

**Imperial College
London**

Dr Gary Fuller

gary.fuller@imperial.ac.uk

@drgaryFuller

Air pollution in the 21st Century: evidence and the case for action

WM Air, Birmingham 18th Oct 2023

 **Clean Air
Programme**
www.ukcleanair.org/



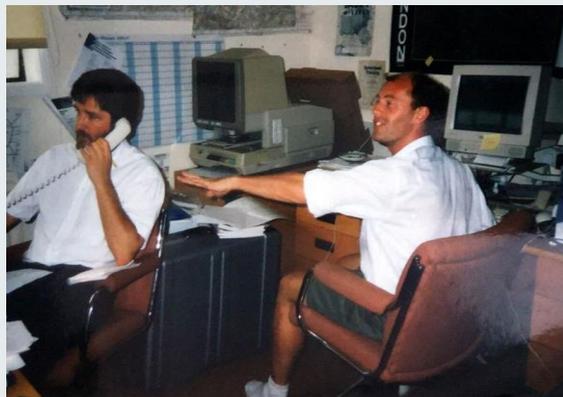
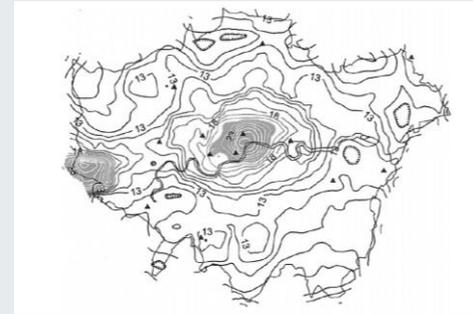
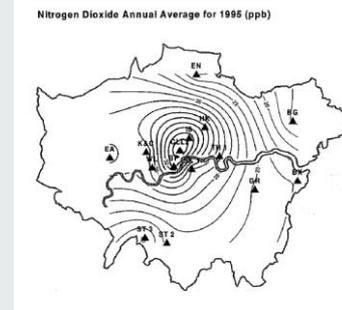


seiph London Air Quality Network
Current Air Quality Information

This report was generated on 27 June 2007 at 12:20 GMT.

Information from London Air Quality Network and affiliated stations:

Local Authority	Station	CO ₂ (ppm)	CO (ppm)	NO ₂ (ppb)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (ppb)	O ₃ (ppb)
City of London	City	385	0.5	15	15	10	1	15
City of London	City	385	0.5	15	15	10	1	15
City of London	City	385	0.5	15	15	10	1	15
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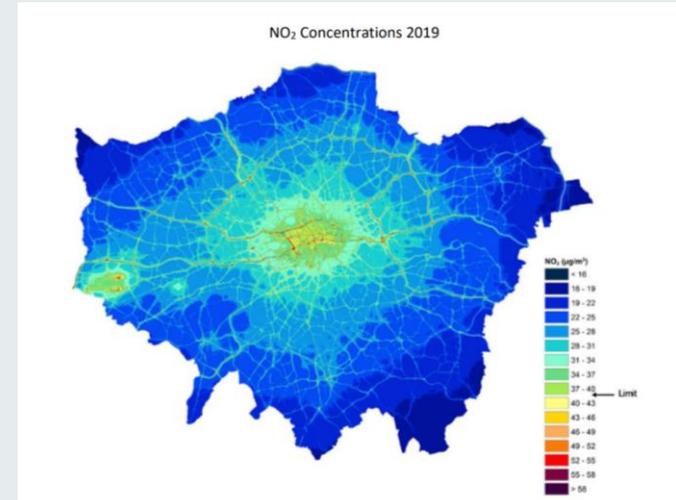
Free air quality sensors for communities

YOUR AIR, YOUR COMMUNITY, YOUR IDEAS

breathelondon.org/apply

The CityAir app for iOS & Android

THE HEATTEST WAY AROUND LONDON



The evidence on air pollution and health grows by the day

- 61,372 papers since 1931
- 56,117 in the last 30 years (91%)
- 37,600 in the last ten years (61%)

But our policy framing and actions largely reflect the science of the 20th century and not the 21st.

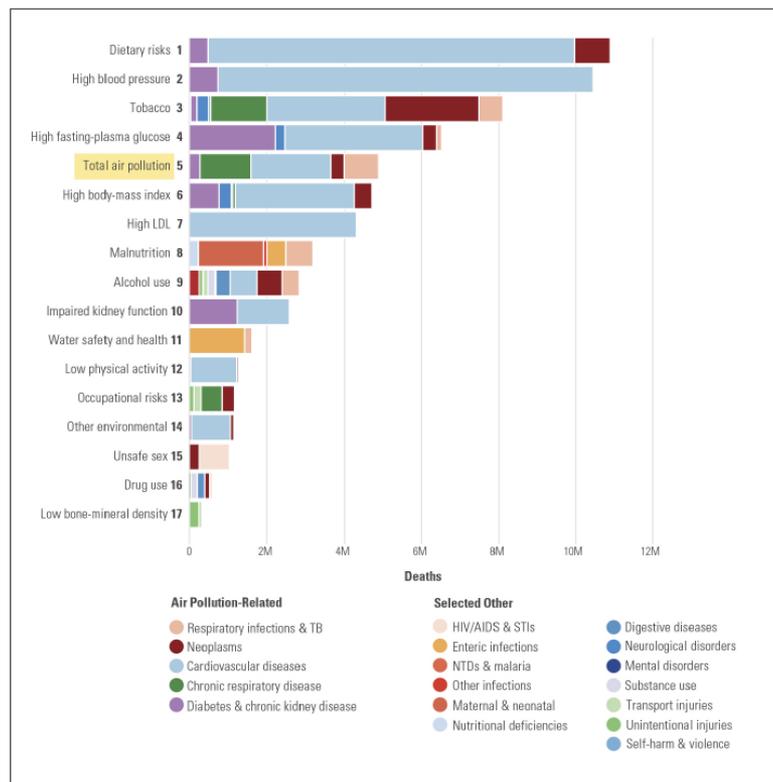


As of 9th Oct 2023

Air pollution is a global health emergency*

Air pollution is the fifth leading risk factor for mortality worldwide. It is responsible for more deaths than many better-known risk factors such as malnutrition, alcohol use, and physical inactivity. Each year, more people die from air pollution-related disease than from road traffic injuries or malaria.

Figure 1. Global ranking of risk factors by total number of deaths from all causes for all ages and both sexes in 2017.



Explore the rankings further at the [IHME/GBD Compare site](#).



4.9 million early deaths, each year

* Says WHO



Health impacts in the UK (annual)

Estimates of annual deaths attributable to air pollution in the UK

- 40,000 (RcP 2016) (PM2.5 and NO2)
- 55,000 (EEA, 2017) (PM2.5, NO2 and O3)
- **29,000 - 43,000 [Mitsakou et al 2022 – UKHASA] [PM2.5 and NO2]**
- 64,000 – Lelieveld et al 2019 using new global air pollution impact analysis
- 99,000 from global estimates Vohri et al 2021



February 2023 was the 10th anniversary of the death of Ella Kissi Deborah

The first person in the UK (& globally?) to have air pollution listed as a cause of death on her death certificate.

Far reaching prevention of future deaths report



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Environment Climate crisis Wildlife Energy Pollution

Air pollution

How anti-Ulez campaigners misused air pollution finding in Ella Adoo-Kissi-Debrah death



Amelia Gentleman
@ameliagentleman
Sat 16 Sep 2023 11:00 BST

OPINION

Check for updates

1 South London
2 Greener Practice
3 Cornwall

Air pollution should be listed on death certificates

We need national guidance for clinicians on the inclusion of air pollution on death certificates, argue Laura-Jane Smith, Mike Tomson, and Kath Brown

Laura-Jane Smith,¹ Mike Tomson,² Kath Brown^{2,3}

Air pollution is often framed as a modern problem, continue to be exposed to such high levels of air

...”yet no one else has had air pollution included as a contributing cause of death. This causes confusion for the public, and allows those opposed to public health interventions to misuse statistics on cause of death to minimise the problem of air pollution.”



ONS 17th March 2022 and many more times in FOI responses:

“It is unusual for wider contextual factors, such as exposure to pollution or air quality, to be recorded among the causes of death.”

“It may be more informative to consider epidemiological studies which estimate numbers or proportions of deaths which can be attributed to exposure to pollution or poor air quality. A number of reports have been published by Public Health England...”

Last winter marked the 70th anniversary of London's Great Smog



London 1952

- it took a disaster for air pollution and health to be finally connected

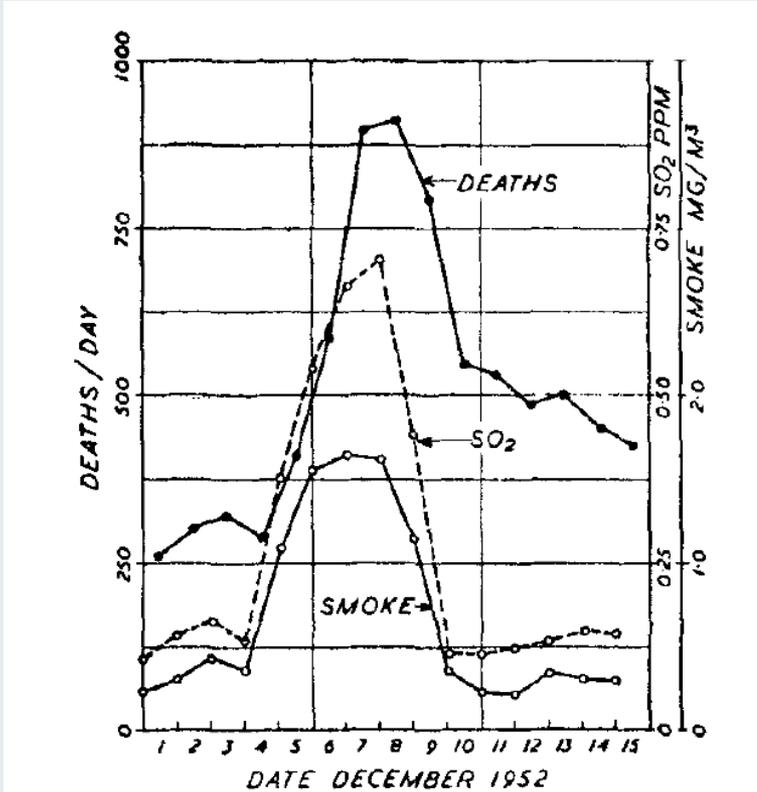


Figure 1. Daily air pollution and deaths.

Air pollution aspects of the London fog of December 1952

By E. T. WILKINS
D.S.I.R., Fuel Research Station, Greenwich

MoH report (1954) – 4,000 deaths
Bell et al 2001 - 12,000 deaths

They have no memorial except in the 1956
Clean Air Act and a book (last slide)



Then in 1993 - the six cities study (30 years ago!)

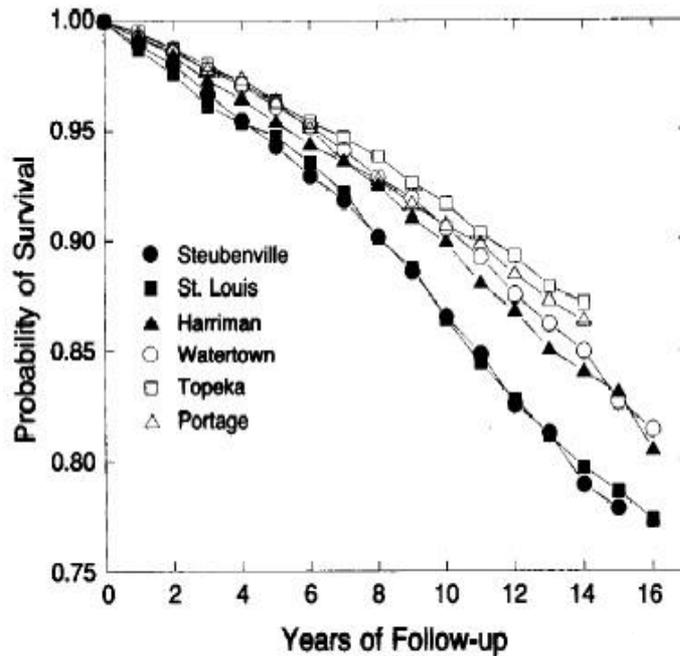
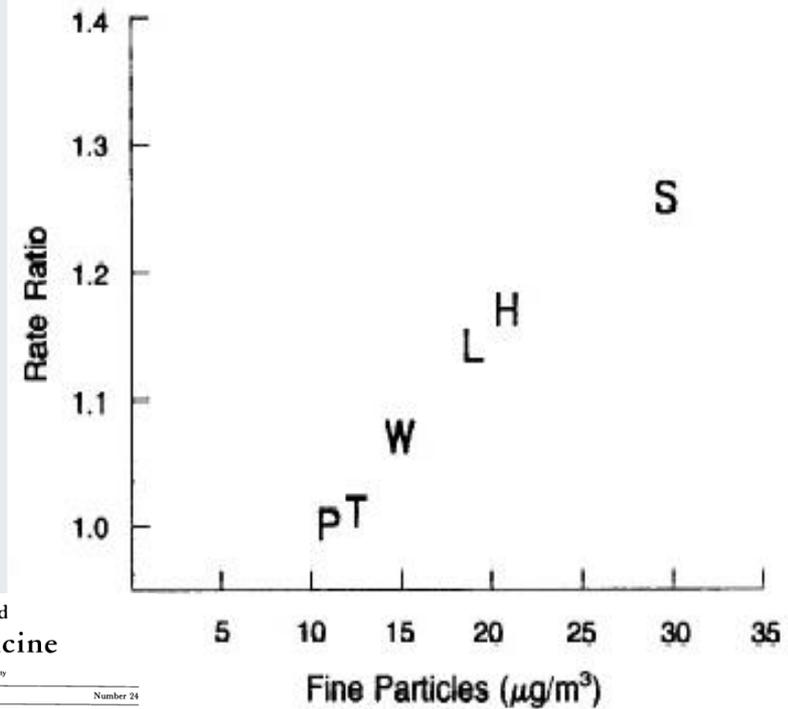


Figure 2. Crude Probability of Survival in the Six Cities, Acc to Years of Follow-up.



The New England
Journal of Medicine

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Volume 329

DECEMBER 9, 1993

Number 24

AN ASSOCIATION BETWEEN AIR POLLUTION AND MORTALITY IN SIX U.S. CITIES

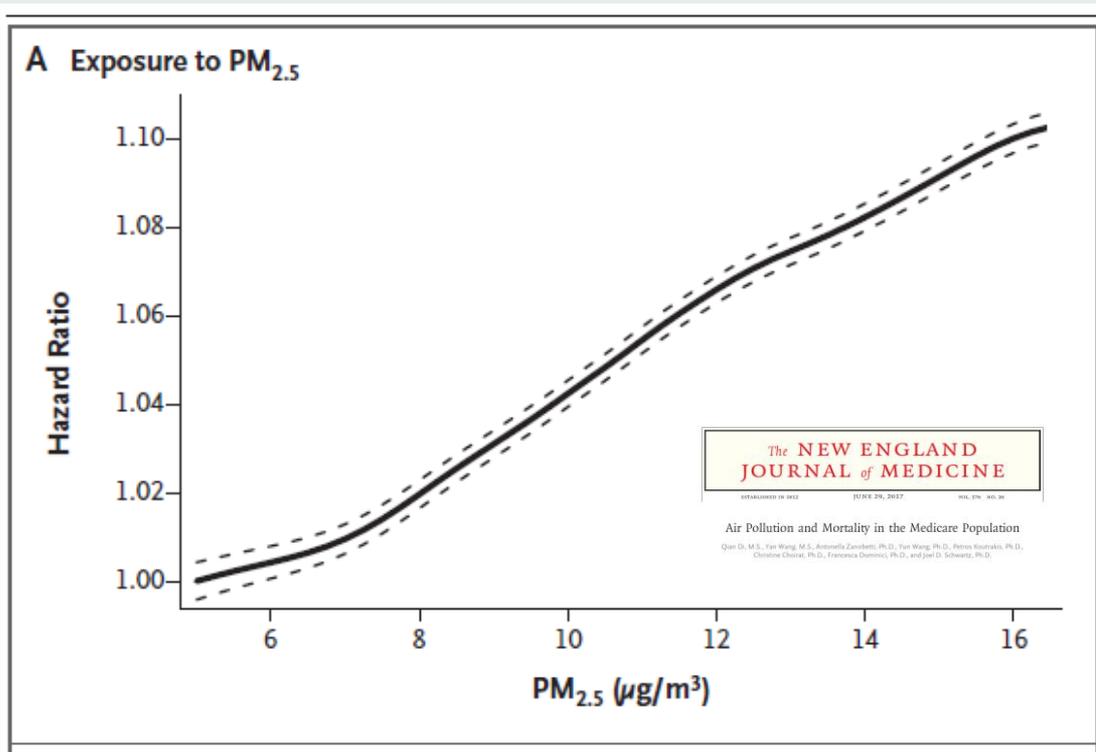
DOUGLAS W. DOCKERY, Sc.D., C. ARDEN POPE III, Ph.D., XIPING XU, M.D., Ph.D.,
JOHN D. SPENGLER, Ph.D., JAMES H. WARE, Ph.D., MARTHA E. FAY, M.P.H.,
BENJAMIN G. FERRELL, JR., M.D., and FRANK E. SPEIZER, M.D.

Today, health evidence does not support a threshold

Health effects found to the lowest levels measured and well below current EU & UK Limits 20-25 $\mu\text{g m}^{-3}$, US limits of 12 $\mu\text{g m}^{-3}$ and the Env Act target of 10 $\mu\text{g m}^{-3}$ for 2040!

WHO set new Guideline of 5 $\mu\text{g m}^{-3}$ in 2021.

We need to move beyond limit values to reducing concentrations for all communities.



INSIGHTS | PERSPECTIVES

AIR QUALITY

Keeping air pollution policies on track

Focusing on trends rather than compliance can lead to more effective policies

By Gary W. Fuller and Anna Font

2013 and 2017 (3).

The need for this change in emphasis, and feedback into policy, was strikingly illustrated by the recent diesel car emissions scandal, where car manufacturers produced vehicles that passed regulatory tests but produced much more pollution when used on the roads. In Europe, where policies had favored diesel vehicles since the mid-

Around the world, thousands of instruments are measuring air pollution. The World Air Quality website (7) provides near-real time air pollution data from stations across North America, Europe, and through the Middle East to Southeast Asia and across Australia and New Zealand. Occasionally, one of these data points loops into the news. Beijing frequently made the headlines in the early part of this decade but, for the past 2 years, Delhi has



CCME
Canadian Council of Ministers of the Environment / Le Conseil canadien des ministres de l'environnement

GUIDANCE DOCUMENT ON AIR ZONE MANAGEMENT

PH 1481
978-1-896997-89-6 PDF

Impact of London's low emission zone on air quality and children's respiratory health: a sequential annual cross-sectional study

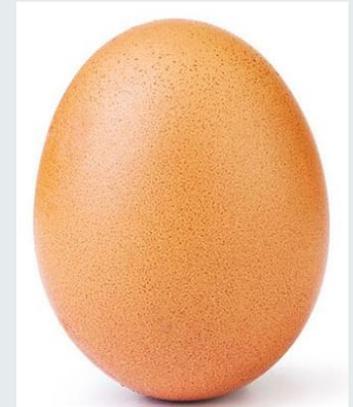
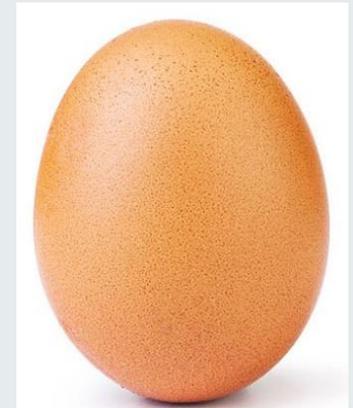
Ian S Mudway, Isobel Dundas, Helen E Wood, Nadine Marlin, Jeenath B Jamaludin, Stephen A Bremner, Louise Cross, Andrew Grieve, Alex Nanzer, Ben M Barratt, Sean Beevers, David Dajnak, Gary W Fuller, Anna Font, Grainne Colligan, Aziz Sheikh, Robert Walton, Jonathan Grigg, Frank J Kelly, Tak H Lee, Chris J Griffiths

Summary

Background Low emission zones (LEZ) are an increasingly common, but unevaluated, intervention aimed at improving urban air quality and public health. We investigated the impact of London's LEZ on air quality and children's respiratory health.



Lancet Public Health 2018
Published Online
November 14, 2018



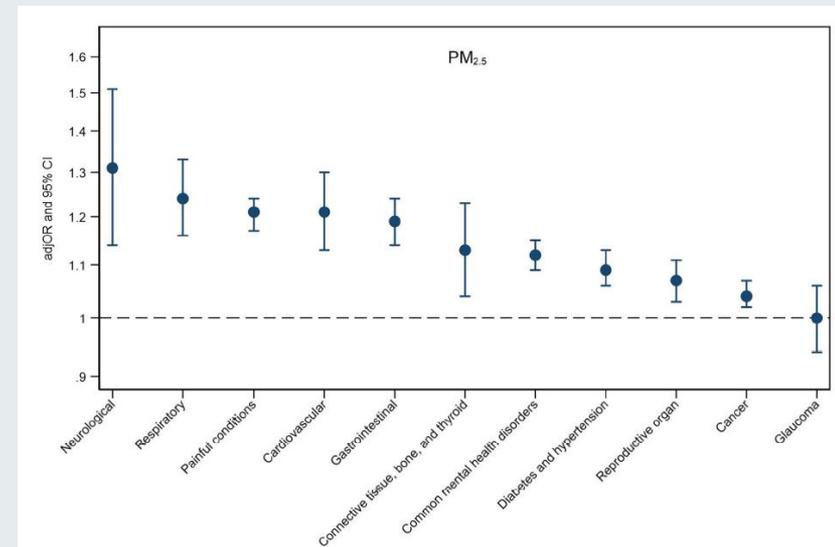
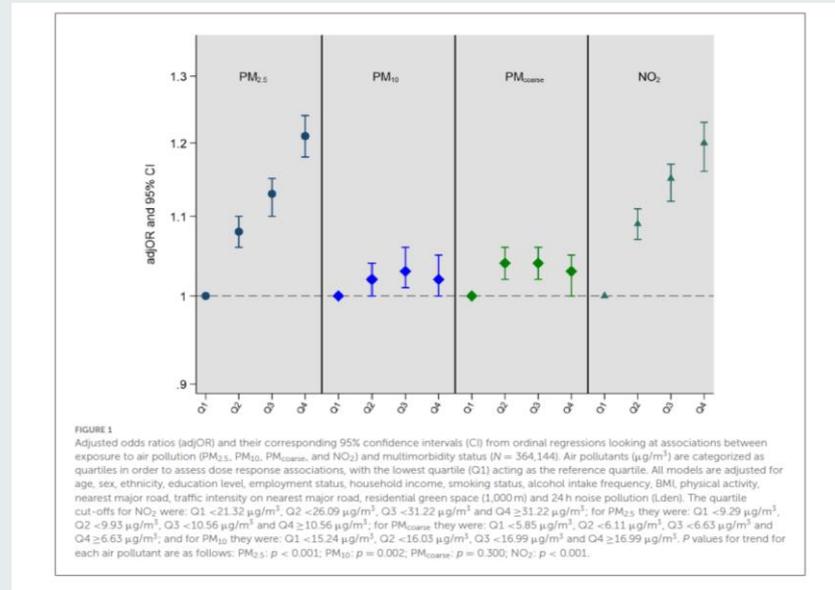
“Within London's LEZ, a smaller lung volume in children was associated with higher annual air pollutant exposures”
But better air – bigger children's lungs.

(With all credit to Jim Gauderman et al for pioneering this type of study)

Are the impacts of air pollution hiding in plain sight in the everyday ailments that affect the lives of so many?



An extra 20% chance of multiple long-term illnesses for those living with particle pollution that is worse than the 2040 England target.



Air pollution affects us through the different stages of our life



Nearly 60,000 studies since 1932, over half of these took place in the last ten years.

Imperial College London
 Environmental Research Group
 Projects

Impacts of air pollution across the life course – evidence highlight note

Independent analysis prepared by:
 Gary Fuller, Stav Friedman and Ian Mudway
 Environmental Research Group, Imperial College London

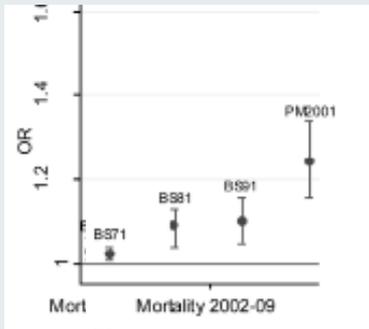
Life stage	Health impact
Pregnancy and birth outcomes	Foetal development Low birth weight Gestational age and pre-term births Miscarriage Sperm count and mobility
The developing child: from birth, through adolescence	Lung growth Asthma Blood pressure Cognitive abilities Inattention and hyperactivity Mental health and illness
Adulthood	Early death Cardiac health Stroke Brain and mental health Respiratory health Cancer Multiple chronic illnesses

Cognitive decline, dementia and air pollution

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

Chairman: Professor Frank Kelly
 Chairman of Subgroup on Cognitive Decline and Dementia: Professor Robert L. Maynard

We are now learning that air pollution can have life-long impacts



ORIGINAL ARTICLE

Early-Life Exposure to the Great Smog of 1952 and the Development of Asthma

Prashant Bharadwaj¹, Joshua Graff Zivin¹, Jamie T. Mullins², and Matthew Neidell³

¹Department of Economics, University of California San Diego, La Jolla, California; ²Department of Resource Economics, University of Massachusetts Amherst, Amherst, Massachusetts; and ³Mailman School of Public Health, Columbia University, New York, New York

ORCID ID: 0000-0002-6827-760X (J.T.M.).

Downloaded from <http://thorax.bmj.com/> on February 9, 2016 - Published by group.bmj.com
Thorax Online First, published on February 8, 2016 as 10.1136/thoraxjnl-2015-207111

Environmental exposure



ORIGINAL ARTICLE

Historic air pollution exposure and long-term mortality risks in England and Wales: prospective longitudinal cohort study

Anna Hansell,^{1,2} Rebecca E Ghosh,¹ Marta Blangiardo,¹ Chloe Perkins,⁵ Danielle Vienneau,^{1,3,4} Kayoung Goffe,¹ David Briggs,⁵ John Gulliver¹

Respiratory epidemiology

Original research

Air pollution associated with incidence and progression trajectory of chronic lung diseases: a population-based cohort study

Xiaojie Wang,¹ Lan Chen,¹ Miao Cai,¹ Fei Tian,¹ Hongtao Zou,¹ Zhengmin (Min) Qian,² Zilong Zhang,¹ Haitao Li,³ Chongjian Wang,¹ Steven W Howard,⁵ Yang Peng,^{6,7} Li'e Zhang,^{6,7} Elizabeth Bingheim,² Hualiang Lin,¹ Yunfeng Zou^{7,8}

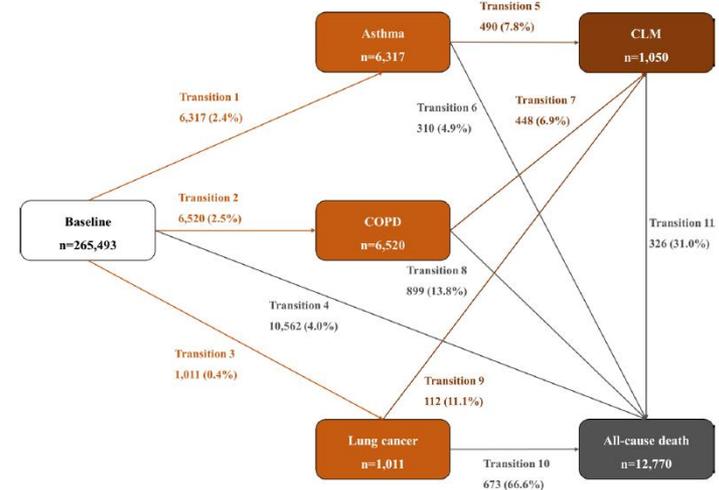


Figure 3 Numbers (percentages) of participants in transition pattern B from baseline to incident chronic lung disease, chronic lung multimorbidity (CLM) and all-cause death. COPD, chronic obstructive pulmonary disease.

Reasons to be cheerful



What happens when air pollution goes away?

Dublin smoky coal ban

Mortality in a General Hospital and Urban Air Pollution

IAN KELLY
M.B., B.Ch.

Trinity Medical School Building
St. James's Hospital
Dublin 8

LUKE CLANCY
M.B., B.Sc., F.R.C.P.I.

The New York Times

Dublin Journal; Fair Is City but Foul Is Air When Smog Creeps In

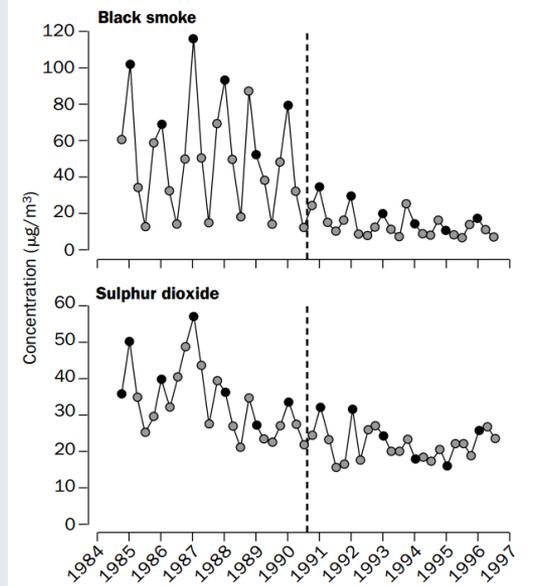
By SHEILA RULE, Special to the New York Times
Published: January 19, 1989

The smog creeps menacingly through doors and windows here. It attacks throats and lungs. It sometimes invades Dublin to such a degree that night appears to fall by midday.



Dublin city centre, Friday 25 November 1988, 2pm

Respiratory mortality decreased significantly, by 17%, after the 1990 [smoky coal] ban in Dublin and, to a lesser extent, after the 1995 and 1998 bans.



ARTICLES

Effect of air-pollution control on death rates in Dublin, Ireland: an intervention study

Luke Clancy, Pat Goodman, Hamish Strickland, Douglas W Dockery

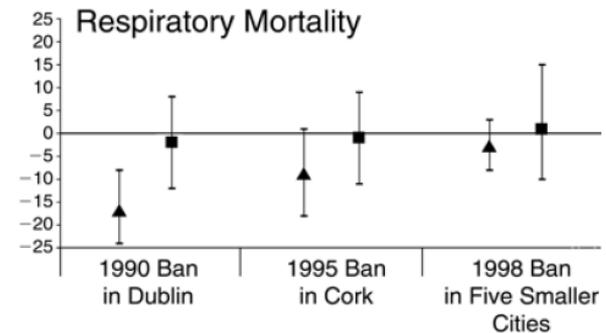


Figure. Percent change in cause-specific mortality for the ban-affected and comparison counties after the 1990, 1995, and 1998 coal bans. CI denotes confidence interval.



RESEARCH REPORT

HEALTH EFFECTS INSTITUTE

Effect of Air Pollution Control on Mortality and Hospital Admissions in Ireland

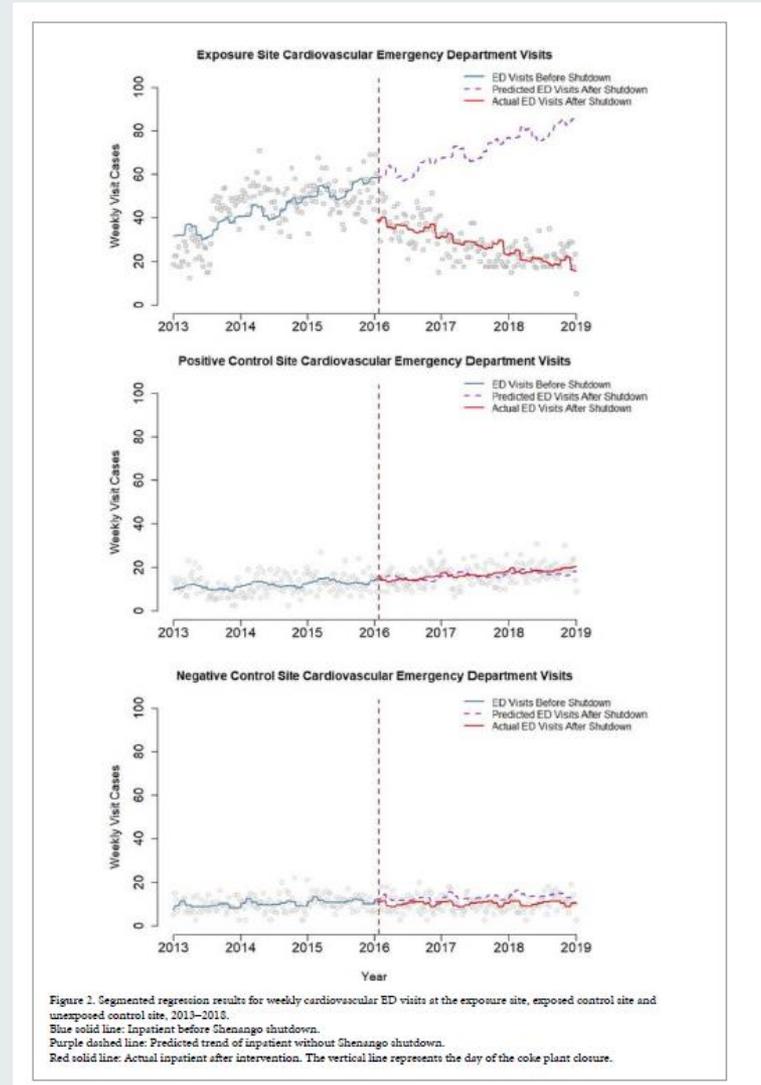
Number 176
July 2013

Douglas W. Dockery, David Q. Rich, Patrick G. Goodman, Luke Clancy, Pamela O'Meara-Strickland, Pirethia George, and Tessa Keeble

What happens when air pollution goes away? Pennsylvania - coal processing plant



There was an immediate 42% decrease in emergency room visits for heart problems and further declines in the three years that followed, until the end of study, showing that the closure led to long-term health improvements. A similar pattern was seen in stroke cases. These changes were not seen in two communities away from the plant that were used as experimental controls.



Do low emission zones improve health?

- 2003 CONGESTION CHARGING SCHEME
- 2008 LONDON LOW EMISSION ZONE
- 2019 LONDON ULTRA-LOW EMISSION ZONE
- 2022 INNER LONDON ULEZ
- 2023 OUTER LONDON ULEZ

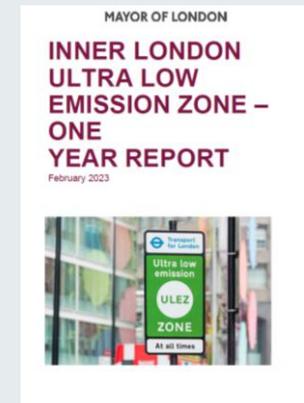
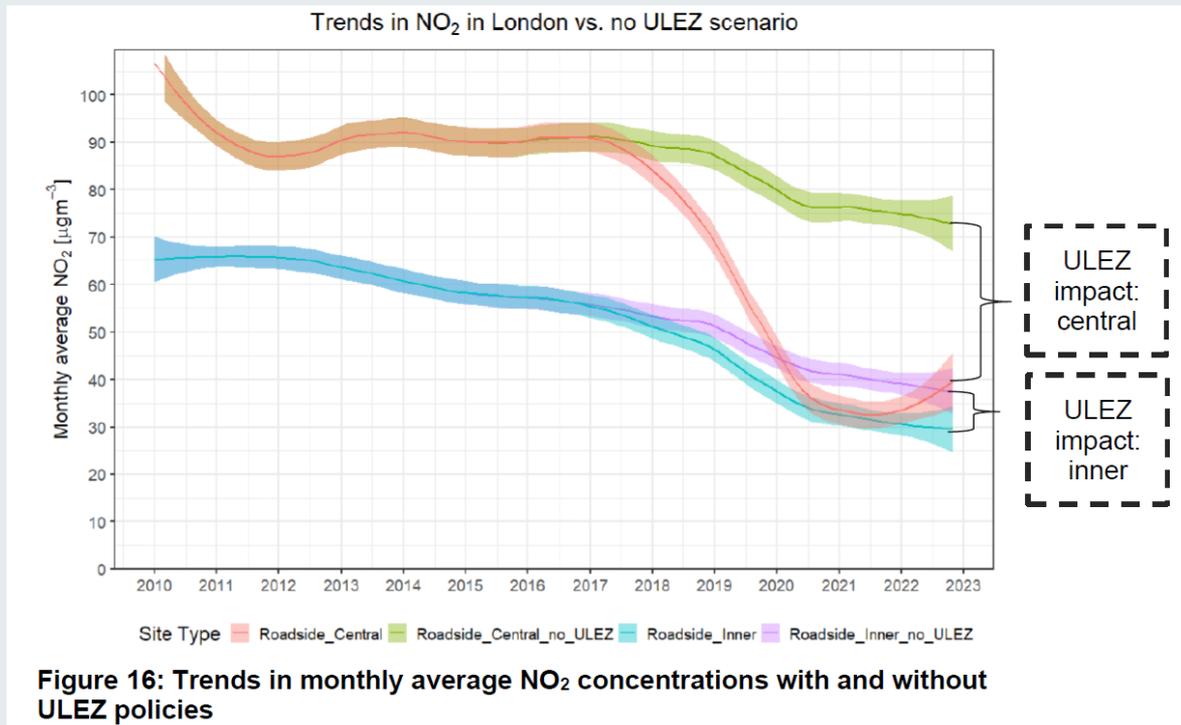


Figure 16: Trends in monthly average NO₂ concentrations with and without ULEZ policies

Do low emission zones improve health?

Review

Health effects of low emission and congestion charging zones: a systematic review

Rosemary C Chamberlain, Daniela Fecht, Bethan Davies, Anthony A Laverty



Five out of eight LEZ studies showed clear reduction in heart and circulatory problems when an LEZ was implemented:

- Fewer admissions to hospital, fewer deaths from heart attacks and strokes, and fewer people with blood pressure problems (Germany Japan and UK).
- Margaryan et al 2021 analysed hospital data from German 69 cities with LEZs - 2%-3% reduction in heart problems and 7%-12% reduction in stroke. Improvements were greatest for older people and resulted in estimated health cost savings of €4.4bn (£3.8bn).

Two out of five studies found improvements in breathing and lung problems, rest found no clear result, none found a worsening.



And finally on wood burning – one of several intervention studies

BMJ

BMJ 2013;345:e8446 doi: 10.1136/bmj.e8446 (Published 8 January 2013)

Page 1 of 11

RESEARCH

Evaluation of interventions to reduce air pollution from biomass smoke on mortality in Launceston, Australia: retrospective analysis of daily mortality, 1994-2007

 OPEN ACCESS

Fay H Johnston *research fellow*¹, Ivan C Hanigan *research associate*^{2,3}, Sarah B Henderson *epidemiologist*⁴, Geoffrey G Morgan *associate professor*^{5,6}

Incentivised replacement of wood stoves with electric heating.

The prevalence of wood stoves in Launceston reduced from 66% to 30% of all households

Decreased air pollution from ambient biomass smoke was associated with reduced annual mortality in males and with reduced cardiovascular and respiratory mortality during winter months.

There were no significant changes in mortality in the control city of Hobart.

260,000 UK workers studied for five years



Cyclists commuters were living longer....
Walking commuters had less heart disease...

Compared to car commuters
Celis-Morales et al 2017

thelancetm-D-23-00216R2
S2213-2600(23)00329-6
Embargo: [add date when known]
Doctopic: Review and Opinion

23TLRM0216

Policy View

Alice C

This version saved: 10:43, 02-Oct-23

Shaping urban environments to improve respiratory health:
recommendations for research, planning, and policy



Mark Nieuwenhuijsen, Audrey de Nazelle, Judith Garcia-Aymerich, Haneen Khreis, Barbara Hoffmann

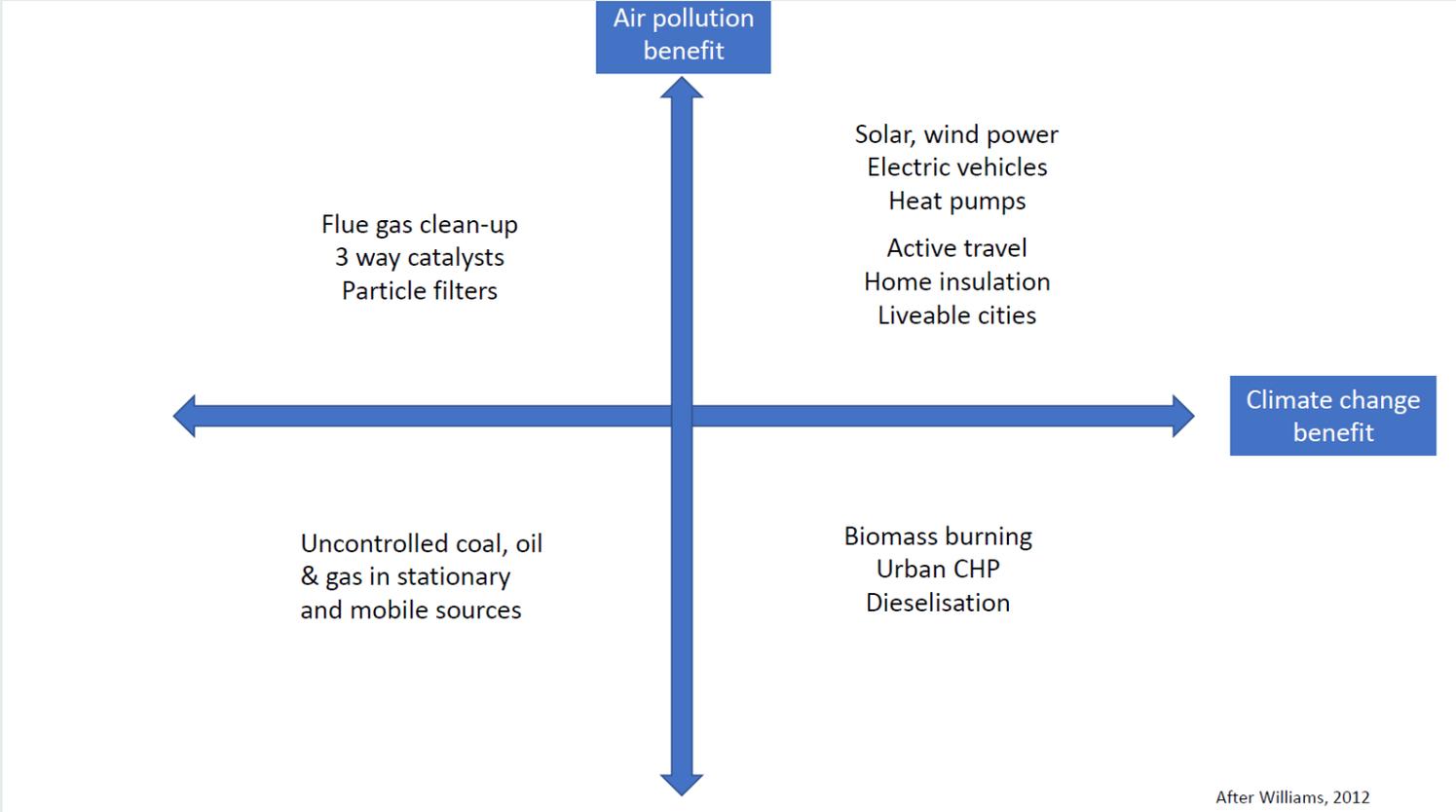
School streets



A study of 16 school streets in London showed that nitrogen dioxide, one of the pollutants from traffic, was reduced by 23% and the number of children walking or cycling to school increased by 18%. With careful design, this can lead to traffic reductions over a wider area.



Tackling air quality and climate change together



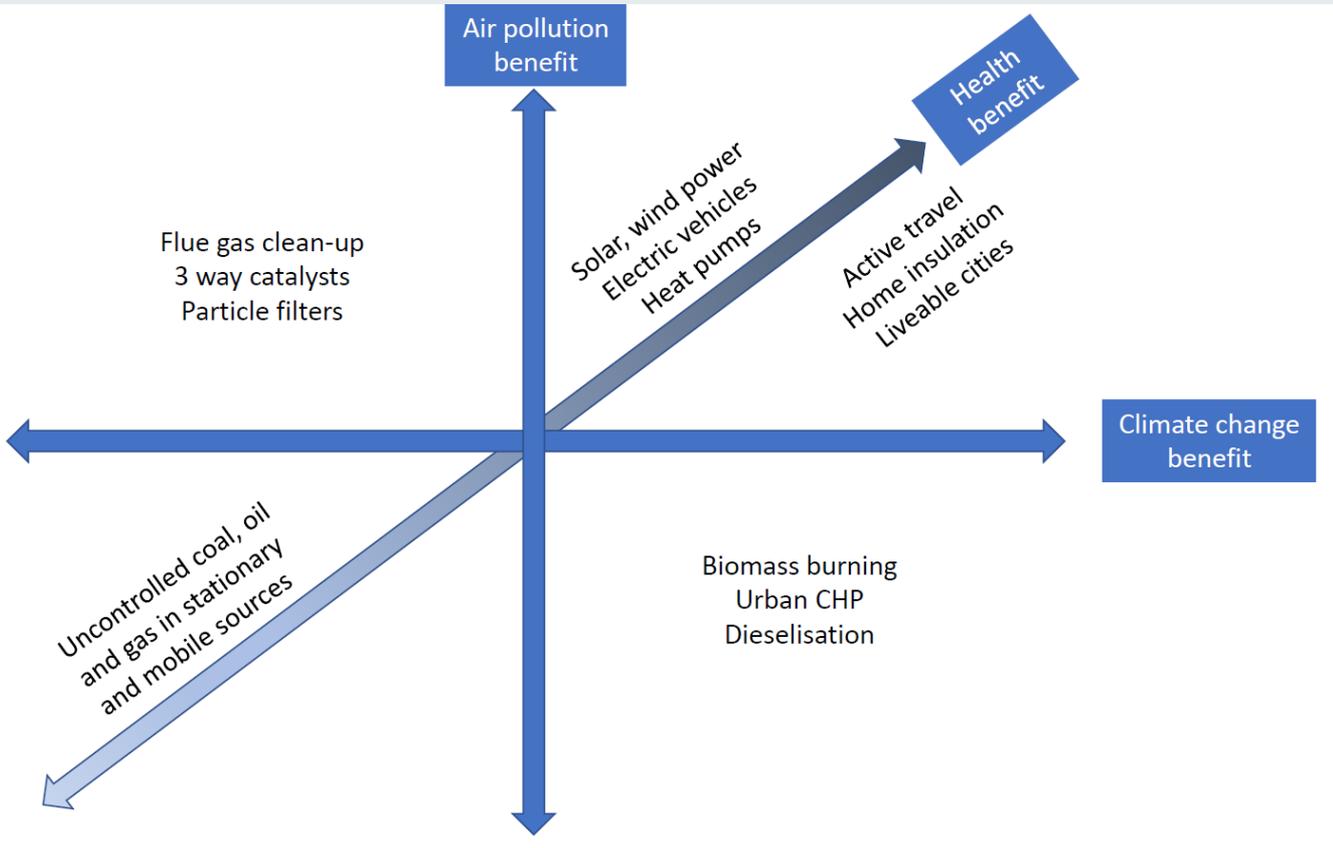
Tackling climate change: what is the impact on air pollution?

Carbon Management (2012) 3(5), xxx-xxxx



Martin Williams*

Tackling air quality and climate change together



Tackling air quality and climate change together

How can we target air pollution, the climate crisis & health?



HARMFUL TO ALL THREE

Fossil fuels

With thanks to Alice Pengelly, University of Southampton

Clean Air Programme Local Government Workshop

- **Date and Time:** Thursday 2nd November 2023 | 11:00 – 16:00 (Arrival from 10:30)
- **Location:** York Barbican, Paragon Street, York, North Yorkshire, YO10 4AH
- **Format:** In-person (only) to facilitate interaction and networking
- **Cost:** Free to attend, lunch provided (please inform requirements).

Key Topics:

- Air quality sensors
- Air quality data and modelling
- Indoor air quality
- Public communication and engagement



Registration: <https://www.eventbrite.co.uk/e/clean-air-programme-local-government-workshop-tickets-708498416837> or visit www.ukcleanair.org or

Low carbon, smog free, socially inclusive, bio-diverse, healthy cities, towns and countryside



Butterfly photo Denis Thorpe / The Guardian

**Imperial College
London**

Dr Gary Fuller

gary.fuller@imperial.ac.uk

@drgaryFuller

www.londonair.org.uk

<https://www.theguardian.com/profile/gary-fuller>

Air pollution in the 21st Century: evidence and the case for action

WM Air, Birmingham 18th Oct 2023

 **Clean Air
Programme**
www.ukcleanair.org/

