

# Exhaled nitric oxide (eNO)

- Exhaled nitric oxide (eNO) is a ubiquitous molecule in the body and is a non-invasive marker of airway inflammation
- eNO is known to be elevated in individuals with asthma, is increased when a subject is having an asthma attack, and is decreased in those individuals using corticosteroid medication
- eNO has been compared with other techniques for measuring inflammation (ex. breath condensate, induced sputum)

# Demographics of the children with asthma



- 19 subjects: 14 male, 5 female
- Ages 6-13
- Medication use:
  - 10 inhaled corticosteroid (ICS) users
  - 9 ICS nonusers
- FEV1%: 67-100%

# Demographics of adult subjects

- 16 Subjects with Respiratory Disease
- Average age = 75 years of age
- 9 Female, 7 Male
- 7 with Asthma; 9 with COPD (or COPD + asthma)
- 11 prescribed Inhaled corticosteroids
  - Funded in collaboration with NYU

# Methods

- Offline method (ATS guidelines)
- Sample collected during technician visit
- Samples were returned to the lab within 24 hours and analyzed using chemiluminescence
- Subject breathes NO-scrubbed air

# Results ICS nonusers

## Children

For a 10  $\mu\text{g}/\text{m}^3$  increase in  $\text{PM}_{2.5}$ , eNO (ppb)

- Personal  $\text{PM}_{2.5}$ : 4.5( 95% CI: 1.02, 7.9)
- Indoor  $\text{PM}_{2.5}$ : 4.2( 95% CI: 1.02, 7.4)
- Outdoor  $\text{PM}_{2.5}$ : 4.3( 95% CI: 1.4, 7.2)
- Central site  $\text{PM}_{2.5}$ : 3.8 (95% CI: 1.2, 6.4)

EHP: 2003: 111: 1625-1629

# Associations between PM, LAC, and eNO - ppb-in adult subjects (*asthmatics*)

Jansen, Larson, Koenig, Lippmann et al

- PM<sub>2.5</sub> Indoor 3.7 (95% CI: -0.7, 8.1)  
Outdoor, 4.2 (95% CI: 1.3, 7.1)
- PM<sub>10</sub> Outdoor, 5.9 (95% CI: 2.9, 8.9)
- LAC Indoor, 3.9 (95% CI: 2.02, 5.9)  
–Outdoor, 2.3, (95%CI: 1.1, 3.6)  
–Personal, 1.2, (95% CI: 0.2, 2.2)  
– PM (change/10 $\mu$ g/m<sup>3</sup>;LAC per 1  $\mu$ g/m<sup>3</sup>)

# Associations between PM, LAC, and eNO - ppb-in adult subjects (*COPD*)

Jansen, Larson, Koenig, Lippmann et al

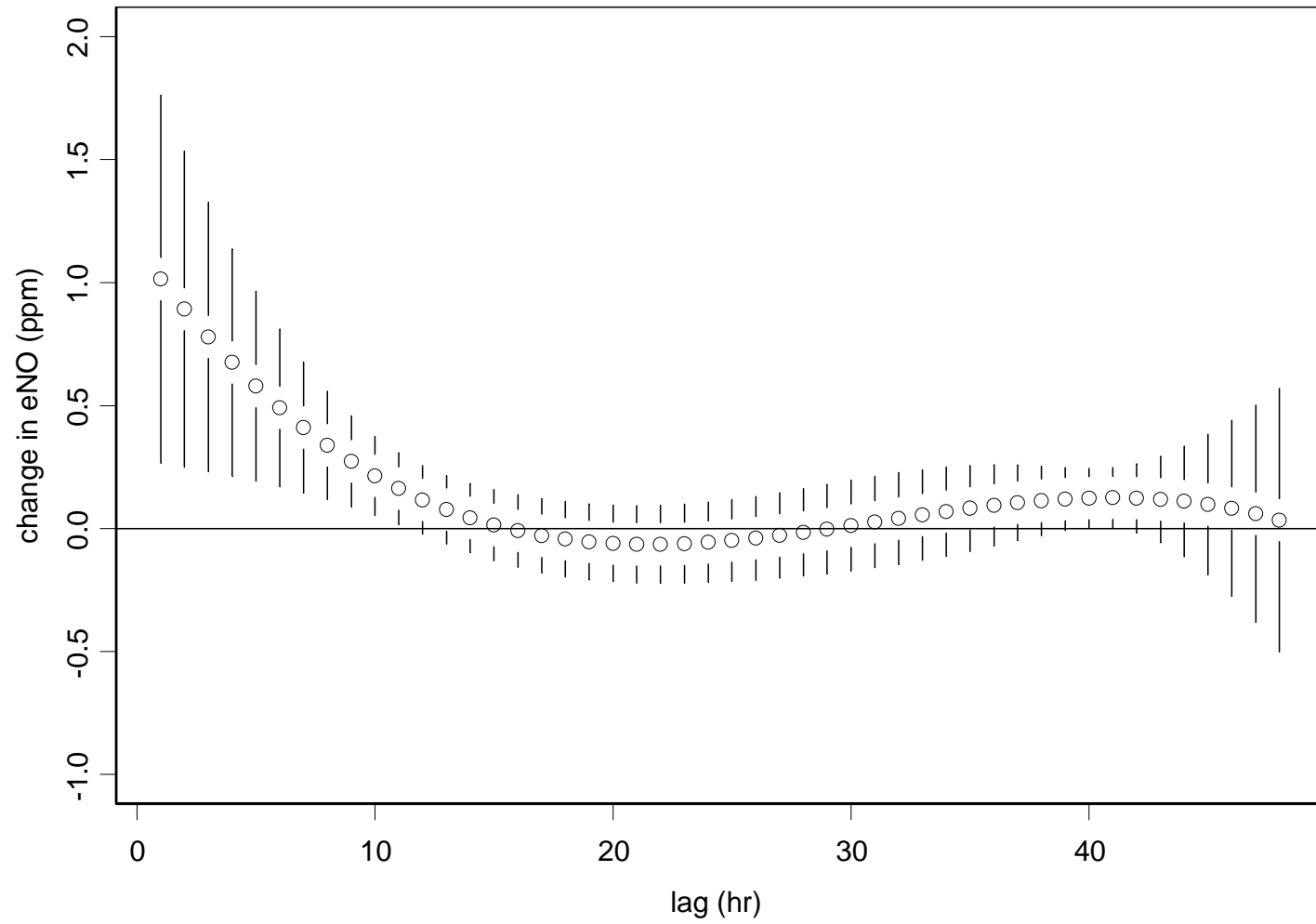
- PM<sub>2.5</sub> Indoor -0.3 (95% CI: -7.4, 6.8)
  - Outdoor 3.8 (95% CI: -1.8, 9.5)
- PM<sub>10</sub> Outdoor 4.4 (95% CI: -1.1, 10.0)
- LAC Indoor 1.2 (95% CI: -1.2, 3.4)
  - Outdoor 1.8 (95% CI: -1.0, 4.6)
  - Personal 0.6 (95% CI: -0.6, 1.9)
  - PM (change/10 $\mu$ g/m<sup>3</sup>;LAC per 1  $\mu$ g/m<sup>3</sup>)

# Exhaled nitric oxide in children with asthma and short term PM exposure in Seattle

Therese Mar, Karen Jansen, Kristin Shepherd, Thomas Lumley, Timothy Larson, Jane Koenig

Submitted to EHP

# effect of lags on eNO



# Associations with outdoor- and indoor generated PM: EHP online Jan 2005

Allen, Larson, Mar, Koenig, et al

Exposure	Model	Med Use	Change per 10 $\mu\text{g}/\text{m}^3$			p-value
			estimated $\text{PM}_{2.5}$	95% LCI	95% UCI	
$E_{ig}$	Combined	No	3.29	-1.14	7.73	0.15
		Yes	-4.94	-10.94	1.06	0.11
$E_{ag}$	Combined	No	4.98	0.28	9.69	0.04
		Yes	1.67	-3.77	7.12	0.55
$E_{ig}$	Recursive	No	-0.19	-8.37	8.00	0.97
		Yes	-0.47	12.03	11.10	0.94
$E_{ag}$	Recursive	No	5.63	-0.62	11.88	0.08
		Yes	-4.30	-14.60	6.01	0.41
$E_{ig}$	Predictive	No	3.46	-0.90	7.83	0.12
		Yes	-4.99	-11.01	1.04	0.11
$E_{ag}$	Predictive	No	5.33	0.31	10.35	0.04
		Yes	1.66	-3.75	7.06	0.55

# Some lessons from the Panel studies

- Exhaled nitric oxide (eNO) is a useful tool for assessment of PM effects
- Similar effects were seen in children and adults with respiratory disease
- The lag time between exposure and effects is short
- Outdoor-generated PM is more toxic than indoor-generated PM

# Fine aerosols and asthma: Covert, Larson, Schreuder, Koenig

- Ultrafine particles measured for 2+ years at central site
- The ultrafine, accumulation and  $2.5\mu\text{m}$  modes were tested for associations with Emergency Dept visits for asthma in children. No associations were seen
- This outcome differs from several other studies in Seattle. Reasons for the difference are being explored