INQUINAMENTO ATMOSFERICO ed EFFETTI SULLA SALUTE

Gennaro D’Amato

Responsabile Area Clinica Associazione Italiana di Pneumologia (AIPO)

Università di Napoli, Federico II, Scuola di Specializzazione in Malattie dell’Apparato Respiratorio

Unità Operativa Complessa di Malattie Respiratorie e Allergiche Azienda Ospedaliera ad Alta Specialità di Rilievo Nazionale A.Cardarelli Napoli

Chairman World Allergy Organization Committee and Task Force on Climate Change, air pollution and Allergic Respiratory Diseases.
Air pollution is associated with mortality and morbidity for respiratory and cardiovascular diseases.

PM and ozone are aggravating factors of asthma and increase the effects of airborne allergens with different mechanisms.

Living near heavy traffic roads is associated with impaired respiratory health and lung development.

Subjects living in urban areas tend to be more affected by plant-derived respiratory disorders than those living in rural areas.

Global warming affects start, duration and intensity of pollen season.

Subjects affected by pollen allergy should be alert to the danger of being outdoors during a thunderstorm in the pollen season.
What Has Changed over the Last 100 years?

- Increased Allergy
- Urbanisation and Pollution
  - $SO_2$
  - $NO_2$
  - $CO_2$
  - $O_3$
  - Particles
  - VOC
- Increased Temperatures
- Increased $CO_2$ levels
- Increased Allergy
Relationship between outdoor and indoor air pollution

**Outdoor**: O₃, NO₂, respirable PM, DEP, SO₂

**Indoor**: tobacco smoke, NO₂, CO, acid aerosols
In the last 50 years 50% of pluvial forests of our Planet have been destroyed.

Each year 13 millions of forests hectares are destroyed or deteriorated.

Each hour about 50 hectares of wood disappear.
Food cultivation on wasted areas of tropical pluvial forests determined about 35% of deforestation in South America, 70% in African and 50% in Asian countries.
There are 20 cities expected to have > 10 million inhabitants by the year 2015 and two thirds of mankind are expected to live in megalopolis by 2020. Current projections suggest that the world population will be close to nine billion by 2050.
L'uomo è l'unico animale che ha distrutto il suo ambiente a spese della sua specie...
Pollutants involved in development of respiratory diseases

Chemical agents

**Outdoor**: respirable PM; DEP; Ozone, Nitrogen dioxide; sulfure dioxide.

**Indoor**: tobacco smoke, nitrogen dioxide, Carbon monoxide, acid aerosols
Asthma and allergy results from multiple factors, including gene–environment interactions

- Epigenetic mechanisms such as DNA methylations may constitute a link between genetic and environmental factors, as several environmental factors have proved to influence methylation patterns

Holloway JW et al. Genomics and the respiratory effects of air pollution exposure. Respirology 2012

Koppelman GH et al. Recent advances in the epigenetics and genomics of asthma. Curr Opin Allergy Clin Immunol 2011
The Possible Ways by which Atmospheric Pollution may Increase Allergy and Asthma

Enhancement of Organ Hyper-responsiveness

Enhanced Pollen Production and Antigenicity

Genetic Predisposition

Allergic Sensitisation

Enhancement of Sensitization

Triggering Episodes of Disease

Disease
Associations between PM and Respiratory Health


- **Hospitalization for respiratory and cardiovascular diseases.** (Morgan et al, *AJPH* 1998; Schwartz & Morris, *AJE* 1995; Dockery & Stone NEJM 2007);

- **Asthma attacks.** (Ostro et al, *AJPH* 1991; Schwartz J et al, *ARRD* 1993);

- **Asthma medication use.** (Pope et al, *ARRD* 1991; Roemer et al, *ARRD* 1993);

- **Lung function.** (Hoek & Brunekreef, *AEH* 1993; Ackermann-Liebrich et al, *AJRCCM* 1997; Downs et al NEJM 2007);

- **Lung function in children.** (Horak FJ et al. ERJ 2002; Annesi I et al Resp Med 2007)

AIR POLLUTION AND ALLERGIC ASTHMA

The PIAMA study

✓ PM2.5 levels were independently associated with significant increases in incidence and prevalence of asthma, as well as asthma symptoms

✓ In-utero and early life exposure to PM2.5, black carbon, and soot is correlated to incidence of asthma, wheeze, and atopy to common allergens later in life

Clark NA et al. Effect of early life exposure to air pollution on development of childhood asthma. Environ Health Perspect 2010
Respiratory Effects of Exposure to Diesel Traffic in Person with Asthma

McCreanor J, NEJM Dec 2007
Walking for 2 hours on Oxford Street induced asymptomatic but consistent reductions in the forced expiratory volume in 1 second (FEV1) (up to 6.1%) and forced vital capacity (FVC) (up to 5.4%).

Mc Creanor J, NEJM Dec 2007
Acute Effects of Ozone

- Respiratory symptoms
- Acute decreases in lung function
- Increased airway responsiveness
- Airway injury and inflammation
- Altered airway permeability
- Systemic oxidative stress and perturbation of antioxidant defences

Immune Changes and Ozone

- Neutrophilic inflammation of the airway mucosa
  - Increases IL-8, GM-CSF, and ICAM-1
  - Albumin, IgG, and alpha-1-antitrypsin increased

- In vitro studies show increases in NF-kB and AP-1
McConnell et al observed that the incidence of new diagnoses of asthma in children are associated with heavy exercise in communities with high concentrations of ozone and PM. As a consequence, air pollution and outdoor exercise could contribute to the development of asthma in children.

McConnell R, Berhane K, Gilliland F et al. Prospective study of air pollution and bronchitic symptoms in children with asthma. AJRCCM 2003;168:790-797
Climate change...

The health benefits of tackling climate change
A Lancet Series

"If properly chosen, action to combat climate change can, in itself, lead to improvements in health. The town is not all bad."

Lancet 2009

...the biggest global health threat of the 21st century
• Global warming results from an increased greenhouse effect in the atmosphere.
• You can picture it as a blanket of gases (CO$_2$, CH$_4$, N$_2$O) that wraps around the Earth and holds the heat in.
CO2 is the most important anthropogenic greenhouse gas and about 75% of CO2 emissions during the past 20 years resulted from fossil fuel burning.

Source: IPCC, 2007 (Working group I)
Le dieci conferme:

- IL RISCALDAMENTO GLOBALE È INEQUIVOCABILE
- EVENTI ESTREMI PIU’ FREQUENTI
- LA FUSIONE DEI GHIACCI STA ACCELERANDO
- L’AUMENTO DEL LIVELLO DEL MARE STA ACCELERANDO
- È COLPA NOSTRA
- LE MODIFICHE AL CLIMA GLOBALE DURERANNO PER SECOLI
- DA 2 A 4 GRADI DI AUMENTO DELLE TEMPERATURE GLOBALI A FINE SECOLO
- DA 50 A 80 CM DI AUMENTO DEL LIVELLO DEL MARE A FINE SECOLO
- I GHIACCI CONTINUERANNO A FONDERSI
- PRECIPITAZIONI PIU’ INTENSE

Corriere della sera, 27 settembre 2013
Determinants of climate changes

Climate change is occurring as a result of greenhouse gas (GHG) (water, CO$_2$, CH$_4$, N$_2$O), emissions from:

- Anthropogenic factors: fossil fuel combustion from energy supply, transport, agriculture, industry, forestry, waste, and commercial and residential buildings.
- Natural factors, like spontaneous combustion (wild fires due to elevated temperatures, volcanoes …)
Climate Change, Air Pollution and Allergy. 

Air pollution leads to:

- Higher Allergenicity

“There is an interaction between air pollutants and allergens that exacerbates the development of atopy and the respiratory symptoms of allergic disease.”  

1 D’Amato G et al. Eur Resp J 2002;  

- Higher Airway Responsiveness

“In atopic subjects, exposure to air pollution increases airway responsiveness to aeroallergens.”  

1

- More Allergens

“increased ... air temperature significantly influences the pollen production, ... and subsequent atmospheric pollen concentration“  

Air pollution may modify the effect of aeroallergens

- The inflammatory effects of O3, particulate matter (PM), and SO2 allow for easier penetration of pollen allergens into the airways.
- Increasing release of antigens from pollen grains.
- Absorb pollen grains and thus prolong their retention in the body once inhaled.

- Some pollutants (DEPs) seem to have an adjuvant immunologic effect on IgE synthesis in atopic subjects which can interact in atmosphere with pollens or paucimicronic particles (Riedl M et al JACI 2005)

Colleen ER, EchoHealth, 2009
D’Amato G et al ERJ 2002; Clin Exp Allergy 2007; MRM 2013
The “urban climate effect”

The plants flower earlier in urban areas than in the corresponding rural areas with earlier pollination of about 2-4 days.

Emberlin et al CEA 1999;
Beggs CEA 2002;
D’Amato et al ERJ2002; Allergy2007; CEA2008; JIACI 2010
What is the Association Between Weather / Climate Variability & Pollen Trends?

Studies on plant responses to elevated CO2 indicate that plants exhibit enhanced photosynthesis and reproductive effects and produce more pollen.

Emberlin et al CEA 1999
D‘Amato et al Allergy 2007;
MRM2013
Changes in CO2 Concentration

Changes in Climate
- heat waves
- extreme events
- precipitation
- temperature

Changes in Aeroallergens
- timing
- location
- quantity

Human Health Impacts:
- allergic rhinitis
- asthma exacerbation
- atopic dermatitis
Inquinamento atmosferico urbano, variazioni climatiche e patologia respiratoria

Introduzione

Il massiccio aumento delle emissioni in atmosfera di agenti inquinanti prodotti negli ultimi decenni nei paesi industrializzati dal frenetico aumento dei trasporti pubblici e privati, e, prevalentemente nei paesi in via di sviluppo, dall’urbanizzazione crescente, dall’attività industriale e dalla deforestazione selvaggia, ha fatto sì che la qualità dell’aria che respiriamo costituisca un problema ambientale importante. Questa problematica riguarda non solo i paesi europei e l’America (non solo Nord ma anche Cen-
inquinanti, arrestando la deforestazione e concertando una gestione sostenibile delle risorse.

È necessario porre un freno ai cambiamenti climatici, decurtando le emissioni di CO₂ e degli altri inquinanti, arrestando la deforestazione e concertando una gestione sostenibile delle risorse.

D’altra parte gli approcci di sanità pubblica, per ridurre l’esposizione dei cittadini.
REVIEW

Urban air pollution and plant-derived respiratory allergy

G. D'AMATO

Division of Pneumology and Allergology, Department of Chest Diseases, Azienda Ospedaliera ad Alta Specialità, 'A. Cardarelli', Naples, Italy

Effects of climate change on environmental factors in respiratory allergic diseases

G. D'Amato* and L. Cecchi†‡

*Division of Respiratory and Allergic Diseases, Department of Chest Diseases, High Speciality Hospital 'A. Cardarelli', Napoli, Italy and †Allergy Clinic, Azienda Sanitaria TOS Firenze, Florence, Italy
Allergenic pollen and pollen allergy in Europe

The allergenic content of the atmosphere varies according to climate, geography and vegetation. Data on the presence and prevalence of allergenic airborne pollens, obtained from both aerobiological studies and allergological investigations, make it possible to design pollen calendars with the approximate flowering period of the plants in the sampling area. In this way, even though pollen production and dispersal from year to year depend on the patterns of preseason weather and on the conditions prevailing at the time of anthesis, it is usually possible to forecast the chances of encountering high atmospheric allergenic pollen concentrations in different areas. Aerobiological and allergological studies show that the pollen map of Europe is changing also as a result of cultural factors (for example, importation of plants such as birch and cypress for urban parklands), greater international travel (e.g. colonization by ragweed in France, northern Italy, Austria, Hungary etc.) and climate change. In this regard, the higher frequency of weather extremes, like thunderstorms, and increasing episodes of long range transport of allergenic pollen represent new challenges for researchers. Furthermore, in the last few years, experimental data on pollen and subpollen-particles structure, the pathogenetic role of pollen and the interaction between pollen and air pollutants, gave new insights into the mechanisms of respiratory allergic diseases.

G. D'Amato², L. Cecchi³,⁴, S. Bonini⁵,⁶, C. Nunes⁷,⁸, I. Annesi-Maesano⁹, H. Behrendt¹⁰, G. Liccardi¹, T. Popov¹⁰, P. van Cauwenberge¹¹

¹Division of Respiratory and Allergic Diseases, Department of Chest Diseases, High Speciality Hospital “A. Cardarelli” Napoli; ²Interdepartmental Centre of Bioclimatology, University of Florence, Florence; ³Allergy Clinic, Azienda Sanitaria 10 Firenze, Florence; ⁴Second University of Naples, Naples, Italy; ⁵Institute of Neurobiology and Molecular Medicine National Research Council, ARTOV, Rome, Italy; ⁶Centro de Imunologia do Algarve, Portimao, Portugal; ⁷INSERM, UMR S 707: EPAR, Paris, France; ⁸Université Pierre et Marie Curie – Paris 6, UMR S 707: EPAR, Paris, France; ⁹KKG Umweltdermatologie und Allergologie GSF/TUM, Munich, Germany; ¹⁰Clinical Centre of Allergology, Medical University, Sofia, Bulgaria; ¹¹Department of Oto-Rhino-Laryngology, University Hospital Gent, Belgium
Projected projections of the effect of climate change on allergic asthma: the contribution of aerobiology


Endorsed by EAACI and ERS
Task force on “Climate change, air pollution and respiratory diseases”
Chairpersons:
G. D’Amato and I. Annesi

• Global warming affects start, duration and intensity of pollen season
• Air pollution is associated with mortality and morbidity for respiratory and cardiovascular diseases.
• PM and ozone are aggravating factors of asthma and increase the effects of airborne allergens with different mechanisms.
• Living near heavy traffic roads is associated with impaired respiratory health and lung development.
• Subjects living in urban areas tend to be more affected by plant-derived respiratory disorders than those living in rural area.
ERS POSITION STATEMENT

Climate change and respiratory disease: European Respiratory Society position statement


ABSTRACT: Climate change will affect individuals with pre-existing respiratory disease, but the extent of the effect remains unclear.

The present position statement was developed on behalf of the European Respiratory Society in order to identify areas of concern arising from climate change for individuals with respiratory disease, healthcare workers in the respiratory sector and policy makers. The statement was developed following a 2-day workshop held in Leuven (Belgium) in March 2008.

Key areas of concern for the respiratory community arising from climate change are discussed and recommendations made to address gaps in knowledge. The most important recommendation was the development of more accurate predictive models for predicting the impact of climate change on respiratory health.

Respiratory healthcare workers also have an advocacy role in persuading governments and the European Union to maintain awareness and appropriate actions with respect to climate change, and these areas are also discussed in the position statement.
Current knowledge of effects of climate change on respiratory allergy is provided by epidemiological and experimental studies on the relationship between asthma and environmental factors, such as meteorological variables, airborne allergens and air pollution.

D’Amato G, Holgate S.T. Environmental Risk Factors and Bronchial asthma. Clin Exp Allergy 2005

Urban Air Pollution and Climate Change as Environmental Risk Factors of Respiratory Allergy: An Update

G D’Amato,1 L Cecchi,2,3 M D’Amato,4 G Liccardi1

1Division of Pneumology and Allergology, Department of Respiratory Diseases, High Specialty Hospital “A.Cardarelli,” Naples, Italy
2Interdepartmental Centre of Bioclimatology, University of Florence, Florence, Italy
3Allergy Clinic, Azienda Sanitaria 10, Florence, Italy
4Division of PneumoPhthisiology, Department of Respiratory Diseases, High Specialty Hospital “V. Monaldi,” Naples, Italy
Effects of climate change on respiratory allergy

D’Amato & Cecchi, *Effects of Climate Change on Environmental Factors in Respiratory Allergic Diseases*. Clinical and Experimental Allergy 2008

- **Positive effects**
  - Reduced susceptibility to upper respiratory infections (due to increase in winter temperature)

- **Negative effects**
  - Earlier start, increase of length and intensity of pollen season
  - Increase of pollutants levels
  - Increase of heavy precipitation events (e.g., thunderstorms)
  - Increased occurrence of episodes of long distance transport of pollen and pollutants

Additional points:
- Increase of heavy precipitation events (e.g., thunderstorms)
- Increased occurrence of episodes of long distance transport of pollen and pollutants
- Reduced susceptibility to upper respiratory infections (due to increase in winter temperature)

D’Amato & Cecchi, *Effects of Climate Change on Environmental Factors in Respiratory Allergic Diseases*. Clinical and Experimental Allergy 2008
Earlier start of pollen release

Higher allergenicity and/or production of pollen

Longer duration of exposure

greater likelihood of the development of new sensitizations

greater likelihood of the development of allergy

Earlier appearance of symptoms

Cecchi L. D’Amato G et al
Allergy, 2010
Climate Change, Migration and Allergic Respiratory Diseases: An Update for the Allergist

Gennaro D’Amato (Chair), MD, Menachem Rottem, Ronald Dahl, Michael Blaiss, Erminia Ridolo, Lorenzo Cecchi, Nelson Rosario, Cassim Motala, Ignacio Ansotegui, Isabella Annesi-Maesano,
Climate change affects allergic respiratory diseases

In a review from the World Allergy Organization’s Special Committee on Climate Change and Allergy (WAO Journal, July 2011), D’Amato et al report that local climate changes coupled with air pollution and altered weather patterns might have a significant effect on the frequency and severity of allergic respiratory diseases. Climate changes have affected local plant growth, as well as pollen production and dispersion, resulting in earlier and longer pollination seasons that potentially could lead to increased duration of symptoms in sensitized subjects. Alterations in local vegetation and airborne allergens caused by climate change can result in new pollen sensitization and increased prevalence of allergic respiratory disease. Editors’ note: For those readers interested in this topic, further articles on the relationship among climate change, air pollution, and allergy can be found in the January 2012 issue of the Journal of Allergy and Clinical Immunology.

Committee chair Gennaro D’Amato, from High Specialty Hospital A. Cardarelli, Naples, Italy, commented on the importance of this topic: “Strategies to reduce climatic changes and air pollution are political in nature, but citizens and in particular health professionals and societies must raise their voices in the decision process to give strong support for clean policies on both national and international levels.”
ORIGINAL RESEARCH

Short-term effects of airborne pollens on asthma attacks as seen by general practitioners in the Greater Paris area, 2003-2007

Bich Tram Huynh, Séverine Tual, Clément Turbelin, Camille Pelat, Lorenzo Cecchi, Gennaro D’Amato, Thierry Blanchon, *Isabella Annesi-Maesano

Conclusions: For the first time, a significant short-term association was observed between Poaceae pollen counts and consultations for asthma attacks as seen by GPs.

Table 2. Spearman’s correlation matrix of pollen counts with air pollutants and meteorological variables, Paris and surrounding area, 2003-7.

<table>
<thead>
<tr>
<th>Pollens</th>
<th>Betula</th>
<th>Cupressa</th>
<th>Fraxinus</th>
<th>Poaceae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Betula</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cupressa</td>
<td>0.31*</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fraxinus</td>
<td>0.18*</td>
<td>0.76*</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Poaceae</td>
<td>0.52*</td>
<td>0.75*</td>
<td>0.77*</td>
<td>1.00</td>
</tr>
<tr>
<td>Pollutants</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO₂</td>
<td>-0.05</td>
<td>-0.21*</td>
<td>0.10</td>
<td>-0.64*</td>
</tr>
<tr>
<td>O₃</td>
<td>0.41*</td>
<td>0.57*</td>
<td>0.31*</td>
<td>0.85*</td>
</tr>
<tr>
<td>SO₂</td>
<td>0.01</td>
<td>-0.18*</td>
<td>0.12</td>
<td>-0.58*</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>0.04</td>
<td>0.03</td>
<td>0.11</td>
<td>0.00</td>
</tr>
<tr>
<td>Meteorological variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean temperature (°C)</td>
<td>0.04</td>
<td>0.25*</td>
<td>-0.05</td>
<td>0.80*</td>
</tr>
<tr>
<td>Relative humidity (%)</td>
<td>-0.41*</td>
<td>-0.56*</td>
<td>-0.34*</td>
<td>-0.70*</td>
</tr>
</tbody>
</table>

*p<0.01
This is a collaboration of the WAO Special Committee on Asthma and the WAO Special Committee on Climate Change

Contact details:
Prof. Gennaro D’Amato  Leader

Meteorological Conditions, Climate Change, New Emerging Factors and Bronchial Asthma

1. Air pollution episodes
Isabella Annesi-Maesano, Tari Haahtela, Stephen Holgate, Blanca del Rio Navarra, Gennaro D’Amato

2. Thunderstorm
Gennaro D’Amato, Nelson Rosário, Guy Marks

3. Sandstorm
Saleh Al-Muhsen, Mona Al-Ahmed, Hasan Bayram, Pallav Gupta

4. Extreme weather events
Bertil Forsberg, Francesco Forastiere, Paola Michelozzi (heat waves)

5. Climate changes
Gennaro D’Amato, Lorenzo Cecchi, Isabella Annesi-Maesano, Ruby Pawankar, Erminia Ridolo

6. Pollen allergy and meteorological factors
Lorenzo Cecchi, Jae Won Oh, Lawrence DuBuske, Ignacio Ansotegui, Jeroen Buters, Carlos Nunes, Gennaro D’Amato

7. Molds and meteorological factors
Jay Portnoy, Isabella Annesi-Maesano, Jeroen Douwes, Maximiliano Gómez, CS Park

8. Allergy in the tropics
Carlos Baena-Cagnani, Ruby Pawankar, M. Sánchez Borges, Dennis Ledford, Ebopy Sibanda

9. Migration and Urbanization
Carlos Baena-Cagnani, Menachem Rottem, Nelson Rosário, Gennaro D’Amato

10. Conditioned air in indoor environments
Gennaro D’Amato; co-authors to be identified

11. Rain, humidity, dampness
Lorenzo Cecchi, Gennaro D’Amato, Mendell Berkeley(?); additional authors to be identified

12. Cold weather
Todor Popov, Paola Michelozzi, Klea Katsuyannico, Louis Philippe Boulet, Gennaro D’Amato

13. Wildfires
Isabella Annesi-Maesano; co-authors to be identified (among Sarah Elise Fi from UK or Rappold.Ana@epa.gov)

14. Conflicts

15. Climate change, allergic implications and economical aspects
Erminia Ridolo, G Gabbi;
Review article

Thunderstorm-asthma and pollen allergy

Thunderstorms have been linked to asthma epidemics, especially during the pollen seasons, and there are descriptions of asthma outbreaks associated with thunderstorms, which occurred in several cities, prevalently in Europe (Birmingham and London in the UK and Napoli in Italy) and Australia (Melbourne and Wagga Wagga). Pollen grains can be carried by thunderstorm at ground level, where pollen rupture would be increased with release of allergenic biological aerosols of paucimicronic size, derived from the cytoplasm and which can penetrate deep into lower airways. In other words, there is evidence that under wet conditions or during thunderstorms, pollen grains may, after rupture by osmotic shock, release into the atmosphere part of their content, including respirable, allergen-carrying cytoplasmic starch granules (0.5–2.5 μm) or other paucimicronic components that can reach lower airways inducing asthma reactions in pollinosis patients. The thunderstorm-asthma outbreaks are characterized, at the beginning of thunderstorms by a rapid increase of visits for asthma in general practitioner or hospital emergency departments. Subjects without asthma symptoms, but affected by seasonal rhinitis can experience an asthma attack. No unusual levels of air pollution were noted at the time of the epidemics, but there was a strong association with high atmospheric concentrations of pollen grains such as grasses or other allergenic plant species. However, subjects affected by pollen allergy should be informed about a possible risk of asthma attack at the beginning of a thunderstorm during pollen season.

G. D'Amato1, G. Liccardi1, G. Frenguelli2
1Division of Pneumology and Allergology, Department of Respiratory Diseases, High Speciality Hospital “A. Cardarelli”, Napoli, Italy; 2Department of Plant Biology, University of Perugia, Perugia, Italy

Key words: allergic asthma; bronchial asthma; bronchial hyperreactivity; climate changes; environment and allergy; pollen allergy; pollinosis; respiratory allergy; thunderstorm-asthma.

Prof. Gennaro D’Amato
Division of Pneumology and Allergology
Department of Respiratory Diseases
High Speciality Hospital “A. Cardarelli”
Via Rione SIGNORE
10 80121 Napoli
Italy

Accepted for publication 5 October 2006
Weather changes with Climate Change

- Increase in thunderstorms
- High number of thunderstorms in spring and summer as same time at high pollen counts
- Pollen grain rupture with thunderstorms with higher levels of respirable allergens; also increase in ozone
- More asthma outbreaks
  - UK, Australia, and Italy

Davidson et al, BMJ 1996;
Girgis et al, Eur Resp J 2000;
D’Amato et al, BMJ 2005

London 25 June 1994

Grass pollen grain bursts by osmotic shock and releases starch granules.

Thunderstorm
Thunderstorm related epidemics of rhinitis and asthma exacerbations

Under wet conditions or during thunderstorms pollen grains may, after rupture by osmotic shock, release part of their cytoplasmic content into the atmosphere.

Decreasing use of fossil fuels and controlling vehicle emissions.

Reducing the private traffic in towns.

Improving the public transport.

Planting in cities non-allergenic trees.
CHANGES in CO2 CONCENTRATION

CHANGES in CLIMATE
Including:
- heat waves
- extreme events
- precipitation
- temperature

CHANGES in AEROALLERGENS
Including:
- timing
- location
- quantity

Atmospheric Pollutants
($O_3$, PM, $NO_2$, $SO_2$, CO)

HUMAN HEALTH IMPACTS
For example:
- allergic rhinitis
- asthma exacerbation
- atopic dermatitis

Policies measures:
MITIGATION

Policies measures:
ADAPTATION
Strategies to reduce climate changes and air pollution are political in nature, but citizen and in particular health professionals and societies must raise their voices in the decision process to give strong support for clean policies on both national and international levels.
Thank You
gdamatormap@gmail.com
Gruppo facebook
“Respiro Campania”