IMPERIAL

Dr Gary Fuller

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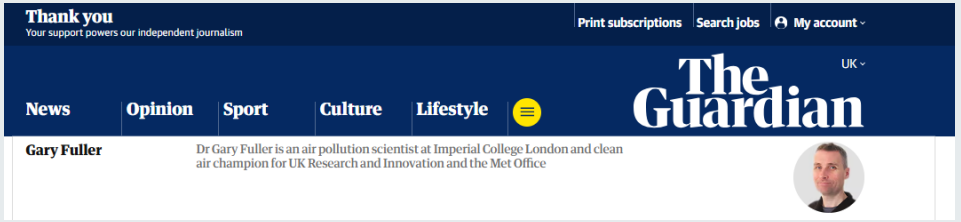
www.theguardian.com/profile/gary-fuller

Air pollution in the 21st century

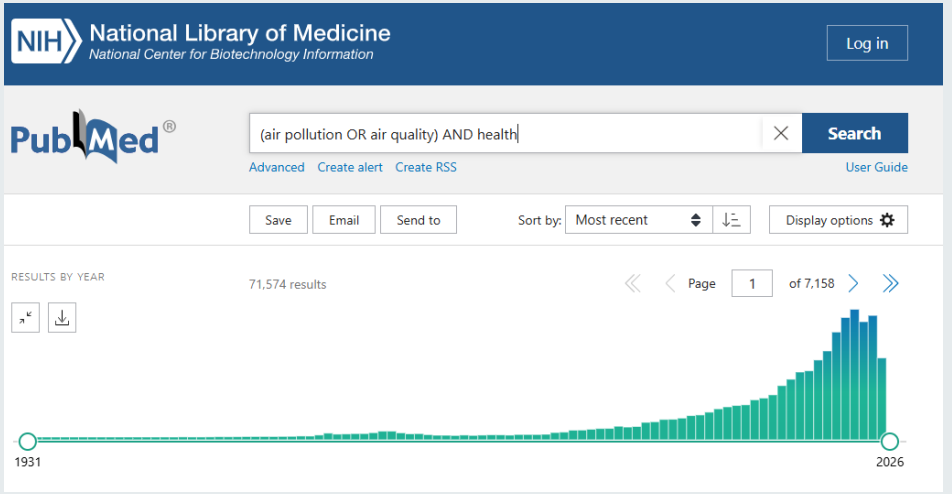
Sussex Air Quality Conference, 9th Oct 2025

Clean Air Programme
www.ukcleanair.org/



The evidence on air pollution and health grows by the day

- 71,574 papers since 1931
- 68,983 in the last 50 years
- 62,849 since 2000 (88%)
- 43,907 in the last ten full years (61%)



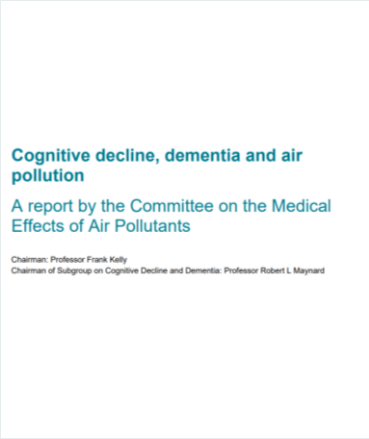
As of 12th August 2025

The pace of evidence is hard to keep up with.

Our policy framing and actions largely reflect the science of the 20th century and not the 21st

Air pollution affects us through the different stages of our life

Life stage	Heath 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



https://www.london.gov.uk/sites/default/files/2023-04/Imperial%20College%20London%20Projects%20-%20impacts%20of%20air%20pollution%20across%20the%20life%20course%20%E2%80%93%20evidence%20highlight%20note.pdf

Short-term effects with lags of day

Medium-term effects from short-term exposure (eg 60 days in Mebrahtu et al 2023 in Bradford)

Long-term exposure over years – Six cities study

Air pollution affects us through the different stages of our life

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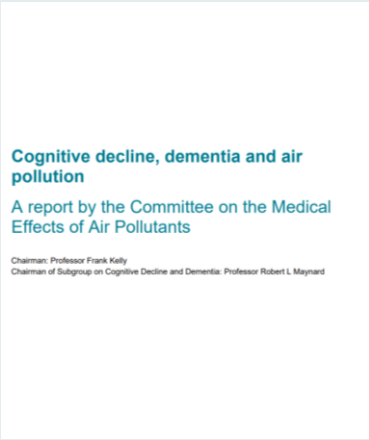


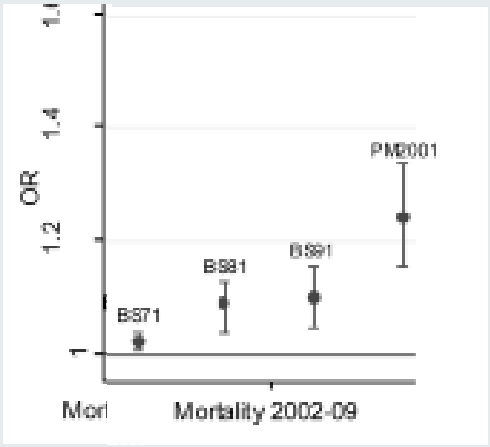
https://www.london.gov.uk/sites/default/files/2023-04/Imperial%20College%20London%20Projects%20-%20impacts%20of%20air%20pollution%20across%20the%20life%20course%20%E2%80%93%20evidence%20highlight%20note.pdf

Short-term effects with lags of day

Medium-term effects from short-term exposure (eg 60 days in Mebrahtu et al 2023 in Bradford)

Long-term exposure over years – Six cities study

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



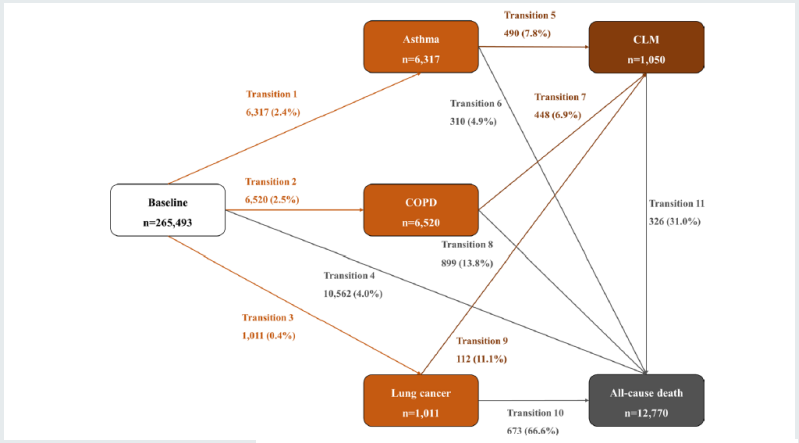


Figure 3 ORs (95% CI) per 10 µg/m^3 for BS exposure in 1971, 1981 and 1991 and PM_{10} in 2001 and mortality in each subsequent decades. Adjusted for age and sex, social class of individual and area, population density and geographical region. Source: ONS Longitudinal Study (authors' own work). CV, BS, black smoke; cardiovascular disease; ONS, Office for National Statistics.

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,[4] Steven W Howard,[5] Yang Peng,[6,7] Li'e Zhang,[6,7] Elizabeth Bingheim,[2] Hualiang Lin,[1] Yunfeng Zou[7,8]

Data from UKBiobank – avg 12 year follow-up

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

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

OPEN ACCESS

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 Gulliver[1]

ORIGINAL ARTICLE

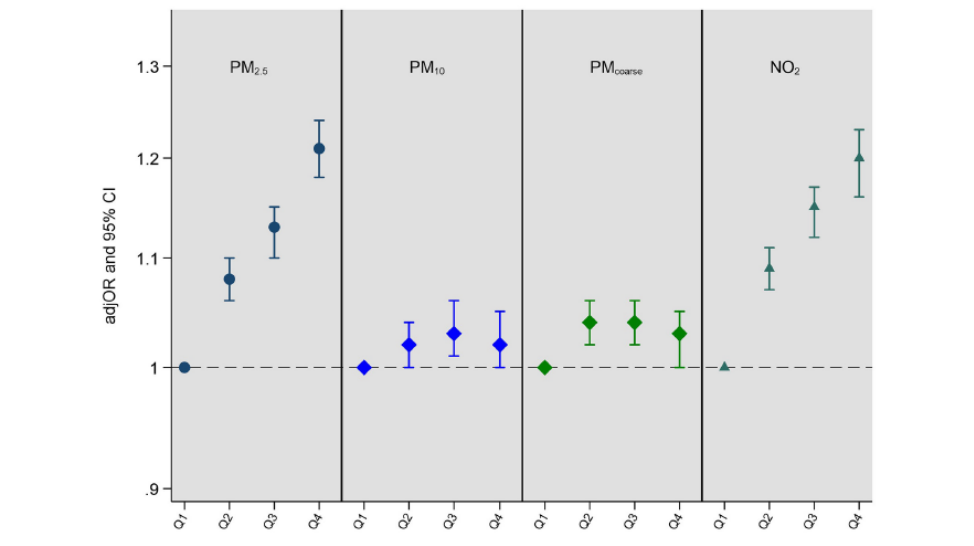
Early-Life Exposure to the Great Smog of 1952 and the Development of Asthma

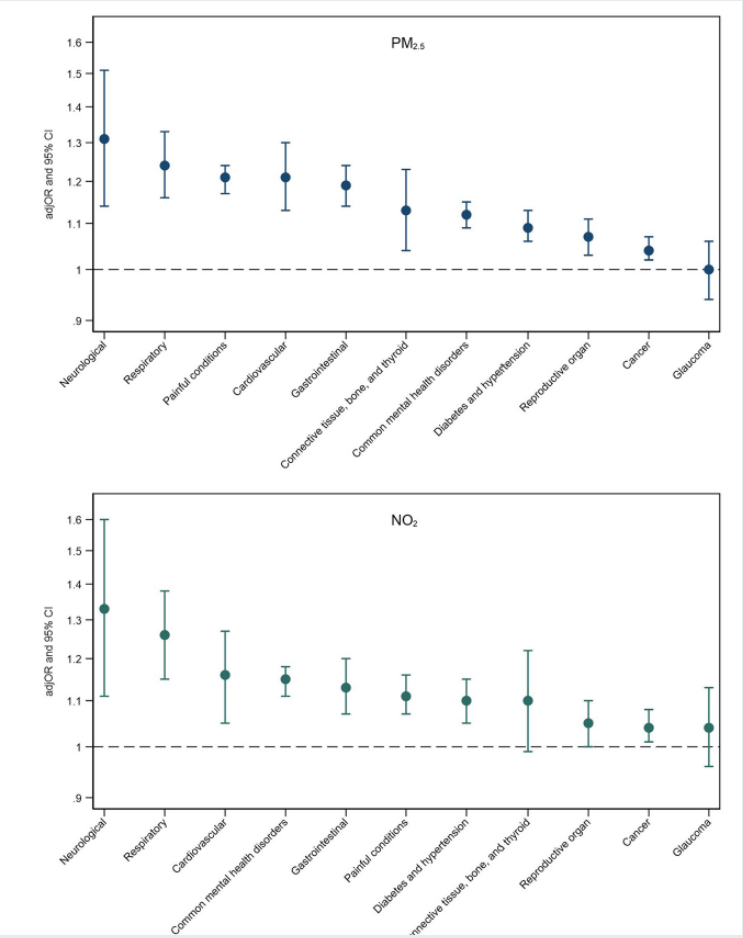
Prashant Bharadwaj[1], Joshua Graff Zivin[1], Jamie T. Mullins[2], and Matthew Neidell[3]

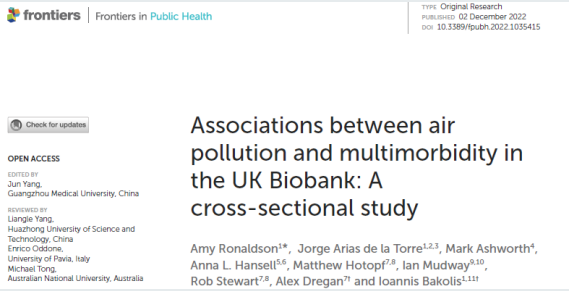
[1]Department of Economics, University of California San Diego, La Jolla, California; [2]Department of Resource Economics, University of Massachusetts Amherst, Amherst, Massachusetts; and [3]Mailman School of Public Health, Columbia University, New York, New York

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

Is air pollution hiding in plain sight in the burden of chronic diseases that affect so many?






frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 02 December 2022
DOI 10.3389/fpubh.2022.1035415

Check for updates

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Michael Tong,
Australian National University, Australia

Associations between air pollution and multimorbidity in the UK Biobank: A cross-sectional study

Amy Ronaldson[1*], Jorge Arias de la Torre[1,2,3], Mark Ashworth[4], Anna L. Hansell[5,6], Matthew Hotopf[7,8], Ian Mudway[9,10], Rob Stewart[7,8], Alex Dregan[7†] and Ioannis Bakolis[1,11†]

Thank you

The Guardian

News Opinion Sport Culture Lifestyle

Pollutionwatch

UK study adds to evidence of air pollution link to long-term illness

Research found greater chances of multiple chronic illnesses in people living in polluted areas

Gary Fuller

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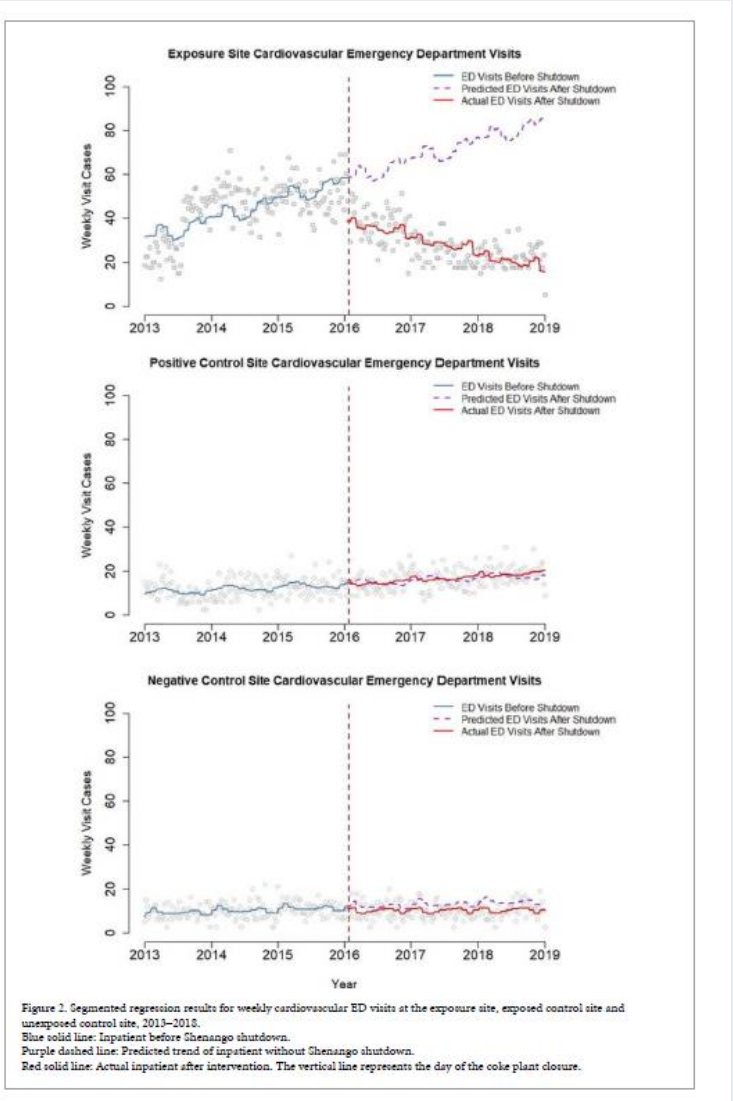
360,000 studied in the UK
156,00 had more than once chronic illness – 43%

But why is progress so slow?
Time for a different framing?

Air pollution is a problem that we can solve
Healthier and happier places to live

Air pollution is a problem that we can solve
Healthier and happier places to live

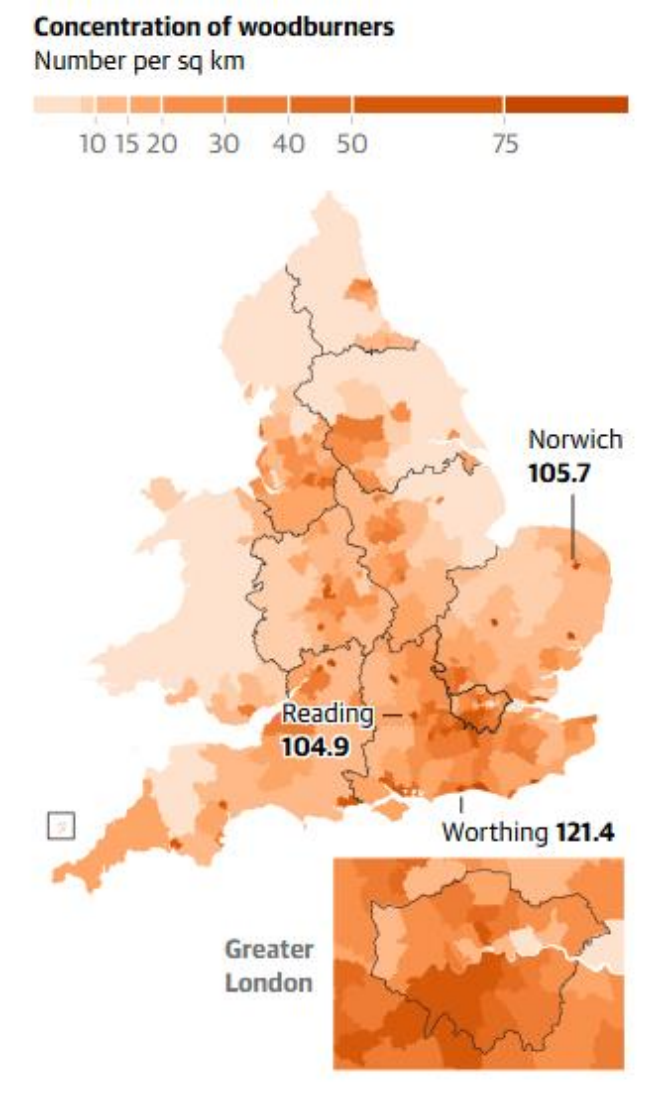
What happens when air pollution goes away? Pennsylvania - coal processing plant

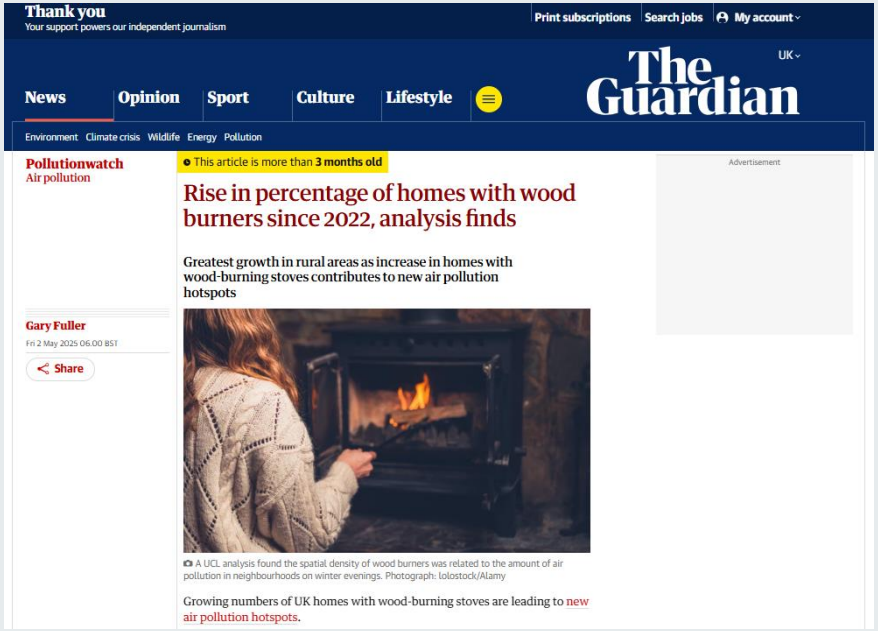


There was **an immediate 42% decrease in emergency room visits for heart problems** and further declines in the three years that followed, until the end of study, showing that the closure led to **long-term health improvements**. A similar pattern was seen in stroke cases. These changes were not seen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

https://iopscience.iop.org/article/10.1088/2752-5309/ace4ea

https://www.theguardian.com/environment/2023/aug/25/pittsburgh-coal-plant-closure-emphasises-benefits-cleaner-air



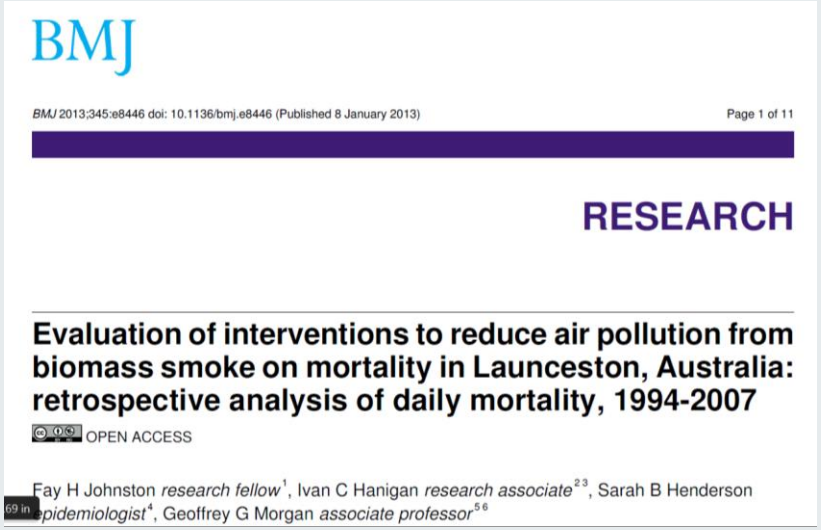


https://www.theguardian.com/environment/2025/may/02/rise-in-percentage-of-homes-with-wood-burners-since-2022-analysis-finds

Maps from EPC data by Kennedy et al 2025

~20% of primary PM emissions comes from home burning, 11 % from wood burning indoors - NAEI.

Reducing 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.

Ultra low
emission
ULEZ
ZONE

Do low emission zones improve health?

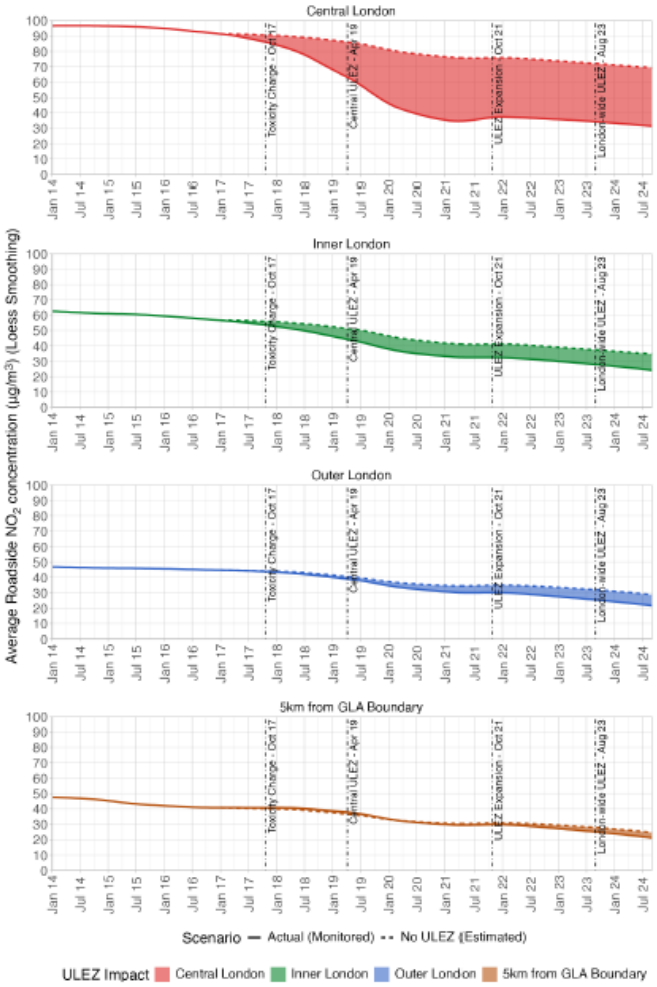


Figure 13: Trends in monthly average NO_2 concentrations in London zones with and without the ULEZ

Due to the London-wide ULEZ expansion:
In the **first year** of operation,
roadside **NO_2 concentrations** in outer London
…. on average up to **4.8 per cent lower**
than would have been expected without the London-wide ULEZ expansion.

All phases of the ULEZ…In 2024, compared to a scenario without the ULEZ, and its expansions.

- **54 per cent lower in central London**
- **29 per cent lower in inner London**

https://www.london.gov.uk/programmes-strategies/environment-and-climate-change/environment-and-climate-change-publications/london-wide-ultra-low-emission-zone-one-year-report

Do low emission zones improve health?

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

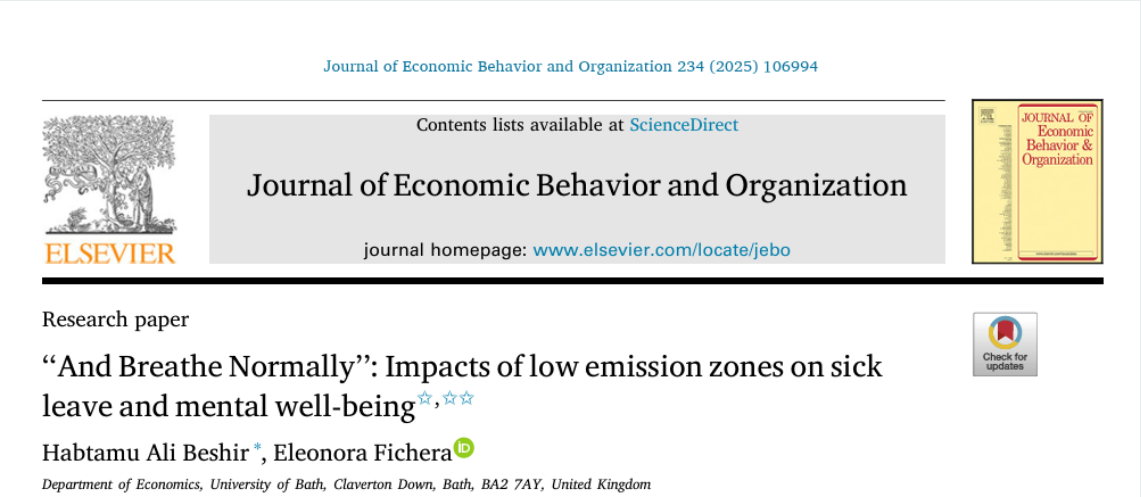
- Fewer admissions to hospital, fewer deaths from heart attacks and strokes, and fewer people with blood pressure problems (Germany Japan and UK).
- Margaryan et al 2021 analysed hospital data from German 69 cities with LEZs - 2%-3% reduction in heart problems and 7%-12% reduction in stroke. Improvements 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.

In the Tokyo zone there were health gains over a 12-year study period compared with a control city (Osaka) – Takashi et al 2016

https://www.thelancet.com/journals/lanpub/article/PIIS2468-2667(23)00120-2/fulltext
https://www.theguardian.com/environment/2023/jun/30/low-emission-zones-lez-improving-health-studies

Do low emission zones improve health? London



Journal of Economic Behavior and Organization 234 (2025) 106994

Contents lists available at ScienceDirect

Journal of Economic Behavior and Organization

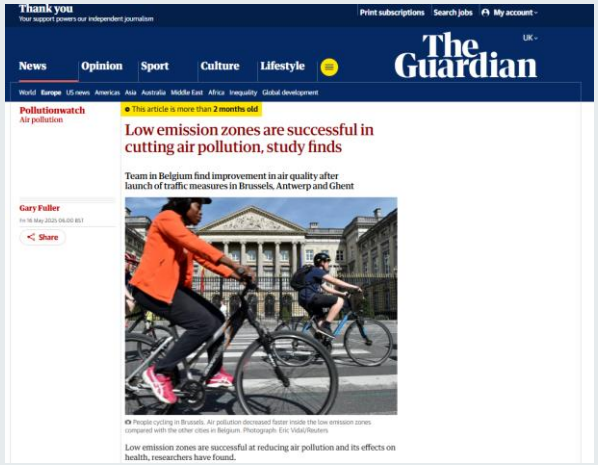
journal homepage: www.elsevier.com/locate/jebo

Research paper

"And Breathe Normally": Impacts of low emission zones on sick leave and mental well-being☆,☆☆

Habtamu Ali Beshir *, Eleonora Fichera

Department of Economics, University of Bath, Claverton Down, Bath, BA2 7AY, United Kingdom



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Pollutionwatch

Air pollution

This article is more than 2 months old

Low emission zones are successful in cutting air pollution, study finds

Team in Belgium find improvement in air quality after launch of traffic measures in Brussels, Antwerp and Ghent

Gary Fuller

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Low emission zones are successful at reducing air pollution and its effects on health, researchers have found.

[Prof Eleonora Fichera](#) University of Bath, said: "We found significant improvements in respiratory health and mental wellbeing, as well as an 18.5% reduction in the likelihood of taking sick leave. These results show that the zones not only improved air quality but also contribute to better overall wellbeing and higher labour market participation."

Also new results from Imperial College London on hospital admissions are in review

Do low emission zones improve health?

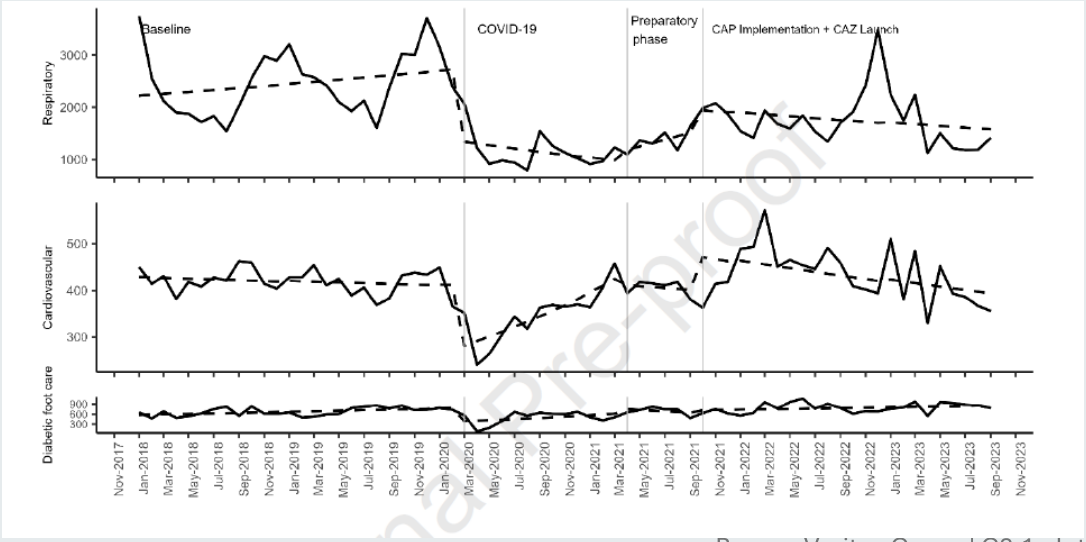
Bradford, UK

<u>After one year of the zone:</u>

GP visits for respiratory illnesses were down by 25%
GP visits for heart problems decreased by 24%
732 fewer visits a month, compared with pre-Covid levels and <u>benefits were increasing over time</u>.
There were fewer patients with breathing problems at the Bradford Royal Infirmary emergency department, too, but no change was found for cardiovascular visits.

https://www.sciencedirect.com/science/article/pii/S0013935125002397?via%3Dihub

https://www.theguardian.com/environment/2025/may/16/low-emission-zones-successful-cutting-air-pollution-researchers-find



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

https://www.thelancet.com/journals/lanpub/article/PIIS2468-2667(18)30202-0/fulltext

EUROPEAN RESPIRATORY JOURNAL
ORIGINAL RESEARCH ARTICLE
Z. YU ET AL.

Associations of improved air quality with lung function growth from childhood to adulthood: the BAMSE study

Zhebin Yu[1], Simon Kebede Merid[2], Tom Bellander[1,3], Anna Bergström[1,3], Kristina Eneroth[4], Antonios Georgelis[1,3], Jenny Hallberg[2,5], Inger Kull[2,5], Petter Ljungman[1,6], Susanna Klevebro[2,5], Massimo Stafoggia[1,7], Gang Wang[1,2], Göran Pershagen[1,3], Olena Gruzieva[1,3] and Erik Melén[2,5]

[1]Institute of Environmental Medicine, Karolinska Institutet, Stockholm, Sweden. [2]Department of Clinical Sciences and Education, Södersjukhuset, Karolinska Institutet, Stockholm, Sweden. [3]Centre for Occupational and Environmental Medicine, Region Stockholm, Stockholm, Sweden. [4]SLB-analys, Environment and Health Administration, Stockholm, Sweden. [5]Sachs' Children and Youth Hospital, Södersjukhuset, Stockholm, Sweden. [6]Department of Cardiology, Danderyd Hospital, Stockholm, Sweden. [7]Department of Epidemiology, Lazio Regional Health Service, Rome, Italy.

Corresponding author: Erik Melén (erik.melen@ki.se)

https://publications.ersnet.org/content/erj/early/2023/02/02/1399300301783-2022

"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!

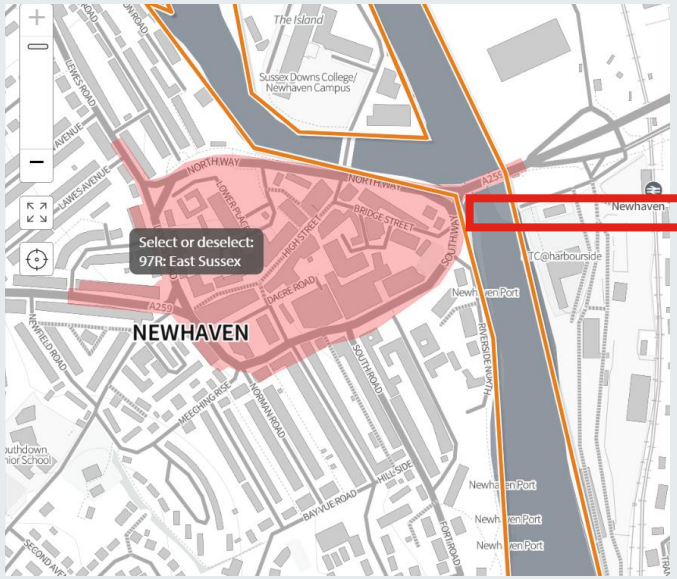
(With all credit to Jim Gauderman et al for pioneering this type of study)

Watch out for results from →

CHILL
Children's Health in London & Luton

Would a public health orientated approach be better?

Air quality management area

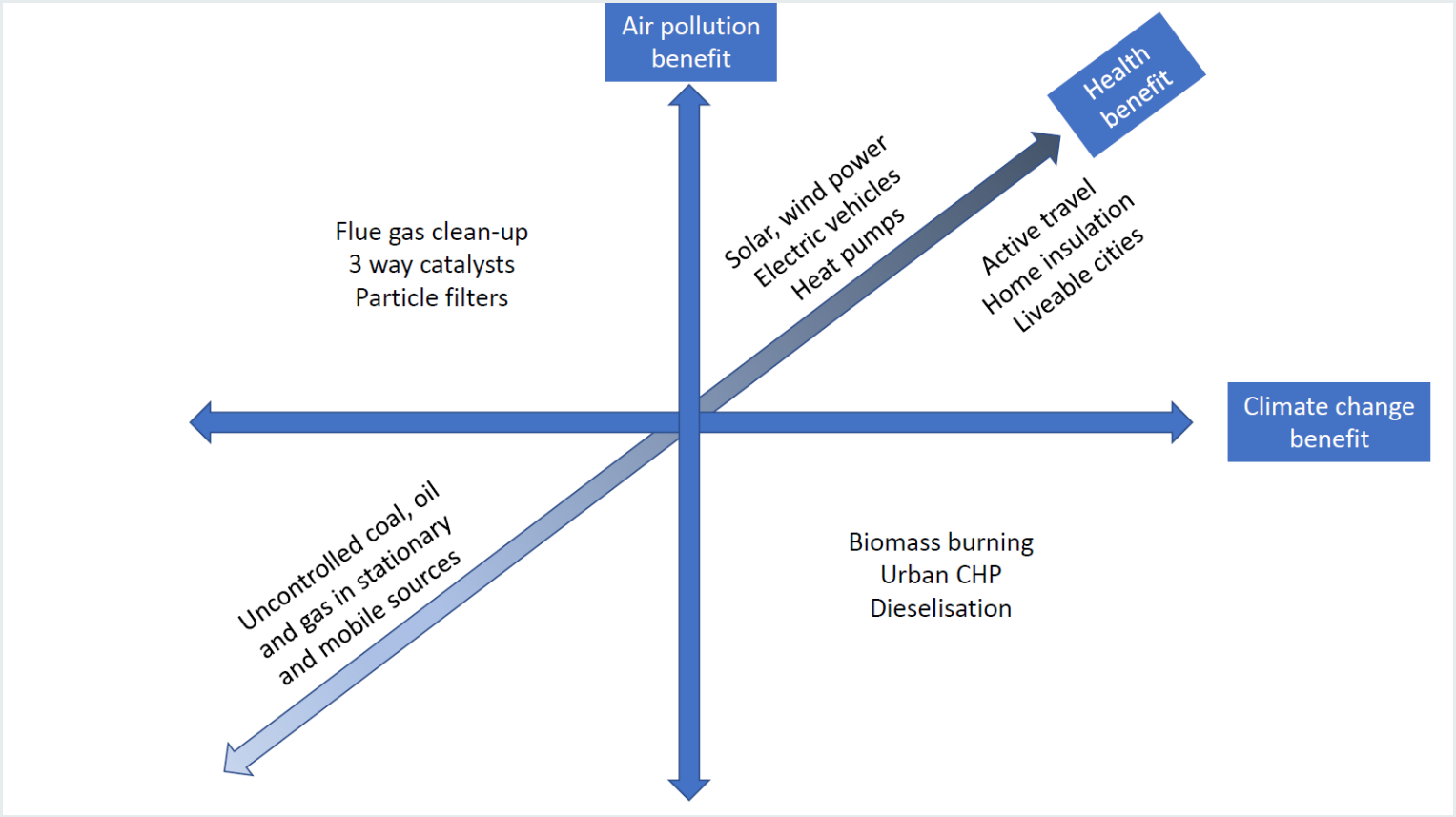


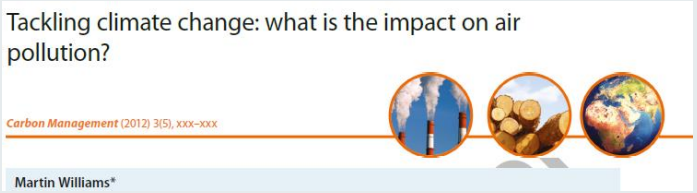
PM2.5 vulnerability indicator

Air Quality in East Sussex

JSNA Local Briefing 2024

Tackling air quality and climate change together





Net zero and future air pollution

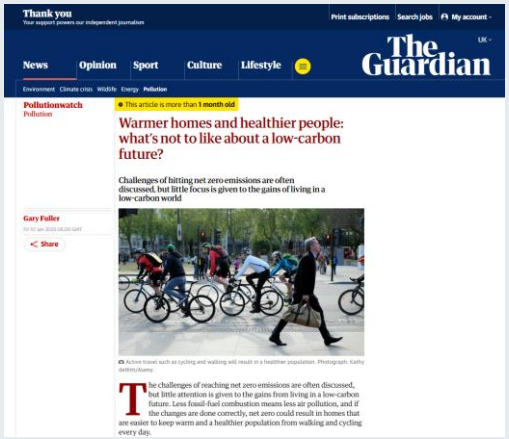
Cutting combustion will cut air pollution

Active travel aspects of net zero also have large public health gains

- UK £26 - £30 bn gains from reduced mortality - £20 bn gains from less illness by 2060 from net zero in transport and buildings. This tips the cost benefit, especially for investment in buildings.

- USA: between 4,000 and 15,000 fewer deaths by 2035 saving $65nb to $128bn by 2035.

- See links to peer reviewed papers in …..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Warmer homes and healthier people: what's not to like about a low-carbon future?
Challenges of hitting net zero emissions are often discussed, but little focus is given to the gains of living in a low-carbon world
Gary Fuller
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The challenges of reaching net zero emissions are often discussed, but little attention is given to the gains from living in a low-carbon future. Less fossil-fuel combustion means less air pollution, and if the changes are done correctly, net zero could result in homes that are easier to keep warm and a healthier population from walking and cycling every day.

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Rolling back on climate actions may spell rise in preventable illness – study
Net zero policies would result in fewer deaths saving UK billions, say researchers
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Countries that weaken or stop their net zero and climate actions may be consigning their populations to decades of preventable illness.

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How climate policies reduce air pollution saving lives and money
Early deaths from air pollution in US could be reduced by between 4,000 and 15,000 a year by 2035, study shows
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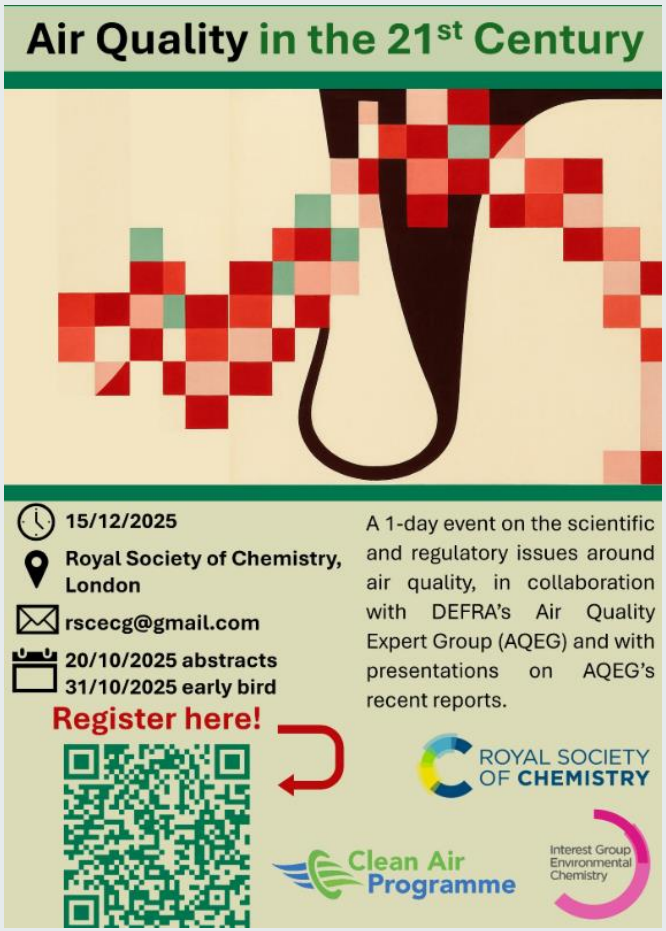
https://www.theguardian.com/environment/2025/feb/21/rolling-back-on-climate-actions-may-spell-rise-in-preventable-illness-study
https://www.theguardian.com/environment/2025/jan/10/warmer-homes-healthier-people-low-carbon-future
https://www.theguardian.com/environment/2024/nov/29/climate-policies-reduce-air-pollution-saving-lives-money

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

Butterfly photo Denis Thorpe / The Guardian

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



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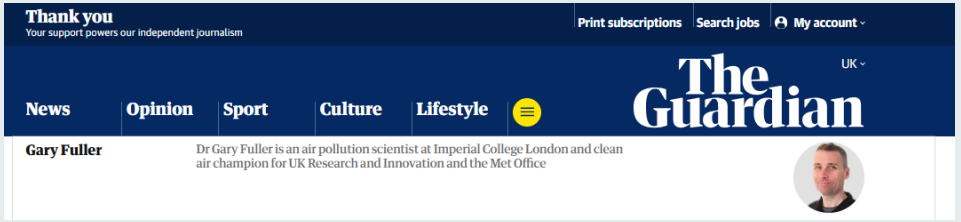
Air pollution in the 21st century

Sussex Air Quality Conference, 9th Oct 2025

Clean Air Programme
www.ukcleanair.org/