Air Pollution in London: impacts on children's health

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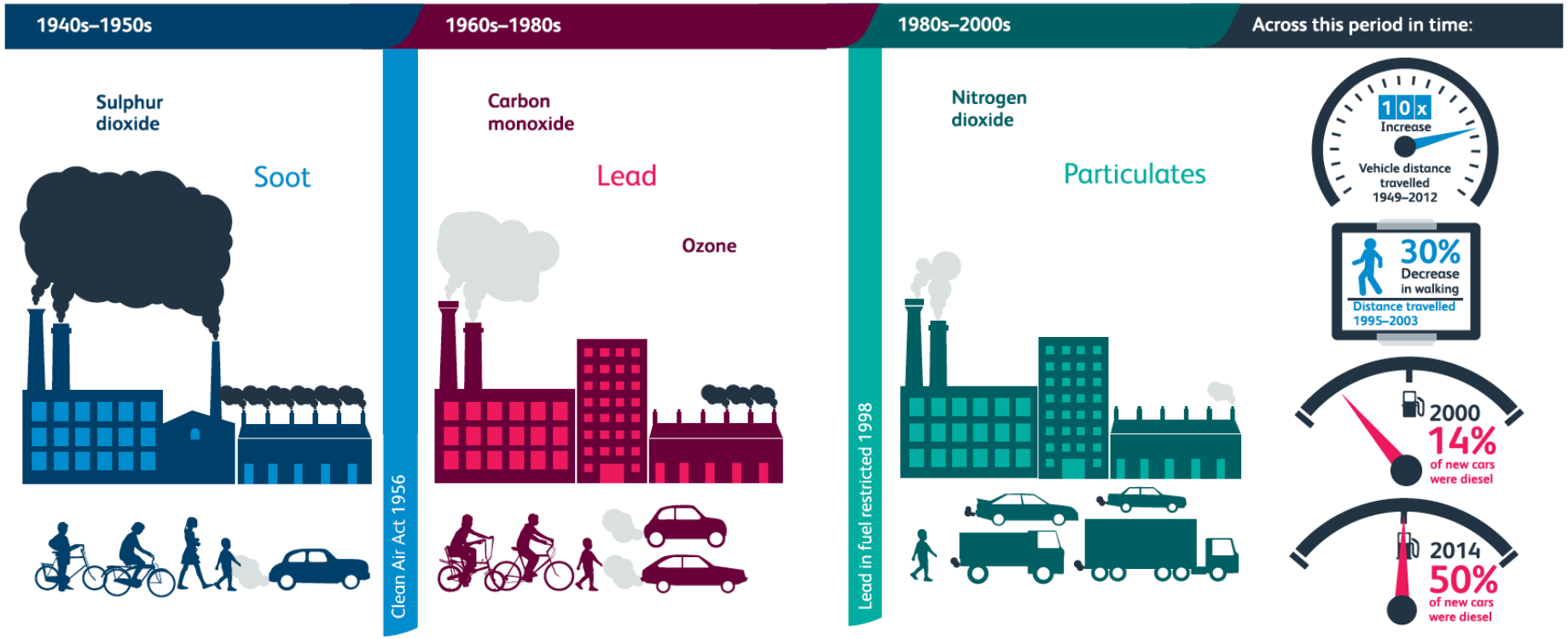
The changing face of air pollution



Short & long-term effects

COMEAP

COMMITTEE ON THE MEDICAL EFFECTS OF AIR POLLUTANTS

The Mortality Effects of Long-Term Exposure to Particulate Air Pollution in the United Kingdom

A report by the Committee on the Medical Effects of Air Pollutants

What about short term effects?
What about other pollutants?

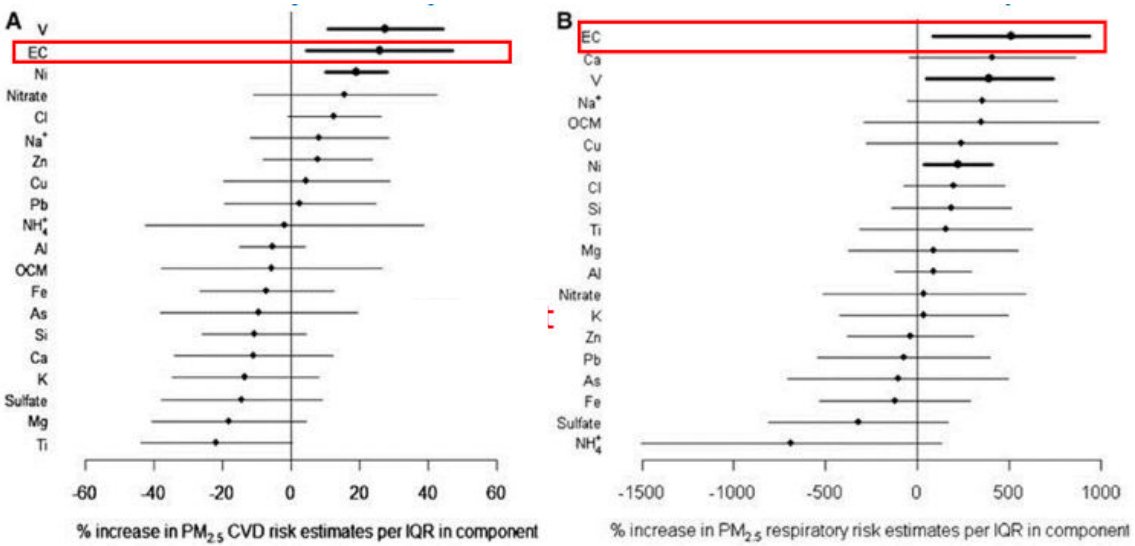
As a result of poor air quality:

- UK population lost 340,000 years of life in 2008
- This loss of life is **equivalent to 29,000 deaths (40,000)**
- the average loss of life would have been 2 years, (though the actual amount would vary between individuals).
- The burden can also be represented as a loss of life expectancy from birth (for everyone) of 6 months in susceptible populations

Published December 2010

Black Carbon – a better health indictor?

Toxic component or source indicator?

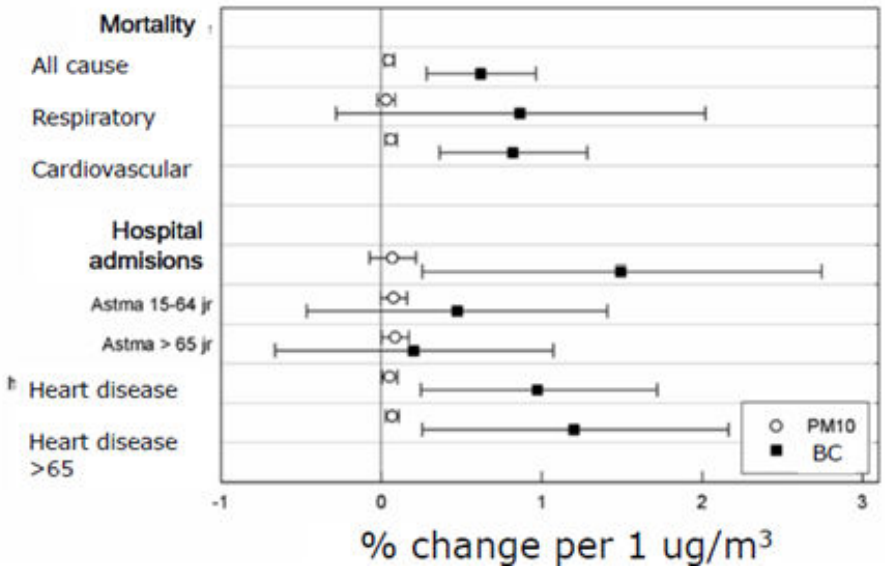


Estimated county- and season-specific relative risks (RR) of cardiovascular and respiratory hospitalization associated with $PM_{2.5}$ components in 106 U.S. counties for the years 1999 through 2005

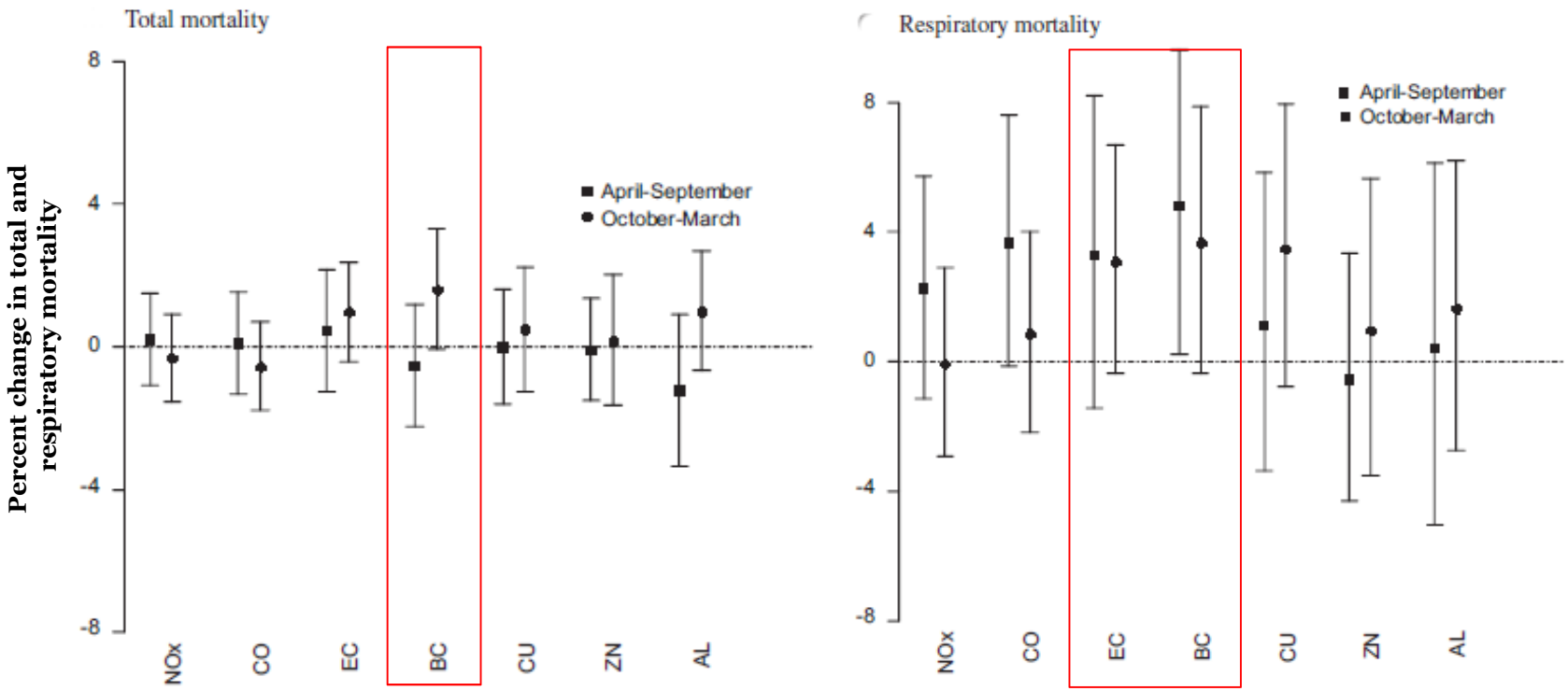
Bell et al, Am J Respir Crit Care Med, 2009

Systematic review and meta-analysis of health effects of BC compared with PM mass based on data from time-series studies and cohort studies that measured both exposures

Janssen et al, Environ Health Perspect, 2011

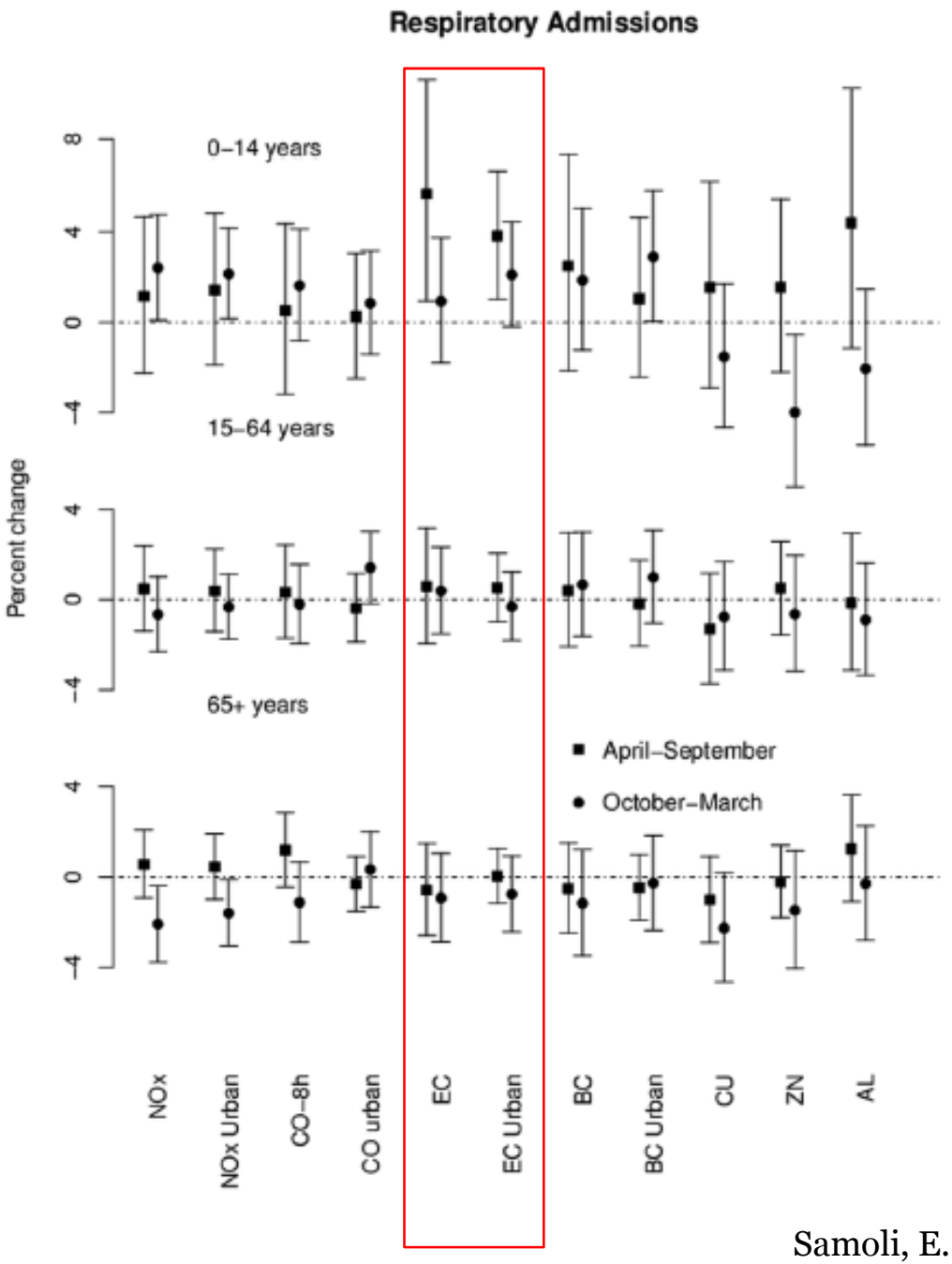


Short-term exposure to traffic-related air pollution and daily mortality in London (*2011–2012*)



NOx: General traffic indicator
CO: Petrol vehicle exhaust
EC: Diesel vehicle exhaust
BC: Diesel vehicle exhaust
Cu: Brake wear
Zn: Tire wear
Al: Road dust resuspension

Atkinson RW, et al. Int J Hyg Environ Health. 2016;219(6):566-72



Short-term exposure to traffic-related air pollution & respiratory hospital admissions in London

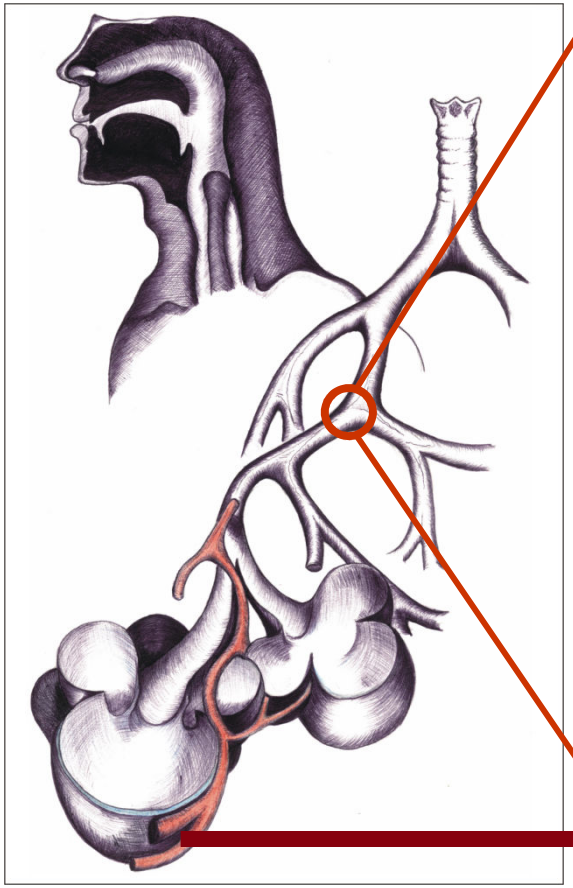
NOx: General traffic indicator
CO: Petrol vehicle exhaust
EC: Diesel vehicle exhaust
BC: Diesel vehicle exhaust
Cu: Brake wear
Zn: Tire wear
Al: Road dust resuspension

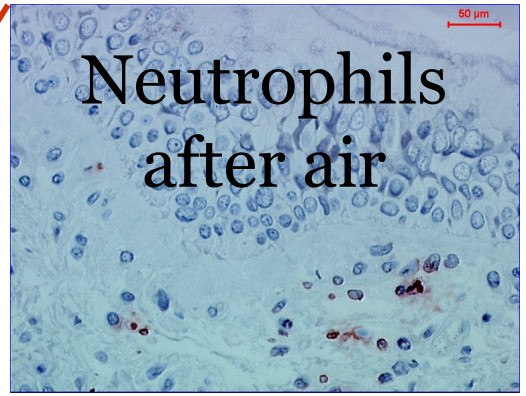
Samoli, E., et al. Occup Environ Med 2016;73:300–307.

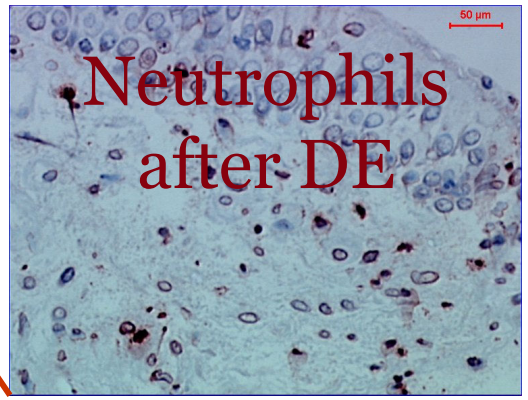
Controlled Diesel Exposures

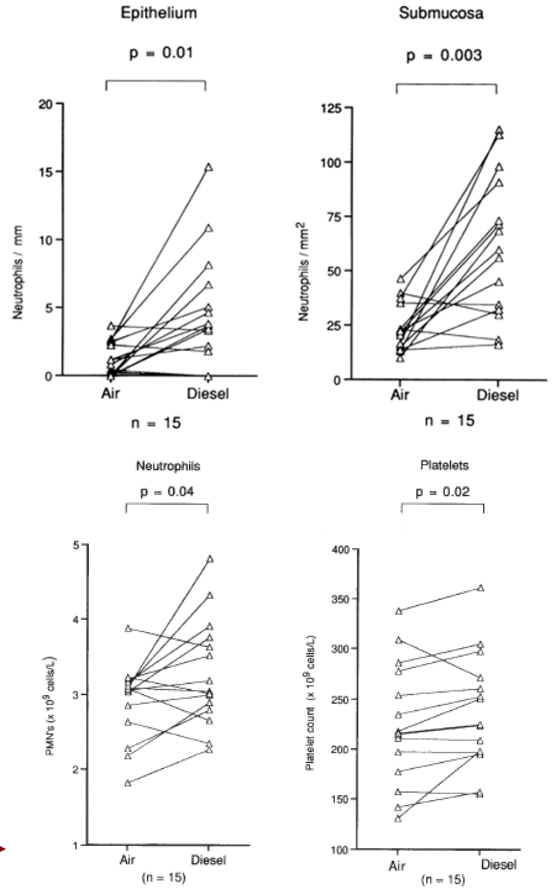
Exposure to DE: PM_{10} 300µg/m³ and filtered air for 1 hour & 100µg/m³ and filtered air for 2 hours

Diesel induces inflammation









Inflammation
Impaired lung function
Impaired microbial defences

Blood viscosity
Impaired vascular function
Ischaemia
Arrhythmias

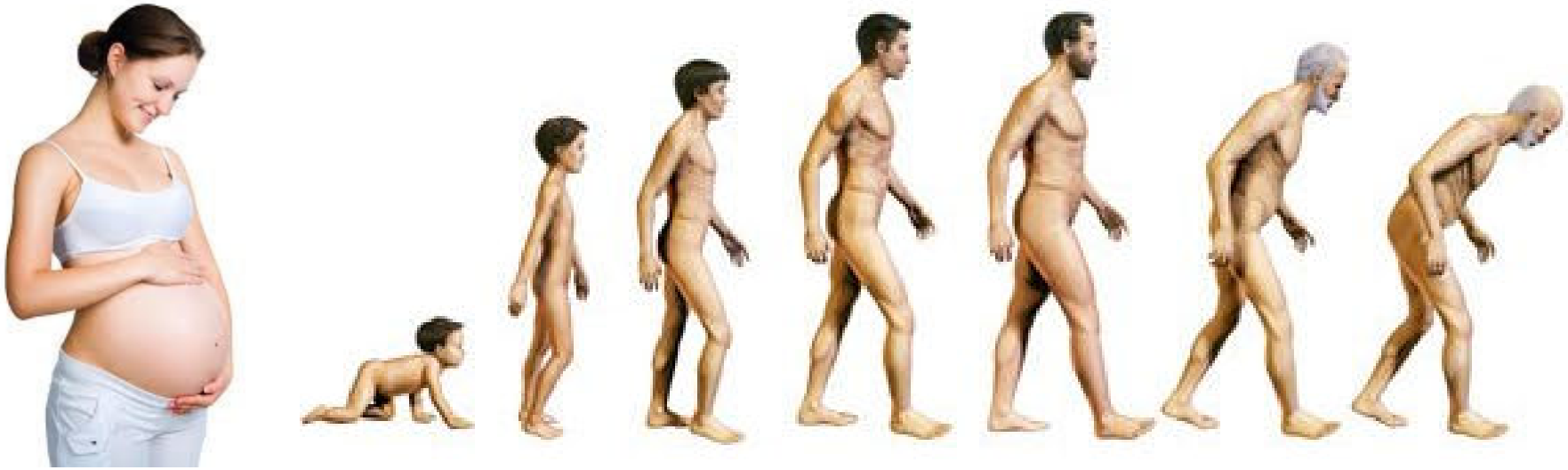
Impacts of Air Pollution across the Life Course

Low birth weight

Smaller lungs
Cognitive ability?

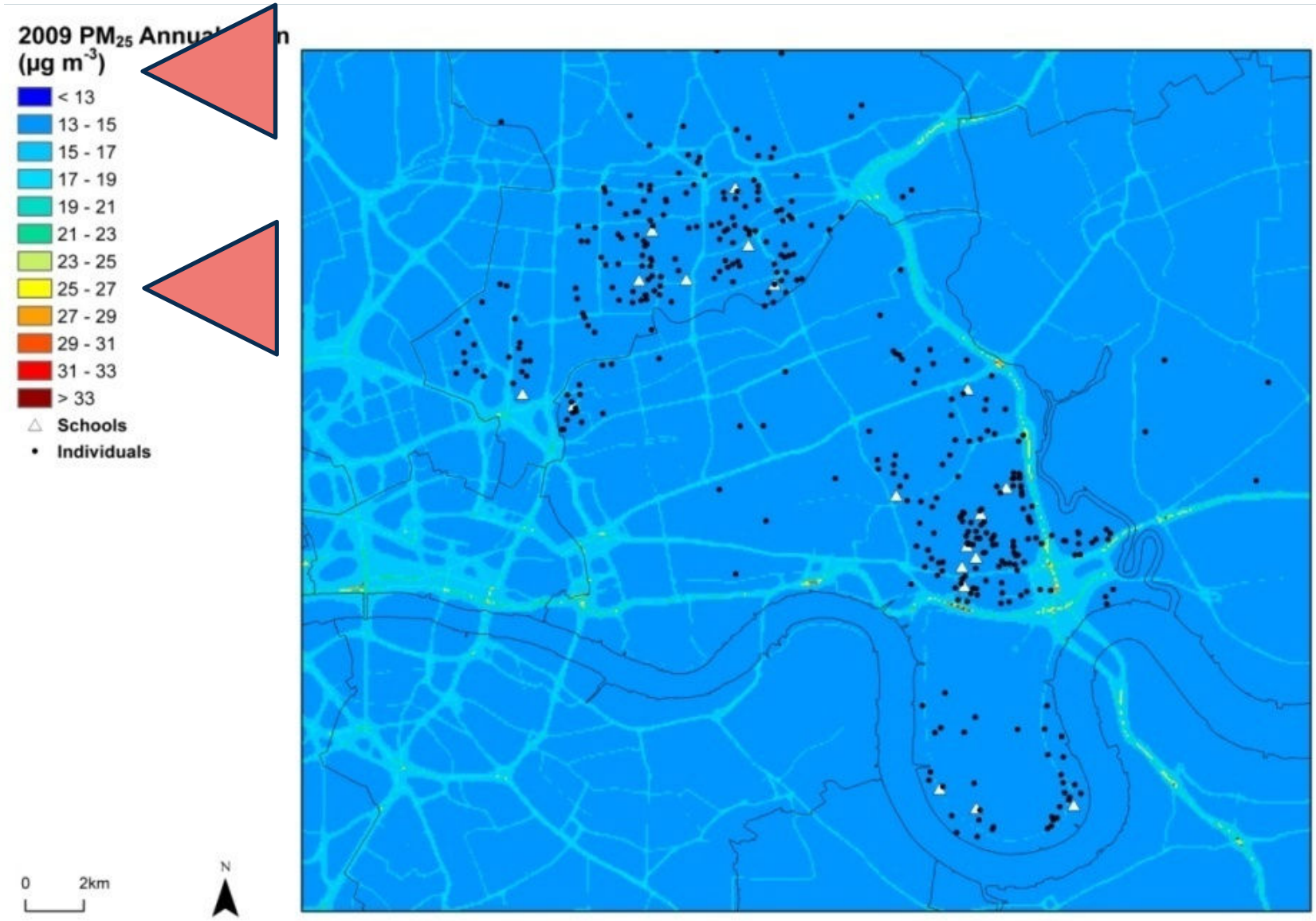
Increased risk of chronic disease
Acute respiratory exacerbations

Acute and chronic
Premature death
Dementia

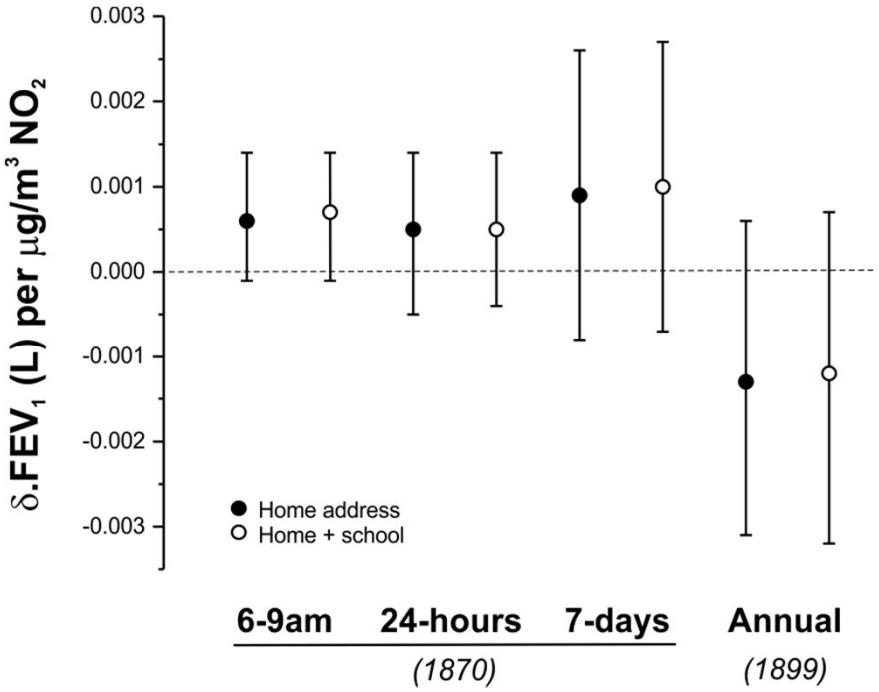


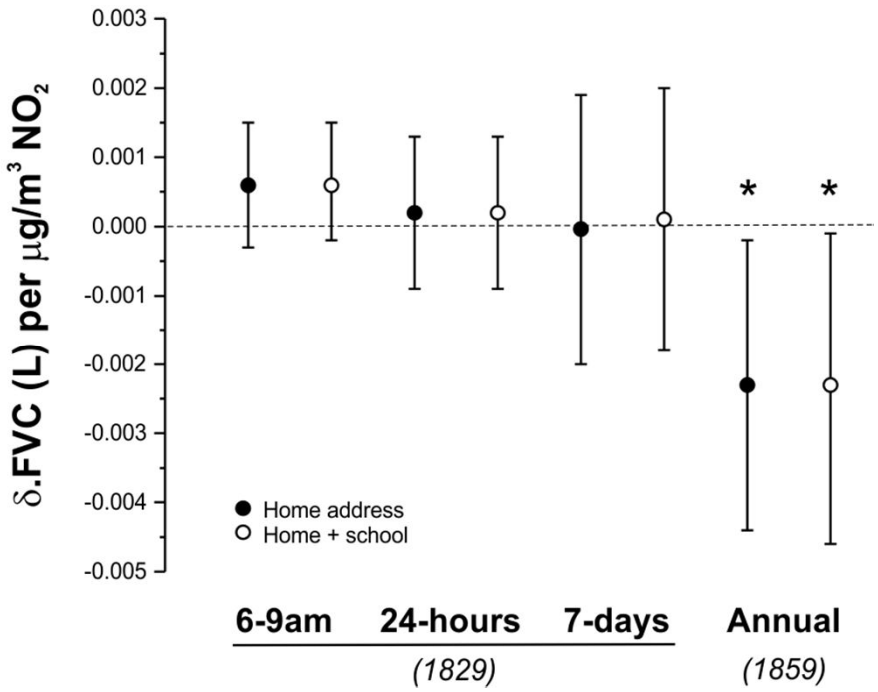

What about growing up here?

Pollution in Tower Hamlets & Hackney



Evidence of reduced lung volumes





Causes for Optimism

Evidence that improving air pollution delivers measurable health benefits

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 MARCH 5, 2015 VOL. 372 NO. 10

Association of Improved Air Quality with Lung Development in Children

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ABSTRACT

BACKGROUND

Air-pollution levels have been trending downward progressively over the past several decades in southern California, as a result of the implementation of air quality-control policies. We assessed whether long-term reductions in pollution were associated with improvements in respiratory health among children.

METHODS

As part of the Children's Health Study, we measured lung function annually in 2120 children from three separate cohorts corresponding to three separate calendar periods: 1994–1998, 1997–2001, and 2007–2011. Mean ages of the children within each cohort were 11 years at the beginning of the period and 15 years at the end. Linear-regression models were used to examine the relationship between declining pollution levels over time and lung-function development from 11 to 15 years of age, measured as the increases in forced expiratory volume in 1 second (FEV_1) and forced vital capacity (FVC) during that period (referred to as 4-year growth in FEV_1 and FVC).

RESULTS

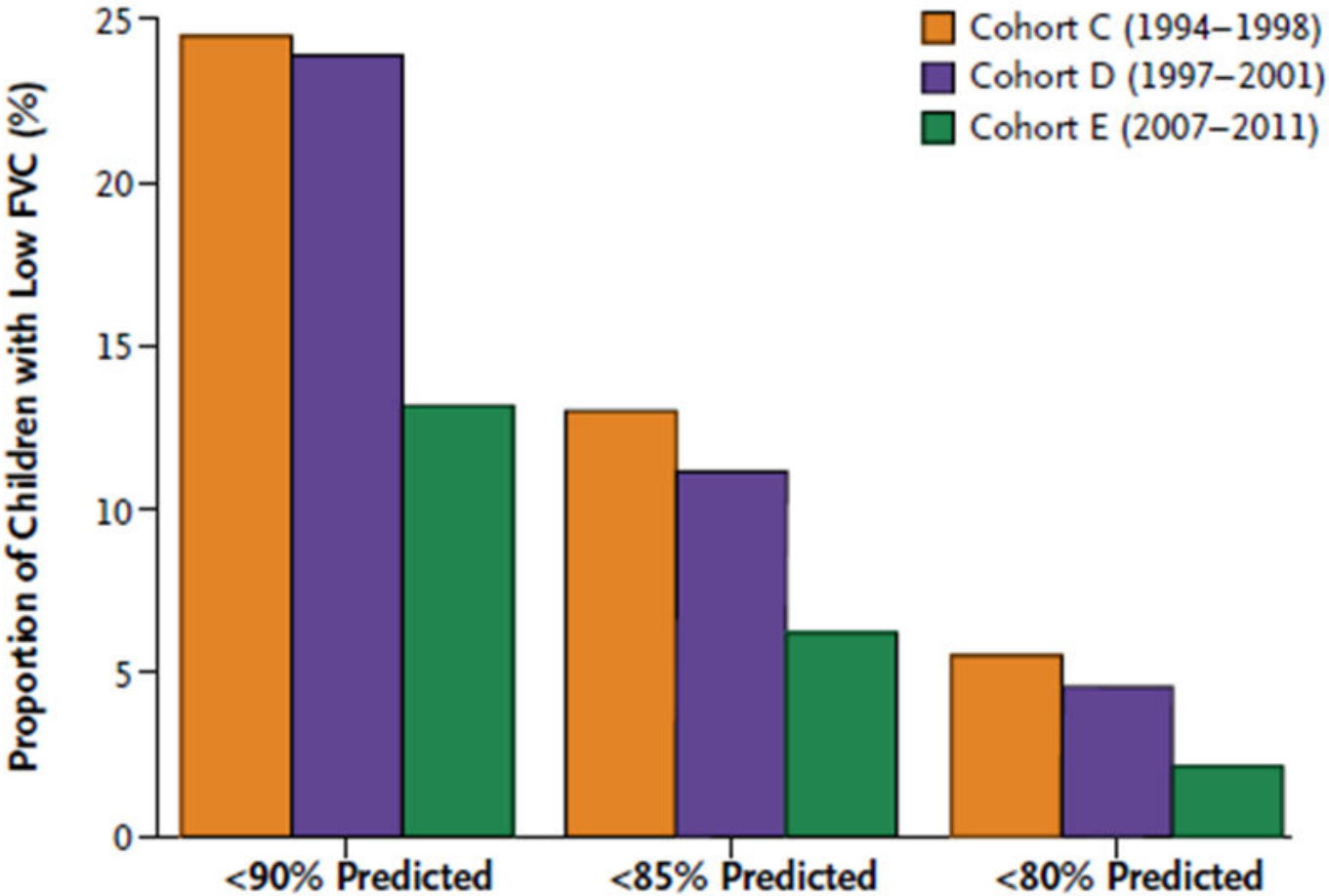
Over the 13 years spanned by the three cohorts, improvements in 4-year growth of both FEV_1 and FVC were associated with declining levels of nitrogen dioxide ($P<0.001$ for FEV_1 and FVC) and of particulate matter with an aerodynamic diameter of less than 2.5 μm ($P=0.008$ for FEV_1 and $P<0.001$ for FVC) and less than 10 μm ($P<0.001$ for FEV_1 and FVC). These associations persisted after adjustment for several potential confounders. Significant improvements in lung-function development were observed in both boys and girls and in children with asthma and children without asthma. The proportions of children with clinically low FEV_1 (defined as <80% of the predicted value) at 15 years of age declined significantly, from 7.9% to 6.3% to 3.6% across the three periods, as the air quality improved ($P=0.001$).

CONCLUSIONS

We found that long-term improvements in air quality were associated with statistically and clinically significant positive effects on lung-function growth in children. (Funded by the Health Effects Institute and others.)

From the Department of Preventive Medicine, University of Southern California, Los Angeles (W.J.G., R.U., E.A., K.B., R.M., E.R., R.C., F.G.) and Sonoma Technologies, Petaluma (F.L.) — both in California. Address reprint requests to Dr. Gauderman at the Department of Preventive Medicine, University of Southern California, 2001 Soto St., 202-K, Los Angeles, CA 90032, or at jim@usc.edu.

N Engl J Med 2015;372:905-13.
DOI: 10.1056/NEJMoa1414123



Gauderman WJ, et al. NEJM. 2015;372(10):905-913.

ULEZ study – summary

Luton Comparison Cohort

2018 | Year 2 | Year 3 | Year 4

Yearly assessments

ULEZ implementation

2018 | Year 2 | Year 3 | Year 4

London ULEZ Intervention Cohort

Child respiratory health, QOL and costs data collection

GP record collection

Air quality data collection and modelling

Linkage and Analysis