





WASHINGTON, DC



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

Health professionals advocate: The fossil fuel divestment campaign targeting health insurers

Speaker: Dr. Ashley McClure

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

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JULY 10 12 noon - 1 pm EST

Air Quality, Climate Change, & Transportation



SPEAKERS:

Paulina Muratore Union of Concerned Scientists

Scott Goldstein Transportation for America JULY 17

COVID-19,

Climate Change,

& Equity

SPEAKERS:

Dr. Doris Browne

Former President NMA

Dr. Kimberly Gordon

Assistant Prof, Psychiatry,

Tulane University

School of Medicine

COVID-19

JULY 24

CLIMATE

Consortium CME Webinars

EQUITY

Preventing Heat Illness in Practice



SPEAKER:

Dr. Ronda McCarthy Medical Director, Concentra and author of "Outcomes of a Heat Stress Awareness Program", Journal of Occupational and Environmental Medicine JULY 31 12 noon - 1 pm EST

Climate Change & Pregnancy

Heat, Air Pollution and Birth Outcomes



Climate Change & Mental Health

What Physicians can do about the Mental Health effects of Climate Change



SPEAKERS: Dr. Bruce Bekkar Dr. Nate Denicola Dr. David Pollack

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Heat, Climate Change and Dermatology

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

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









CME WEBINAR SERIES: COVID-19, Climate, and Equity July 24, 2020

Heat Illness in Practice

>	00:00:03 / 01:06:56 दी•)	Speed (:

Climate Change, Heat Stress and Worker Health



American College of Occupational and Environmental Medicine



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

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

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
 ¹ skin blood flow
 - Only effective if core temperature higher than external
 - Evaporation of sweat







Cutaneous Vasodilation

Up to 60% cardiac output

Heat waves

 $-\uparrow$ Death from all causes

Kenny et al. TEMPERATURE 3:119–145 (2016)

Ye et al. Environ Health Perspect 120:19–28 (2012)





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
 - Hypertonic dehydration
 - Athletes, Outdoor workers: High rate
 - Loss of water and salt coupled with drinking water
 - Hypotonic 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 ≥ 70% metabolic E

Physiologic Factors

- Aerobic conditioning
- Acclimitization
 - ^[] morbidity/mortality
 - \bigcirc thermal threshold to onset of sweat
 - û sweat volume
 - ↓ sweat Na+

Physiologic Factors

- Aerobic conditioning
- Acclimitization
- Age

Physiologic Factors: Infants and Children

- Increased heat production
 - î metabolic rate
 - û % metabolic energy as heat
- Immature eccrine function
 - Preterm: do not sweat
 - Term: variable, limited body regions
 - Children:
 ¹ thermal threshold to sweat &
 ¹ volume
- Limitations of agency and understanding

Basu et al. *Paediatric and Perinatal Epidemiology*, 2015, **29**, 407–415 Jhun et al. Epidemiology. 2017 September ; 28(5): 728–734. Smith *Nutrients* **2019**, *11*, 2010; doi:10.3390/nu11092010



- ①① mortality in heat waves
- Social factors
 - Live alone
 - Poverty
 - No access to AC
 - Loss of mobility
 - J Agency
- Physiologic
- Co-morbidities
- Medications

Physiologic Factors: Aging

- \$\Psi Sweat
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 - Begins at 40 yrs
 - Progressive
 - <u>Threshold to onset sweat</u>
 - ↓ Volume

Physiologic factors: Gender and Pregnancy

- Females
 - Lower sweat output
 - (①) core temperature
 - -(1) conditioning
 - ☆ subcutaneous fat deposition

Physiologic factors: Gender and Pregnancy

Females

- Lower sweat output
- $-(\hat{1})$ core temperature
- $-(\mathbf{D})$ conditioning
- ☆ subcutaneous fat deposition

Pregnancy

- û core temperature
- ☆ metabolic heat production

Bekkar et al: JAMA Network Open. 2020;3(6):e208243.



Co-Morbidities: Obesity

- ① risk of heat related illness
- Fat
 - retards heat transfer from core to skin
 - I heat-holding capacity
- (1) 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

Williams. Global warming, heat related Illnesses and the dermatologist. Int J Womens Dermatol 2020 In Press

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®)

Duran et al. Systematic review of anticholinergic risk scales in older adults. Eur J Clin Pharmacol 2013; 69:1485-1496. Williams. Global warming, heat related Illnesses and the dermatologist. Int J Womens Dermatol 2020 In Press

Drugs That Affect Thermoregulation

- Anticholinergics
- Neuromediators
- Antihypertensives
- Diuretics

Westaway et al. J Clin Pharm Ther 2015; 40: 363-367 Levine et a;. 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
 - <u>https://www.sciencedirect.com/jour</u> <u>nal/international-journal-of-</u> <u>womens-dermatology/articles-in-</u> <u>press</u>
- Skin as the organ of heat dissipation
 - Williams. Global Warming, heat related illness and the dermatologist. IJWD 2020 In Press



Why Skin?





Courtesy of Elayne Fivenson

The Skin Cancer Epidemics



Jemel et al. J Natl Cancer Inst 93:678, 2001

Jemel et al. J Natl Cancer Inst 93:678, 2001

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 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 Krutmann et al. J Dermatol Sci 85:152-161, 2017 Koohgoli et al. Exper Dermatol 26:384-387, 2017

Skin Effects of Air Pollution



Skin Aging & Pigmentation

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

Shifting Landscape of Infectious Diseases





Mosquitos: Dengue fever Zika Yellow Fever Chikungunya West Nile virus Malaria

Ticks: Lyme disease Rocky Mountain Spotted Fever Ehrlichosis 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



https://www.dni.gov/files/documents/Newsroom/Testimonies/2018-ATA---Unclassified-SSCI.pdf

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</p>

Coates and Norton: The effects of Climate Change on Infectious Diseases with Cutaneous Manifestations. IJWD In Press, 2020

Floods



Nontuberculous Mycobacteria See Bandino IJWD in Press

- Minor trauma most common injury
- Secondary infections frequent

 'Unusual' organisms
- See Bandino et al. The infectious and non-infectious dermatological consequences of flooding: a field manual for the responding provider. Am J Clin Dermatol 2015;16:399-424



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.



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