
  - excessive sweating
  - wearing tight or non-breathable clothing





# Heat Rash

*Self limiting illness*

1. Stop activity and allow skin to dry
2. Increase fluid intake
3. Good personal hygiene
4. See doctor if persists, signs of infection



# Heat Cramps

- Painful spasm of muscles from work
- Due to salt (Na) deficiency
- Onset during or after work





# Heat Cramps

## *Self limiting illness*

1. Have worker rest in shady, cool area
2. Drink water or other cool beverages
3. Wait a few hours before allowing returning to strenuous work
4. Seek medical attention if cramps don't go away

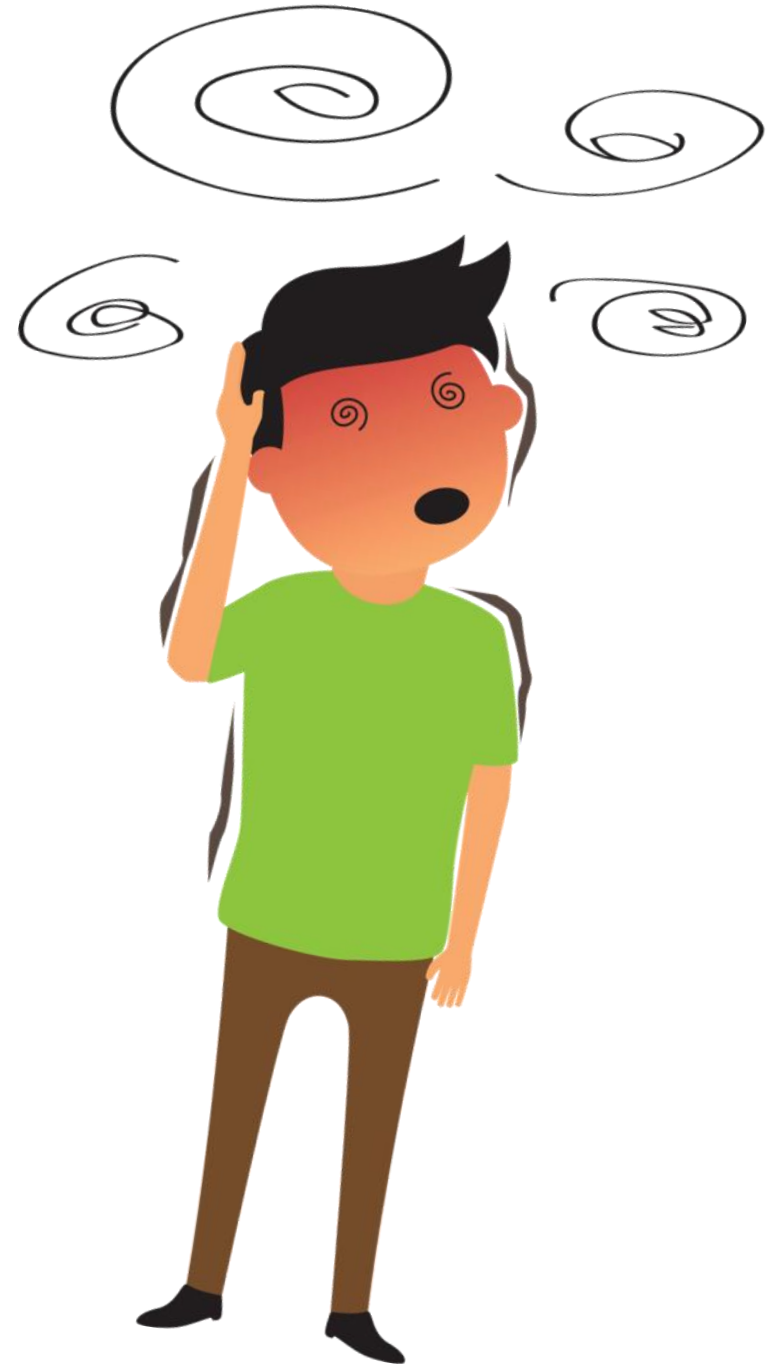




# Heat Syncope

*Fainting when standing up*










- “Tank” (blood volume) is low
- Blood pools in dilated blood vessels
- Drains fluid from brain





# Heat Exhaustion

- Medical Illness
- Fever
- Non-specific symptoms
  - Cool, pale, clammy skin
  - Stomach nausea or vomiting
  - Faint or dizzy

| HEAT EXHAUSTION   | OR  | HEAT STROKE  |
|---|---|--|
| Faint or dizzy  |  | Throbbing headache, confusion  |
| Excessive sweating  |  | No sweating  |
|  Cool, pale, clammy skin   |   | Body temperature above 103°<br>Red, hot, dry skin   |
| Nausea or vomiting  |  | Nausea or vomiting   |
| Rapid, weak pulse    |   | Rapid, strong pulse   |
| Muscle cramps    |   | May lose consciousness    |
| <ul style="list-style-type: none"><li>• Get to a cooler, air conditioned place</li><li>• Drink water if fully conscious</li><li>• Take a cool shower or use cold compresses</li></ul> |   | <b>CALL 9-1-1</b> <ul style="list-style-type: none"><li>• Move person to cooler place</li><li>• Cool using cool cloths or bath</li><li>• Do not give anything to drink</li></ul> |

# Heat Exhaustion

*Get your workers temperature down*

1. Get into a cool area
2. Lie down, feet elevated
3. Soaked towels, ice packs
4. Drink water (max 1.5L in 1 hour)
5. >30 minutes seek medical review

**HEAT EXHAUSTION**

Faint or dizzy —————

Excessive sweating —————

Cool, pale, clammy skin

Nausea or vomiting —————

Rapid, weak pulse —————

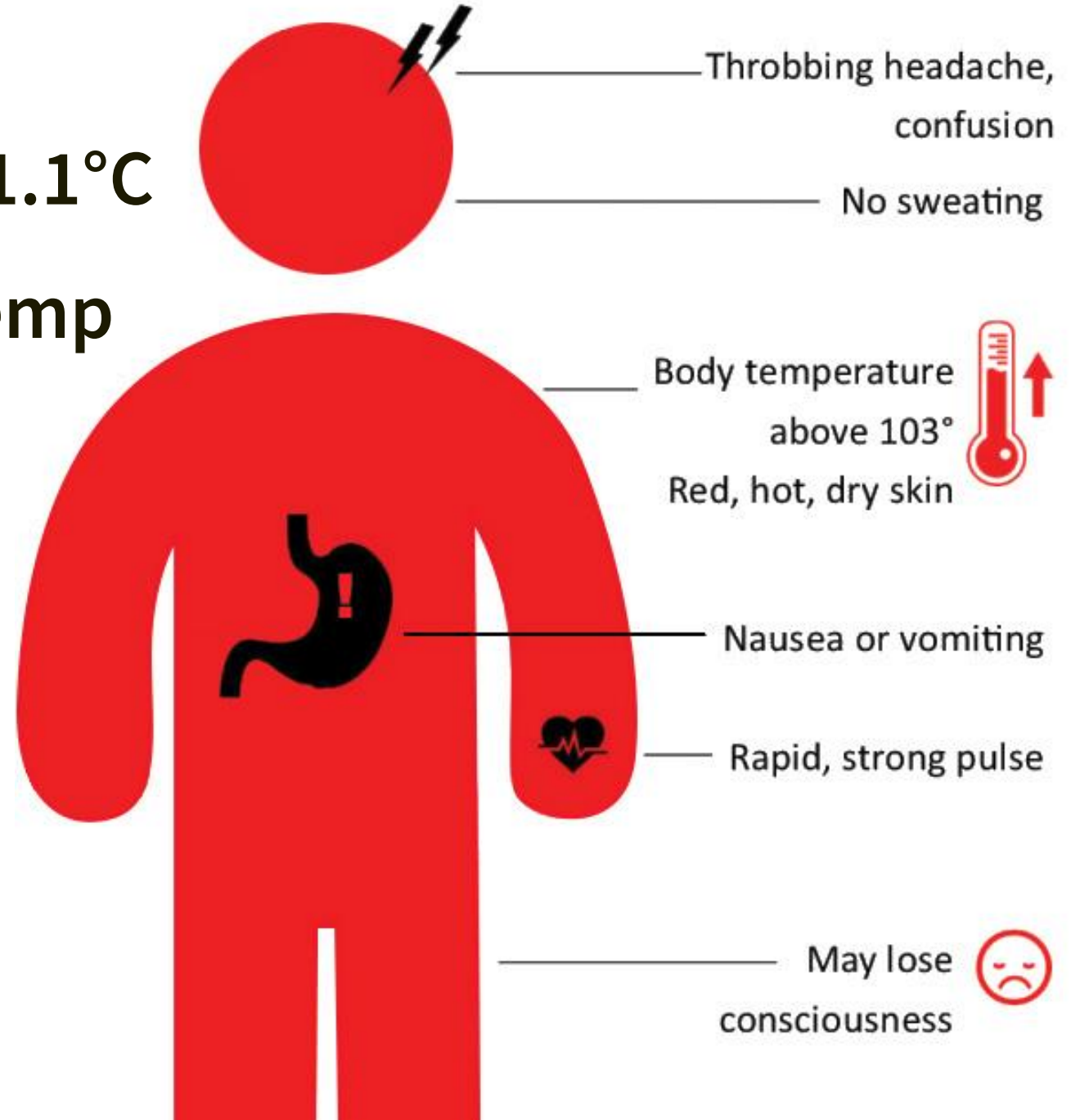
Muscle cramps —————

- Get to a cooler, air conditioned place
- Drink water if fully conscious
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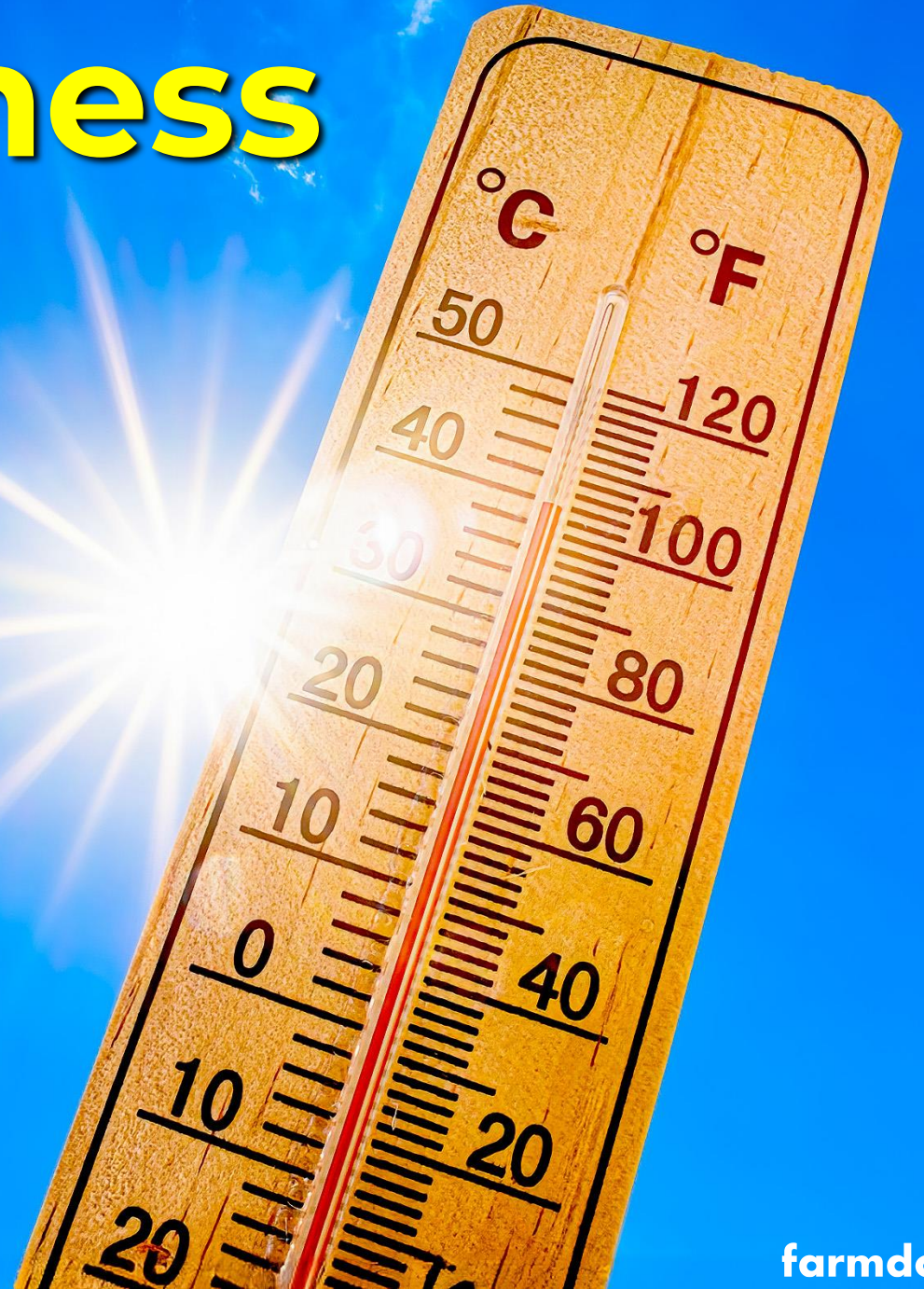
# Heat Stroke

- Core temp near 106°F or 41.1°C
- Unable to regulate body temp & failure of sweating
- **Symptoms**
  - Confusion
  - Loss of consciousness
  - Seizures
  - Skin red, hot & dry
  - Hyperventilation common



# Heat related illness

*How bad is it?*





# NC farm fined \$187,500 for labor violations after death of worker

WFAE | By Lisa Worf

Published March 12, 2024 at 7:41 AM EDT



|| LISTEN • 1:26



David Boraks / WFAE

- The farm only scheduled one five-minute break for the six-hour day.
- Shaded or cool areas were not provided for during those breaks. Breaks were taken inside of a hot bus that had no air-conditioning and was often parked in a field with direct sunlight.
- While a 10-gallon cooler was available, there were no cups, so employees had to place their head under the spigot to drink.
- There was no protocol for administering first aid or calling emergency responders for workers with signs of heat-related illness.

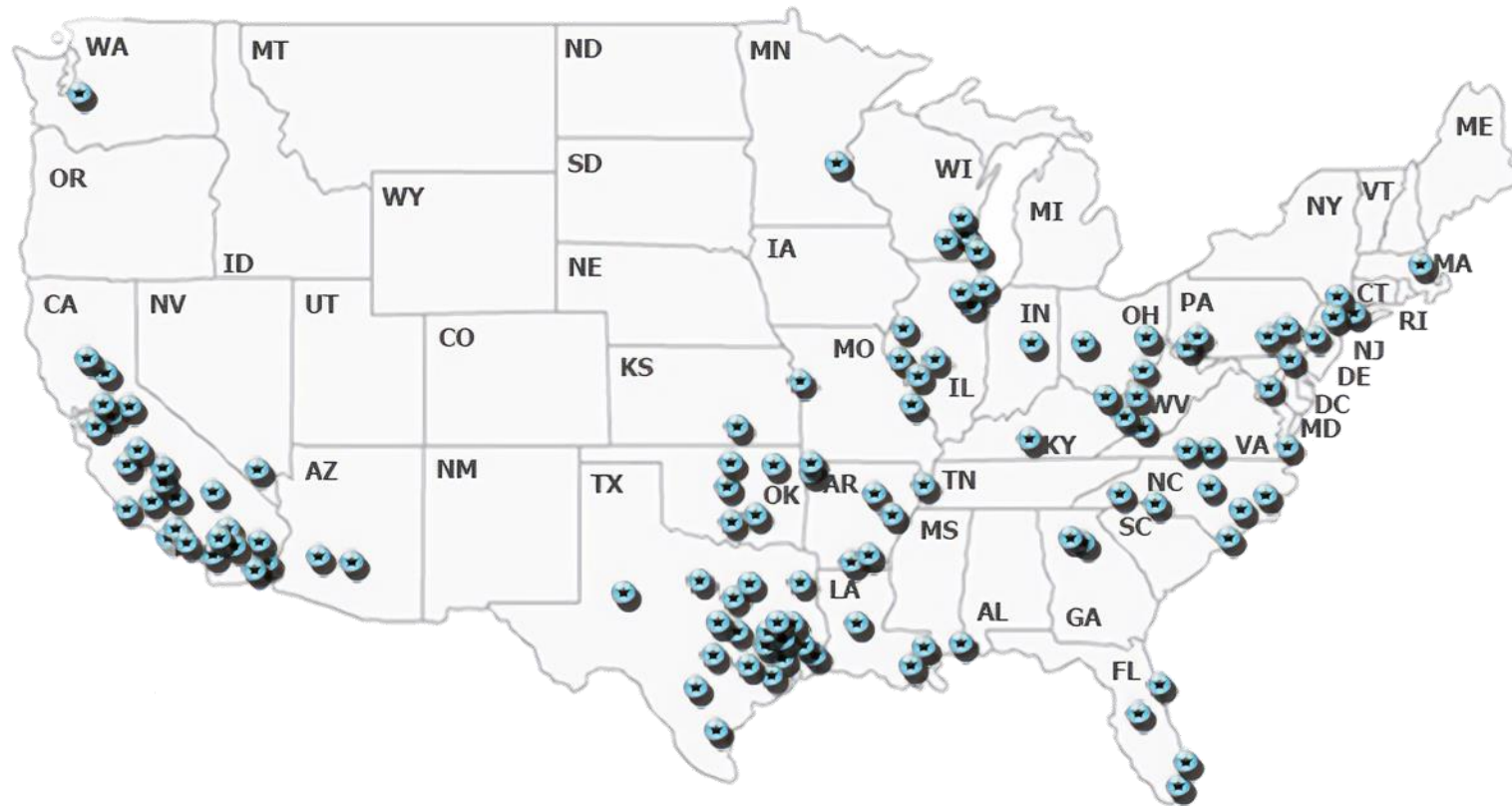
# Frequent patterns in heat related death investigations

- Colleagues nearby **FAILED** to recognize the signs of heat-related illness
- Workers working alone, failed to recognize symptoms or call for help
- Lack of coordination between parties responsible for workers safety
- Need for systems to identify when a worker is suffering heat related illness (and allow them to seek assistance if isolated)
- The need to schedule work to avoid the hottest times of the day or season of the year





# Heat-related fatalities in outdoor workers, 2008-14



**2004–2018, U.S.**

**702 heat-related  
deaths /yr**

- 415 with heat as the underlying cause
- 287 as a contributing cause occurred in the United States annually.

# The Heat Index

Relative Humidity (%)

| °F  | 40  | 45  | 50  | 55  | 60  | 65  | 70  | 75  | 80  | 85  | 90  | 95  | 100 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 110 | 136 |     |     |     |     |     |     |     |     |     |     |     |     |
| 108 | 130 | 137 |     |     |     |     |     |     |     |     |     |     |     |
| 106 | 124 | 130 | 137 |     |     |     |     |     |     |     |     |     |     |
| 104 | 119 | 124 | 131 | 137 |     |     |     |     |     |     |     |     |     |
| 102 | 114 | 119 | 124 | 130 | 137 |     |     |     |     |     |     |     |     |
| 100 | 109 | 114 | 118 | 124 | 129 | 136 |     |     |     |     |     |     |     |
| 98  | 105 | 109 | 113 | 117 | 123 | 128 | 134 |     |     |     |     |     |     |
| 96  | 101 | 104 | 108 | 112 | 116 | 121 | 126 | 132 |     |     |     |     |     |
| 94  | 97  | 100 | 103 | 106 | 110 | 114 | 119 | 124 | 129 | 135 |     |     |     |
| 92  | 94  | 96  | 99  | 101 | 105 | 108 | 112 | 116 | 121 | 126 | 131 |     |     |
| 90  | 91  | 93  | 95  | 97  | 100 | 103 | 106 | 109 | 113 | 117 | 122 | 127 | 132 |
| 88  | 88  | 89  | 91  | 93  | 95  | 98  | 100 | 103 | 106 | 110 | 113 | 117 | 121 |
| 86  | 85  | 87  | 88  | 89  | 91  | 93  | 95  | 97  | 100 | 102 | 105 | 108 | 112 |
| 84  | 83  | 84  | 85  | 86  | 88  | 89  | 90  | 92  | 94  | 96  | 98  | 100 | 103 |
| 82  | 81  | 82  | 83  | 84  | 84  | 85  | 86  | 88  | 89  | 90  | 91  | 93  | 95  |
| 80  | 80  | 80  | 81  | 81  | 82  | 82  | 83  | 84  | 84  | 85  | 86  | 86  | 87  |

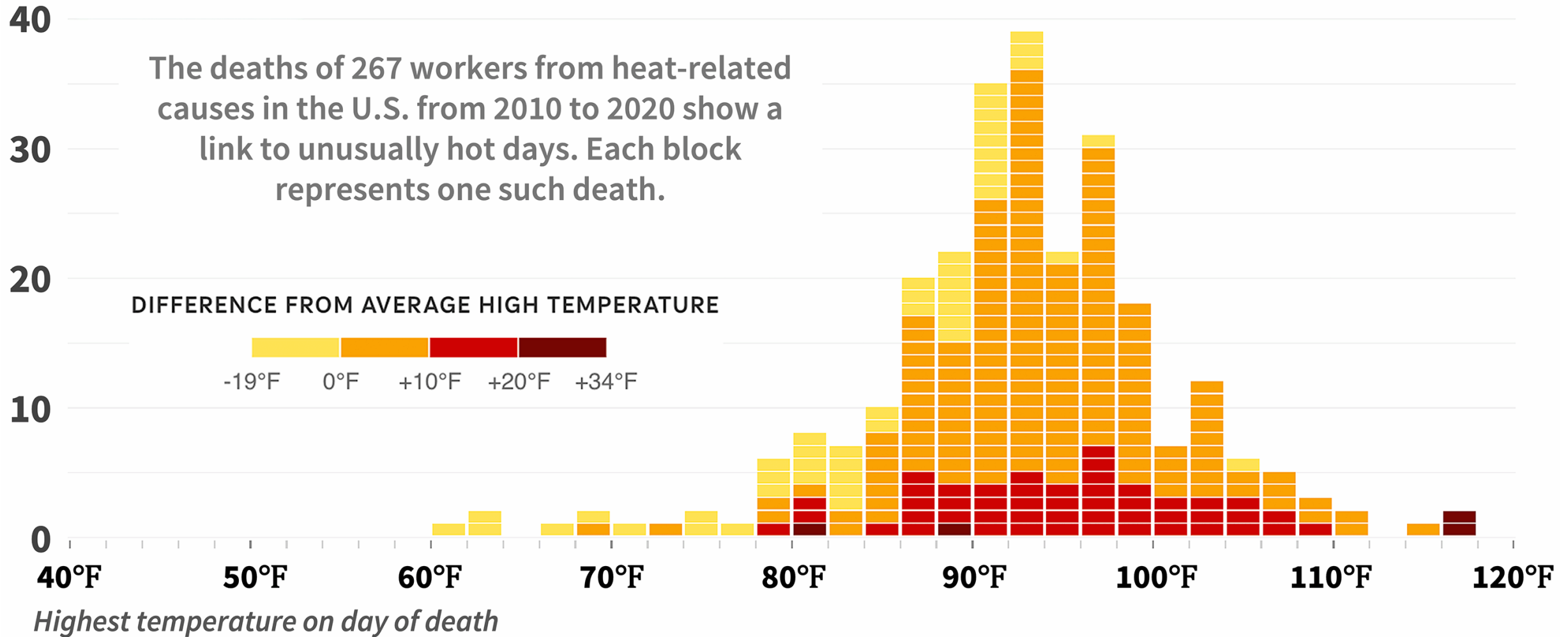
Heat Index  
(Apparent  
Temperature)

Air Temperature

| <b>With Prolong Exposure and/or Physical Activity</b> |  | <b>% of Work-related deaths</b> |
|---|--|---------------------------------|
| <b>Extreme Danger</b>                                 | <b>Heat stroke or sunstroke highly likely</b>                    | <b>1%</b>                       |
| <b>Danger</b>   | <b>Sunstroke, muscle cramps, and/or heat exhaustion likely</b>   | <b>27%</b>                      |
| <b>Extreme Caution</b>                                | <b>Sunstroke, muscle cramps, and/or heat exhaustion possible</b> | <b>47%</b>                      |
| <b>Caution</b>  | <b>Fatigue possible</b>  | <b>20%</b>                      |
| <b>No Danger</b>                                      |  | <b>5%</b>                       |



# Most Heat-Related Worker Deaths Happened On 90°F Plus, Hotter-Than-Average Days



Source: U.S. Occupational Safety and Health Administration and PRISM Climate Group

Credit: Data analysis by Robert Benincasa/NPR, Cascade Tuholske and David Nickerson/Columbia University. Graphic by Duy Nguyen and Ruth Talbot/NPR.

# When are new workers most vulnerable to heat-related deaths?

**~50%**

occur on a worker's

**1<sup>st</sup> day**

on the job  
(Arbury 2014)

**>70%**

occur on a worker's

**1<sup>st</sup> week**

on the job  
(Tustin 2018)



# Hired migrant and seasonal farmworkers

- ~2.5 million in the US

  - 55,000 in Illinois

- 80% in crops  
20% in livestock

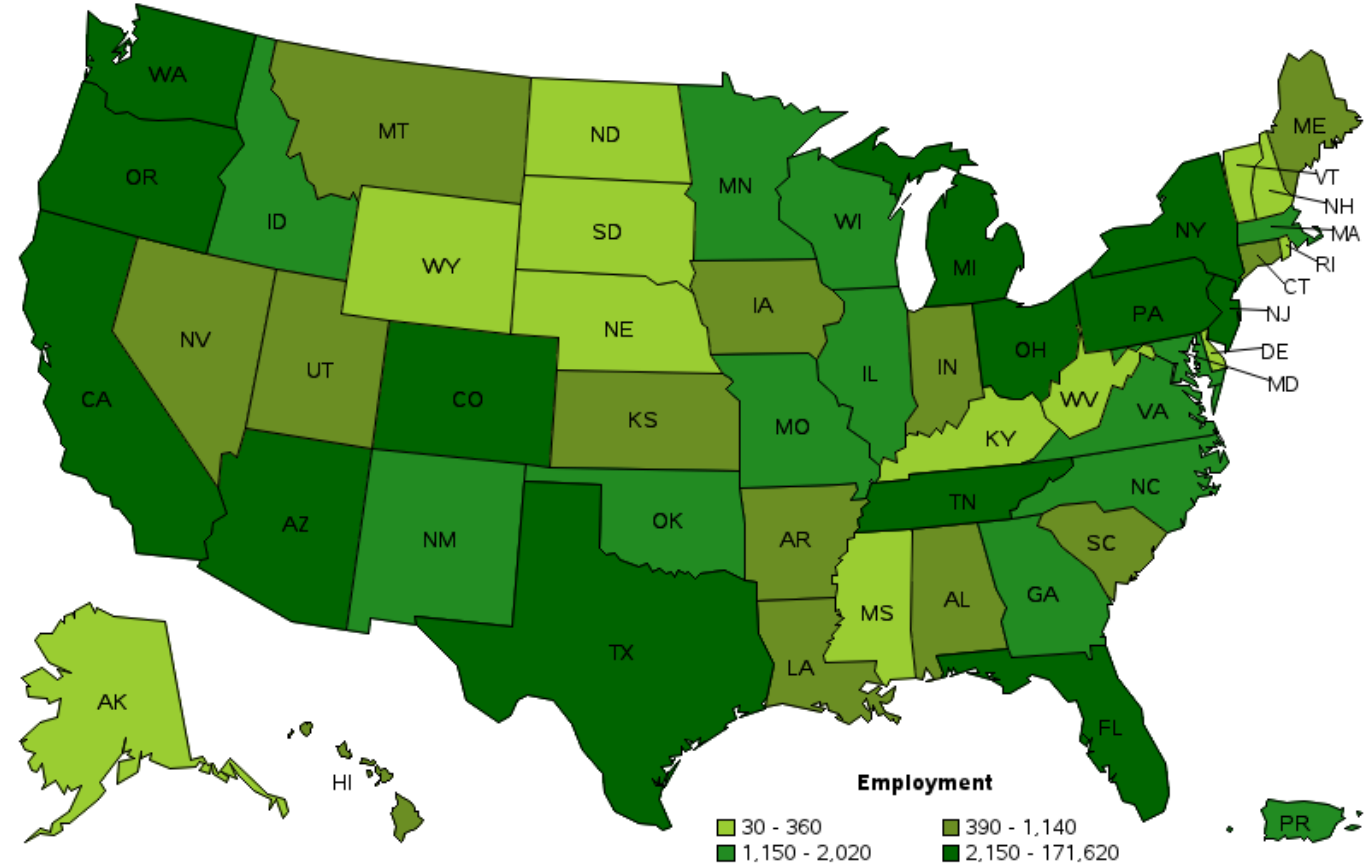
- 26% women

- Mean age: 40s

- Majority foreign born,  
Spanish speaking

- ~50% lack legal status/work authorization

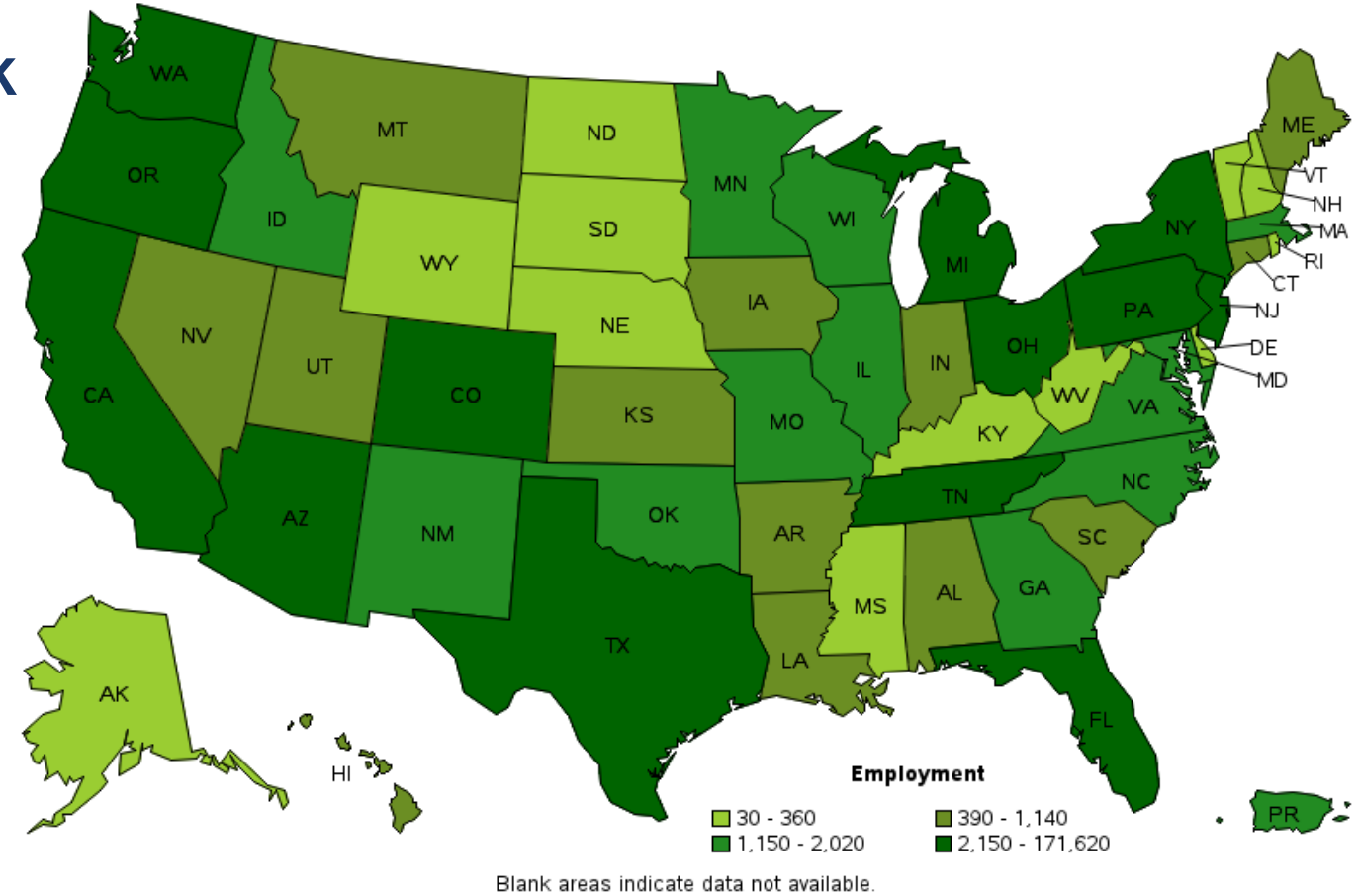
Employment of farmworkers and laborers, crop, nursery, and greenhouse by state, May 2023



# Hired migrant and seasonal farmworkers

- 80% settled in the U.S.
  - 10% travel >75miles for work
- 5-10% follow the crop (South to North)
- ~3-10% crosses the US border to work
  - H2A visa holders brought to work in Ag during summer in Illinois

Employment of farmworkers and laborers, crop, nursery, and greenhouse by state, May 2023





# How bad is heat stress among farmworkers?

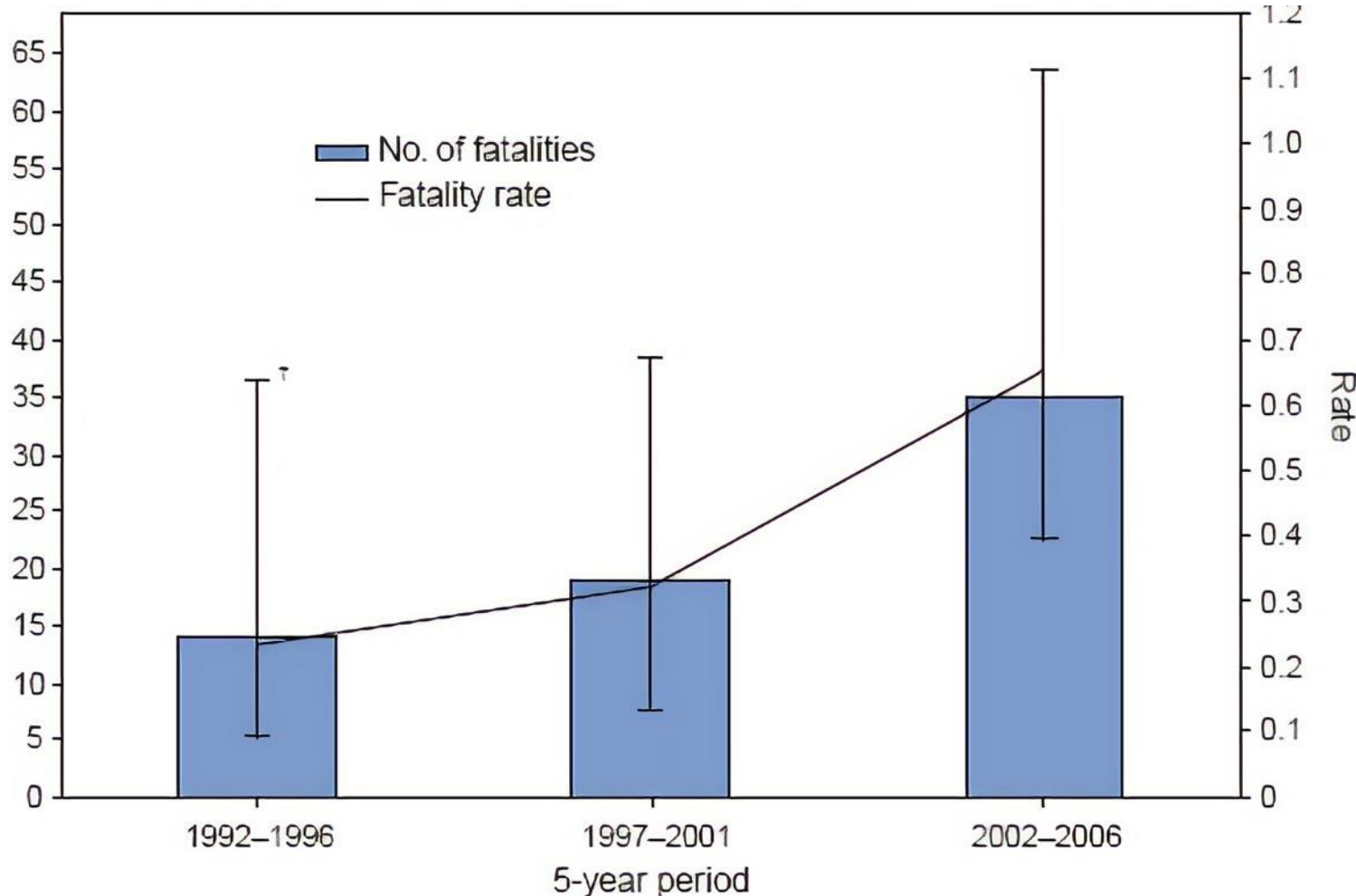
Heat-related illnesses and injuries are underreported

- Regulation exemptions
- Many farmworkers are employed temporarily
- Language and cultural barriers



# How bad is heat stress among farmworkers?

## Number and rate\* of heat-related deaths among crop workers, by 5-year period - United States, 1992 -2006



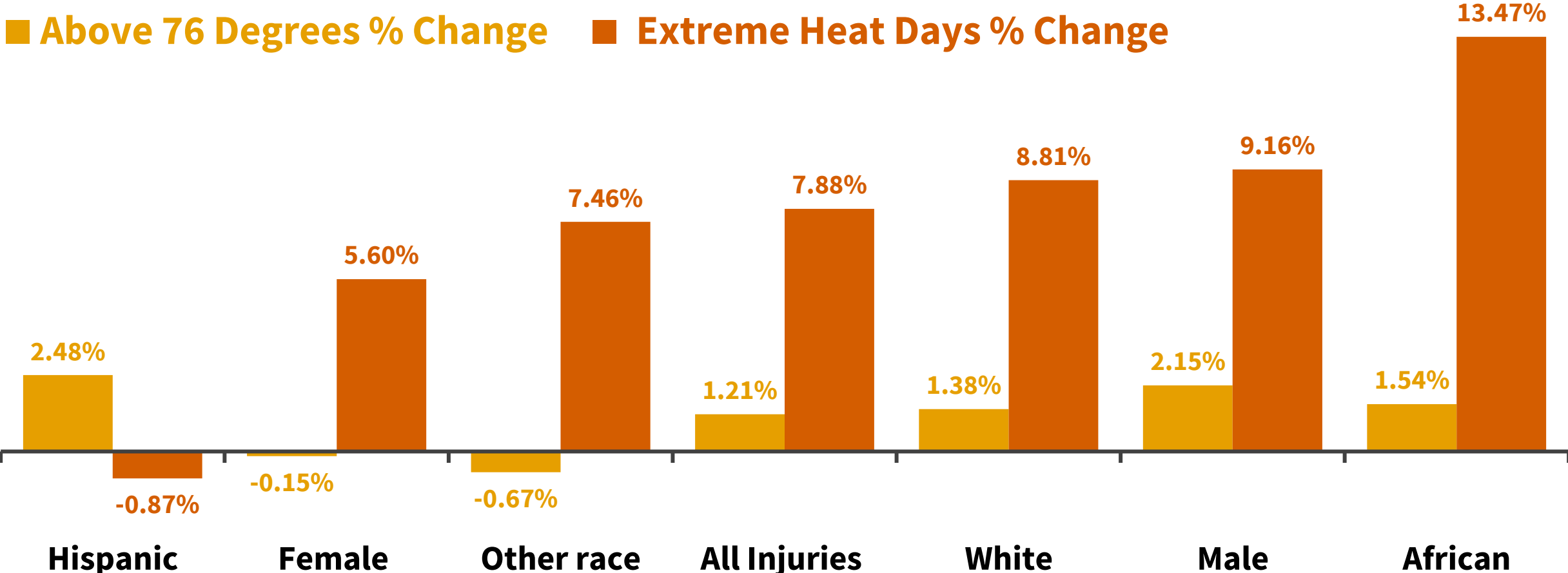
\* Per 100,000 workers. Rates calculated using annual national average estimates of employed civilians aged  $\geq 15$  years based on the Current Population Survey

95% confidence interval for fatality rate.



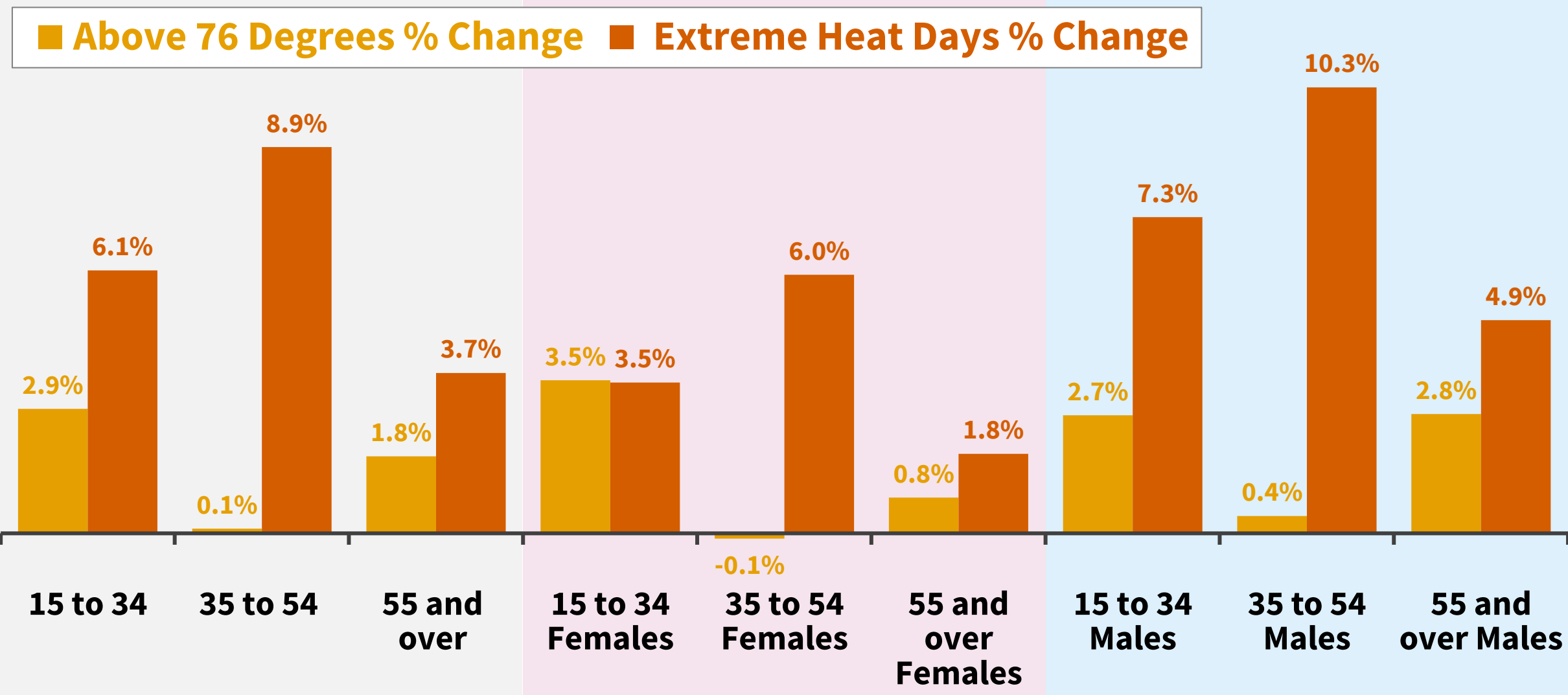
# Using statistical models to estimate the increase in hospital visits for various injury types during hot summer days and extreme heat days in Illinois from 2017 to 2022.

■ Above 76 Degrees % Change   ■ Extreme Heat Days % Change

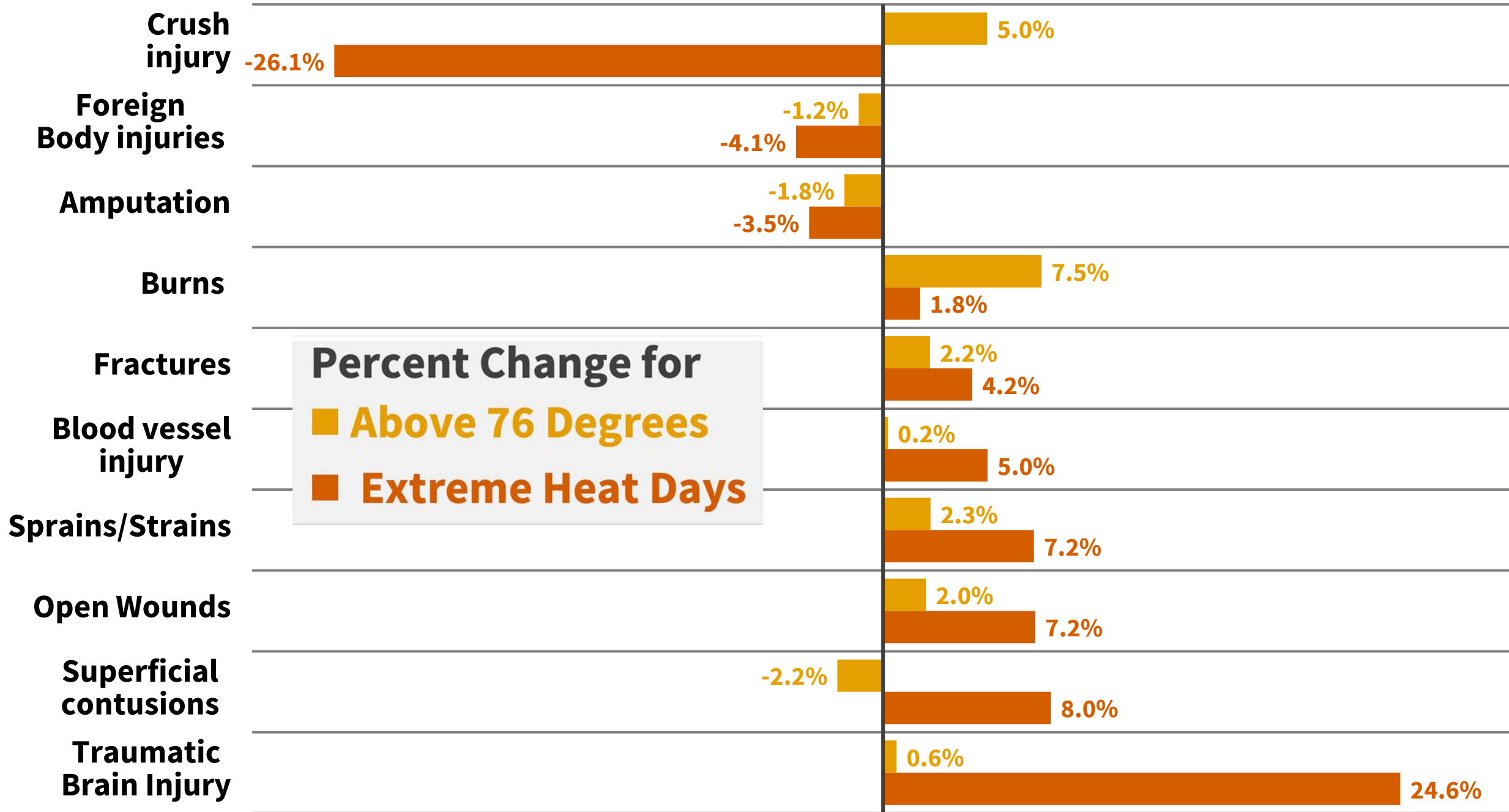


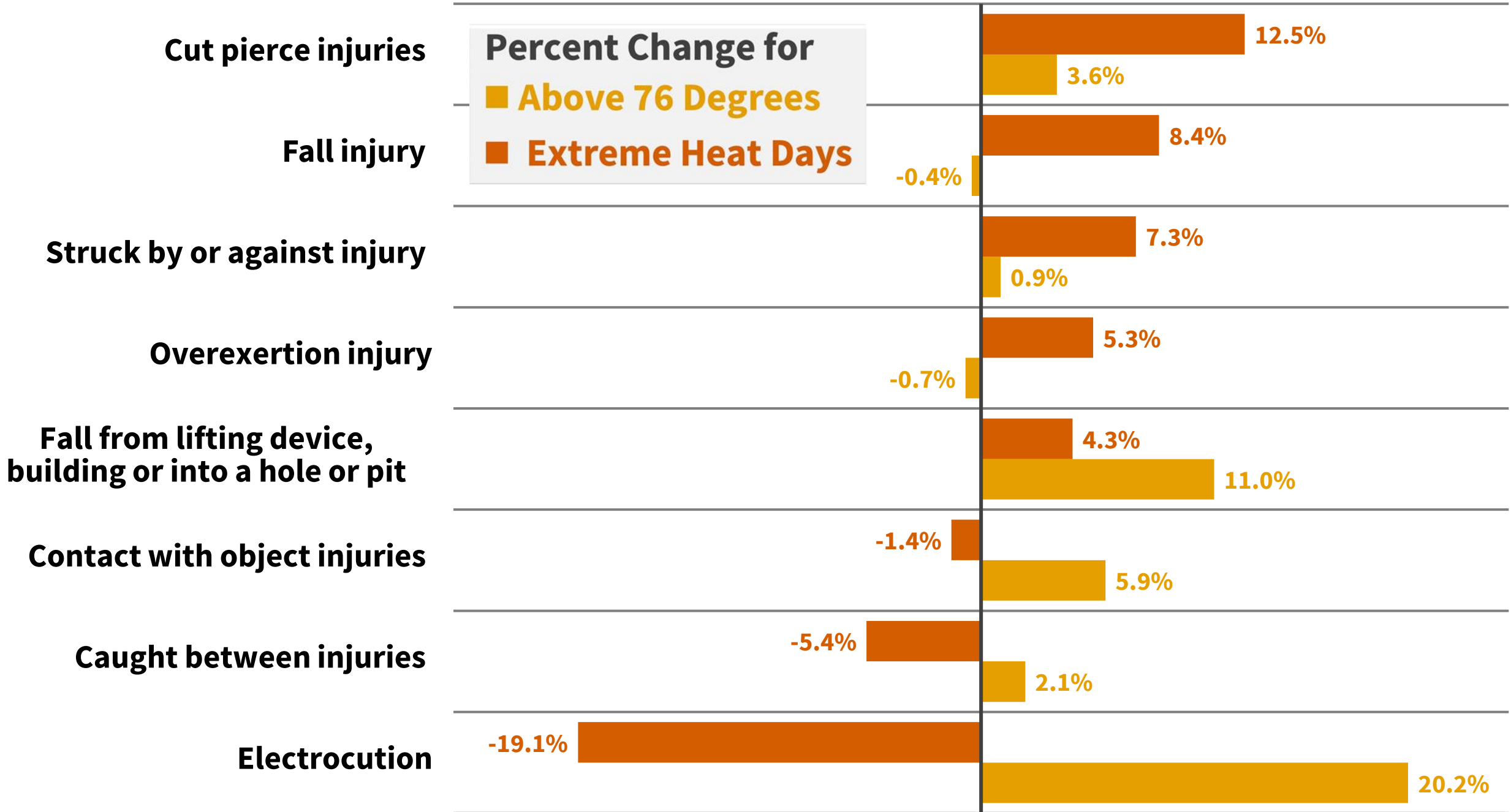
African American

# Using statistical models to estimate the increase in hospital visits for various injury types during hot summer days and extreme heat days in Illinois from 2017 to 2022.











# How do we prevent it?



# Federal OSHA Field Sanitation Standards

## Occupational Safety and Health Act of 1970

“**Covered** agricultural **employers** must provide potable drinking water, suitably cool and in sufficient amounts, dispensed in single-use cups or by fountains, located so as to be **readily accessible** to all employees.”

**Employers** must maintain such facilities in accordance with public health sanitation practices, including upkeep of water quality through daily change (or more often if necessary)...”



# WA's Outdoor Heat Exposure Rule (2008)

## Applies to all outdoor work from May 1-September 30

| <b>Element</b>                    | <b>Details</b>   |
|-----------------------------------|--|
| <b>Water</b>                      | Provide enough water so that each employee can drink 1 quart/hour and encourage them to do so            |
| <b>Response to signs/symptoms</b> | Must let employees stop working, provide ways for employees to reduce body temperature, and monitor them |
| <b>Training</b>                   | Train all employees and supervisors about risks, prevention, and response system                         |

# Summary of the barriers

1. Federal OSHA does not have a Heat Standard
2. Independent contractors are often responsible for abiding to regulations but they are also paid for how much their crews pick
3. Immigration status is often used as a threat to dissuade farmworkers from defending their rights, reduces their political and economic power

# Summary of the barriers

4. Farmworkers are paid by how much they pick so if water is a 30 min roundtrip walk from where they are working, many will choose to not get water
5. Bathrooms are often  $\frac{1}{4}$  mile away
6. The field sanitation regulation does not specify how close drinking water is required to be to workers; farms with 11 or fewer employees are exempt from it



# Prevention Principles

**Written and verbal instructions**

**Encourage water 750ml per hour**

**Teach awareness**

**Counsel and monitor high risk employees**

**Acclimatisation and medical screening**

# Heat illness prevention methods for farmworkers

## Common

- **Drinking more water**
- **Resting in shaded areas**

## Uncommon

- **Changing work hours**
- **Changing work activities**
- **Going to air-conditioned areas during or after work**

# Encourage Hydration

- **Thirst is not an adequate stimulus for total replacement during work**
- **Encourage small amount of cool water (250ml) every 15 minutes**
- **Water should be freely available at work area and palatable**
- **Avoid sports drinks (↓ rate absorption)**
- **Avoid Caffeine and alcohol**



# Staying Hydrated

## *A Quick Peek Tells All*



| Hydrated   |                              |  | De-hydrated   |  |  |                                    |  |
|--|------------------------------|--|---|--|--|------------------------------------|--|
| <b>1</b><br>FULLY<br>HYDRATED                        | <b>2</b><br>WELL<br>HYDRATED | <b>3</b><br>HYDRATED   | <b>4</b><br>MILDLY<br>DEHYDRATED                              | <b>5</b><br>DEHYDRATED                       | <b>6</b><br>VERY<br>DEHYDRATED                                     | <b>7</b><br>SEVERELY<br>DEHYDRATED | <b>8</b><br>DANGEROUSLY<br>DEHYDRATED                              |
| Maintain current fluid intake to stay well hydrated. | Fluid intake is adequate.    | Still in the hydrated range but fluid intake may need a slight increase. | Starting the dehydration process. Increase water consumption. | Drink more fluids to replenish water levels. | Increased fluid intake is necessary to prevent worsening symptoms. | Rapidly increase fluid intake.     | Critical need to rehydrate and replenish electrolytes immediately. |

# Heat Acclimatization

- Acclimatization process
- An acclimatization period is recommended for any new workers to site or workers returning from extended leave (i.e.>14 days) in a more temperate climate
- It should be noted that individuals differ in their ability to acclimatize to heat.

# Shade and Rest

- **Employees shall have access to shaded or air-conditioned areas to prevent or recover from heat illness symptoms and where they can take their rest breaks**
- **Employees shall be allowed a recovery period**
- **Tents and some temporary structures or devices can provide shade**



# Personal Risk Factors

- An individual's age
- Lack of acclimatization or dehydration
- Health: Obesity and being de-conditioned
- Water, caffeine or alcohol consumption
- Missed meals
- Pregnancy, diabetes, skin or sweat gland disorders
- Dehydration causes (i.e. diarrhea)
- Blood pressure or cardiovascular problems
- Use of certain prescription medications

# Medications

*In one study 29% Heat related deaths took medications associated with Heat Related Illness (HRI)*

- Alcohol and methamphetamine
- Antidepressants
- Anticonvulsants
- Antipsychotics
- Benzodiazepines
- Opioids
- Antiplatelet medications
- Diabetes medications

# What do farmworkers' know about heat stress and what do they do to prevent it?

## Knowledge

- Risk factors for heat stress:
  - Wearing dark colored clothing
  - Age
  - Being overweight

## Lack of Knowledge

- Prior history of heat illness was a risk factor
- Amount of time needed for the body to acclimate to heat



# Texas Heat Stress Awareness Program

| Group    | Criteria                         | Protocol                                      |
|----------|----------------------------------|---|
| <b>A</b> | <b>No increased risk</b>         | <b>HRI prevention education</b>               |
| <b>B</b> | <b>1x risk factors</b>           | <b>Nurse review and education, Quick card</b> |
| <b>C</b> | <b>2x risk factors</b>           | <b>Individualized medical program</b>         |
| <b>D</b> | <b>Unstable health condition</b> | <b>Suitable duties related to heat</b>        |

McCarthy, R. Outcomes of a Heat Stress Awareness Program on heat related illness in municipal outdoor workers. JOEM.

Publish ahead of print online.

# Texas Outcomes

- **Workers' compensation costs went down by 50% per Heat Related Illness (HRI)**
- **Workers with HRI had two or more identified risk factors**
- **Total number of HRI cases decreased after implementation of the program**

# In Summary

**Heat Related Illness will occur**

**Awareness of the signs and symptoms**

**5 prevention principles**

**Strong culture and good communication**





# Acknowledgements



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National Institute for Occupational  
Safety and Health #U540H012503

The screenshot shows the NIOSH website homepage. At the top, there is a navigation bar with the CDC logo, the NIOSH name, and a search bar. Below the navigation bar are several menu items: About NIOSH, Federal Register Notices, Board of Scientific Counselors, Contact, NIOSH Careers, Training and Workforce Development, Peer Review Agenda, and a SITE INDEX link. The main content area features two primary sections: 'All Workplace Safety & Health Topics' and 'Extramural Programs'. The 'All Workplace Safety & Health Topics' section includes a sub-section for 'All NIOSH Workplace Safety and Health Topics, sorted by topic name.' The 'Extramural Programs' section provides an overview of NIOSH's extramural research, training, and surveillance programs. To the right of these sections is a list of links: About Program Portfolio, NIOSH Publications and Products, Newsroom, NIOSH Science Blog, Meetings and Events, and Data and Statistics Gateway. Below these sections is a 'New and Featured' section with two featured items: 'NIOSH Science and Service Awards' and 'NIOSH Bibliography of Communication and Research Products 2023'. To the right of the 'New and Featured' section is another list of links: Join NIOSH and Partners for the 5th Annual National Stand-Down to Prevent Struck-by Incidents, Lyme Disease Awareness Month, Wildfire Awareness Month, NIOSH Healthcare Personal Protective Technology Targets for 2020 to 2030, and eNews: Volume 22, Number 2 (June).

The **Great Lakes Center for Farmworker Health and Wellbeing** is part of a network of Centers for Agricultural Safety and Health funded by The National Institute for Occupational Safety and Health (NIOSH).

The center is comprised of academics and service providers across multiple disciplines who recognize the critical importance of hired migrant and seasonal farmworkers in sustaining agriculture and our food supply chain.

The team works in Illinois, the Midwest, and beyond to promote and protect the health and wellbeing of these essential workers.

For more information

<https://farmworkerhealth.uic.edu/>

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WELCOME

Farmworkers' rights are human rights.

Whatever your interest in visiting our site may be—whether as a worker or employer in the agricultural industry, a service provider who works with farmworkers, a researcher, a policymaker, and more—we're glad you're here.

Learn more about us →

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