Post 9/11: High Asthma Rates Among Children in Chinatown, New York

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Disclosures

Support

- Stony Brook MD with Recognition in Research Program for student funding
- NSpire Corp. who loaned 3 spirometers
- NYC Department of Education for approval of study
- NYS Department of Environmental Conservation for air pollution data
Post 9/11: High Asthma Rates Among Children in Chinatown, NY

- Background
- Hypotheses
- Study Population
- Methods/Data Collection
- Results
- Conclusions
Post 9/11: High Asthma Rates Among Children in Chinatown, NY

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NYC Households With At Least One Person With Asthma (2000 Census data)

- Non-Hispanic white: 11.0
- Non-Hispanic black: 15.8
- Puerto Rican: 28.0
- Dominican: 14.8
- Central/South American: 13.0
- Mexican: 5.0
- Other Hispanic (Cuban): 16.8
- Chinese: 6.8
- Asian Indian: 7.3
- Other Asian: 11.7

*Other Asian comprises Korean, Japanese, Filipino, Vietnamese, and other Pacific Islanders*

Composition of Dust and Smoke Aerosol from the Collapse of the WTC
(collected on September 16 and 17, 2001)

- Calcium
- Phthalate esters
- Plastic
- Combusted Jet Fuel
- Soot
- Inorganic metals
- Radionuclides
- Ionic species
- Asbestos (0.8%-3.0% of the mass)

Increased Asthma Severity After 9/11

• Chinese-American children with pre-existing asthma had more asthma-related clinic visits overall. (p=.002)

• Asthmatic children living within 5 miles of Ground Zero had more clinic visits compared to those living further away. (p=.013).

• There were more prescriptions for asthma medications. (p=.018)

Asthma in Chinatown 1 year after 9/11

Mean Percent Predicted Peak Flow Rates By Quarter

Yearly Quarters

Quarter 1, 2000
Quarter 4, 2000
Quarter 1, 2001
Quarter 2, 2001
Quarter 3, 2001
Quarter 4, 2001
Quarter 1, 2002
Quarter 2, 2002
Quarter 3, 2002

Mean Percent Predicted Peak Flow Rates

Region 1
Region 2

9/11/01

40%
50%
60%
70%
80%
90%
100%
110%
Lin, et al. found

- Self-reported asthma rates among 476 second-graders at 4 Chinatown elementary school students of 16% in 2005 and 21.6% in 2006.

- Redline screening questionnaire yielded rates of 46.1% and 52%, respectively.

- 1/3 of students who underwent spirometry had airway obstruction.

Post 9/11: High Asthma Rates Among Children in Chinatown, NY

• Background
• Hypotheses
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• Methods/Data Collection
• Results
• Conclusions
HYPOTHESES

1. Chinatown asthma rates are still higher than that reported for other ethnic groups in the 2000 Census.

2. The rate of asthma in Chinatown is persistently high and did not decrease since the previous studies.
Post 9/11: High Asthma Rates Among Children in Chinatown, NY

- Background
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Study Population

1000 students attending the closest, ethnically, and socioeconomically homogeneous elementary school proximal to the World Trade Center.
ASTHMA IN CHINATOWN AFTER 9/11

• Background
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• Conclusions
Methods/Data Collection

June/July 2008

• Questionnaires
• Spirometry
• Air pollution data
Questionnaire

- Distributed to parents
- Demographic data: age, gender, weight, height
- Presence of household smokers
- Use of asthma medication
- Diagnosis of asthma by a pediatrician
- Alternative medicine (herbal, moxibustion) for asthma
Spirometry

- Required parental consent
- Required student assent

- Equipment:
  - Koko Legend Portable Office Spirometers
Spirometry

- Spirometry calibrated daily and results adjusted for temperature, barometric pressure, age, height, gender, and race.

- A minimum of 8 forced vital capacity (FVC) maneuvers were performed to achieve 3 acceptable flow-volume loops with 2 being within 200 mL for FVC and forced expiratory volume at 1 second (FEV1).

- The value assigned to a participant was the largest acceptable value within 200 mL of a second value.
2 fine particulate sampler monitors were deployed on the roof (14m above ground) of the elementary school. Installed by NYS Department of Environmental Conservation, 2.5 µm-sized particulate mass samples collected continuously every 3 days.
Using a DUSTREAM™ vacuum collection system, dust from around the school was collected and sent to Indoor Biotechnologies (Charlottesville, VA) to be analyzed by ELISA for concentrations of antigens:

- Mouse
- Rat
- Feline (cat)
- Cockroach
- 3 groups of dust mites
- Dog
Post 9/11: High asthma rates among children in Chinatown, NY

- Background
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Results

• We received 353 questionnaires from parents of children at an elementary school in Chinatown.

• We conducted spirometry on 202 students.
Self-Reported Asthma Rates Among Students Without Spirometry

12.6% for those Living < 1 Mile from Ground Zero
vs. 4.8% for those living further away
Self Reported Asthma From Children with Spirometry

Residential Distance from Ground Zero

- Asthma
- No asthma

# of children

< 1 mile

> 1 mile
Post 9/11: High asthma rates among children in Chinatown, NY

58/202 or 29% of Students 4-12 Years Old With FEV1 <80% (72%±6.8% S.D.)

Spirometric Values for Children ≥ 7 Years Old with FEV1 < 75%

- FEV1 <80%: 58, 29%
- FEV1 ≥80%: 144, 71%

- FEV1 ≤75%: 29, 17%
- FEV1 >75%: 138, 83%
Outdoor Air Pollution Levels Collected on Roof of School
Indoor Aeroallergens

<table>
<thead>
<tr>
<th>Mite Allergens</th>
<th>Cat</th>
<th>Dog</th>
<th>Cockroach</th>
<th>Rat</th>
<th>Mouse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Der p 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per f 1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mite Group 2</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fel d 1</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Can f 1</td>
<td>0.31</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bla g 2</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rat n 1</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Mus m 1</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0.068</td>
</tr>
</tbody>
</table>
Post 9/11: High asthma rates among children in Chinatown, NY

- Background
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Conclusions

1. Chinatown asthma rates are still higher than other groups (29% vs. the NYC reference rate of 13%). These rates indicate persistence of elevated rates, as suggested by Lin and colleagues.

2. Air pollution levels exceed EPA standards and are unhealthy (> 35 μg/m³/d). This may account for increased asthma incidence. It is possible that exposure to various toxins on 9/11 accentuated the effect of subsequent exposure to air pollution.

3. The difference between parent-reported prevalence of asthma (12.6%) and tested prevalence (29% overall) corresponds to those reported by the Harlem Children’s Zone Asthma Initiative and suggests a high degree of unmet need for asthma treatment and lower-than-necessary child well-being and health status.
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References

ALLERGY SYMPTOMS & ELEVATED AIRWAYS RESISTANCE AMONG CHILDREN LIVING NEAR THE WORLD TRADE CENTER

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John Chen, Ph.D.
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Support

– Stony Brook MD with Recognition in Research Program for student funding
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– Carefusison Corporation for Impulse Oscillometer agreement
Allergy Symptoms, Airway Resistance Near the WTC

- Background
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Allergy Symptoms, Airway Resistance Near the WTC

- Background
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- Methods/Data Collection
- Results
- Conclusions
Background

• Allergy symptoms have not been studied in the cohort of children attending school near the World Trade Center, which has been a dusty construction site since 9/11.

• Impulse Oscillometry (IOS) of the small airways as a measure of peripheral airways lung function and airway hyper-responsiveness has not been studied in those children alive on 9/11 and those born and raised in the area thereafter, where asthma rates are high even using less-sensitive spirometry.

• The specific chemical composition of air pollution particles particles currently in the neighborhood has not been examined.
Allergy Symptoms, Airway Resistance Near the WTC

- Background
- Hypotheses
- Study Population
- Methods/Data Collection
- Results
- Conclusions
Hypotheses

1. Allergy symptoms are common among children attending school near the World Trade Center.

2. Impulse Oscillometry (IOS) will show small airways function deficits and airway hyper-responsiveness not only among those children alive on 9/11, but also those born and raised in the area thereafter.

3. The specific chemical composition of air pollution particles will yield harmful levels of lead.
Allergy Symptoms, Airway Resistance Near the WTC

- Background
- Hypotheses
- Study Population
- Methods/Data Collection
- Results
- Conclusions
Study Population

1000 students attending the closest, ethnically, and socioeconomically homogeneous elementary school proximal to the World Trade Center were surveyed.

158 completed both student and parental surveys. 129 completed impulse oscillometry.
Study Sample

• Inclusion Criteria
  Student at elementary school (K-5)
  Chinese-American (~99% of school)

• Exclusion Criteria
  Special education students
Allergy Symptoms, Airway Resistance Near the WTC

- Background
- Hypotheses
- Study Population
- Methods/Data Collection
- Results
- Conclusions
Methods/Data Collection

June/July 2008

- Redline Questionnaires
- Impulse Oscillometry
- Speciated Air Pollution data
REDLINE QUESTIONNAIRES

STUDENT QUESTIONNAIRE

Name ___________________ Age ______ Grade ______ Teacher ______

Race: ☐ African American ☐ Asian American ☐ Hispanic ☐ White ☐ Native American ☐ Other

Please tell us how often you have any of the following:

1. My breathing sounds noisy or wheezy. ☐ NEVER ☐ SOMETIMES ☐ A LOT
2. It is hard to take a deep breath. ☐ NEVER ☐ SOMETIMES ☐ A LOT
3. It is hard for me to stop coughing. ☐ NEVER ☐ SOMETIMES ☐ A LOT
4. My chest feels tight or hurts after I run, play hard, or do sports. ☐ NEVER ☐ SOMETIMES ☐ A LOT
5. I wake up at night coughing. ☐ NEVER ☐ SOMETIMES ☐ A LOT
6. I wake up at night because I have trouble breathing. ☐ NEVER ☐ SOMETIMES ☐ A LOT
7. I cough when I run, climb stairs or play sports. ☐ NEVER ☐ SOMETIMES ☐ A LOT
8. My eyes get itchy, puffy or burn. ☐ NEVER ☐ SOMETIMES ☐ A LOT
9. I have problems with a runny or stuffy nose. ☐ NEVER ☐ SOMETIMES ☐ A LOT

Please answer the following questions:
10. A doctor or nurse told me that I have asthma. ☐ YES ☐ NO
11. I stayed in the hospital overnight for asthma or trouble breathing this past year. ☐ YES ☐ NO
12. I take medicine or use an inhaler for asthma. ☐ YES ☐ NO
13. I take medicine for allergies. ☐ YES ☐ NO
**PARENT OR GUARDIAN QUESTIONNAIRE**

**Student's Name** ___________________ **Age** ___ **Grade** ___ **Teacher** ___________________

**Student's Race:** [ ] African American [ ] Asian American [ ] Hispanic [ ] White [ ] Native American [ ] Other

Please tell us how often your child has any of the following. (If your child has more problems in some seasons of the year, please tell us about problems during the worst season.) Does your child . . .

<table>
<thead>
<tr>
<th>Question</th>
<th>Never</th>
<th>Sometimes</th>
<th>A Lot</th>
<th>Don't Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Make noisy or wheezy sounds when breathing?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Have a hard time taking a deep breath?</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3. Develop coughs that won't go away?</td>
<td></td>
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</tr>
<tr>
<td>4. Complain about a chest that feels tight or hurts after running, playing hard, or doing sports?</td>
<td></td>
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<tr>
<td>5. Wake up at night coughing?</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>6. Wake up at night because of trouble breathing?</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>7. Cough when running, climbing stairs or playing sports?</td>
<td></td>
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<td></td>
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<tr>
<td>8. Miss days of school (absent from school) because of breathing problems?</td>
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<td></td>
<td></td>
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<tr>
<td>9. Have eyes that itch, get puffy or burn.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Have problems with a runny, stuffy nose.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please answer the following questions about your child:

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Don't Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. Has a doctor or nurse told you that your child has asthma, reactive airway disease or wheezy bronchitis?</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>12. Has your child stayed in the hospital overnight for asthma or for trouble breathing this past year?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Does your child take medicine (or use an inhaler) for asthma?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Does your child take medicine for allergies?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
家長或監護人問卷調查（7歲以下小孩）

學生姓名__________________ 年齡______ 年級______ 教師姓名__________________

---

1. 呼吸不順暢或有阻塞嗎？
   - 从来没有
   - 有時
   - 多
   - 不知道

2. 深呼吸困難嗎？
   - 从来没有
   - 有時
   - 多
   - 不知道

3. 是否有長時間性的咳嗽？
   - 从来没有
   - 有時
   - 多
   - 不知道

---

4. 是否在睡覺後或運動後會咳嗽？
   - 从来没有
   - 有時
   - 多
   - 不知道

5. 在半夜因咳嗽而驚醒嗎？
   - 从来没有
   - 有時
   - 多
   - 不知道

6. 因呼吸不順而導致半夜起床嗎？
   - 从来没有
   - 有時
   - 多
   - 不知道

7. 在跑步、爬樓梯或運動時咳嗽嗎？
   - 从来没有
   - 有時
   - 多
   - 不知道

8. 因呼吸道的問題而不上學（缺席）嗎？
   - 从来没有
   - 有時
   - 多
   - 不知道

9. 覺得眼睛酸澀、紅腫、刺痛嗎？
   - 从来没有
   - 有時
   - 多
   - 不知道

10. 流鼻涕或鼻塞的問題嗎？
    - 从来没有
    - 有時
    - 多
    - 不知道

---

請回答以下有關你孩子的問題：

11. 是否曾經有醫生或護士告訴你，你孩子有哮喘病？
    - 是
    - 否
    - 不知道

12. 在過去的一年，你孩子是否曾經因哮喘病或呼吸性疾病而住院？
    - 是
    - 否
    - 不知道

13. 你孩子是否服用哮喘病藥物或使用哮喘噴霧器？
    - 是
    - 否
    - 不知道

14. 你孩子有否因過敏而服用藥物嗎？
    - 是
    - 否
    - 不知道
學生問卷調查 (7至14歲)
姓名_________________________年齡______年級______教師姓名_________________________

1. 呼吸不暢順或有雜音。□ 〇 〇 〇
   - 有時 有時 有時 有多

2. 深呼吸有困難。□ 〇 〇 〇
   - 有時 有時 有時 有多

3. 我咳嗽時，咳嗽不會容易停止。□ 〇 〇 〇
   - 有時 有時 有時 有多

4. 當跑完步，玩得激烈，或運動完之後，
   會覺得胸口緊或不舒服。□ 〇 〇 〇
   - 有時 有時 有時 有多

5. 我會在半夜因咳嗽而醒來。□ 〇 〇 〇
   - 有時 有時 有時 有多

6. 我會因為呼吸不順而導致半夜起床。□ 〇 〇 〇
   - 有時 有時 有時 有多

7. 當我跑步，爬樓梯或運動時，我會咳嗽。□ 〇 〇 〇
   - 有時 有時 有時 有多

8. 我的眼睛會覺得發癢，紅腫，刺痛。□ 〇 〇 〇
   - 有時 有時 有時 有多

9. 我有流鼻涕或鼻塞問題。□ 〇 〇 〇
   - 有時 有時 有時 有多

請回答以下的問題：

10. 曾經有醫生或護士告訴我，我有哮喘病。□ 〇 〇
    - 有 沒有

11. 在過去的一年，我曾經因哮喘病或呼吸道疾病而住院。□ 〇 〇
    - 有 沒有

12. 我有服用哮喘病藥物或使用哮喘噴霧器。□ 〇 〇
    - 有 沒有

13. 我因過敏而服用藥物。□ 〇 〇
    - 有 沒有
Impulse Oscillometry
A Jaeger MasterScreen Impulse Oscillometry system (CareFusion Germany 234 GmbH) was loaned by CareFusion Corporation and training was provided by Steven Spungen, M.S.

The IOS requires three trials of twenty seconds each to take 100 complete measurements.

A loudspeaker delivers pulse-shaped pressure flow excitation to the respiratory system.

The overall impedance of the pulse is due to the resistive and viscoelastic forces of the respiratory system.
• IOS is reported as resistance and reactance measured in cm of water per liter per second.

• The Jaeger IOS was calibrated with a reference resistor (2 cm H₂O/L/s) according to the manufacturer’s instructions.

• Multifrequency impulses were applied over twenty second trials to the airway through the mouthpiece during tidal breathing. Children used a noseclip.

• Three reproducible trials were obtained if they lacked artifacts from coughing, breath holding, swallowing or vocalization.
Allergy Symptoms, Airway Resistance Near the WTC

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- Conclusions
## Results

Table 1. Correlations of Parent and Child Responses for Asthma and All Allergy Symptoms from the Validation Sample*(n = 158)

<table>
<thead>
<tr>
<th>Student Question# (Paired with Parent Questions**)</th>
<th>Sample Size</th>
<th>Responses</th>
<th>Two-sided P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Making noisy or wheezing (1)</td>
<td>87</td>
<td>0.748</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hard to take a deep breath (2)</td>
<td>84</td>
<td>0.895</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hard to stop coughing (3)</td>
<td>90</td>
<td>0.646</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Chest feels tight after run (4)</td>
<td>85</td>
<td>0.880</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Wake up at night coughing (5)</td>
<td>93</td>
<td>0.749</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Wake up at night because of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trouble breathing (6)</td>
<td>87</td>
<td>0.713</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cough when climbing stairs (7)</td>
<td>85</td>
<td>0.738</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Have eyes itch, get puffy (8)</td>
<td>89</td>
<td>0.870</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Have problems with a runny,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stuffy nose (9)</td>
<td>89</td>
<td>0.824</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>A doctor or nurse told me that</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have asthma (10)</td>
<td>89</td>
<td>0.935</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Stayed in hospital overnight (11) * **</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Take medicine for asthma (12)</td>
<td>90</td>
<td>0.848</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Take medicine for allergies (13)</td>
<td>93</td>
<td>0.832</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
R5 is a measure of Total Resp System Resistance and includes central vs. peripheral airways (small airways) and is decreased linearly with increase in height among: 1) students with a self-diagnosis of asthma (S_group); 2) students whose parents noted the child has asthma (P_group); 3) those with both student and parent diagnosis of asthma (In_group) and 4) those students who believe they do not have asthma and their parents agree with them (Ex_group).
Table 1 (n = 114)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Boys (57)</th>
<th>Girls (57)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>8.20 ± 1.86</td>
<td>8.35 ± 1.79</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>131.57 ± 11.65</td>
<td>132.28 ± 11.08</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>31.24 ± 8.92</td>
<td>30.08 ± 8.66</td>
</tr>
<tr>
<td>Mean_R5</td>
<td>7.24 ± 2.14</td>
<td>6.74 ± 2.28</td>
</tr>
<tr>
<td>Mean_R20</td>
<td>3.42 ± 1.13</td>
<td>3.28 ± 0.80</td>
</tr>
<tr>
<td>Mean_x5</td>
<td>-2.77 ± 2.58</td>
<td>-2.74 ± 2.94</td>
</tr>
</tbody>
</table>

When comparing boys higher vs. girls
Results

- Mean $R_5$, $X_5$ and $R_{20}$ (resistance at 5 Hz, reactance at 5 Hz, and resistance at 20 Hz, respectively) given in centimeters of H2O per liter per second were high.

- Boys and girls with average ages of 8 years, height of 132 cm, and weight 31 kg, had: Boys values of $R_5=7.2$, $X_5=-2$, and $R_{20}=3$; and Girls values of $R_5=6.7$, $X_5=-2.7$, $R_{20}=3.2$.

- Mean values for the entire group of boys and girls were: $R_5=6.99$, $X_5=-2.75$, $R_{20}=3.35$.

$R_5$, Resistance at 5 Hz; $X_5$, reactance at 5 Hz; $R_{20}$, Resistance at 20 Hz

†IOS measurements are given in centimeters of H2O per liter per second, except for resonant frequency, which is given in Hertz. IOS measurements are given as resistance and reactance at 5 and 20 Hz.
Total PM2.5 Levels from 6/1/08 to 8/31/08 at the Bronx, Queens, and Manhattan Sites

- **Bronx IS52**
- **Queens QC II**
- **Manhattan Division Street**
- **EPA Standard Value**
Speciated Air Pollution Data

Indium Concentrations at the Bronx, Queens, and Manhattan Sites

- Bronx IS52
- Queens QC II
- Manhattan Division Street

Date

Chemical Concentration (ug/m3)
Vanadium Concentrations at the Bronx, Queens, and Manhattan Sites

- Bronx IS52
- Queens QC II
- Manhattan Division Street

Date

Chemical Concentration (ug/m3)

0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
0.045
0.05

2001-04-01
2001-11-12
2002-06-25
2003-02-05
2003-09-18
2004-04-30
2004-12-11
2005-07-27
2006-03-09
2006-10-20
2007-06-02
2008-01-13
2008-08-25
Lead Concentrations at the Bronx, Queens, and Manhattan Sites

![Graph showing lead concentrations at different sites over time. The x-axis represents dates from 2001-04-01 to 2008-06-14, and the y-axis represents chemical concentration (ug/m3) ranging from 0 to 0.06. The graph includes data for the Bronx IS52, Queens QC II, and Manhattan Division Street sites.]
Allergy Symptoms, Airway Resistance Near the WTC

- Background
- Hypotheses
- Study Population
- Methods/Data Collection
- Results
- Conclusions
Conclusions

• Allergy and respiratory symptoms are common among those children (confirmed by parents) responding to the survey distributed among classrooms at the closest elementary school to the World Trade Center site.

• There were strong correlations between responses from children and their parents.

• Frequent severe symptoms such as wheezing and chest tightness, juxtaposed with use of allergy and asthma medications, supports the concept that these patients are not clinically well-controlled.
Conclusions

- Boys and girls in this cohort had increased values of airway resistance at 5 Hz, with boys having higher values than girls.

- Frequency dependence between resistance values at 5 Hz and 20 Hz suggest small airways dysfunction rather than central airways narrowing.
Conclusions

• Air pollution levels are high and contain detectable lead, vanadium, and indium.