Climate Change & Dermatology

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Disclosures/Conflicts

• AAD Expert Resource Group on Climate Change & Environmental Issues Co-Founder and Co-Chair
  – I am speaking on behalf of myself and not the AAD
Outline

• Climate change, wildfires, & pollution:
  – Atopic dermatitis, inflammatory skin disease

• Warming & extreme weather:
  – Cutaneous sequelae

• Vectors & changing geographic patterns of disease
  – Cutaneous infections
Special Issue on Climate Change & Dermatology

Edited by Misha Rosenbach, Mary L. Williams
Volume 7, Issue 1,
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Wildfires, Global Climate Change, and Human Health

Rongbin Xu, M.B., B.S., Pei Yu, M.B., B.S., Michael J. Abramson, M.B., B.S., Ph.D., Fay H. Johnston, B.M., B.S., Ph.D., Jonathan M. Samet, M.D., Michelle L. Bell, Ph.D., Andy Haines, M.B., B.S., M.D., Kristie L. Ebi, Ph.D., M.P.H., Shanshan Li, M.D., Ph.D., and Yuming Guo, M.D., Ph.D.

November 26, 2020
DOI: 10.1056/NEJMsr2028985
Association of Wildfire Air Pollution and Health Care Use for Atopic Dermatitis and Itch

Raj P. Fadadu, MD; Barbara Grimes, PhD; Nicholas P. Jewell, PhD; Jason Vargo, PhD; Albert T. Young, BA; Katrina Abubakar, MD, MA, MSCE; John R. Balmes, MD; Maria L. Wei, MD, PhD

RESULTS Visits corresponding to a total of 4147 patients (mean [SD] age, 44.6 [21.1] years; 2322 [56%] female) were analyzed. The rates of visits for AD during the Camp Fire for pediatric patients were 1.49 (95% CI, 1.07-2.07) and for adult patients were 1.15 (95% CI, 1.02-1.30) times the rate for nonfire weeks at lag 0, adjusted for temperature, relative humidity, patient age, and patient volume at the clinics for pediatric patients. The adjusted rate ratios for itchy clinic visits during the wildfire weeks were 1.82 (95% CI, 1.20-2.78) for the pediatric patients and 1.29 (95% CI, 0.96-1.75) for adult patients. A 10-μg/m³ increase in weekly mean PM₁₀ concentration was associated with a 7.7% (95% CI, 1.9%-13.7%) increase in weekly pediatric itchy clinic visits. The adjusted rate ratio for prescribed systemic medications in adults during the Camp Fire at lag 0 was 1.45 (95% CI, 1.03-2.05).

CONCLUSIONS AND RELEVANCE This cross-sectional study found that short-term exposure to air pollution due to the wildfire was associated with increased health care use for patients with AD and itchy. These results may provide a better understanding of the association between poor air quality and skin health and guide health care professionals' counseling of patients with skin disease and public health practice.

Wildfire Smoke Pollution, Climate Change, and Skin Disease

Kenneth W. Keer, MD, MPH

Taking these things together means that Fadadu et al. captured only a small portion of the smoke-related skin health morbidity resulting from the Camp Fire. Given the millions of Californians who were exposed to the Camp Fire's drifting smoke and the population prevalence of atopic dermatitis (as high as 20% in children and 10% in adults) and extrapolating from the increased incidence of atopic dermatitis and itch reported by Fadadu et al., it is likely that many thousands of people developed smoke-related skin health problems. To prepare for and manage the health consequences of the growing problem of wildfire smoke pollution requires more knowledge about how wildfire smoke affects health and health care use. A comprehensive, targeted research strategy along with resources to implement the strategy are needed. In addition, because continuing climate change will likely worsen this situation and add skin health stressors (e.g., heat and increased UV radiation), it should be expected that the health care burden of atopic dermatitis and other air pollution-sensitive skin diseases will grow substantially in coming years. Improved pharmacologic treatments and other interventions for these conditions will be helpful in addressing this growing problem, but more effective policies and practices to mitigate climate change and reduce wildfires will be even more helpful.
Atopic Dermatitis, Climate Change, & Pollution

• Air pollutants from wildfires, volcanic ash, power plants, motor vehicle emissions
  – PM$_x$, nitrogen oxides, sulfur oxides, and volatile organic compounds
  – PM may be coated with polycyclic aromatic hydrocarbons which are lipophilic, penetrate skin, and induce oxidative stress
    • Pregnane X receptor, aryl hydrocarbon receptor

• Numerous studies demonstrating increased pollution with increased incidence & severity of AD

• Temperature, humidity, UV exposure, & precipitation may also influence AD
  – Increased pollen count

Conclusion

Taken together, it seems the changing environment, attributable to climate change, is having a profound effect on the epidemiology of AD. Increased temperatures, increased humidity, increased pollen, and air pollution are all associated with changes in the epidemiology and severity of atopic dermatitis.
...aging, inflammatory diseases (atopic dermatitis, cellulitis, psoriasis) acne, hair loss, and skin cancers (melanoma and SCC)
Holocene variation in atmospheric CO₂ and global temperature

Global temperature reconstruction of Marcott et al. (2013)

Thermometer measurements of temperature compiled by NOAA

- NOAA Climate at a Glance: https://www.ncdc.noaa.gov/cag/time-series/global/globe/


Direct measurements of CO₂

Measurements of CO₂ from glacial ice

Thousands of years before present ("present" = AD 1950)
The carbon skyscraper: A new way of picturing rapid, human-caused climate change

By Benjamin Strauss
Jan. 12, 2021 at 2:05 p.m. EST

Changes in carbon dioxide per 1000 years

Last 100 years

Thousands of years before present
Anyone born after June 1, 1976, about 2/3 the global population, has never experienced a below average month in their lifetimes.
Global surface temperatures have been rising annually for decades.

The frequency of extreme storms once remained within a fairly tight range...

...but it increased sharply as global temperatures rose.

Wind Speed vs. Water Temperature

Hurricane Strength and Ocean Temperatures

For more, see Dr. Michael Mann:

@NASAClimate
Zeke Hausfather
New York Times, 9/12/17, D Leonhardt
WATER-RELATED DISASTERS

(OFDA/CRED International Disaster Database)°

Courtesy of Dr. Justin Bandino
After severe flooding, WHO reports skin diseases are the most common issue (19% of consultations), more than diarrhea (14%) or respiratory infxn (14%)

Flood-associated dermatological issues:
- Infections:
  - *S. aureus*
  - *Streptococcus*
  - *Vibrio vulnificus*
  - *Aeromonas hydrophilia*
  - *Mycobacterial infection*
  - *Fungal infections*
  - *Dermatophyte infections*
  - *Parasitic infections*
- Arthropod bites
- Animal bites
- Immersion foot
- Contact dermatitis
- Laceration from debris
- Traumatic injury
Fig. 2  
a. Hemorrhagic bullae and necrotizing fasciitis due to *Vibrio vulnificus*.  
b. Sporotrichoid spread of *Mycobacterium marinum*.  
c. Solitary abscess secondary to *Mycobacterium fortuitum* infection, packed with gauze.  
d. Mucin (Mollaret) bodies as seen in a KOH preparation.  
e. Mucin foot exhibiting a large plaque of draining sinuses.  
f. A well-defined, solitary, verrucous lesion of blastomycosis.  
g. Superficial necrosis from cutaneous mucormycosis.
Lyme

Ogden NH, et al. Environ Health Perspect 2014
Levy S. Environ Health Perspect 2014
CDC: Illnesses from ticks and mosquitoes tripled over 13 years

Figure 5.2: Changes in Lyme Disease Case Report Distribution
Dengue

Chikungunya

Zika

a–c, Projected data shown for 2020 (a), 2050 (b) and 2080 (c). d–f, Changes in areas classified as at-risk (using the suitability threshold of 0.467).

Climate Change

Original Article
Seasonal Models of Herpangina and Hand-Foot-Mouth Disease to Simulate Annual Fluctuations in
Mitsuyoshi Urashima1,2,*, Nahoko S1
1Division of Clinical Research and Development, Jikei University School of Medicine
2Infectious Disease Surveillance Center, National Institute
(Received February 10, 2003. Accepted May 28, 2003)
SUMMARY: In order to investigate the effects of global warming on the seasonal occurrence of herpangina and hand-foot-mouth disease, we constructed a model using meteorological and serologic data. The model was able to predict the incidence of these diseases with high accuracy.

Effect of meteorological variables on the incidence of hand, foot, and mouth disease in children: a time-series analysis in Guangzhou, China
Yong Huang1, Te Deng1, Shicheng Yu2, Jing Gu1, Cunrui Huang1, Gexin Xiao1 and Yuantao Hao1

Review
Temperature and humidity affect the incidence of hand, foot, and mouth disease: a systematic review of the literature – a report from the International Society of Dermatology Climate Change Committee
Sarah J. Coates1, MD, Mark D. P. Davis2, MD, and Louise K. Andersen3, MD

International Journal of Dermatology 2018
Coccidioidomycosis

Areas Endemic for Coccidioidomycosis

Climate Change and Risk of Leishmaniasis in North America: Predictions from Ecological Niche Models of Vector and Reservoir Species

Camila González1, Ophelia Wang2, Stavana E. Strutz3, Constantino González-Salazar4, Victor Sánchez-Cordero5, Sahotra Sarkar6

1Laboratorio de Sistemas de Información Geográfica, Departamento de Zoología, Instituto de Biología, Universidad Nacional Autónoma de México, Coyocán, México, 2Department of Geography and the Environment, University of Texas at Austin, Austin, Texas, United States of America, 3Biodiversity and Biocultural Conservation Laboratory, Section of Integrative Biology, University of Texas at Austin, Austin, Texas, United States of America, 4Laboratorio de Análisis Especiales, Departamento de Zoología, Instituto de Biología, Universidad Nacional Autónoma de México, Coyocán, México

Pigott et al. eLife 2014;3:e02851
Mcllwee BE, et al. JAMA Dermatol 2018
Incidence of Endemic Human Cutaneous Leishmaniasis in the United States

Bridget E. McIlwee, DO; Stephen E. Weis, DO; Gregory A. Hosler, MD, PhD

Figure 2. Previously Unreported Cases of Endemic Cutaneous Leishmaniasis Diagnosed in Humans From 2006 Through 2017

McIlwee et al.,
JAMA Derm 2018
### 2030 Health risks +1.5°C

<table>
<thead>
<tr>
<th>Health Category</th>
<th>2010</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrheal Infections</td>
<td>85,000</td>
<td>150,000</td>
</tr>
<tr>
<td>Heat &amp; Cold Illnesses</td>
<td>35,000</td>
<td>35,000</td>
</tr>
<tr>
<td>Hunger</td>
<td>225,000</td>
<td>380,000</td>
</tr>
<tr>
<td>Malaria &amp; Vector Borne Diseases</td>
<td>20,000</td>
<td>20,000</td>
</tr>
<tr>
<td>Meningitis</td>
<td>30,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Environmental Disasters</td>
<td>5,000</td>
<td>7,000</td>
</tr>
<tr>
<td>Air Pollution</td>
<td>1,400,000</td>
<td>2,100,000</td>
</tr>
<tr>
<td>Indoor Smoke</td>
<td>3,100,000</td>
<td>3,100,000</td>
</tr>
<tr>
<td>Occupational Hazards</td>
<td>55,000</td>
<td>80,000</td>
</tr>
<tr>
<td>Skin Cancer</td>
<td>20,000</td>
<td>45,000</td>
</tr>
<tr>
<td><strong>World</strong></td>
<td>4,975,000</td>
<td>5,957,000</td>
</tr>
</tbody>
</table>

DaraInt.org
Effect of current pledges and policies

Global greenhouse gas emissions

Gigatons of carbon dioxide

Projected emissions:
- No climate policies: 4.1-4.8°C
- Current policies: 3.1-3.7°C
- Pledges: 2.6-3.2°C
- 2°C pathways
- 1.5°C pathways

Historical emissions

Source: Climate Action Tracker
CLIMATE SUMMIT

WHAT IF IT'S A BIG HOAX AND WE CREATE A BETTER WORLD FOR NOTHING?

- ENERGY INDEPENDENCE
- PRESERVE RAINFORESTS
- SUSTAINABILITY
- GREEN JOBS
- LIVABLE CITIES
- RENEWABLES
- CLEAN WATER, AIR
- HEALTHY CHILDREN
- ETC. ETC.
# Climate Change — A Health Emergency

Caren G. Solomon, M.D., M.P.H., and Regina C. LaRocque, M.D., M.P.H.

N ENGL J MED 380;3 NEJM.ORG JANUARY 17, 2019

## Selected Resources for Physicians’ Response to Climate Change.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Website</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>American College of Physicians</td>
<td><a href="http://www.acponline.org">www.acponline.org</a></td>
<td>Climate change tool kit</td>
</tr>
<tr>
<td>American Lung Association</td>
<td><a href="http://www.lung.org">www.lung.org</a></td>
<td>“State of the Air” report on air pollution</td>
</tr>
<tr>
<td>Health Care without Harm</td>
<td><a href="https://noharm.org">https://noharm.org</a></td>
<td>Environmentally responsible health care, physician advocacy network</td>
</tr>
<tr>
<td>Medical Society Consortium on Climate and Health</td>
<td><a href="https://medsocietiesforclimatehealth.org">https://medsocietiesforclimatehealth.org</a></td>
<td>Coalition of U.S. medical societies supporting climate action, educational materials, and consensus statements</td>
</tr>
<tr>
<td>Physicians for Social Responsibility</td>
<td><a href="http://www.psr.org">www.psr.org</a></td>
<td>List of local chapters, “Climate change makes me sick” educational campaign</td>
</tr>
<tr>
<td>The Lancet Countdown on Health and Climate Change</td>
<td><a href="http://www.lancetcountdown.org">www.lancetcountdown.org</a></td>
<td>International research collaboration tracking the world’s response to climate change, including a policy brief for the United States</td>
</tr>
</tbody>
</table>
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Volume 7, Issue 1,
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Thank you
Some Dermatology Articles on Climate Change


Andersen LK1, Davis MDP2. Dermatology at the forefront - also with regard to actual politics. Ring J1.


Muller SA1. Climate change, dermatology and ecosystem services; trends and trade-offs. Muller SA1.

Muller SA, Muller IS. A message from the President of the International Society of Dermatology. Climate change and the International Society of Dermatology challenge for the 21st century.

International Journal of Women’s Dermatology January 2021 Special Issue