CME WEBINAR SERIES
September 11, 2020
Heat, Climate Change, and Dermatology
Today’s Speakers

Host: Neelu Tummala, MD, MA

Mary L. Williams, M.D.
Clinical Professor of Dermatology and Pediatrics
University of California San Francisco
September CME Webinars

Friday Sep 4
12 noon - 1 pm EST
Disaster Relief: How to Build Healthcare Resilience
Speaker: Dr. Caitlin Rublee

Friday Sep 11
12 noon - 1 pm EST
Heat, Climate Change, & Dermatology
Speaker: Dr. Mary Williams

Friday Sep 18
12 noon - 1 pm EST
Ophthalmology & Waste from the OR
Speakers: Dr. David Chang & Dr. Cassandra Thiel

Friday Sep 25
12 noon - 1 pm EST
Climate, Health, Disabilities, & Equity
Speaker: Dr. Marcalee Alexander

1 CME credit is available from George Washington University for each webinar. Once registered, you’ll receive a zoom link by email prior to the webinar.

Register at: bit.ly/Sep-CME-Webinars
View recordings on our website: DocsForClimate.org
Questions

Submit questions using the Q&A function

Share general comments with the group in the chat. If chat box hasn’t appeared, click chat bubble at bottom of your screen
Heat, Climate Change and Dermatology

Mary L. Williams, M.D.
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Heat, Climate Change and Dermatology

- Dermatologic conditions impacted by climate change
- Skin as the organ of heat dissipation
- Implications for clinical practice
A small increase in annual temperature produces a big increase in heat-related illness.
Heat Illness in Practice

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

- **Heat Syncope**: Dehydrated or poorly acclimatized individuals develop peripheral vessel dilation, diminished blood flow to the brain, and faint
- **Heat Cramps**: Excessive sweating resulting in muscle cramps or spasms
- **Heat Exhaustion**: Increased core body temperature, decreased cardiac output
- **Heat Injury**: Rhabdomyolysis, acute renal injury, disseminated intravascular coagulation, acute liver failure, increased core body temperature
- **Heat Stroke**: Multisystem failure, central nervous system dysfunction, high core body temperature

Climate Change, Heat Stress and Worker Health

Ronda McCarthy, MD, MPH, FACOEM
National Medical Director, Medical Surveillance Services
Concentra
July 24, 2020
Heat Gain and Loss

- Heat gain
  - Warm environment
  - Metabolism
    - Basal
    - Muscular activity
    - >80% metabolic energy expended as heat

- Heat loss
  - Transfer to environment
    - Conduction, convection & radiation
    - Augmented by ↑ skin blood flow
    - Only effective if core temperature higher than external
  - Evaporation of sweat
Core Thermal Sensors
Hypothalamic Thermoregulatory Center
Spinal Sympathetic Neurons
Sympathetic Chain Ganglia
Postganglionic Sympathetic Nerves
Acetylcholine
Eccrine Sweat Glands
Cutaneous Vasculature
Nitric oxide
Cutaneous Thermal Sensors
Cutaneous Vasodilation

- Up to 60% cardiac output

- Heat waves
  - ↑ Myocardial infarctions
  - ↑ Death from all causes

Sweat rate and salt content

- Dependent upon rate of sweat production
  - 10-100 mM Na
  - Elderly: Low rate
    - Loss of free water coupled with reduced thirst
    - Hyper-tonic dehydration
  - Athletes, Outdoor workers: High rate
    - Loss of water and salt coupled with drinking water
    - Hy-po-tonic dehydration
Efficiency of Sweat in Cooling

- Environmental Factors
- Physiologic differences
- Pathologic states
- Medications
Environmental Factors

- Sweat must evaporate
- Ambient temperature
- Relative humidity

Physiologic Factors

• Aerobic conditioning
  – Reduces % metabolic E generating heat
  – Heat $\geq$ 70% metabolic E
Physiologic Factors

• Aerobic conditioning

• Acclimitization
  – ↓ morbidity/mortality
  – ↓ thermal threshold to onset of sweat
  – ↑ sweat volume
  – ↓ sweat Na+
Physiologic Factors

- Aerobic conditioning
- Acclimitization
- Age
Physiologic Factors: Infants and Children

• Increased heat production
  – $\uparrow$ metabolic rate
  – $\uparrow$ % metabolic energy as heat

• Immature eccrine function
  – Preterm: do not sweat
  – Term: variable, limited body regions
  – Children: $\uparrow$ thermal threshold to sweat & $\downarrow$ volume

• Limitations of agency and understanding

Basu et al. Paediatric and Perinatal Epidemiology, 2015, 29, 407–415
Smith Nutrients 2019, 11, 2010; doi:10.3390/nu11092010
Elderly

• ↑↑ mortality in heat waves

• Social factors
  • Live alone
  • Poverty
  • No access to AC
  • Loss of mobility
  • ↓ Agency

• Physiologic

• Co-morbidities

• Medications
Physiologic Factors: Aging

- Cutaneous vasodilation
- Sweat
  - Begins at 40 yrs
  - Progressive
  - Threshold to onset sweat
  - Volume
Physiologic factors: Gender and Pregnancy

• Females
  – Lower sweat output
  – (↑) core temperature
  – (↓) conditioning
  – ↑ subcutaneous fat deposition

Physiologic factors: Gender and Pregnancy

- **Females**
  - Lower sweat output
  - $\uparrow$ core temperature
  - $\downarrow$ conditioning
  - $\uparrow$ subcutaneous fat deposition

- **Pregnancy**
  - $\uparrow$ core temperature
  - $\uparrow$ metabolic heat production

Co-Morbidities: Obesity

• ↑ risk of heat related illness
• Fat
  – retards heat transfer from core to skin
  – ↓ heat-holding capacity
• (↓) aerobic conditioning
• Comorbidities
  – Diabetes
  – Hypertension
Disorders of Sweat Production

• Autonomic neuropathies
  – Parkinson disease
  – Multiple sclerosis
  – Sjögren syndrome

• Genetic traits
  – Ectodermal dysplasias
  – Fabry disease
  – Hypermobile Ehlers-Danlos Syndrome

• Widespread dermatitis

Keeping Cool

- Air Conditioning
- Fans
- Showers, wading pools
- Spray bottles, personal misters
- Wet pj’s
- Cooling vests, hats, neck wraps
Classes of Drugs with Anticholinergic Effects

- **Anticholingerics**
  - e.g., Scopolamine, atropine

- **Antihistamines**
  - e.g., diphenhydramine (Benadryl®); hydroxyzine (Atarax®)

- **Antipsychotics**
  - e.g., chlorpromazine (Thorazine®)

- **Antiparkinsonians**
  - E.g., benztopine (Cogentin®)

- **Bladder antispasmodics**
  - e.g., oxybutynin (Oxytrol®)

- **Muscle relaxants**
  - E.g., cyclobenzaprine (Flexeril®)

- **Antiemetics**
  - e.g., meclizine

- **Antidepressants**
  - e.g., imipramine (Tofranil®)

Drugs That Affect Thermoregulation

- Anticholinergics
- Neuromediators
- Antihypertensives
- Diuretics

Levine et al. J Med Toxicol 2012; 8:252-257
Preventing Heat Illnesses

• Recognize who is vulnerable and why
  – Educate patient/family
  – Strategies to reduce risk
    • Means to cool themselves
    • Maintain hydration
    • Limit activities
    • Review and adjust medications
Climate Change and Dermatology

• Dermatologic conditions impacted by climate change
  – International Journal of Women’s Dermatology

• Skin as the organ of heat dissipation
Why Skin?
The Dermatological Effects of Climate Change

- UV and heat-related illnesses
- Exposure to allergens and pollutants
- Vector-borne pathogens
- Weather-related diseases/injuries

Courtesy of Elayne Fivenson
The Skin Cancer Epidemics

Melanoma incidence in US


Basal Cell Carcinoma

https://dermnetnz.org
Climate Change and Skin Cancer

- The epidemic will continue
  - Warmer temperatures – more time out of doors
Climate Change and Skin Cancer

- Warmer temperatures
- Holes in the Stratospheric (‘good’) ozone layer
  - Letting more UVB into atmosphere
  - Not closed until 2050
- Parker: “The influence of climate change on skin cancer incidence”. IJWD, in press 2020

Pollution: Fellow-Traveler of Climate Change

• Air pollution is generated as fuels combust
  - Industry
  - Wildfires
Air Pollution and Skin

• Skin is permeable to lipophilic pollutants
  – Polycyclic hydrocarbons coating particulate matter
• Nitrous oxide, ozone
• Oxidative stress
  – Ozone
  – Polycyclic hydrocarbons

Elentner et al. JID 138:109-120, 2017
Oetjen et al JID 138:8-10, 2017
Skin Effects of Air Pollution

- Skin Aging & Pigmentation

https://dermnetnz.org
Skin Effects of Air Pollution

- Skin Aging & Pigmentation
- Atopic dermatitis
  - Risk of developing
  - Flares
- Eczema in older adults
- Schachtel et al. “Climate change and pediatric skin health”, IJWD 2020 in press.
Skin Effects of Air Pollution

- Skin Aging & Pigmentation
- Atopic dermatitis
  - Risk of developing
  - Flares
- Eczema in older adults
- Acne flares
- Roberts: “Air Pollution and Skin Disorders”, IJWD in Press 2020

https://dermnetnz.org
Shifting Landscape of Infectious Diseases

Mosquitoes:
- Dengue fever
- Zika
- Yellow Fever
- Chikungunya
- West Nile virus
- Malaria

Ticks:
- Lyme disease
- Rocky Mountain Spotted Fever
- Ehrlichiosis
- Meat allergy

Sand flies:
- Leishmaniasis

Fleas:
- Typhus
- Plague

Coates and Norton: The effects of Climate Change on Infectious Diseases with Cutaneous Manifestations. IJWD In Press, 2020
Global Distribution of *Aedes aegypti*
Prevention of Vector-borne Diseases

• Prevent exposure
  – Eradicate breeding grounds

• Cover skin
  – Long sleeves, long pants
  – Tuck pant legs into socks
  – Nets

• Use repellants
  – Ticks & Mosquitos: 20-30% DEET
  – Infants > 2 months
  – No self-Rx for children < 10 years
Coates and Norton: The effects of Climate Change on Infectious Diseases with Cutaneous Manifestations. IJWD In Press, 2020
Floods

- Minor trauma most common injury
- Secondary infections frequent
  - ‘Unusual’ organisms

https://www.npr.org/sections/thetwo-way/2017/08/28/546735184/
Photo by David J Philip/ AP
Heat, Climate Change and Dermatology

• Skin as the organ of heat dissipation
  – How it works
  – Who is vulnerable

• Impacts of climate change on skin health
  – Skin Cancer
  – Pollution affects on skin
  – Infectious disease
  – Flooding
More in the IJWD on Climate Change and Skin

- Silva and Rosenbach. Climate change and dermatology: An introduction.
- Kwak et al. Mass migration and climate change.
- Blum et al. Greening the office: Saving resources, saving money and educating our patients.
- Fathy et al. Combating climate change in the clinic.
- Sabzevari et al. Sunscreens: Increasing awareness of UV filters and their potential toxicities to us and our environment.
AAD’s Expert Resource Group on Climate Change and Environmental Issues: Leadership

- Misha Rosenbach, M.D.
- Mary E. Maloney, M.D.
- David Fivenson, M.D.
- Sarah J. Coates, M.D.
- Markus D. Boos, M.D., Ph.D.
- Caroline A. Nelson, M.D.
- John S Barbieri, M.D., M.B.A.
- Eva R. Parker, M.D.
Questions

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Health professionals advocate: The fossil fuel divestment campaign targeting health insurers
Speaker: Dr. Ashley McClure

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