

Children's Health and Traffic Exposures

Jim Gauderman, Ph.D.

University of Southern California

Keck School of Medicine

JimG@USC.EDU

The USC Children's Health Study



John Peters, P.I.

Ed Avol

Kiros Berhane

Jim Gauderman

Frank Gilliland

Mike Jerrett

Fred Lurmann

Nino Kuenzli

Rob McConnell

Duncan Thomas

The USC Children's Health Study

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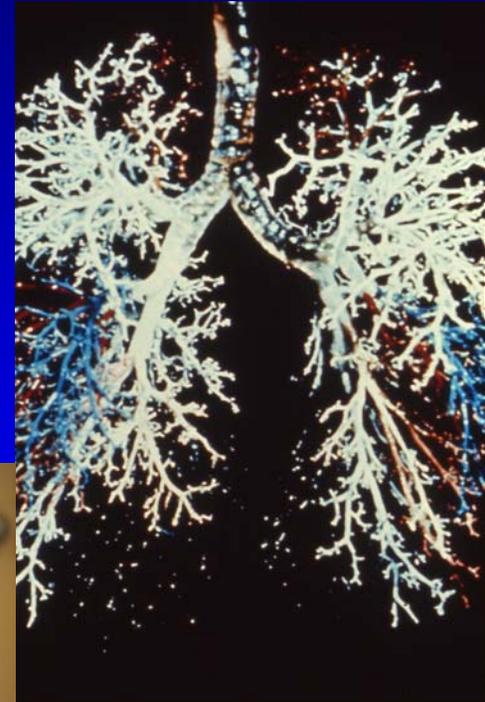
Federal: NIEHS

NHLBI

EPA

Children's Health Study Goals

- Is air pollution associated with chronic health effects?
 - Lung development
 - Respiratory symptoms
 - Asthma



Regional Pollution



Local Pollution



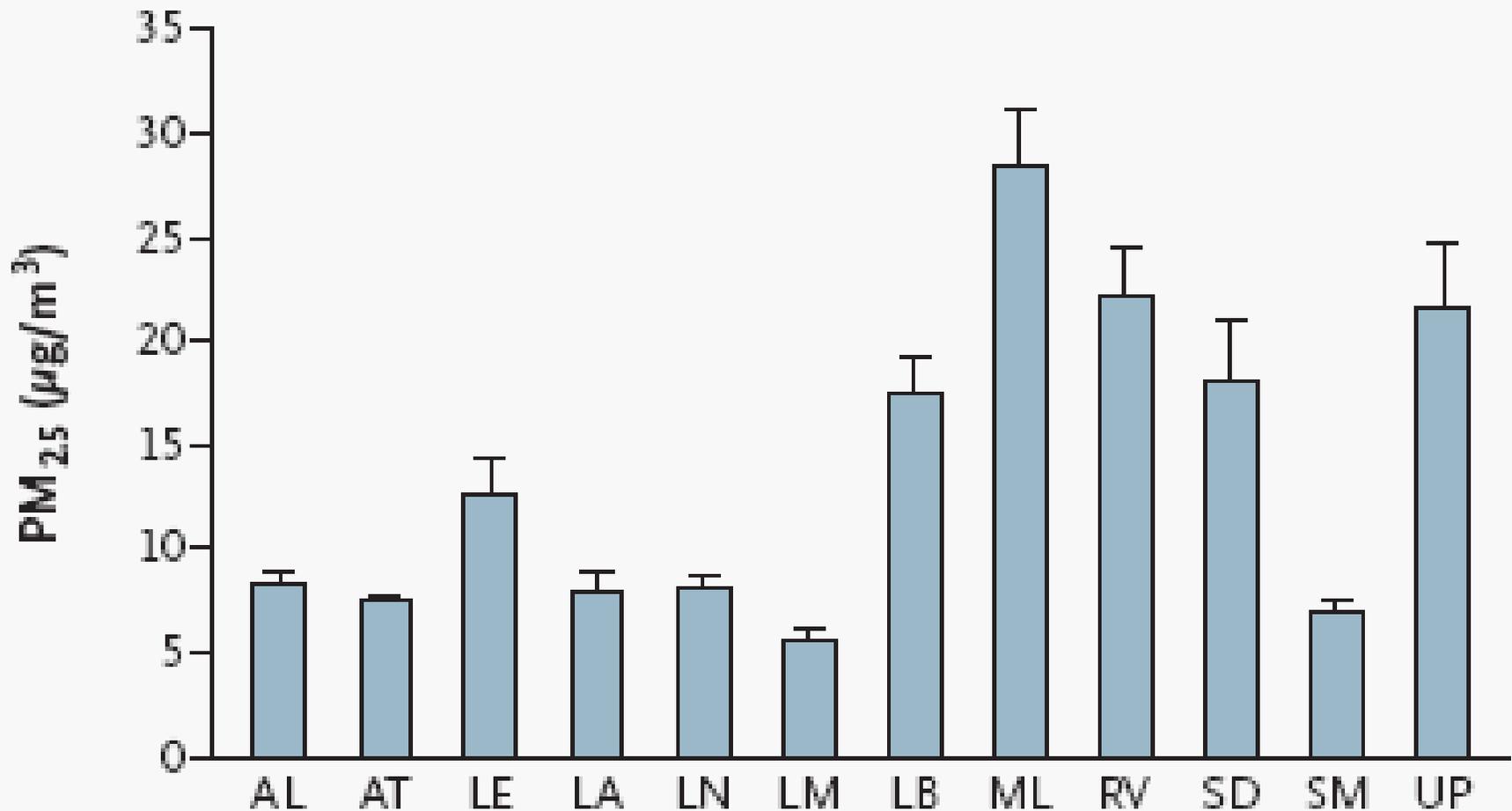
The USC Children's Health Study



Summary of Pollutants

- Continuous monitoring in each study community since 1994
 - Particulate Matter: PM_{10} , $PM_{2.5}$, EC, OC
 - Nitrogen Dioxide (NO_2)
 - Acid vapor: Primarily nitric acid
 - Ozone (O_3)

Mean PM_{2.5} levels, 1994-2000



Children's Health Study Goals

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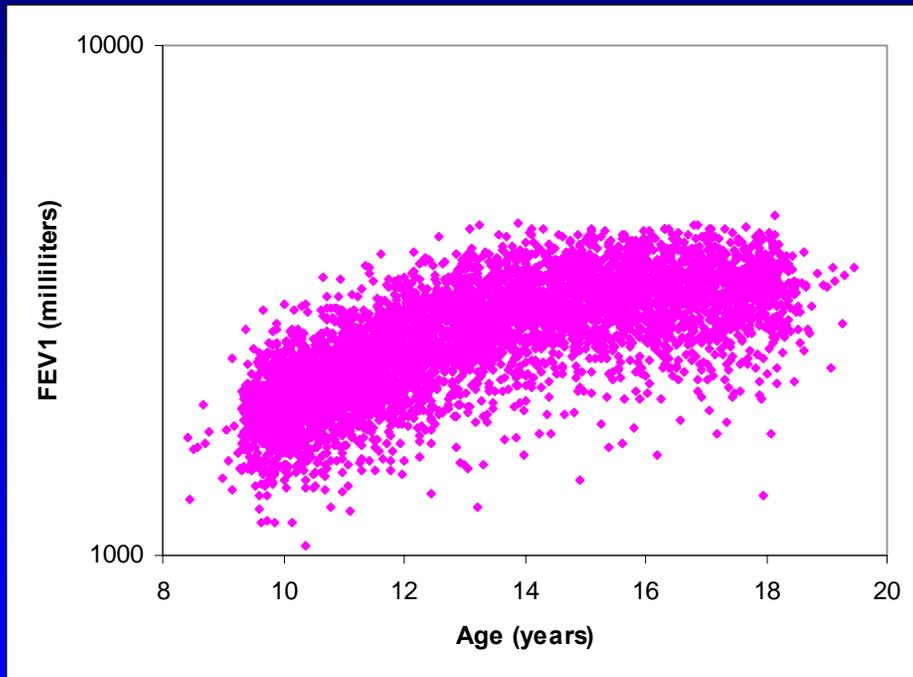
Annual lung function testing

4th grade through 12th

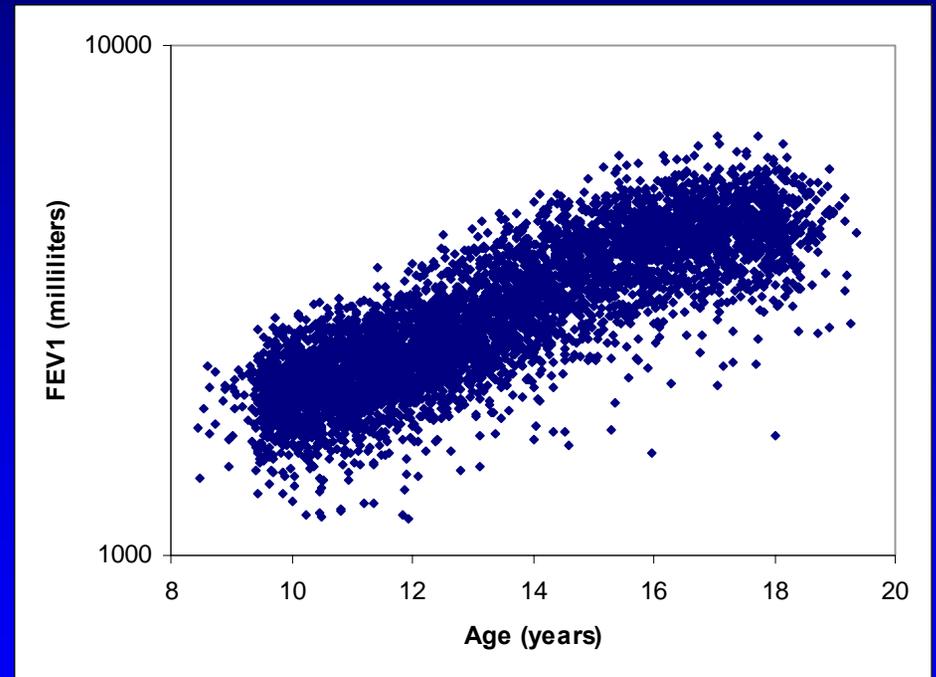
FEV₁: Volume of air exhaled
in 1 second

FEV₁ Growth Over 8 Years

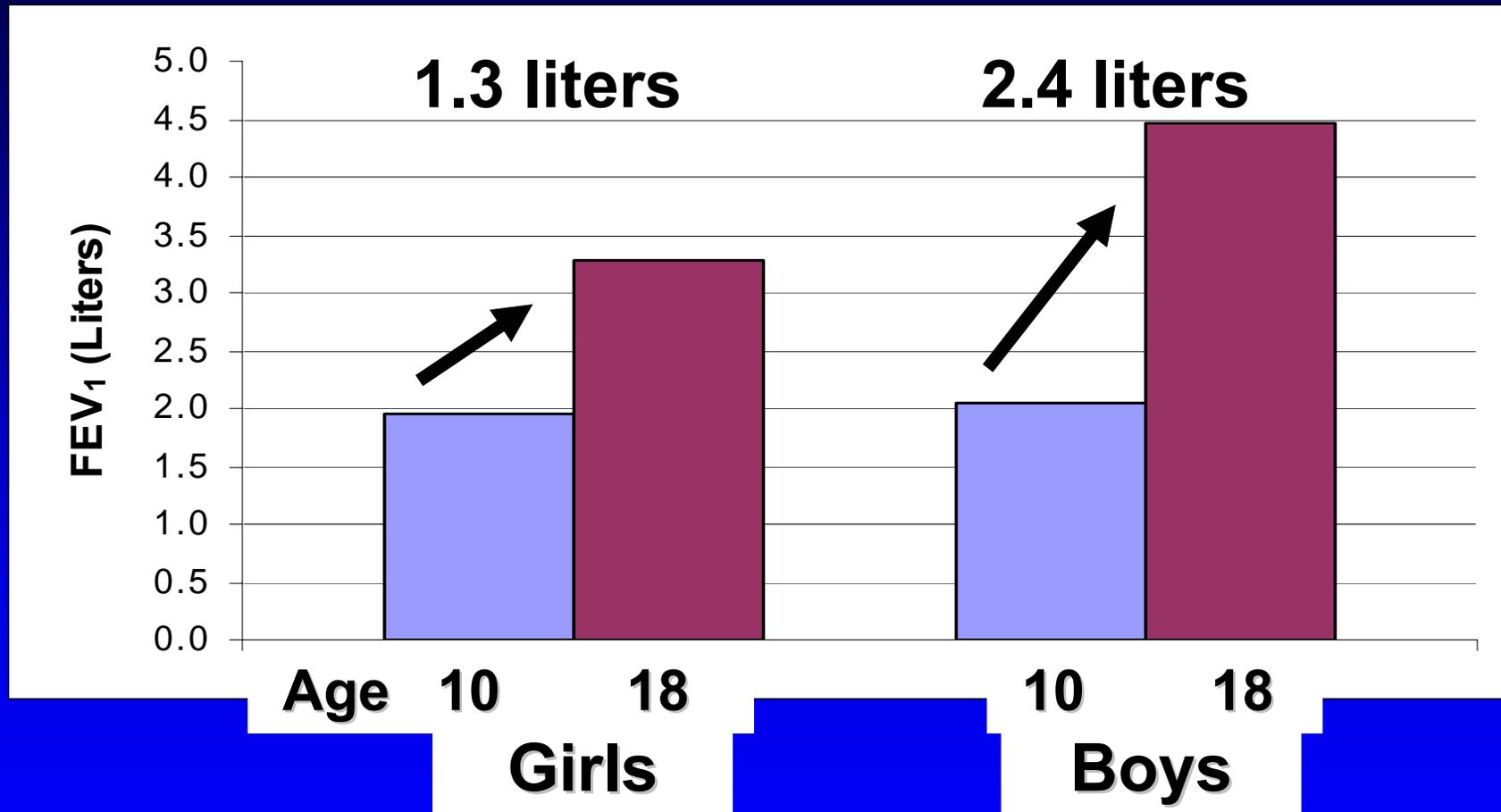
Girls



Boys

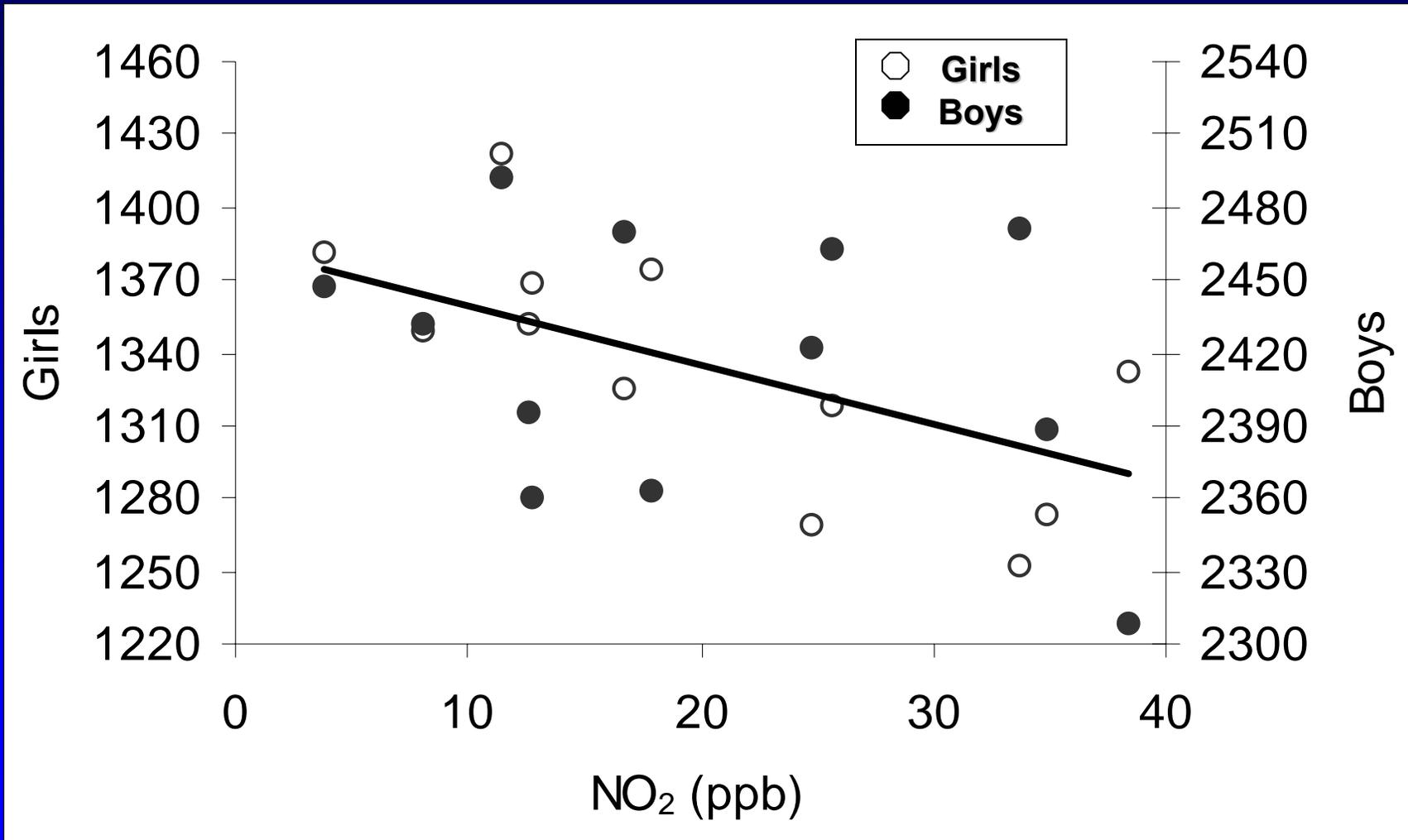


Average FEV₁ in Girls and Boys



Key Question: Does 8-year growth vary across communities with respect to pollution?

Yes, Pollution Slows Lung Function Growth

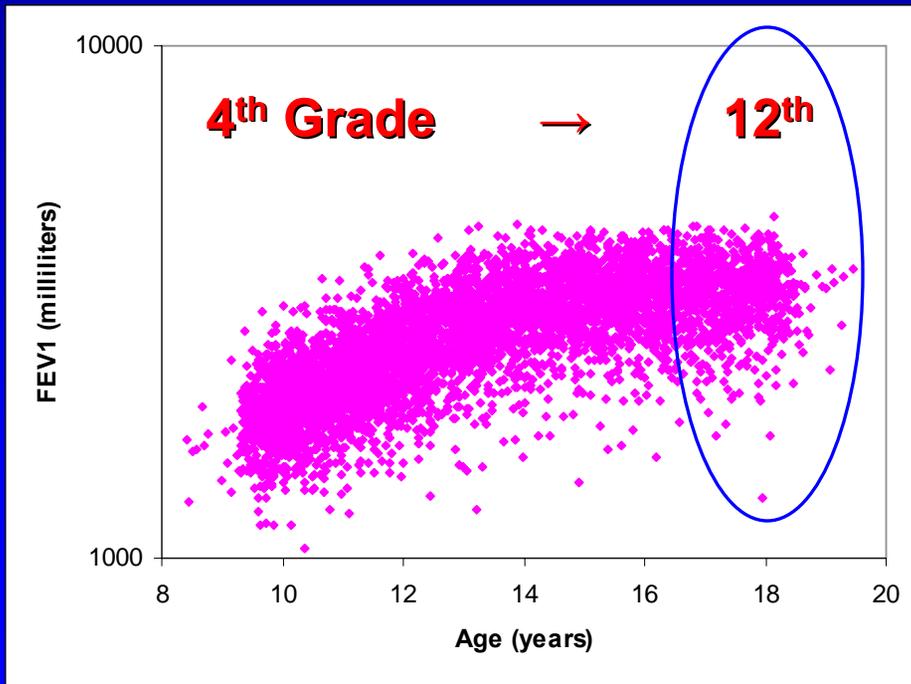


Gauderman et al., 2004

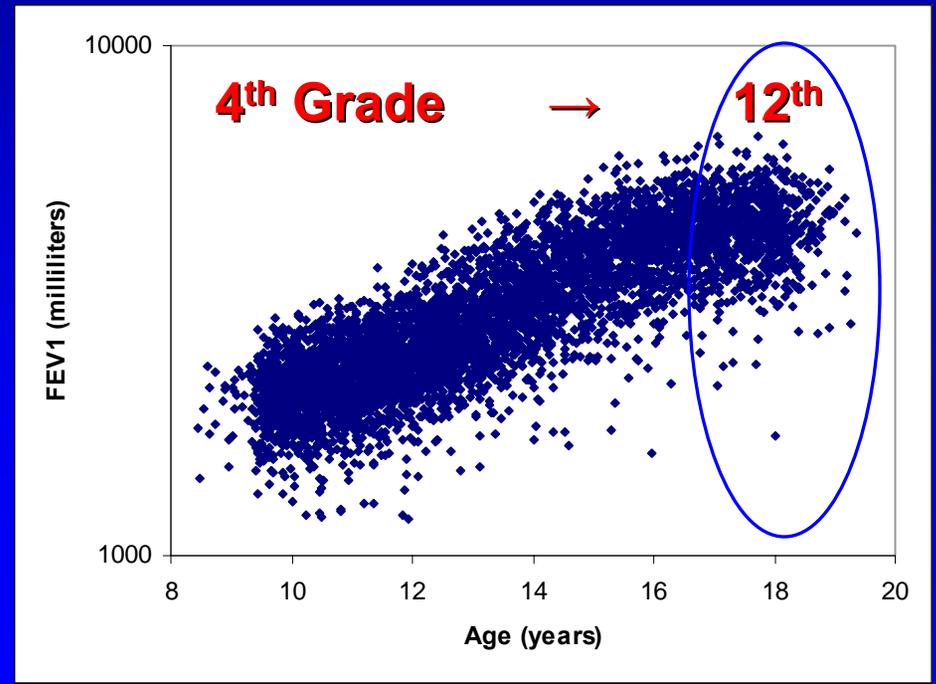
Clinically significant deficits?

- Below 80% of normal at age 18?

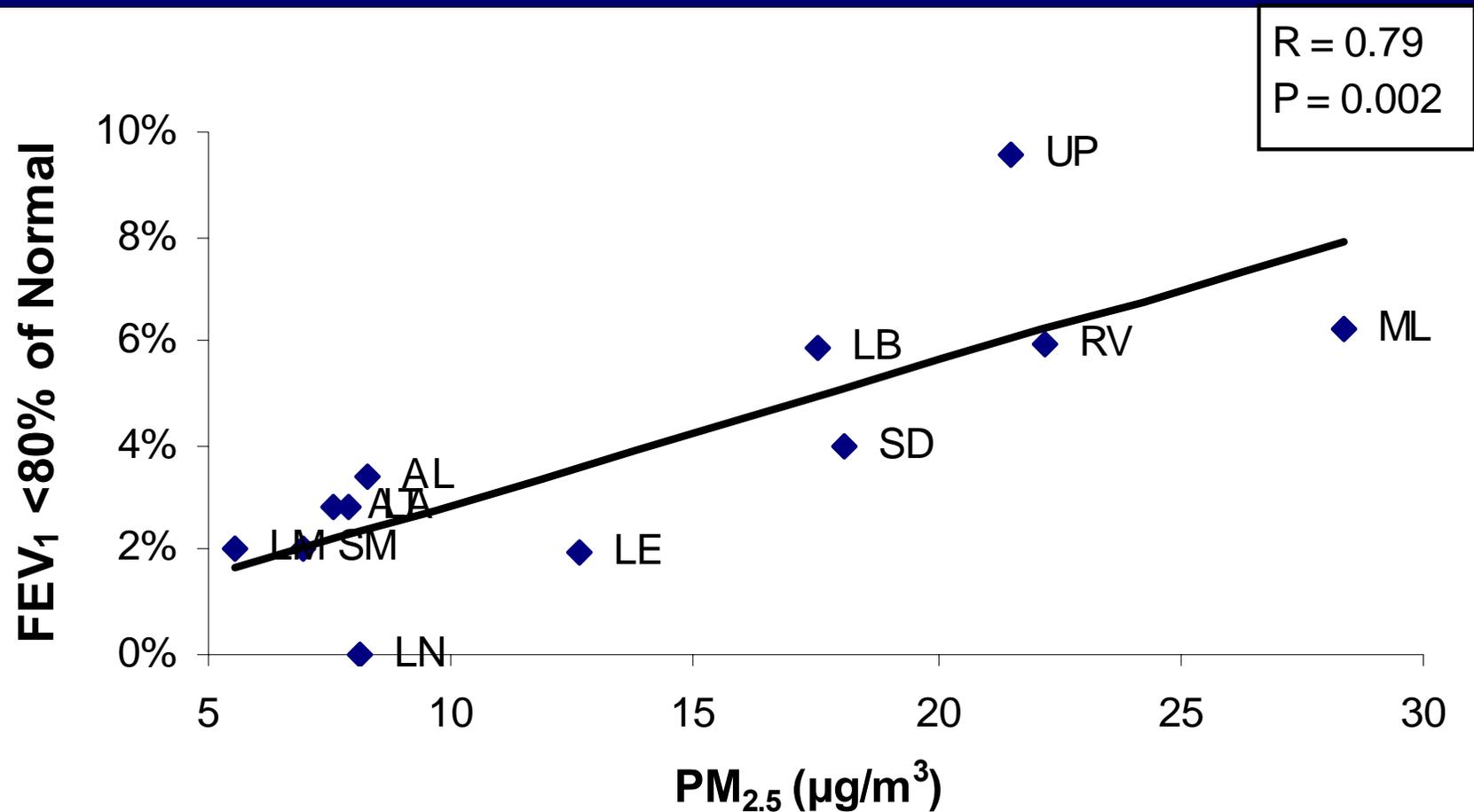
Girls



Boys

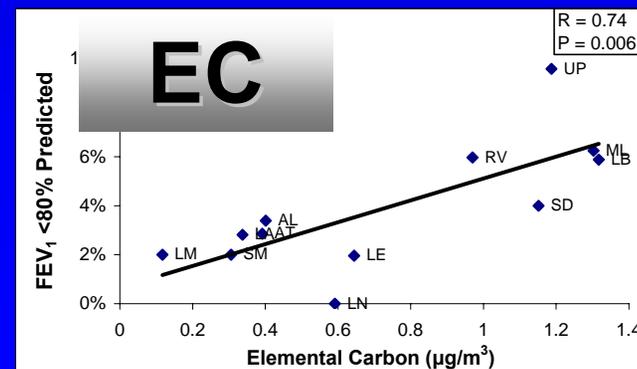
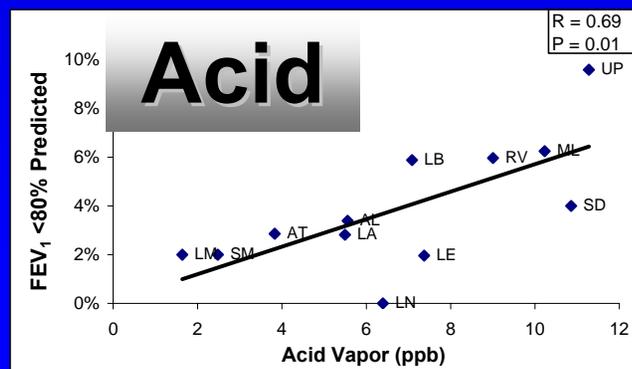
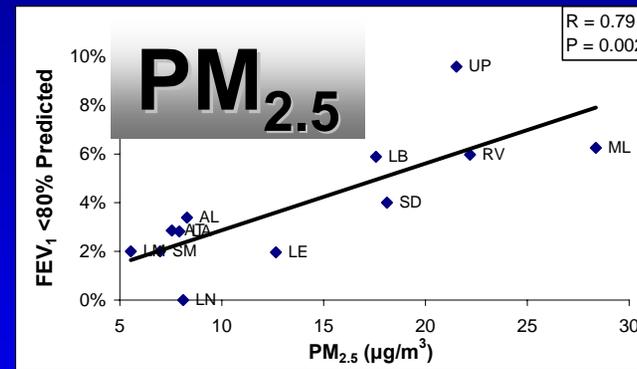
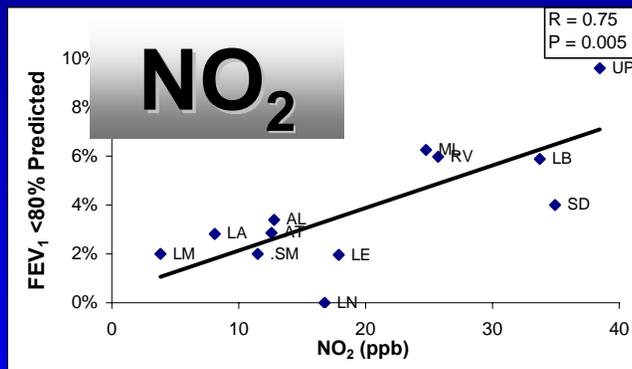
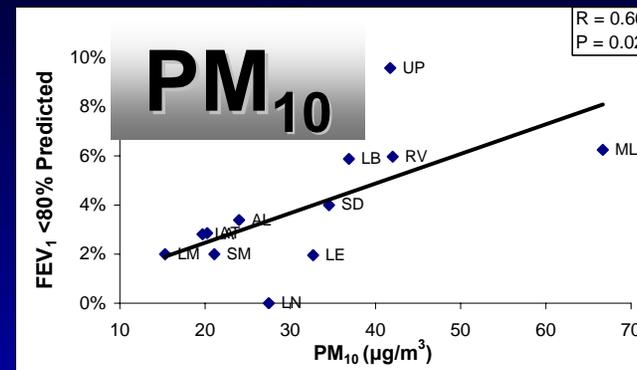
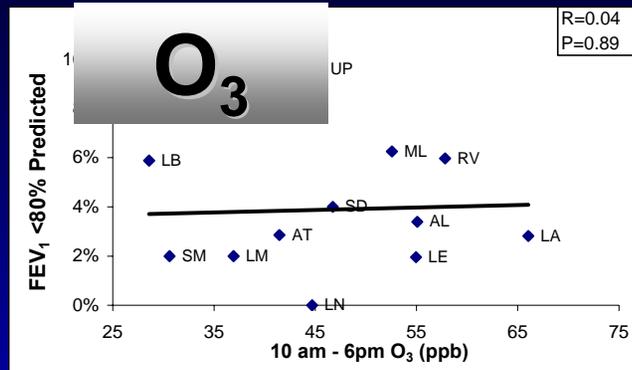


18-year-olds living in polluted communities are 4 to 5 times more likely to have abnormally low lung function.



Gauderman et al., 2004

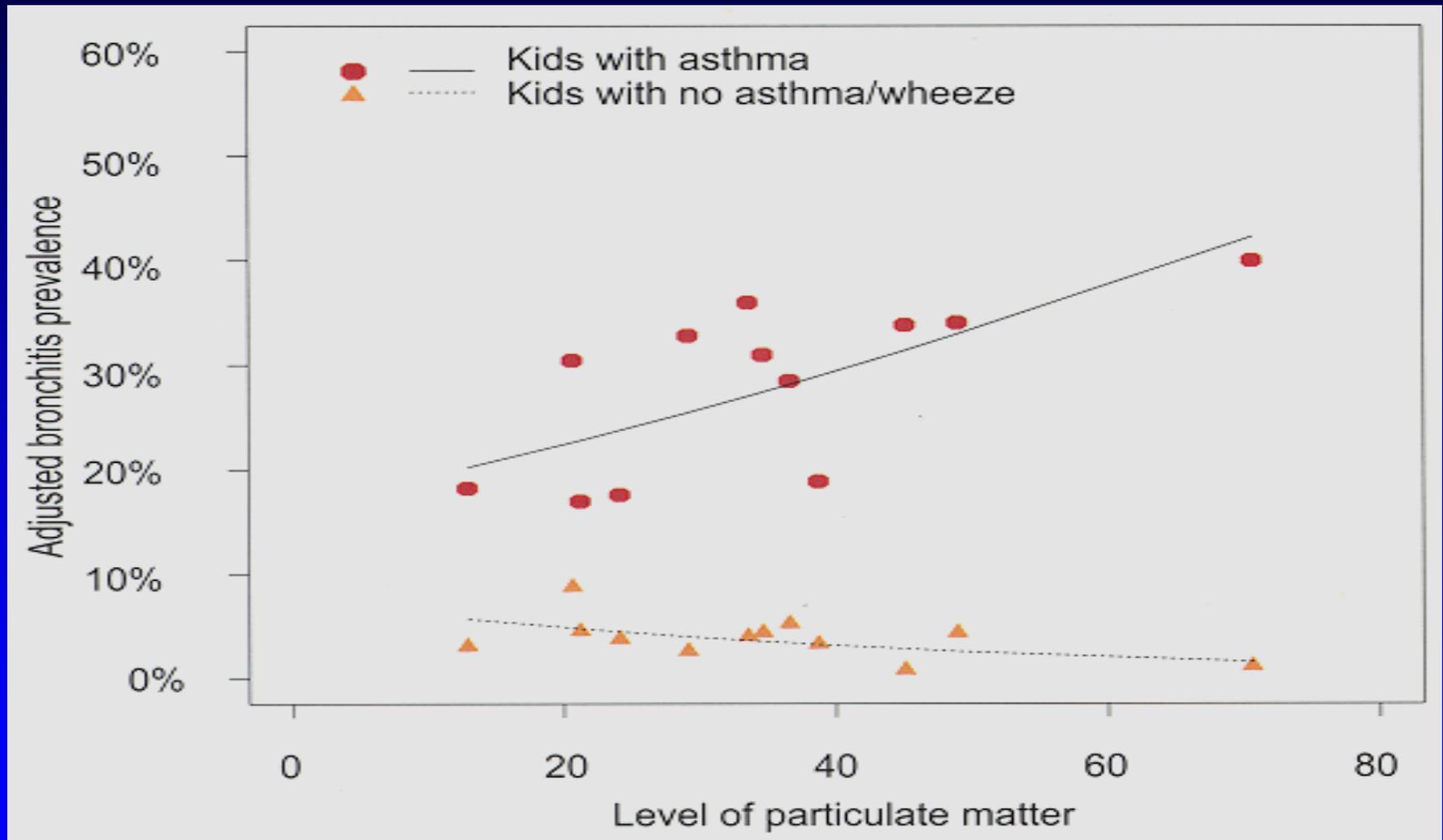
Low Lung Function Associated w/ Many Pollutants



Children's Health Study Goals

- Is childhood exposure to ambient pollutants associated with:
 - Lung development?
 - Respiratory symptoms?
 - Asthma?

PM₁₀ and Bronchitis in Asthmatics



(McConnell, et al., 1999; see also McConnell et al., 2003)

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Ozone and New-onset Asthma

For children living in a high ozone community, the risk of asthma was 3 times higher if they played at least three team sports



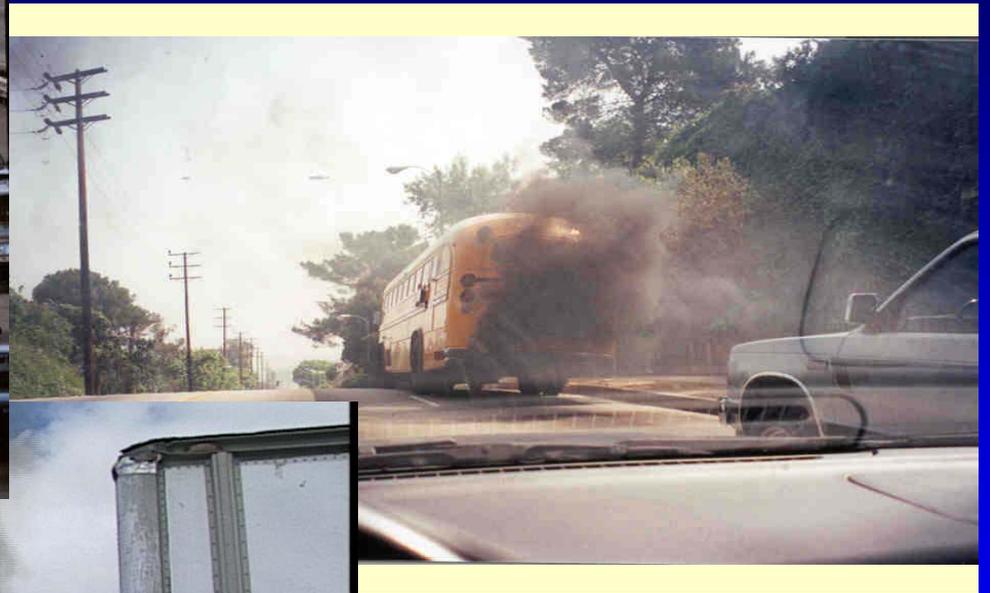
(McConnell et al., 2002)

Air Pollution and Health

- High pollution communities vs. low pollution
 - Lower lung function
 - Increased symptoms
 - Increased asthma



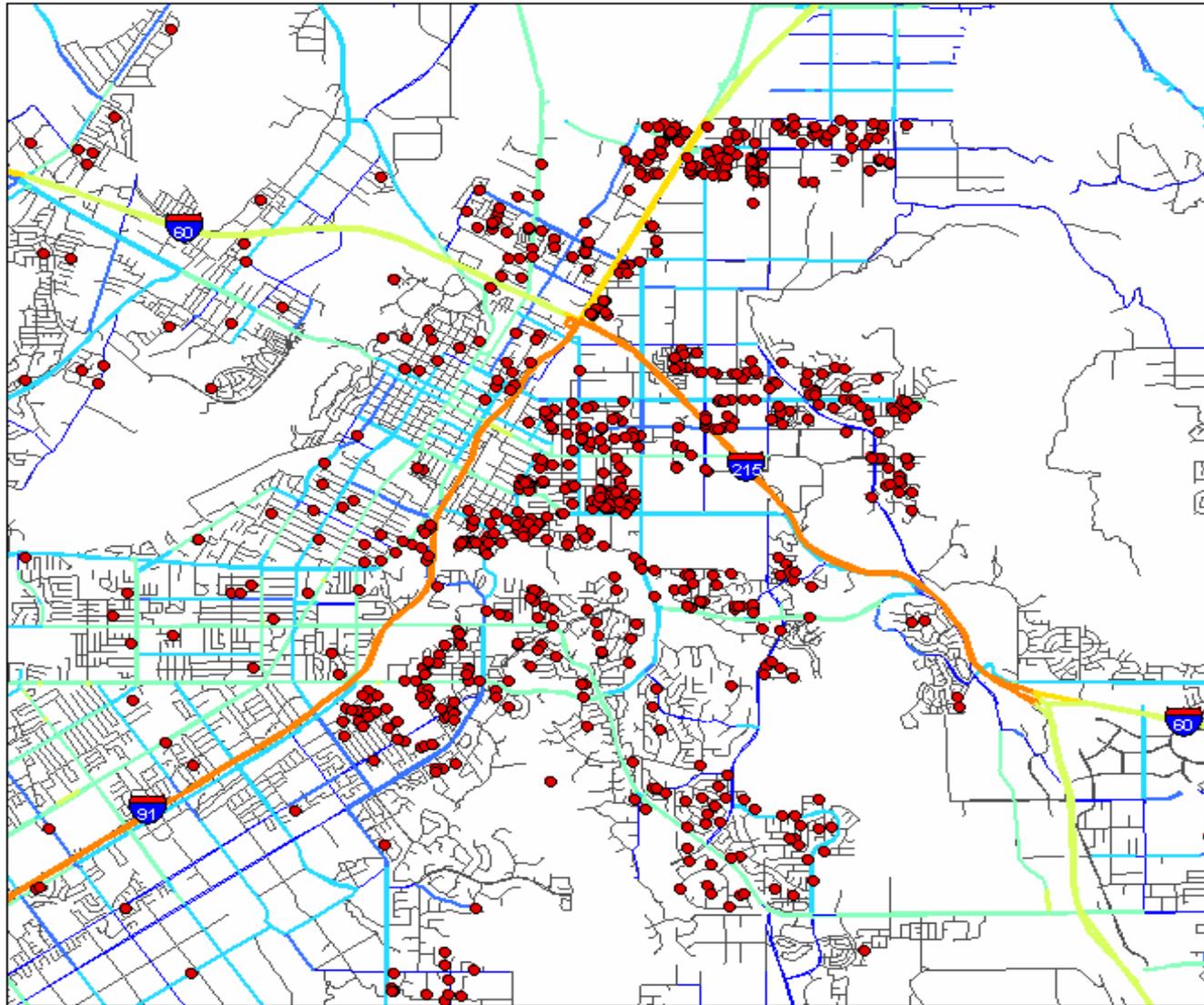
What About Local Exposures?



Local Exposures

- **Several studies in Europe linking traffic exposure to respiratory symptoms**
- **S.F. bay area study relating pollution exposure at schools to symptoms (Kim et al. 2004)**
- **We studied residential NO₂, traffic, and asthma (Gauderman et al., 2005)**

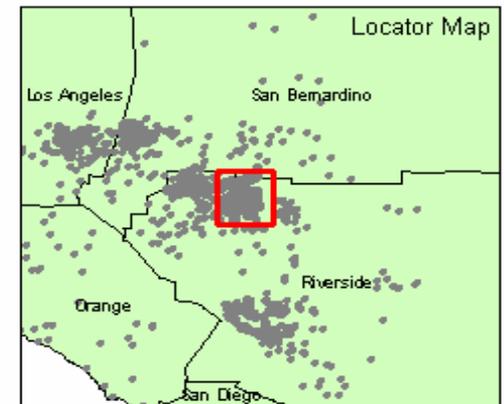
Riverside



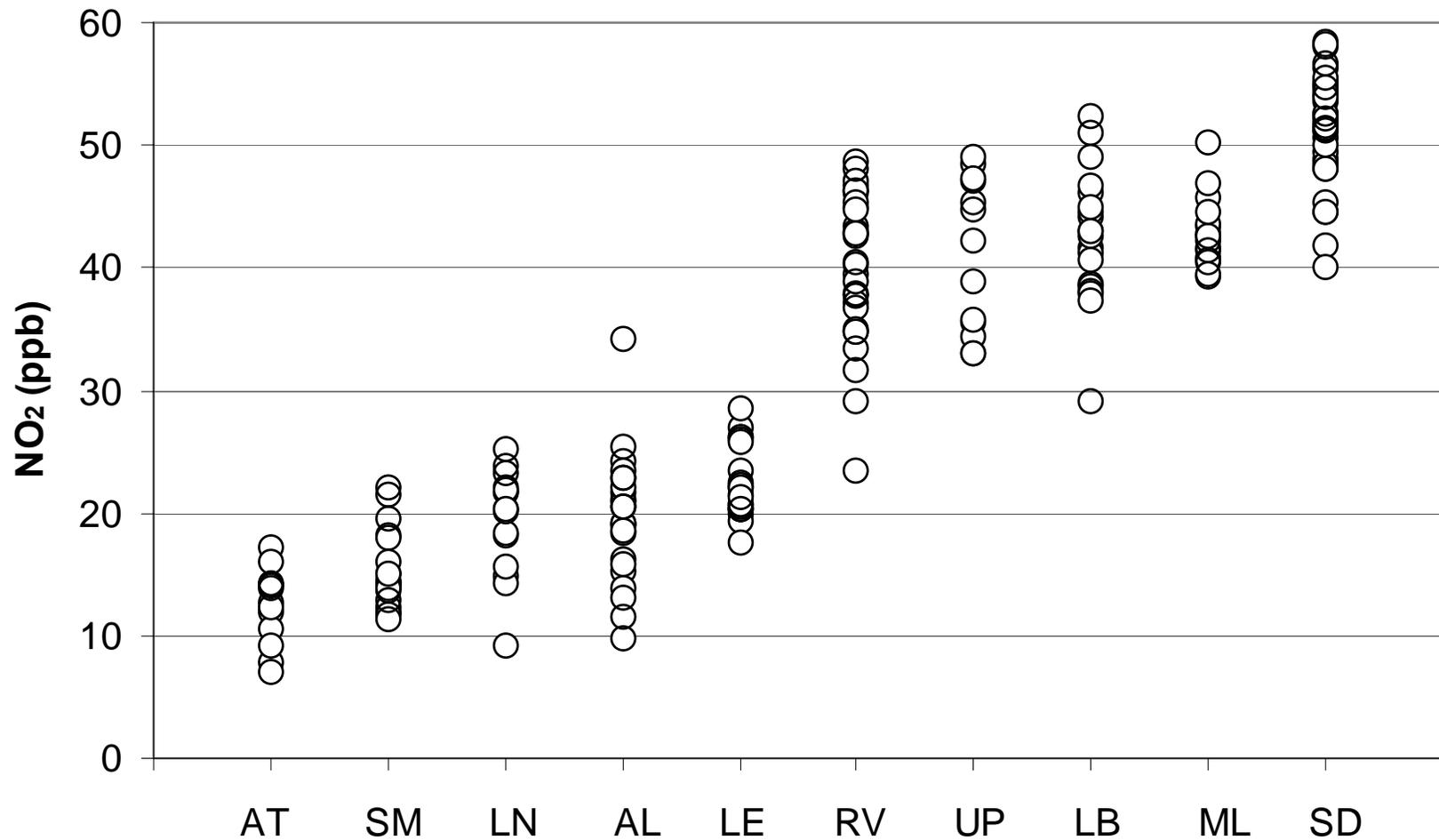
Legend

- Residence Locations
- TeleAtlas Road Links
- Annual Average Daily Traffic
- 10 - 3,000
- 3,001 - 5,000
- 5,001 - 10,000
- 10,001 - 25,000
- 25,001 - 50,000
- 50,001 - 75,000
- 75,001 - 150,000
- 150,001 - 231,000
- Local Road

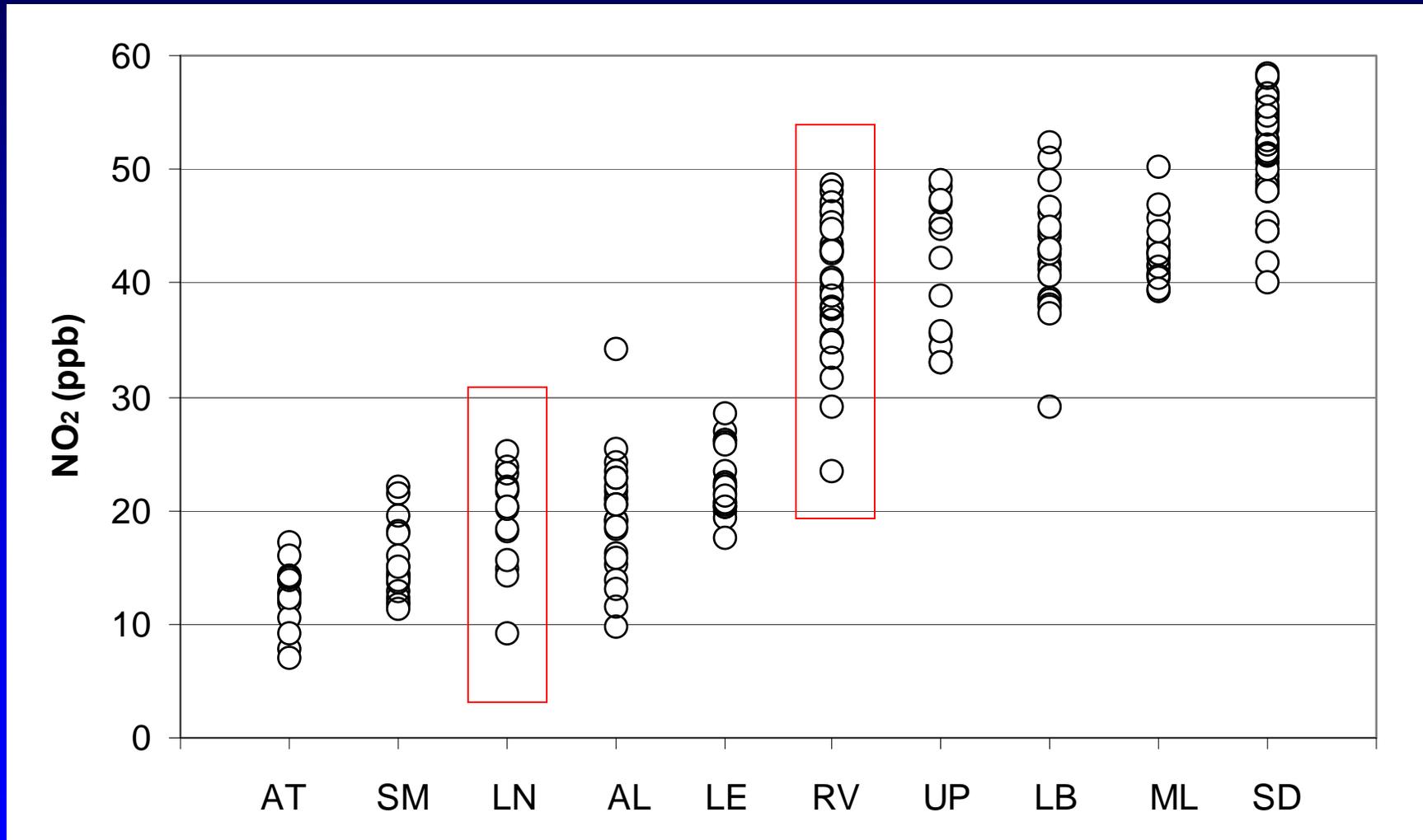
0 1 2 Kilometers



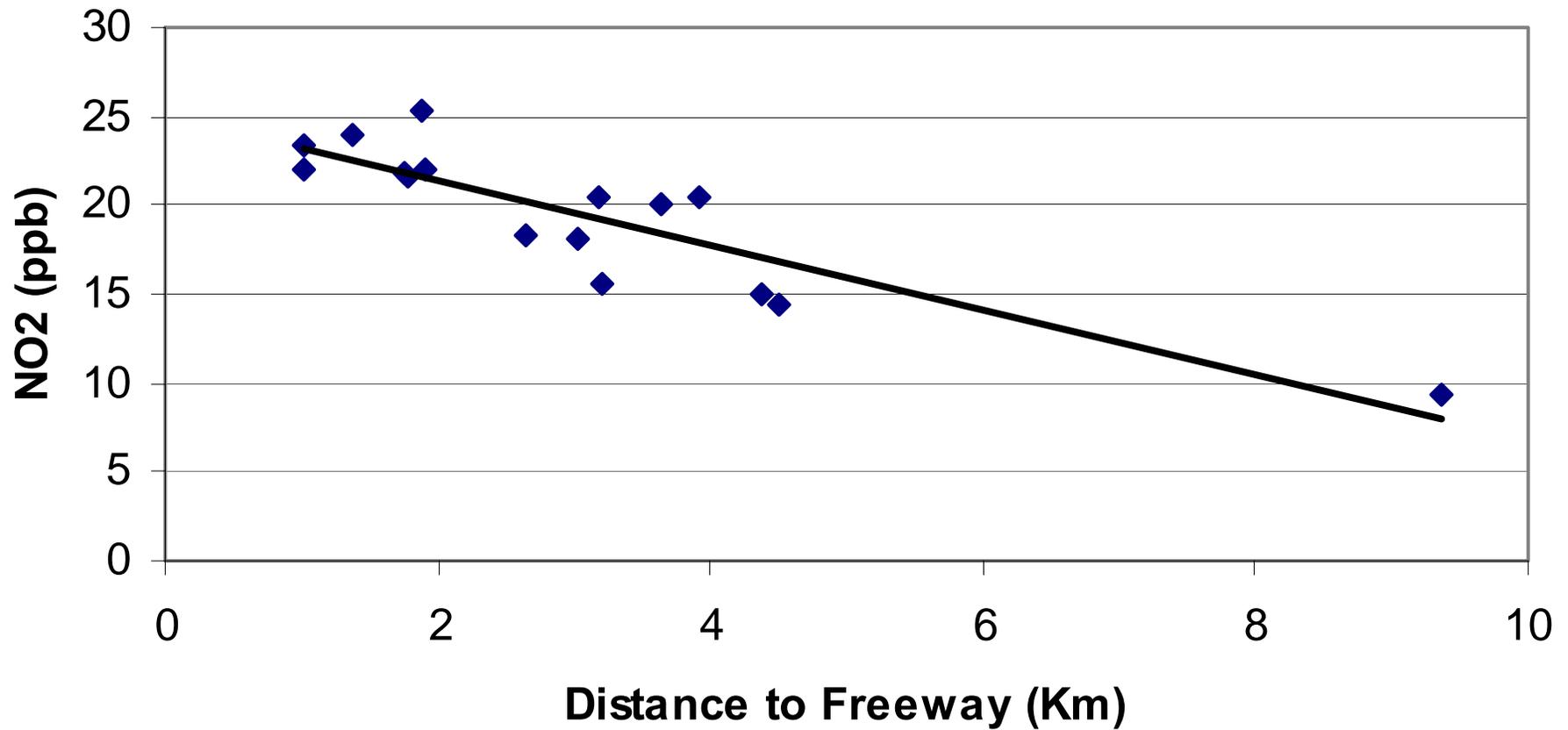
Measured NO₂ at 208 Homes



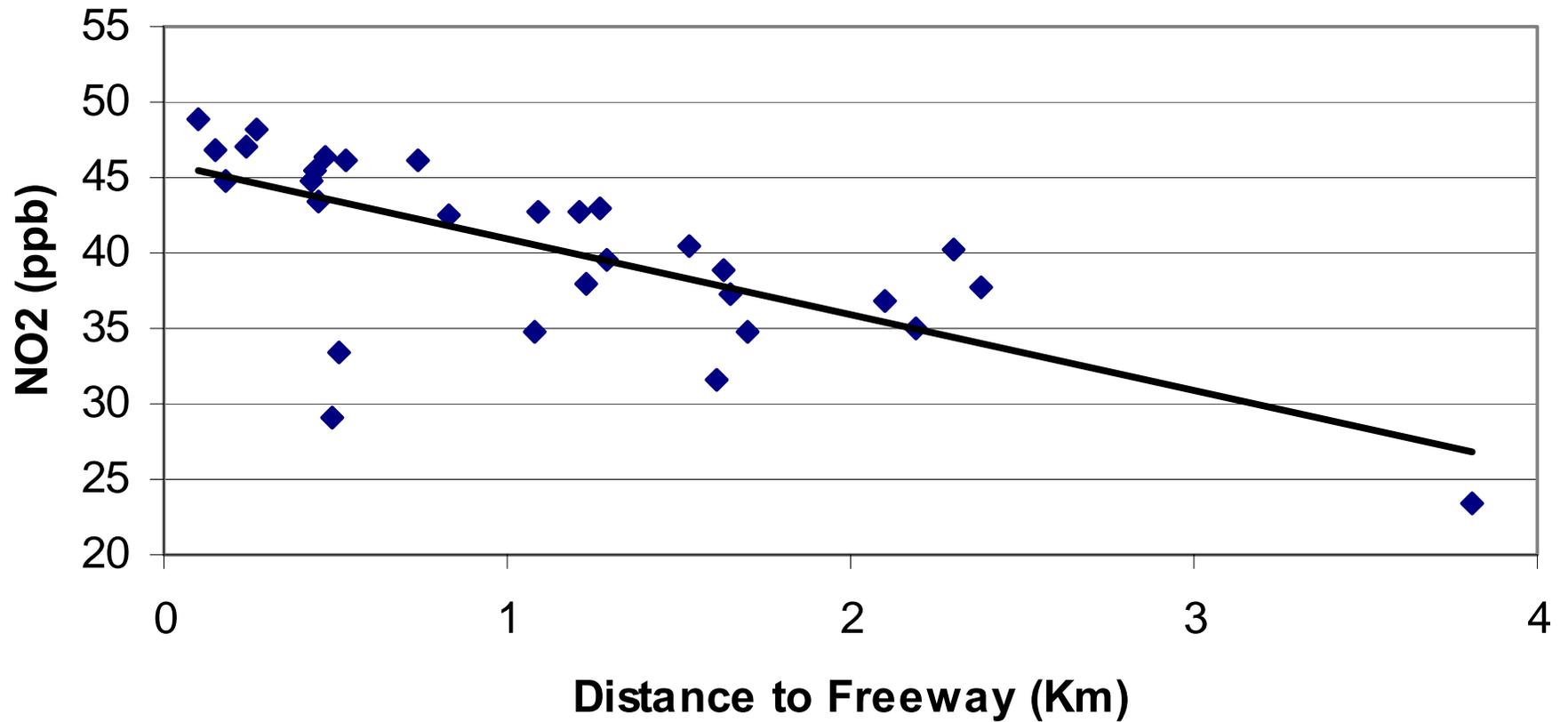
How Does NO₂ Relate to Freeways?



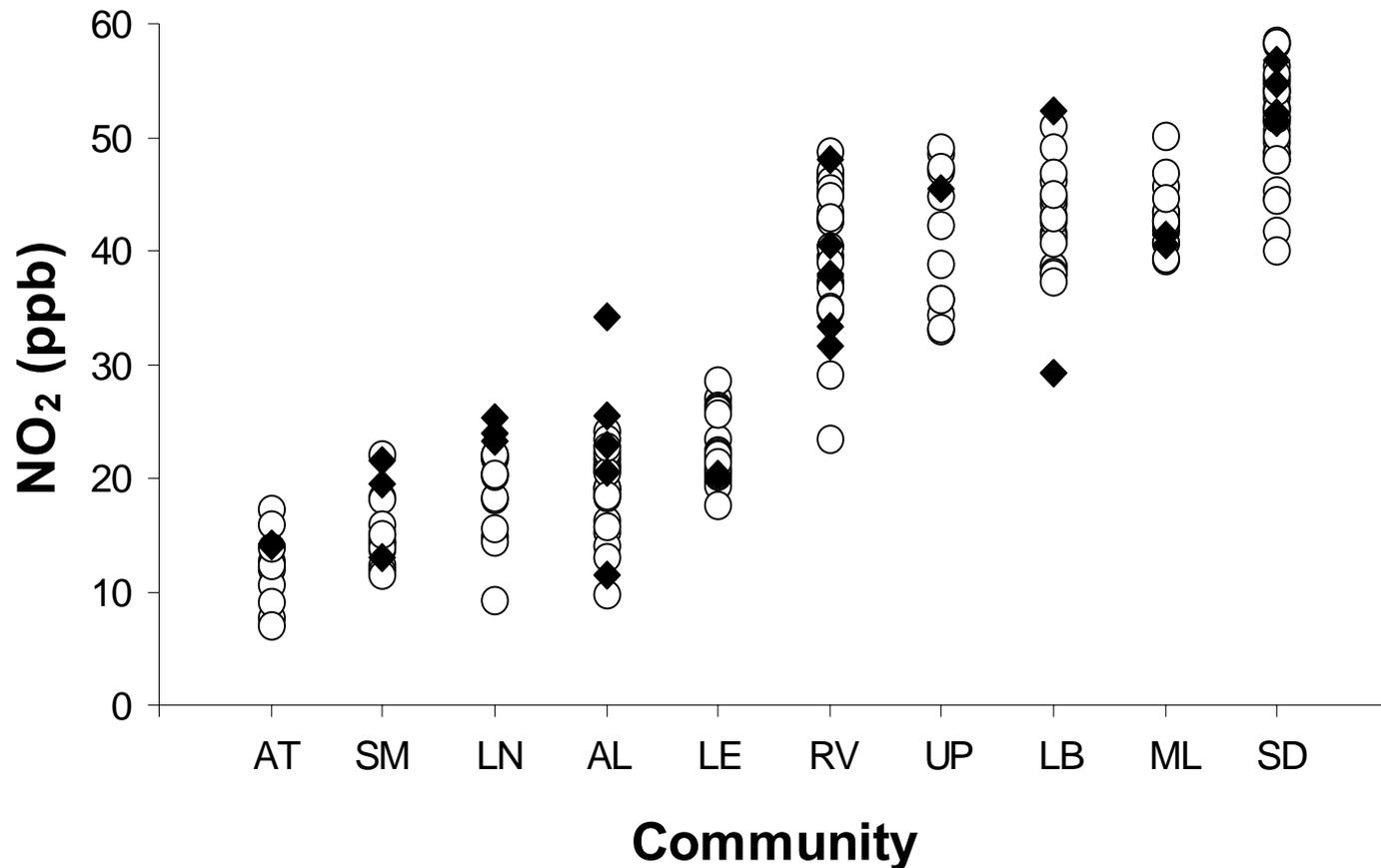
NO₂ vs. Distance to Freeway (Lancaster)



NO₂ vs. Distance to Freeway (Riverside)



NO₂ Levels vs. Asthma Status



◆ Home of a child with doctor-diagnosed asthma

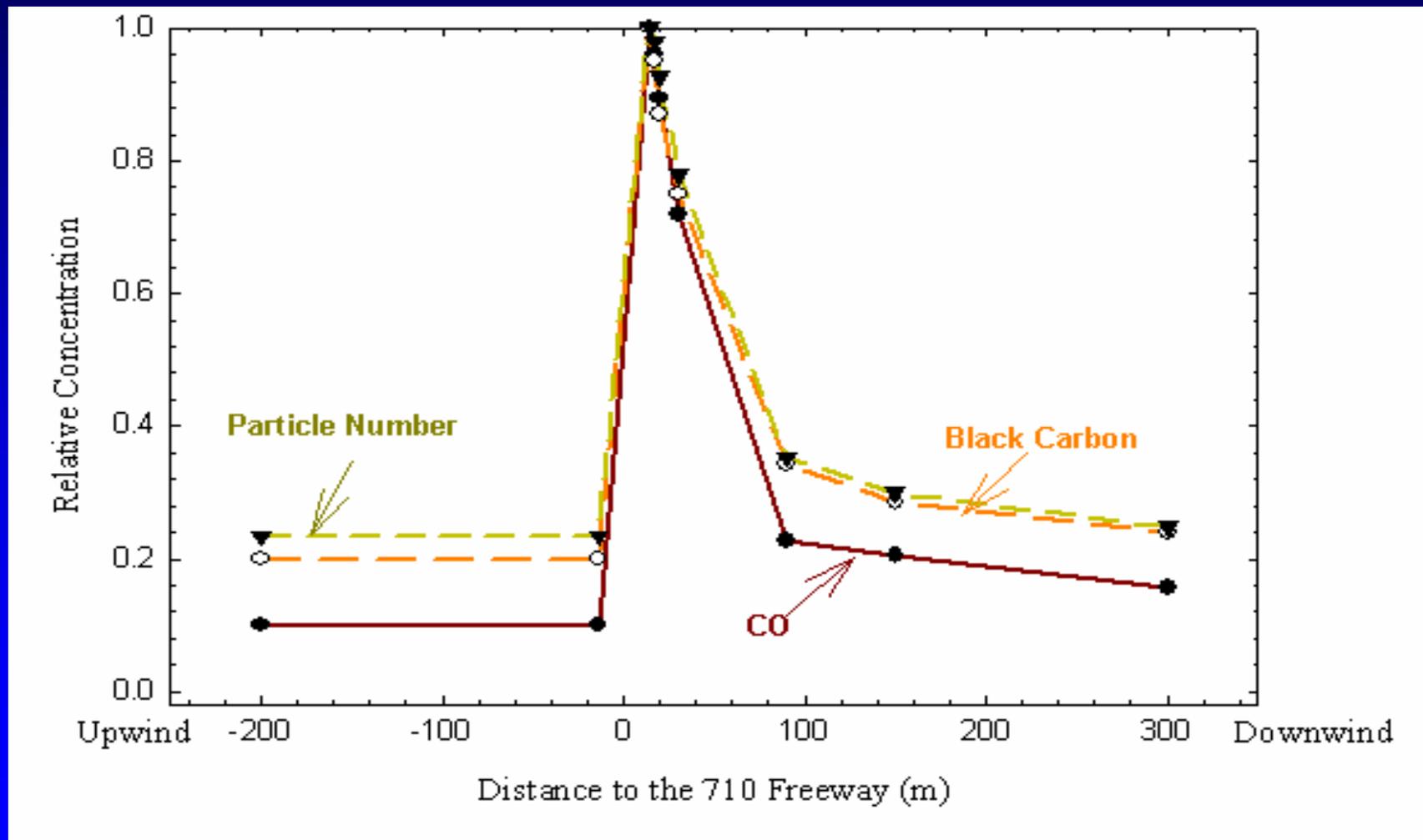
83%
Increase in
Asthma risk
per 5.7 ppb
of NO₂

How Do NO₂ and Traffic Correlate with Asthma Prevalence?

Exposure metric	Odds Ratio per IQR	
	OR ^a	(95% C.I.)
Measured NO ₂	1.83	(1.04, 3.21)
Distance to Freeway	1.89	(1.19, 3.02)

Wheezing, asthma-med use also associated

There are LOTS of Small Particles Near Busy Roadways



(Zhu et al., 2002)

Current CHS Study Communities

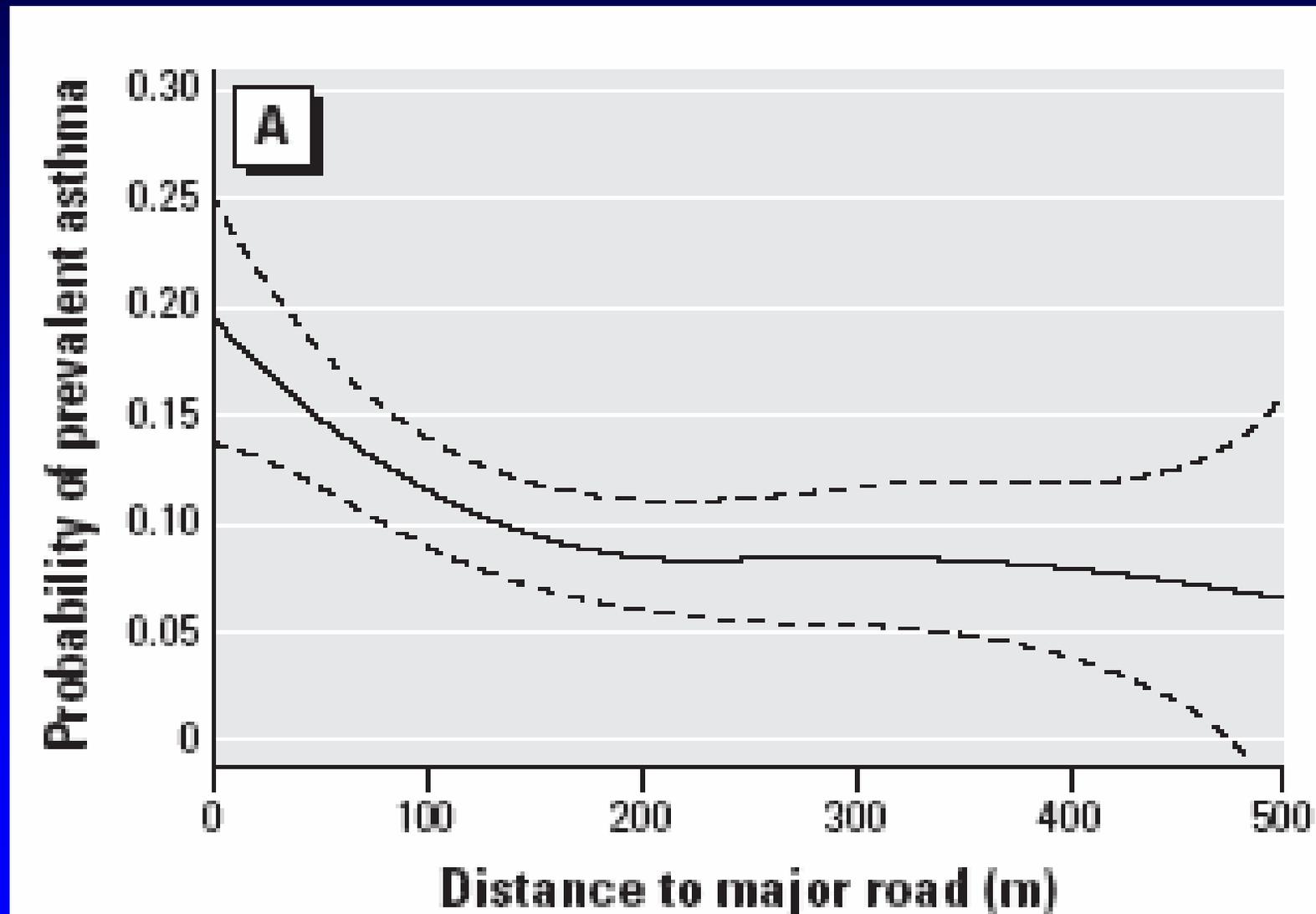


Asthma and Other Busy Roads

- Asthma risk increased ~50% within 75m of a major road
 - 15% live this close to a major road
 - Highest risk in:
 - Lifetime Residents
 - No family history of asthma

McConnell, et al., 2006 (released yesterday)

Asthma Prevalence in Long-term Residents with No Family History



Summary

- Air pollution associated with chronic health effects



- Regional and local pollution are important



- More work needed to identify specific traffic-related pollutants linked to health