Making the Connection:
Climate Changes Allergies and Asthma
May 9, 2016, 1:30 pm EDT
Welcome

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American Public Health Association
Making the Connection:

Climate Changes Health webinar series

Part I – Climate Changes Allergies and Asthma
May 9, 1:30 p.m. EDT

Part II – Climate Changes Children’s Health
May 26, 1:30 p.m. EDT

Part III – Changing Climate through Healthy Community Design and Transportation
June 7, 1:30 p.m. EDT

Part IV – Climate Changes Mental Health
June 29, 1:30 p.m. EDT
Follow the conversation on social media using the hashtags #APHAWebinar and #ClimateChangesHealth. For more information on how climate change impacts health, please visit www.apha.org/climate.
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Chair, Council on Medical Legislation
Co-Chair, Commission on Environmental Health
National Medical Association
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&
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Disclosures

- **FEDERAL FUNDING**
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  - National Institute of Allergy and Infectious Diseases

- **CORPORATE /ORGANIZATIONAL**
  - Associate Editor, JACI
  - Board of Directors, AAAAI
  - Springer (Editor, Current Allergy and Asthma Reports)
  - Up-to-Date
  - Glaxo Smith Kilne (Clinical Trial)
Climate Change and Ambient Air Pollution

Outdoor pollution
General facts about pollutant exposure and asthma exacerbation

- Generally, increases in asthma exacerbation occurs 24-48 hours after the pollutant exacerbation
- Often, exacerbations occur with pollutant exposures less than current NAAQS standards
- Pollutants enhance response to allergen
Actions of Inhaled Pollutants

- **Ozone**
  - **Acute airway inflammation**
  - Increased airway reactivity
  - Temporarily immediate decrease in lung function
  - Increased airway reactivity (twitchiness)

- **PM**
  - **Acute airway inflammation**
  - Some increased airway reactivity (twitchiness)
  - May decrease lung function
  - CV effects
    - Coagulation
    - HRV
Asthmatics are more susceptible to ozone effects and have increased response to allergens after ozone exposure.
## Air Quality Index for Ozone

<table>
<thead>
<tr>
<th>Index Values (Conc. Range)</th>
<th>Air Quality Descriptors</th>
<th>Cautionary Statements for Ozone</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 50 (0-60 ppb)</td>
<td>Good</td>
<td>No health impacts are expected when air quality is in this range.</td>
</tr>
<tr>
<td>51 – 100 (61-75 ppb)</td>
<td>Moderate</td>
<td>Unusually sensitive people should consider limiting prolonged outdoor exertion.</td>
</tr>
<tr>
<td>101 – 150 (76-104 ppb)</td>
<td>Unhealthy for Sensitive Groups</td>
<td>Active children and adults, and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion.</td>
</tr>
<tr>
<td>151 – 200 (105-115 ppb)</td>
<td>Unhealthy</td>
<td>Active children and adults, and people with respiratory disease, such as asthma, should avoid prolonged outdoor exertion; everyone else, especially children should limit prolonged outdoor exertion.</td>
</tr>
<tr>
<td>201 – 300 (116-374 ppb)</td>
<td>Very Unhealthy</td>
<td>Active children and adults, and people with respiratory disease, such as asthma, should avoid all outdoor exertion; everyone else, especially children, should limit outdoor exertion.</td>
</tr>
</tbody>
</table>
# AQI-PM

## Air Quality Guide for Particle Pollution

<table>
<thead>
<tr>
<th>Adjective</th>
<th>Air Quality Index (AQI)</th>
<th>Concentration PM 2.5 (µg/m³ - 1-3 hr. avg.)</th>
<th>Cautionary Statement</th>
<th>Health Effects Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>0-50</td>
<td>0-38</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Moderate</td>
<td>51-100</td>
<td>39-88</td>
<td>Unusually sensitive people should consider reducing prolonged or heavy exertion</td>
<td>None</td>
</tr>
<tr>
<td>Unhealthy for Sensitive Groups</td>
<td>101-150</td>
<td>89-138</td>
<td>People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.</td>
<td>Increasing likelihood of respiratory symptoms in sensitive individuals, aggravation of heart or lung disease and premature mortality in persons with cardiopulmonary disease and the elderly.</td>
</tr>
<tr>
<td>Unhealthy</td>
<td>151-200</td>
<td>139-351</td>
<td>People with heart or lung disease, older adults, and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion.</td>
<td>Increased aggravation of heart or lung disease and premature mortality in persons with cardiopulmonary disease and the elderly; increased respiratory effects in general population.</td>
</tr>
<tr>
<td>Very Unhealthy Alert</td>
<td>201-300</td>
<td>352-526</td>
<td>People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.</td>
<td>Significant aggravation of heart or lung disease and premature mortality in persons with cardiopulmonary disease and the elderly; significant increase in respiratory effects in general population.</td>
</tr>
<tr>
<td>Hazardous</td>
<td>300+</td>
<td>526+</td>
<td>People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.</td>
<td>Significant aggravation of heart or lung disease and premature mortality in persons with cardiopulmonary disease and the elderly; significant increase in respiratory effects in general population.</td>
</tr>
</tbody>
</table>
Figure 8. Ozone concentrations in ppm, 2010 (fourth highest daily maximum 8-hour concentration).
PM-2.5 Nonattainment Areas (2006 Standard)

Nonattainment areas are indicated by color. When only a portion of a county is shown in color, it indicates that only that part of the county is within a nonattainment area boundary.
Anticipated increases in ozone levels in 2030 due to increased greenhouse gas emissions

Similar increases in particulate matter as well
Wildfires and woodsmoke

An emerging threat
Aerial Photos of exposed areas of NC with 2008 Eastern NC wildfires
Asthma ED visits and risk of adverse health outcomes with the wildfires
Climate Change: Impact on Allergens and Viruses
Increased CO₂ linked to increased Ragweed Pollen and increased *Amb a 1* concentration/mg pollen
Change in the length (days) of ragweed pollen season as a function of frost-free days with latitude for the period 1995–2009.

Ziska L et al. PNAS 2011;108:4248-4251
Fig. 2. RSV incidence in Florida compared to temperature and rainfall (June 2010 to May 2013).

Stuart Paynter, Peter D. Sly, Robert S. Ware, Gail Williams, Philip Weinstein

The importance of the local environment in the transmission of respiratory syncytial virus☆☆☆


http://dx.doi.org/10.1016/j.scitotenv.2014.06.021
Potential Interventions

Personal and Societal
Fluticasone Propionate Protects against Ozone-Induced Airway Inflammation and Modified Immune Cell Activation Markers in Healthy Volunteers

Neil E. Alexis,1,2 John C. Lay,1 Angela Haczkó,3 Henry Gong,4,5 William Linn,4,5 Milan J. Hazucha,1 Brad Harris,1 Ruth Tal-Singer,6 and David B. Peden1,2

Figure 2. The percent sputum neutrophils after O₃ exposure for each pretreatment dose of FP (0.5 or 2 mg) or placebo.

*p<0.05 compared with placebo.
Mean Levels of Major Pollutants Before, During, and After the 1996 Summer Olympic Games as a Percentage of the National Ambient Air Quality Standard (NAAQS)

Table 1. Acute Asthma Events and Acute Nonasthma Events Among Children and Youth During the 1996 Summer Olympic Games Compared With the 1996 Summertime Baseline Period

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Type of Asthma Event</th>
<th>Acute Asthma Events Mean (SD) No. of Events Per Day</th>
<th>Acute Nonasthma Events Mean (SD) No. of Events Per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Baseline Period†</td>
<td>Olympic Period†</td>
</tr>
<tr>
<td>Georgia Medicaid claims file</td>
<td>Emergency care and hospitalizations</td>
<td>4.23 (2.81)</td>
<td>2.47 (1.46)</td>
</tr>
<tr>
<td>Health maintenance organization</td>
<td>Emergency care, urgent care, and hospitalizations</td>
<td>1.36 (1.63)</td>
<td>0.76 (0.83)</td>
</tr>
<tr>
<td>Pediatric emergency departments</td>
<td>Emergency care and hospitalizations</td>
<td>4.77 (2.52)</td>
<td>4.24 (2.49)</td>
</tr>
<tr>
<td>Georgia Hospital Discharge Database</td>
<td>Hospitalizations</td>
<td>2.04 (1.53)</td>
<td>1.65 (1.50)</td>
</tr>
</tbody>
</table>

*Defined as June 21–July 18 and August 5–September 1, 1996.
†Defined as July 19–August 4, 1996.
Ensemble-mean U.S.-average population-weighted annual 8-h-max O3 and PM2.5 in 2000, 2050, and 2100 under REF, POL4.5, and POL3.7 scenarios.
Summary

• Asthma is characterized by increased response to a number of agents
  » Air pollutants
  » Allergens
  » Viruses

• Climate Change will increase:
  » Air pollutants
  » Allergens
  » Viral seasons

• It is still possible for:
  » People to protect themselves from asthma attacks due to pollution and other agents
  » Decrease the impact of climate change with environmental policy
Making the Connection: Climate Changes Allergies and Asthma

Mona Sarfaty, MD MPH FAAFP
Presenter Disclosures

Mona Sarfaty

(1) The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:

No financial relationships to disclose
Outline

- Significance of allergic and asthmatic disease
  - Prevalence
  - Symptoms
  - Cost – human and dollar
- How the changing climate is affecting allergy season and asthma
- What we learned by surveying physicians
- Health equity factors
- Public health approach to these problems
Introduction

- Allergies are a common cause of misery for many people.
- Allergic runny nose ("hayfever" or "allergic rhinitis") is the most widespread allergy condition.
  - Symptoms: sneezing, nasal stuffiness (obstruction), itching, post nasal drip, cough, irritability, fatigue.
  - Effects 10-30% of the population.
  - 11 million office visits per year.
  - It costs @$11.2 billion / year to treat.
Allergic Rhinitis (Hayfever) Can Drain Human Potential

- Associated with more absenteeism and more unproductive workdays for adults than any other condition
- Associated with cognitive and psychiatric issues in children and adults
- Children: may have lower exam scores, poor concentration, low self-esteem, impaired athletic performance
- Adults: may have depression, anxiety, lower quality of life scores
Allergies are Changing due to Climate Change

- Allergic rhinitis has 2 peaks per year: Spring and Fall
  - Both are coming earlier
- The allergy season is longer
- Geographic growth region for some allergies is growing
- Allergy season is more intense

Common complaint: “allergy season is worse than last year”
Why is Allergy Season Longer and More Intense?

- Average temperatures are higher
- Precipitation is greater in many places
- More carbon dioxide

These climate change related factors affect plants in several ways:
  - Some plants have spread into new areas
  - Pollen season begins earlier and lasts longer
  - Existing plants may be more robust or grow better or produce more pollen
  - The inciting agent, typically the pollen, is actually different
Comparing 1991-2012 with 1900-1961

Observed U.S. Temperature Change

Temperature Change (°F)
- >1.5
- 1.0 to 1.5
- 0.5 to 1.0
- 0.0 to 0.5
- -0.5 to 0.0
- -1.0 to -0.5
- -1.5 to -1.0
- <=-1.5
Geographic Vulnerability

Figure 1. Intersection of Ragweed-Positive and Eight-Hour Ozone Exceedance-Positive Areas in the Continental United States

Source: US Environmental Protection Agency, US Department of Agriculture

*American Thoracic Society and Environmental Protection Agency, Air Quality and Asthma, 2012

†Richmond City County does not have an ozone monitor, but the broader metro area in encircling Henrico County registered both presence of ragweed and >=1 ozone exceedance days.
Map shows for how long ragweed pollen season has changed from 1995 to 2005. Many people are allergic to Ragweed.

http://www.ars.usda.gov/ & U.S. National Climate Assessment
Why are Allergy Seasons More Intense?

- Study of ragweed pollen showed it is more allergenic due to the carbon dioxide enriched atmosphere (L Zizka, PhD)
  - How did they determine this:
    - Carbon dioxide level is not exactly the same in every part of the U.S.
    - Ragweed was grown in different places where carbon dioxide differed
    - Pollen analyzed and found to have different amounts of the allergenic component

- More pollen production where higher levels of carbon dioxide
- Greater mold growth in some areas (just mentioned)
- Deteriorating air quality
Another Factor Causing Allergic Reactions is Mold

- Mold growth (& spore production) associated with:
  - Increases in precipitation
  - Flooding and recurrent flooding
  - Increases in temperature and/or humidity
  - Plant decay (leaf litter)
  - Improper installation or management of air conditioning

- Mold allergy can cause coughing, wheezing, nasal & throat conditions, and adversely affect persons with asthma or weakened immune systems


Extensive Mold Contamination of Ceiling and Walls
Allergic Rhinitis Is Associated with Other Health Conditions

- Red itchy eyes (conjunctivitis)
- Eczema, itchy rashes affecting the skin
- Worsening of asthma
  - Asthma affects 24 million people
  - Close relationship between asthma and allergies
    - 60% Pediatric Asthma is allergy related
    - 40% Adult Asthma is allergy related
Asthma

- The most common chronic disease of childhood but affects more adults than children
  - 7% of adults or 17.7 million have asthma (NHIS, 2014)
  - 8.6% of children or 6.3 million (NHIS, 2014), but 20% of children in many urban school systems

- Characterized by repeated episodes of coughing, wheezing, chest tightness, breathlessness

- Almost 2 million ED visits, .5 million hospitalizations, 3,630 deaths

- Cost $56 billion per year ($50 billion is direct) (2007)
  - 60% of children and 33% adults with an asthma attack miss school or work
Health Equity Concerns

- Asthma is affected by a number of factors that are a problem for some populations more than others
- Especially factors that contribute to poorer quality environments:
  1. Outdoor air – ozone, particulates including dust, effluents from incinerators, smokestacks, and businesses that use certain chemicals
  2. Indoor air exposures in housing, school, work environments (mold, dust, insect danders)
- Due to connection what affects allergies, affects asthma
Pathogenesis: Ozone irritates the lungs and makes people more vulnerable to the effects of small particles and allergens.*

Current Asthma Prevalence by Age Group, Sex, Race and Ethnicity, Poverty Status, Geographic Region, and Urbanicity: United States, Average Annual 2008-2010 (CDC)
What We Have Learned From Surveying Doctors?

- Program on Climate and Health, GMU, did 3 Surveys of medical societies representing a. lung specialists (ATS) b. allergists (AAAAI) c. African American physicians (NMA).

- 76% of physicians in 3 surveys indicated their own patients were experiencing air pollution related worsening of cardiorespiratory disease (including asthma); 63% indicated that climate change was causing their own patients to have more allergy symptoms and visits.

- We asked for anecdotes describing their patient experiences.
Allergies and Asthma

I have more patients with asthma and allergies coming in with flares earlier and earlier in the year because pollen is produced earlier and earlier. (Tennessee)

Asthma triggered by seasonal allergies which have been getting worse over the past 5 years, with longer pollen periods due to warmer weather. (Nevada)

We all see each year the pollen counts breaking new records which directly impacts our allergic rhinitis and asthmatic patients. (North Carolina)

With the current fluctuations in weather, we have seen quite a few asthma exacerbations. People are used to having the weather be one way so they can predict when they may have trouble with their illness, but now they are finding it more difficult to do so. (Ohio)
Mold Allergies

[I have seen] Numerous patients with fall mold allergies whose symptoms now last well into December since the ground takes longer to freeze. (Michigan)

Mother and daughter who lived in a moldy house presented with asthmatic symptoms that were refractory to treatment until they were moved to a different environment. (Ohio)

Recent rainfall and flooding increased patient in-home exposure to mold and humidity, (this) resulted in asthma emergency visits and hospitalizations. (Unk)
Vulnerability: Multiple Threats

“...children with asthma with more frequent symptoms, exacerbations due to poor air quality; [air] inversions, high allergen counts, rental living accommodations with visual mold, living in areas with high winds, fires.”

(Lung Specialist, Washington state)
Public Health Approach
Conclusion

- Allergy problems are common and occurring for longer seasons and at greater intensity due to conditions caused by climate change, including longer pollen seasons, higher carbon dioxide levels, and factors that support mold growth.

- There is a substantial connection between allergies and asthma.

- The risk factors for allergies and asthma are more severe in vulnerable communities where conditions for good health may be compromised and where environmental injustice has been at work.

- Observations from surveyed physicians.

- Public health approach can help address allergies and asthma.
Thank You!

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Questions and Answers

Please submit questions through the chat box.

For more info on upcoming *Climate Changes Health* webinars, visit www.apha.org/climate-changes-health

*These webinars were funded through a memorandum of understanding between the American Public Health Association and ecoAmerica. The contents of the webinars are solely the responsibility of the presenters and do not necessarily represent the official views of the American Public Health Association or ecoAmerica.*
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