The Future of Otolaryngology: Climate Health & Sustainability

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Moving Forward: Next Century Otolaryngology
Disclosures

• **Amanda Dilger, MD**, faculty for this accredited education activity has no relevant financial relationships with ineligible companies to disclose.

• **Neelima Tummala, MD**, faculty for this accredited education activity has no relevant financial relationships with ineligible companies to disclose.

• **Andy Garman, PsyD, MS**, faculty for this accredited education activity has no relevant financial relationships with ineligible companies to disclose.
Climate Change and the
Future of Otolaryngology

11/4/22

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Clinical Assistant Professor of Surgery at George Washington University
School of Medicine and Health Sciences
Co-Director Climate Health Institute George Washington University
Climate change refers to the anthropogenic global rise in temperature due to release of heat-trapping greenhouse gases

- 1970: 325 CO₂ ppm to 2022: 419 CO₂ ppm
- Global temperatures have reached approximately 1.1°C above pre-industrial temperatures.
Why is it a problem?

Impact of Climate Change on Human Health

- Injuries, fatalities, mental health impacts
- Asthma, cardiovascular disease
- Heat-related illness and death, cardiovascular failure
- Severe Weather
- Air Pollution
- Malaria, dengue, encephalitis, hantavirus, Rift Valley fever, Lyme disease, chikungunya, West Nile virus
- Extreme Heat
- Changes in Vector Ecology
- Respiratory allergies, asthma
- Forcible migration, civil conflict, mental health impacts
- Environmental Degradation
- Increasing Allergens
- Water and Food Supply Impacts
- Water Quality Impacts
- Malnutrition, diarrheal disease
- Cholera, cryptosporidiosis, campylobacter, leptospirosis, harmful algal blooms

https://www.cdc.gov/climateandhealth/effects/default.htm
Temperature and allergic rhinitis

Temperature is the strongest predictor of atmospheric pollen concentration.

Global warming has been linked to:

1. Lengthened growing seasons
2. Pollen growing in new geographic regions
3. Increased concentration of pollen in the environment
Anthropogenic climate change is worsening North American pollen seasons

- Widespread advances and lengthening of pollen seasons (+20 days)
- Increases in pollen concentrations (+21%)
- Anthropogenic climate change has contributed ~50% of the trend in pollen seasons
Cities as harbingers of climate change:
Common ragweed, urbanization & public health

- Compared temperature and CO$_2$ in urban vs rural environments
  - CO$_2$ levels were about 30% higher in the urban areas
  - Temperature was about 1.8° to 2.0°C higher in the urban areas
- Ragweed grew faster, flowered earlier, and produced significantly greater above-ground biomass and ragweed pollen at urban locations than at rural locations.
Air pollution (particulate matter)

**PM10**
- < 10 μm

**HUMAN HAIR**
- 50-70 μm

**PM2.5**
- < 2.5 μm

[https://ww2.arb.ca.gov/resources/inhalable-particulate-matter-and-health](https://ww2.arb.ca.gov/resources/inhalable-particulate-matter-and-health)

Air pollution and chronic rhinosinusitis

Long-Term Exposure to Particulate Matter Air Pollution and Chronic Rhinosinusitis in Nonallergic Patients

Zhenyu Zhang 1, Rebecca J. Kamii 2, Nyall R. London 2, Stella E. Lee 3, Venkataramana K. Sidhaye 2, Shyam Biswal 4, Andrew P. Lane 2, Jayant M. Pinto 5*, and Murugappan Ramanathan, Jr. 2*†

Table 2. Conditional Logistic Regression Analyses for the Association between Long-Term PM2.5 Exposure and Diagnosis of CRS

<table>
<thead>
<tr>
<th>Pollution</th>
<th>Model 1*</th>
<th>Model 2†</th>
<th>Model 3†</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRS (N=6,102)</td>
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<tr>
<td>PM2.5 10-mo</td>
<td>1.18 (0.99–1.41)</td>
<td>1.26 (1.05–1.52)</td>
<td>1.29 (1.07–1.55)</td>
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<tr>
<td>PM2.5 25-mo</td>
<td>1.43 (1.18–1.73)</td>
<td>1.54 (1.26–1.88)</td>
<td>1.58 (1.28–1.91)</td>
</tr>
<tr>
<td>PM2.5 50-mo</td>
<td>1.55 (1.03–2.33)</td>
<td>1.33 (1.08–1.63)</td>
<td>1.28 (1.08–1.56)</td>
</tr>
<tr>
<td>PM2.5 60-mo</td>
<td>1.34 (1.08–1.67)</td>
<td>1.42 (1.13–1.77)</td>
<td>1.44 (1.15–1.81)</td>
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<tr>
<td>Maxillary sinusitis (n=4,092)</td>
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<tr>
<td>PM2.5 10-mo</td>
<td>1.35 (1.09–1.68)</td>
<td>1.39 (1.11–1.74)</td>
<td>1.41 (1.12–1.77)</td>
</tr>
<tr>
<td>PM2.5 25-mo</td>
<td>1.59 (1.33–2.44)</td>
<td>1.76 (1.37–2.25)</td>
<td>1.77 (1.38–2.28)</td>
</tr>
<tr>
<td>PM2.5 50-mo</td>
<td>1.50 (1.17–2.01)</td>
<td>1.54 (1.20–2.03)</td>
<td>1.55 (1.20–2.01)</td>
</tr>
<tr>
<td>PM2.5 60-mo</td>
<td>1.58 (1.21–2.06)</td>
<td>1.60 (1.27–2.12)</td>
<td>1.61 (1.22–2.14)</td>
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<tr>
<td>Frontal sinusitis (n=1,644)</td>
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<tr>
<td>PM2.5 10-mo</td>
<td>1.18 (0.83–1.69)</td>
<td>1.30 (0.90–1.88)</td>
<td>1.28 (0.88–1.87)</td>
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<tr>
<td>PM2.5 25-mo</td>
<td>1.41 (0.96–2.09)</td>
<td>1.67 (1.05–2.75)</td>
<td>1.59 (1.06–2.50)</td>
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<tr>
<td>PM2.5 50-mo</td>
<td>1.45 (0.97–2.18)</td>
<td>1.62 (1.07–2.68)</td>
<td>1.64 (1.07–2.51)</td>
</tr>
<tr>
<td>PM2.5 60-mo</td>
<td>1.25 (0.81–1.97)</td>
<td>1.40 (0.89–2.22)</td>
<td>1.43 (0.90–2.28)</td>
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<tr>
<td>Ethmoidal sinusitis (n=1,851)</td>
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<tr>
<td>PM2.5 10-mo</td>
<td>2.09 (1.77–3.51)</td>
<td>2.74 (1.91–3.94)</td>
<td>2.90 (2.00–4.21)</td>
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<tr>
<td>PM2.5 25-mo</td>
<td>2.81 (1.91–4.13)</td>
<td>3.09 (2.06–4.63)</td>
<td>3.29 (2.23–5.15)</td>
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<tr>
<td>PM2.5 50-mo</td>
<td>2.55 (1.90–3.44)</td>
<td>3.08 (2.01–4.62)</td>
<td>3.31 (2.15–5.08)</td>
</tr>
<tr>
<td>PM2.5 60-mo</td>
<td>2.87 (1.85–4.33)</td>
<td>3.04 (1.92–4.81)</td>
<td>3.27 (2.03–5.25)</td>
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<tr>
<td>Sphenoidal sinusitis (n=948)</td>
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<tr>
<td>PM2.5 10-mo</td>
<td>1.23 (0.80–1.91)</td>
<td>1.37 (0.87–2.18)</td>
<td>1.43 (0.90–2.28)</td>
</tr>
<tr>
<td>PM2.5 25-mo</td>
<td>1.33 (0.82–2.20)</td>
<td>1.50 (0.88–2.50)</td>
<td>1.61 (0.93–2.77)</td>
</tr>
<tr>
<td>PM2.5 50-mo</td>
<td>2.16 (1.26–3.70)</td>
<td>2.46 (1.40–4.33)</td>
<td>2.64 (1.48–4.69)</td>
</tr>
<tr>
<td>PM2.5 60-mo</td>
<td>1.41 (0.79–2.57)</td>
<td>1.67 (0.84–3.94)</td>
<td>1.68 (0.89–3.71)</td>
</tr>
<tr>
<td>Severe sinusitisa (n=369)</td>
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<tr>
<td>PM2.5 10-mo</td>
<td>4.00 (1.71–9.34)</td>
<td>3.49 (1.41–8.87)</td>
<td>4.07 (1.53–10.82)</td>
</tr>
<tr>
<td>PM2.5 25-mo</td>
<td>3.72 (1.38–9.99)</td>
<td>3.67 (1.24–10.8)</td>
<td>4.30 (1.38–13.61)</td>
</tr>
<tr>
<td>PM2.5 50-mo</td>
<td>6.60 (2.98–10.50)</td>
<td>6.67 (2.90–15.53)</td>
<td>7.91 (3.96–20.42)</td>
</tr>
<tr>
<td>PM2.5 60-mo</td>
<td>4.06 (1.44–11.48)</td>
<td>5.88 (1.26–25.55)</td>
<td>4.65 (1.37–15.73)</td>
</tr>
</tbody>
</table>
Respiratory and Cardiovascular Disease

- Increased respiratory disease
  - Asthma
  - Increased risk of pneumonia
  - Increased risk of lung cancer
  - Decreased lung capacity

- Increased cardiovascular disease
  - Heart attacks
  - Cardiac arrhythmias
  - Ischemic stroke
  - Hypertension

https://www.elcaminohealth.org/stay-healthy/blog/understanding-lung-conditions
https://www.health.utah.gov/utahair/CAD/#gsc.tab=0
Nearly all major emission categories—consistently across states, urban and rural areas, income levels, and exposure levels—contribute to the systemic PM$_{2.5}$ exposure disparity experienced by people of color.
Climate Change and Surgical Patients

- Perioperative morbidity
- Major storms
- Pregnancy outcomes
- Heat wave morbidity and mortality
The voluntary pledge asks signees to, at a minimum, commit to:

(1) reducing their organization’s emissions (by 50% by 2030 and to net zero by 2050) and publicly report on their progress
(2) complete an inventory of Scope 3 (supply chain) emissions
(3) develop climate resilience plans for their facilities and communities.
(4) designate an executive lead for this work.

Addressing the Climate Crisis
Health System Responses

Andrew N. Garman, PsyD
Professor of Health Systems Management
Rush University

11/4/2022
About me
After decades of relative inaction, the world is starting to move

<table>
<thead>
<tr>
<th>196 countries (including the U.S.) signed a legally binding agreement to reduce carbon emissions enough to limit global warming to <strong>well below 2 degrees</strong>, and ideally <strong>below 1.5 degrees Celsius</strong>. Globally, these goals will require a minimum 25% reduction - and ideally a 45% reduction - in GHG emissions by 2030.</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 countries (including the U.S.) committed to develop climate-resilient and low-carbon health systems. For federal healthcare providers, these commitments include:</td>
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<tr>
<td>100% carbon pollution-free electricity (CFE) by 2030</td>
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<tr>
<td>100% zero-emission vehicle acquisitions by 2035</td>
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<tr>
<td>50% building emissions reduction by 2032, and net-zero by 2045</td>
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<tr>
<td>Net-zero procurement emissions no later than 2050</td>
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<td>In January 2022, the International Hospital Federation launched the Geneva Sustainability Centre, with a vision to “support hospitals to become leaders for sustainability in their communities.”</td>
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<tr>
<td>In April 2022, HHS appealed to all U.S. healthcare organizations to sign a voluntary pledge to reduce emissions <strong>50% 2030 and achieve net zero by 2050</strong>. In June 2022, Rush University System for Health became one of the first organizations to publicly agree to this commitment.</td>
</tr>
<tr>
<td>The non-profit organization AASHE provides a widely-adopted public reporting system for universities’ sustainability work. As of October 2022, the program lists 1,108 registered universities, of whom <strong>577</strong> submitted sufficient public data for ratings.</td>
</tr>
</tbody>
</table>
Interest in support is growing alongside urgency

Calls for Action:

Pressured By Students, Medical Schools Grapple With Climate Change

In Miami, Florida, aspiring clinicians apply lessons learned while reaching out to the region’s most vulnerable communities.

June 22, 2022
Mayor Lightfoot and Department of Buildings Introduce 2022 Energy Transformation Code, Putting Chicago at Forefront of Global Efforts to Address Climate Change

The New York Times

Princeton endowment to eliminate all fossil fuel holdings

By ROBERT VITBERG 62

July 14, 2021

Growing support:

Biden signs massive climate and health care legislation

The legislation includes the most substantial federal investment in history to fight climate change — some $375 billion over the decade.

Aug 31, 2022, 4:08pm CDT

Stanford receives $1.1 billion gift to create climate school

$492 million in gifts to Duke University further enhanced by Nicholas family’s $25 million donation for Climate and Sustainability

Forbes

University of Utah announces new climate science policy center with $20M gift

NSF invests in use-inspired change and clean energy research

Harvard’s climate action plan

A call for the living city.
Moving toward zero-emission healthcare

The ‘everyone’ agenda

1. Renewable energy
2. Zero-emission buildings
3. Zero-emission transport
4. Sustainable food

The healthcare-specific agenda

5. Low-carbon pharma
6. Circular health care / waste management

The transformational agenda

7. Systems redesign

\[\text{Health sector projected GHG footprint per year (MMt CO}_2\text{e)}\]

1Healthcare Without Harm: https://healthcareclimateaction.org/roadmap-graphics
The transformational agenda

Additional actions:\(^1\):

1. Seed climate and health innovations
2. Integrate sustainability into universal healthcare goals – “green UHC”
3. Maximize use of telehealth
4. Integrate climate-smart health care services into emergency preparedness / response
5. Establish disease prevention as climate change prevention:
   - Tobacco use
   - Meat consumption
   - Obesity reduction
   - Reducing air pollution

Figure 21. Detail of Uncharted Territory from Figure 17. Projected health sector footprint after emissions mitigation actions and economic decarbonization, showing emissions by category.

\(^1\)Healthcare Without Harm: https://healthcareclimateaction.org/roadmap-graphics
What can I do to address the climate crisis?

Amanda Dilger, MD
Facial Plastic and Reconstructive Surgery
Mass. Eye and Ear Infirmary – Cape Cod
Instructor, Harvard Medical School
What brings you joy?
(what gets you up in the morning?
Neglecting your joy will lead to burnout.)

What you should do

What are you good at?
(your special skills, network, resources, & magic)

What is the work that needs doing?
(climate & justice solutions)
Common greenhouse gas emission sources in health care

SCOPE 1
- Onsite energy
- Fleet vehicles
- Waste anesthetic gas
- Refrigerants

SCOPE 2
- Business travel
- Employee commute
- Waste disposal
- Meat procurement
- Pharmaceuticals

SCOPE 3
- Medical devices and equipment

Carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), nitrogen trifluoride ($NF_3$), and sulphur hexafluoride ($SF_6$)

Scope 3 Other: These are the most common emissions for health care, but there are other relevant categories in Scope 3. To review all 15 categories covered in Scope 3, visit the GHG Protocol Scope 3 Guidance.

Source: Practice Greenhealth
Emissions in the OR

Figure 2 Relative contribution of scopes 1, 2, and 3 to the carbon footprint of operating theatres at (A) Vancouver General Hospital, (B) University of Minnesota Medical Center, and (C) John Radcliffe Hospital
FY 2021 MAIN CAMPUS GHG EMISSIONS BY SCOPE

- Scope 1: 500,163 kg CO₂ (14%)
- Scope 2: 3,003,552 kg CO₂ (86%)

FY 2021 MAIN CAMPUS GHG EMISSIONS BY SOURCE

- Scope 1 Vehicle Fuel: 448,102 kg CO₂ (13%)
- Scope 1 Heating/Cooking: 0%
- Scope 1 Generators: 0%
- Scope 1 Anesthetic Gases: 0%
- Scope 2 Electricity: 3,003,552 kg CO₂ (86%)
- Scope 2 Steam: 0%
Sustainability Initiatives

SCOPE 1

- Anesthetic gases
  - Educate anesthesia staff on global warming potential of anesthetic gases
  - Reduce desflurane and nitrous oxide use
- Cooking
  - Replace kitchen equipment with electric alternatives

SCOPE 2

- Steam
  - Improve efficiency and minimize losses
  - Discuss zero-emissions options with steam
Educate Your Patients

Veracity Index 2020 – all professions

“Now I will read you a list of different types of people. For each would you tell me if you generally trust them to tell the truth, or not?”

- Nurses: 93%
- Doctors: 91%
- Engineers: 85%
- Teachers: 84%
- Judges: 83%
- Professors: 82%
- Scientists: 82%
- Museum curators: 76%
- Care home workers: 75%
- Home delivery drivers: 71%
- The Police: 61%
- Lawyers: 57%
- Civil Servants: 56%
- The ordinary man/woman in the street: 53%
- Clergy/priests: 53%
- Economists: 53%
- Pollsters: 49%
- Television news readers: 44%
- Charity chief executives: 44%
- Trade union officials: 42%
- Bankers: 42%
- Local councillors: 37%
- Landlords of private residential properties: 33%
- Business leaders: 30%
- Estate agents: 27%
- Journalists: 23%
- Government Ministers: 16%
- Politicians generally: 15%
- Advertising executives: 13%

Base: 957 and 916 British adults aged 18+, interviewed by telephone 9 – 16 and 16 – 25 October 2020

© Ipsos | Veracity Index 2020 | November 2020 | Version 1 | Public
Join an Advocacy Group

• Sign petitions
• Email, call or meet with your representatives
• Support candidates committed to addressing climate change
• Write Op-Eds, letters to the Editor
Divestment

$40.50 TRILLION
Approximate value of institutions divesting.

1552
Institutions Divesting

• Advocate for sustainable retirement plans at your institution
• Institutional divestment:
  • Freeze any new investment in fossil fuel companies
  • Divest from direct ownership and commingled funds that include fossil fuel public equities and corporate bonds within 5 years
  • End fossil fuels sponsorship
• Examples: apartheid, cigarettes

gofossilfree.org
Offset Your Emissions

• *Last resort – only for emissions you can’t eliminate*

• Donate to companies that invest in renewable energy, forest preservation, emissions reduction strategies etc.

• Scan the QR code to donate to Cool Effect
Thank you!