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Is there an ‘air pollution crisis’ in UK cities?

- Historical data show radical improvements in air quality since the middle of last century.
- Mortality statistics relating to air pollution are not grounded in strong scientific evidence, are the subject of scientific disagreement, and are underwhelming when seen at the level of the individual.
- Activists, politicians, and some scientists, including scientific advisors, have wilfully exaggerated and misinterpreted the mortality risk from air pollution, and failed to communicate shortcomings in the science and scientific debate to politicians and the public.

Background

Since the middle of the last decade, fears about air pollution have risen up local and national policy agendas. This has been led by global agencies, campaigning organisations, and politicians who insist that air pollution represents an urgent 'crisis' that must be confronted for the benefit of public health, especially children's healthy development. Accordingly, many local authorities have begun imposing restrictions on private transport, including radical changes to transport networks, claiming that this will make public roads 'safer' and 'liveable'. These policies, including Low Traffic Neighbourhoods (LTNs), and 'fifteen minute city' schemes, augment local authorities' Net Zero planning, which set out policy frameworks into the 2030s and beyond.

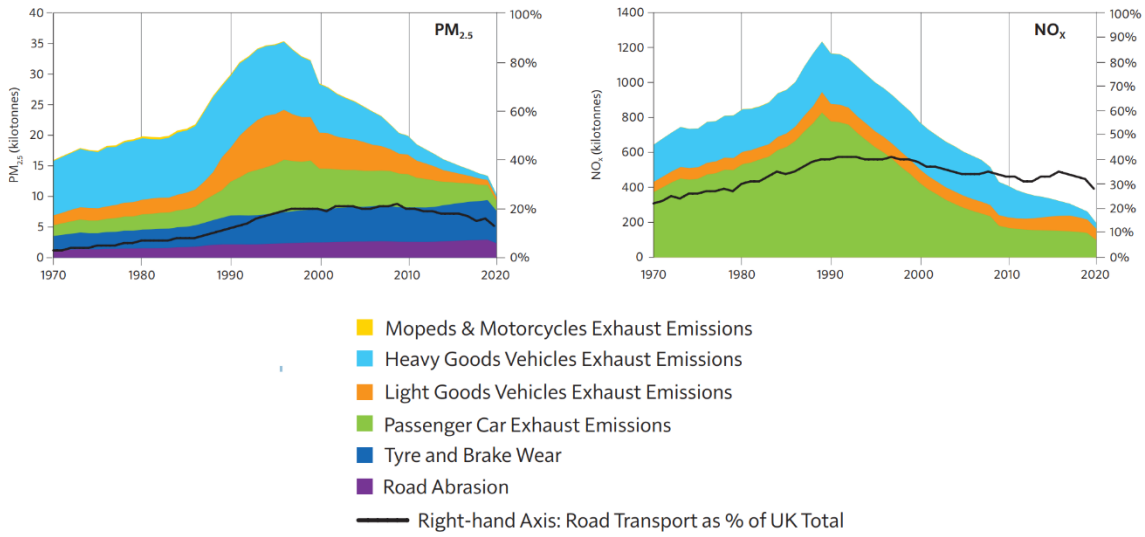
Critics of these policies point out that they will have the effect of severely restricting private car use, both by creating congestion that increases journey times prohibitively, by blocking roads, and by the use of fines for unauthorised access to certain roads restricted to local residents via permit schemes. They argue that local authorities' policy agendas clearly aim to significantly reduce car ownership, or to eliminate it altogether, using draconian interventions that lack democratic legitimacy, without putting place alternatives, greatly inconveniencing all road users, causing increases in air pollution along traffic-reduction scheme boundaries, and antagonising relationships between different interest groups within communities.

Many claims are made by various advocates of the air pollution reduction policy agenda. A complete response to what has become a political movement would be an impossibly overwhelming task. Instead, this article examines key claims of the UK Chief Medical Officer's Annual Report 2022 on Air Pollution and the scientific literature underpinning them, which are often reproduced by others. The main question asked here is whether the loss of utility caused by air pollution mitigation policies has been fairly compared with the putative health benefits they can achieve. This report does *not* argue either that local restrictions on traffic to combat air pollution problems are in themselves unnecessary or illegitimate, or that national policies to require vehicle exhaust standards should not be set for the same reason. The concern is with alarming claims that seem to have the status of scientific fact, but which are not, and have misled policy and public perception.

Air pollution & traffic

One of the major forms of pollution that most concerns medical researchers in the field is particulate matter, abbreviated to PM, with subscript denoting its size. Air quality monitoring distinguishes larger particles (PM_{10}) from smaller particles ($PM_{2.5}$), the latter of which is believed to be the more harmful by virtue of its smaller size, which may enable substances of this kind to penetrate deeper into the body. There are natural sources of PM, including dust, sea salt and pollen. Also of significant concern are nitrogen oxides (NOx).

It is often assumed that the largest source of air pollution is vehicle exhaust. However, the CMO's annual report, referred to above shows that this is not the case with $PM_{2.5}$, most of which is produced by tyre and brake wear and by road abrasion. Private transport vehicles are the greatest source of NOx, but vehicle emissions standards have caused a very significant reduction since 1990. Road transport accounts for approximately 28 per cent of UK NOx emissions, of which roughly half is from private cars, making it the cause of 14 per cent of NOx.



Scientific advice to government typically refers to one or other of the main pollutants of concern – NOx or $PM_{2.5}$ – in their evaluations of the association between air pollution and mortality risk. Though concentrations of these pollutants vary considerably relative to each other in different locations, experts often discuss the benefits of emissions-reduction in terms of average exposure from all sources in terms of just one key pollutant. For example, one report states the potential benefit of '*a reduction in all traffic-related pollutants, consistent with a 1 µg/m3 reduction of* NO_2', whereas other analyses use $PM_{2.5}$ as the reference pollutant. This is not mentioned here as a necessary shortcoming of the scientific advice, but to avoid confusion in the discussion below.

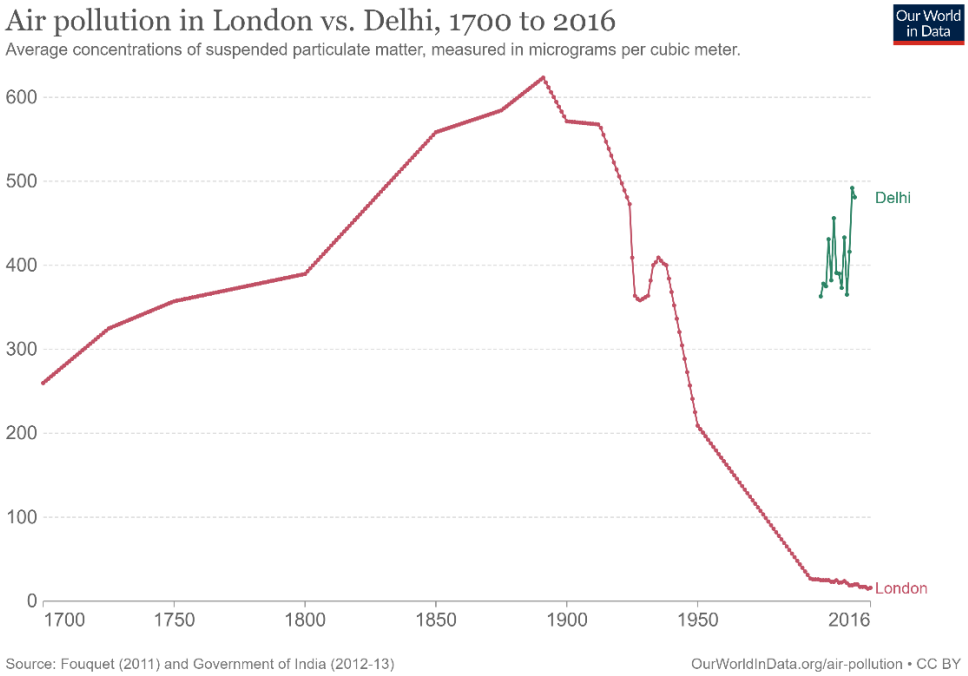
A further issue arises in the wider public debate in relation to measurements of air pollution and World Health Organisation (WHO) recommendations of limits. The WHO's Air Quality Guidelines express exposure limits in much shorter time scales (number of episodes in a year in which a 24 hour average exposure limit is exceeded) than either the bulk of scientific literature or the UK government's expert analyses of it, both of which tend to discuss levels of annual average exposure to produce estimates of mortality risk and the benefits of regulation. However, this report is concerned with UK officials' statements of mortality risk, which are not based in good science. So the WHO's recommendations are not discussed further here.

Global and historical view of air pollution

Out of the 3,779 localities most recently added to the WHO's global Air Quality Database, London ranked 2,622nd for PM2.5. Out of 1,441 localities in the European Region, London ranked 679th. London, with 11.41 µg/m^3 of $PM_{2.5}$ has less air pollution than Berlin (13.4), Paris(15.51), Brussels (20.94), Rome (12.96), Vienna (12.59). In the UK, 13 localities, including Sheffield, Leeds and Manchester had levels of PM2.5 higher than London. On this view, UK cities are not the most polluted either in the world or even by European standards, as some have claimed.

At first glance, historical data on air pollution does not support the claim that the UK is facing a public health emergency. Particulate air pollution in London peaked in 1891 at 623 micrograms per cubic meter (µg/m^3), falling to 15 µg/m^3 by 2015 – a reduction of 98%. Much of this reduction was caused by policies, from the nineteenth century onwards, and also technological developments that enabled the switch to cleaner-burning fuels. Although the Clean Air Act (1956) is widely cited as a cause of this improvement, two thirds of the reduction seen between the peak and the current low

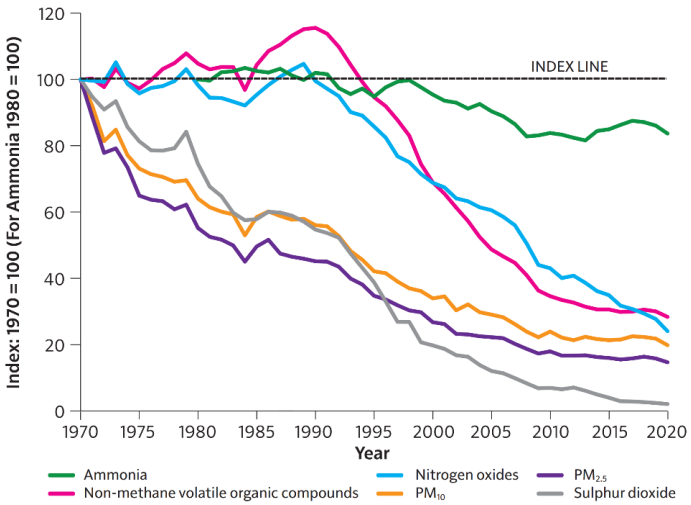
levels of air pollution occurred before it. Furthermore, subsequent progress spans the era in which mass car ownership became a reality.



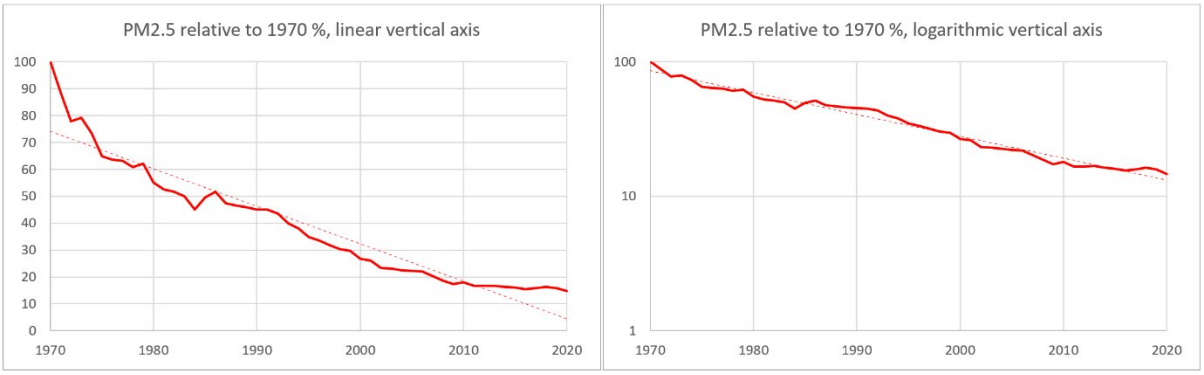
However, the Chief Medical Officer (CMO), Sir Christopher Whitty, argues that air pollution remains the cause of a great number of health problems afflicting the population, and this drives the need for policy:

> It is associated with impacts on lung development in children, heart disease, stroke, cancer, exacerbation of asthma and increased mortality, among other health effects.[…] we have little control as individuals over the level of pollution that we and our families breathe – this must be seen as a societal problem to solve.

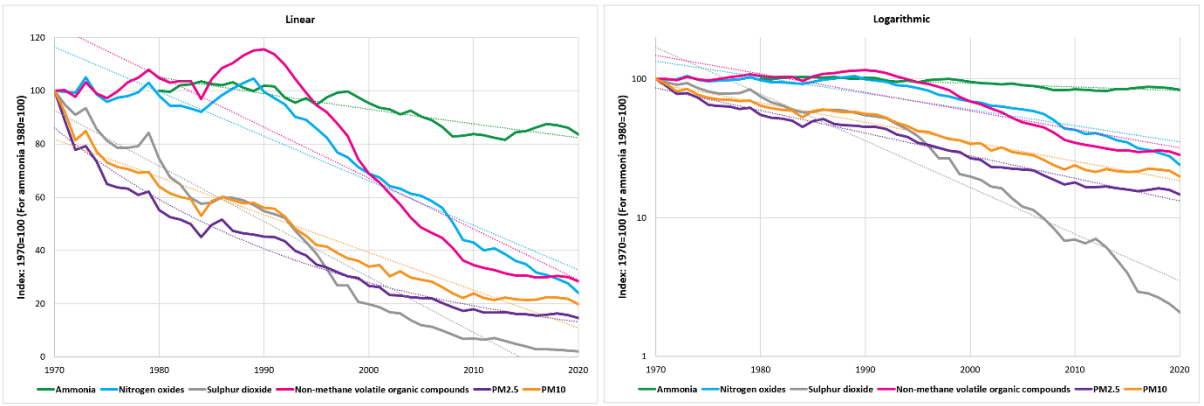
After noting the progress made since the 1970s in reducing air pollution, the CMO claims that *'In the last decade improvements in PM2.5 have stalled, and these especially need attention'*. This claim is based on the following chart included in the CMO's report, showing concentrations in different polluting substances.



Though visual inspection of the chart suggests that the reduction of $PM_{2.5}$ has 'stalled', the CMO's claim is misleading. The curve showing $PM_{2.5}$, for example, appears to show significantly less reduction between 2010 and 2020 than any preceding decade. But atmospheric concentrations of pollutants are now so low relative to levels in 1970 that it is impossible to observe absolute changes over the era on a chart of this kind. To properly demonstrate year-on-year relative change, and the problem with the CMO's chart, we have used the same data to make two charts, below, one with a linear vertical axis (left), and one with a logarithmic vertical axis (right). The logarithmic chart shows that year-on-year percentage reduction of $PM_{2.5}$ has been constant, and that progress has not 'stalled'.



The following charts offer a comparison of the data shown in the CMO's report, using linear (left) and logarithmic (right) vertical axes. Trendlines have also been added. This shows that most categories of air pollution have been falling at broadly constant year-on-year rates since 1970.



The government's own data do not support the CMO's claim that air pollution mitigation policies have stalled. The CMO's claim that greater policy interventions from government are required to address the slowed progress of air pollution reduction are therefore also false.

How were mortality statistics calculated?

Of greater significance to public debate and support for policies than statistics relating to the concentration of polluting substances in the air, is the claim that air pollution causes disease and loss of life. The claim made by the CMO, repeated very frequently in public by policy advocates, is that:

> The mortality burden of long-term exposure to outdoor air pollution in England in 2019 was estimated to be equivalent to 26,000 to 38,000 deaths a year. [7] The figure is noted as 'equivalent to' because air pollution is considered to be a contributory factor to mortality.

> This estimate was calculated by the UK Health Security Agency (UKHSA), based on recommendations from the Committee on the Medical Effects of Air Pollutants (COMEAP) [8], which provides independent advice to government departments and agencies on how air pollution impacts on health.

These figures are shocking at face value. However, the CMO himself points out that these 'deaths' are statistical representations, not deaths as such. Unfortunately, the CMO does not explain how the statistics make an 'equivalent to' a death. Nonetheless, since these figures are offered by the government's senior scientists and panels of experts tasked with evaluating the danger of air pollution, the claim must be taken seriously. The CMO's statement makes the following citations:

[7] Mitsakou C et al. Updated mortality burden estimates attributable to air pollution. In UK Health Security Agency. Chemical hazards and poisons report; Issue 28. Reducing health harms associated with air pollution; 2022.

[8] Committee on the Medical Effects of Air Pollutants (COMEAP).

The UK Health Security Agency (UKHSA) report (Mitsakou, C. *et al* 2022 -- citation 7 in the CMO's report) sheds more light on the CMO's claims that the mortality risk of air pollution is 'equivalent to' 26,000 to 38,000 deaths a year in a more detailed (and perhaps candid) explanation (emphasis added):

> It should be noted that the annual number of 'attributable deaths' associated with long-term average concentrations of pollutants is **not an estimate of the number of people whose untimely death is caused entirely by air pollution**. Instead, it is a way of **representing the effect of air pollution across the whole population**: air pollution is considered to act as a contributory factor to many more individual deaths. Therefore, it is recommended to use expressions such as, ["]an effect equivalent to a specific number of deaths at typical ages" for the burden estimates (1). In COMEAP's report (2)**, the mortality burden was provided in terms of life years lost as well (328,000 to 416,000); although it is not calculated here, this metric is recommended to be used** as it includes information on the age of population and survival rates considering the air pollution exposure.

It is extremely significant that the CMO rejected the recommended form of expression of mortality risk associated with air pollution in the UKHSA's report, despite quoting figures from it. Dividing the life years lost range (328,000 to 416,000) by the 'deaths' range (26,000 to 38,000) gives a clearer statement the 'equivalent to' calculation: a 'death' is perhaps equivalent to 12.6 to 10.9 life years lost respectively. That is to say a more precise statement of equivalence, more worthy of the UK Government's CMO, might be that '*the increased risk of mortality created by air pollution is equivalent to between 26,000 and 38,000 people losing their life between 10.9 and 12.6 years earlier than expected*'.

It would be callous to trivialise such a shortening of a life by this amount by implying that it would be of no consequence. But the UKHSA is categorical that the everyday understanding of 'a death' and the use of the same term in scientific discussions *are not equivalents*. The UKHSA recommendation is a statement of an *ethical* imperative, to not attribute deaths to air pollution causally, and to put caution before adding unjustified drama to seemingly profoundly consequential statistics, requiring urgent and far-reaching policy interventions.

Moreover, even expressing the putative equivalence as so many lives prematurely ended by some number of years may still fail to accurately convey the meaning of the UKHSA's mortality risk

estimates. The estimate is an attempt to measure the impact of air pollution *'across the whole population'*. The loss of between 328,000 and 416,000 life years to the 55,986,500 population of England, therefore might just as well be expressed as representing a loss of between approximately 51 and 65 hours life per person of their life expectancy – currently 84.75 years (or 742,410 hours) for a 65 year old in England.

To put this estimate of risk into perspective, it should be noted that life expectancy in the UK has risen from 71.9 years in 1970 to a peak of 81.7 years in 2019 (the Covid 19 pandemic appears to have reduced this estimate subsequently). It is not clear whether or not the estimate of risk should be considered as cumulative (51 and 65 hours life lost per person per year), but even if it were, life expectancy has been increasing at a much faster rate, of 73 days per person per year, for over half a century – a positive effect between 27 and 35 times greater than the negative effect.

It is not possible for medical science to produce such precise estimates of risk, either at the level of national population or individual. The fact that the same estimate of risk can be expressed equivalently to make either a shocking statement (tens of thousands of deaths) or trivially (hours of lost life expectancy) should signal that the estimate is likely of limited use to informing rational policymaking. Statements of risk which are so extremely sensitive to framing are therefore also sensitive to the political context into which they are introduced.

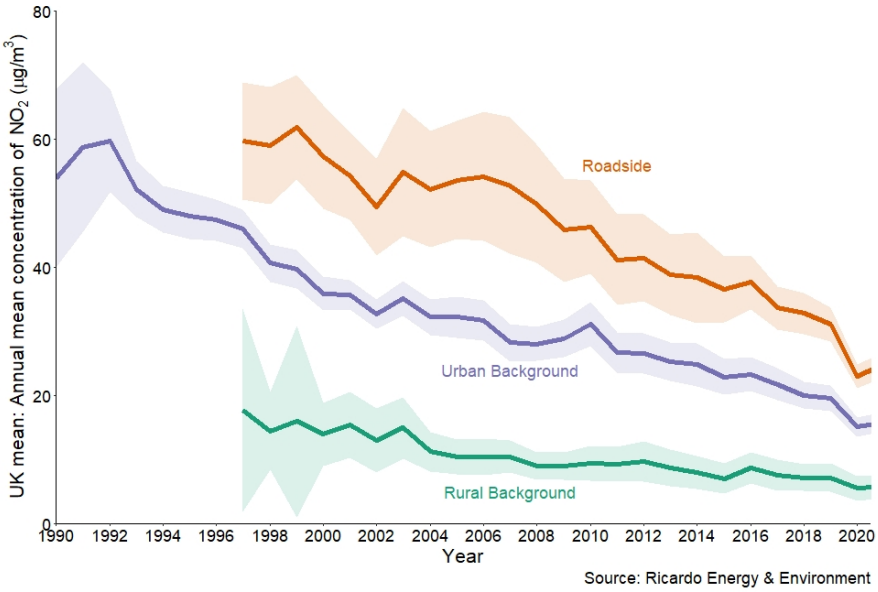
Calculating the benefit of policy

Though the obvious implication of the claim that air pollution causes 26,000 to 38,000 deaths per year is that policies intended to mitigate air pollution will save that many lives, this is a false conclusion. There are natural sources of air pollution that register as pollution (including trees, dust, and sea salt), and the anthropogenic sources of pollution cannot be eliminated in short time frames without consequences that may be measurably worse. However, COMEAP analysis, cited by the CMO, which support UKHSA's estimates of mortality risk, provide an evaluation of air pollution-reduction policies, based on exposure to NOx.

Charged with producing '*advice on how to undertake quantification of the mortality benefits of reducing long-term average concentrations of NO_2*' for the UK Department for Environment and Rural Affairs (Defra), COMEAP produced a report in 2018, *Associations of long-term average concentrations of nitrogen dioxide with mortality*. This work is cited by the UKHSA, in turn cited by the CMO. It found, among other things, that:

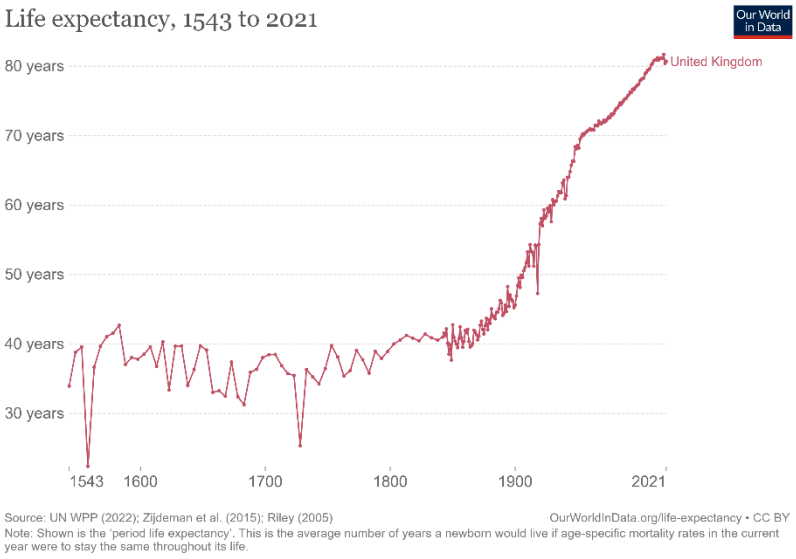
> For a reduction in all traffic-related pollutants, consistent with a 1 µg/m3 reduction of NO_2, about 1.6 million life years could be saved in the UK over the next 106 years, associated with an increase in life expectancy of around 8 days.

The government publishes data on ambient urban, rural and urban-roadside concentrations of NO_2, helpful to this attempt to understand the potential of policy to improve health.



The difference between the urban and rural background level of NO_2 is currently 9 µg/m^3. Thus, if policy could reduce the urban background level of air pollution, consistent with a reduction of 9 µg/m^3 of NO_2, to make it equivalent to the rural background level (as a hypothetical, illustrative target), it would yield a hypothetical benefit of 72 days' increased life expectancy to people born in the year 2129 – i.e. once all those already exposed to current levels of NO_2 had died, leaving only the population that had not.

COMEAP's estimate, which is based on estimates of relative risk of mortality to past exposure to air pollution, demonstrates that there is very little left by way of 'low hanging fruit' to produce significant improvements in life expectancy and health. As has been demonstrated above, the UK has experienced radical improvements in air quality over the last century, and only diminishing returns are possible for increasingly draconian policy interventions. London's coal-fired power stations and industries are gone, as are its 'pea-souper' smog. And so, if there is a relationship between air pollution and life expectancy, eliminating the remaining pollution is highly unlikely to yield the same degree of improvement seen over the period 1900-2019, of 45.6 years to 81.7 years.



But COMEAP's report is far from unequivocal. The report came with the advice to treat its recommendations with caution, citing *'strong uncertainties underlying'* the estimate, emphasis that *'that these are indicative results'*, and requiring that, though the results are useful, *'the caveats and uncertainties are communicated clearly'* to policymakers, which policymakers seem to have ignored.

More troubling for attempts to use the report to inform policymaking is the lack of unanimity between the report's authors, as indicated in the report itself. Three of the 20 committee members dissociated themselves from the report's recommendations, citing, among other things, *'inadequate consideration of uncertainties'* and *'insufficient evidence to infer a causal association between long-term average ambient concentrations of NO_2 and risk of death'*, resulting in the statement that:

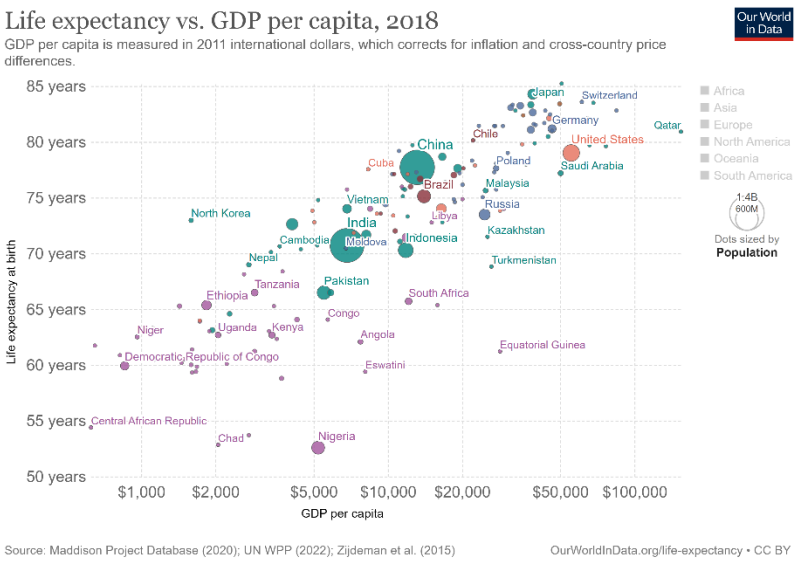
> We think it very likely that basing mortality burden calculations on long-term average ambient concentrations of NO_2 will, despite listing caveats, **mislead the public into believing that exposure to long-term average ambient concentrations of NO_2 is causally associated with an increased risk of death.**

A significant part of the 128-page report is given over to the discussion of the minority views of the committee. This should be understood as a statement about the scientific basis of the report's recommendations, its evaluation of mortality risk, its value to policymaking and to public understanding, and the fact of broader scientific debate about the relationship between air pollution and mortality risk. It is not a disagreement about whether or not air pollution *can* be a risk to health.

Comparing policies

The benefit of even a significant reduction in air pollution levels may be no more than to add a few days to life expectancy, which will likely not be measurable, far into the distant future. The uncertain benefits of eliminating traffic pollution, then, ought to be compared against what is more concretely known about other factors that predict health outcomes.

The most well-established (though not necessarily well-understood) determinant of health outcomes at the global level is per-capita income, as the following chart demonstrates. (NB: logarithmic horizontal axis.)

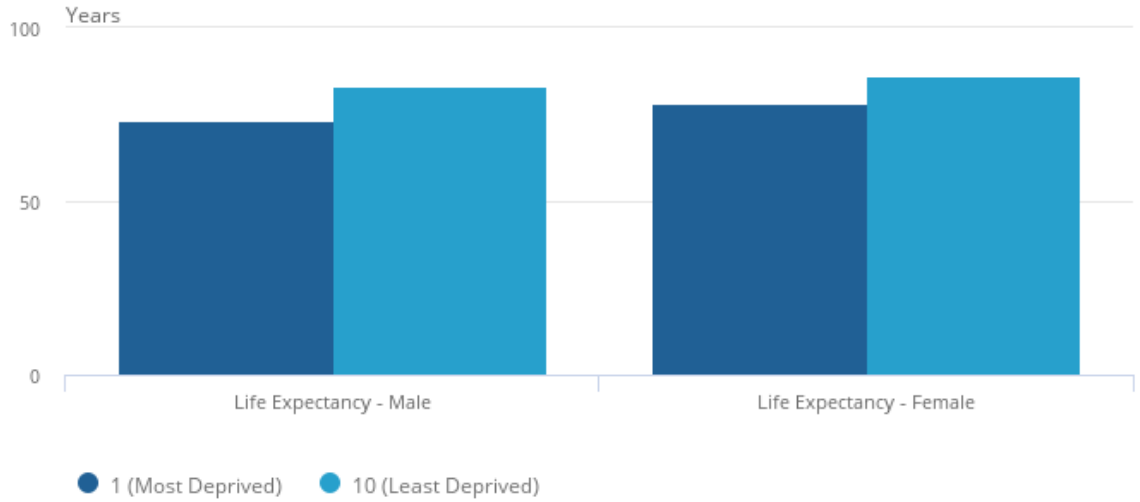


Studies that compare health outcomes against income within the UK bear out the same relationship. The Office for National Statistics (ONS) finds nearly ten years' difference in life expectancy at birth

between males in the least (83.2 years) and most (73.5 years) deprived areas of England. For females, the difference is 8 years, at 78.3 vs 86.3.

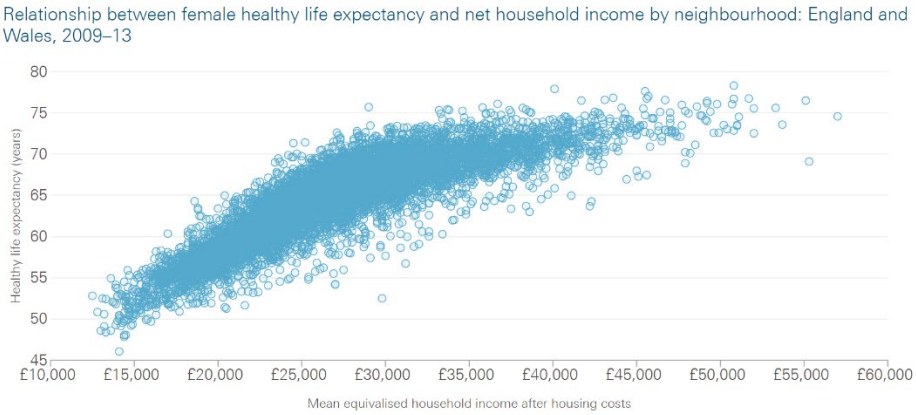
Figure 1: Large differences in life expectancy at birth between the least and most deprived areas of England continue for both males and females

Life expectancy at birth, England, 2018 to 2020



An [analysis by the Health Foundation] uses a slightly different metric to examine health outcomes vs income based on averages at the level of local authority. It finds that: '*An increase in average net annual income of £1,000 in an area is associated with a 0.5-year increase in male healthy life expectancy*'.

The Health Foundation [finds] similarly that '*An increase in household income of £1,000 is associated with a 0.7-year increase in female healthy life expectancy*'.



These results are far more significant than the analyses produced by the committees convened by government departments to examine the relationship between air pollution and mortality risk. The base data examined by income *vs.* health studies is far more tangible and far less sensitive to subjective interpretations and can be analysed straightforwardly to produce robust evidence of a relationship.

The observation of a strong relationship between household income and healthy life expectancy allows a rough sketch of the more tangible benefits that could be achieved by policies that emphasised income, which can be compared to the putative benefits of air pollution-reduction policies. Assuming the average UK household is 2.4 people (1.2 males and 1.2 females), increasing healthy life expectancy by 0.6 years over the course of a lifetime of 81.7 years would require increasing individual incomes by £416 per year per person. 0.6 years is 219 days, which is three times greater than the 72 days of increased life expectancy (NB: not healthy life expectancy) implied by COMEAP's findings for a reduction of urban background air pollution. An increase of a relatively modest per capita annual income of £4,160 would seem to increase healthy life expectancy of the poorest people by six years – far in excess of the putative benefits that can be achieved by banning cars.

It is for advocates of different political tendencies to argue about whether it is best for the government to intervene with redistributionist policies or to put less of a burden on households in the first place, perhaps by lowering taxes and other costs of living, and also to generate more wealth. That would be a healthy democratic debate about how to maximise both wealth and health for the benefit of the entire population, and would not depend either on technocratic panels' judgement, or on alarmist presentations of highly questionable estimates of mortality risk.

Although currently anecdotal – it is not a priority for academic researchers in the field, who are more interested in making the case for traffic-reduction policies by highlighting their benefits – small business owners, including restaurants, retailers and tradespeople, affected by LTNs have reported significant loss of turnover. A survey of 139 business with a shopfront by one campaign in Oxford found that 95 per cent reported losses, most in the range of 15-30 per cent, though some reported losses as high as 50 per cent. Businesses that are dependent on private transport (light goods vehicles) such as builders report both not being able to get to their customers' premises at an agreed time and having to increase their fees to compensate for time lost in traffic, leading to a loss of competitiveness or work.

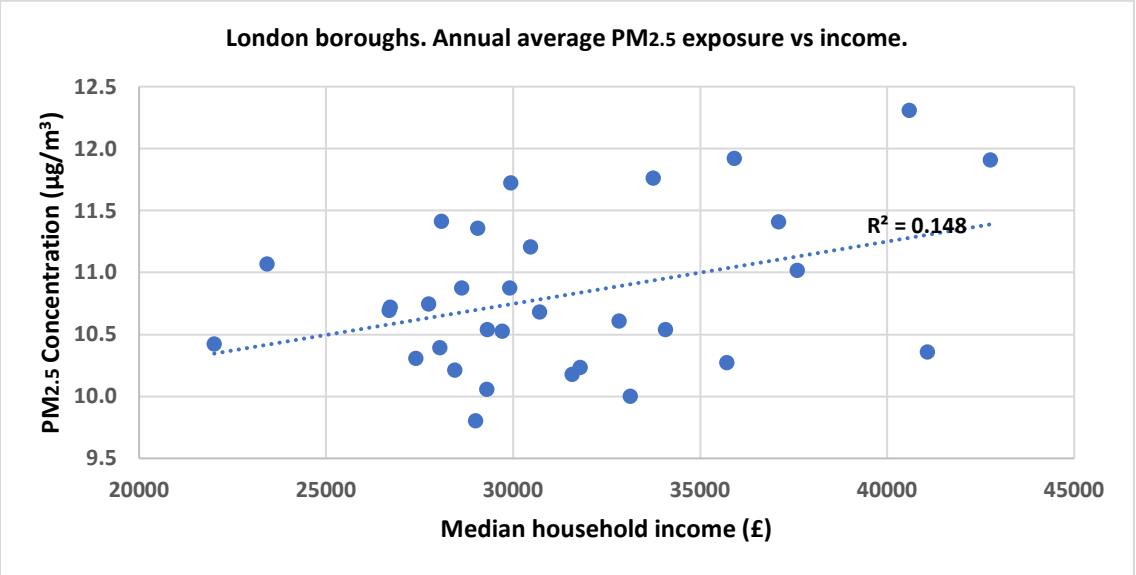
These are significant losses, with likely impacts for businesses and employees alike. Business-owners of all kinds report that they were not consulted about the likely impacts of road closures by local authorities. Given the fact of established relationship between even relatively modest amounts of

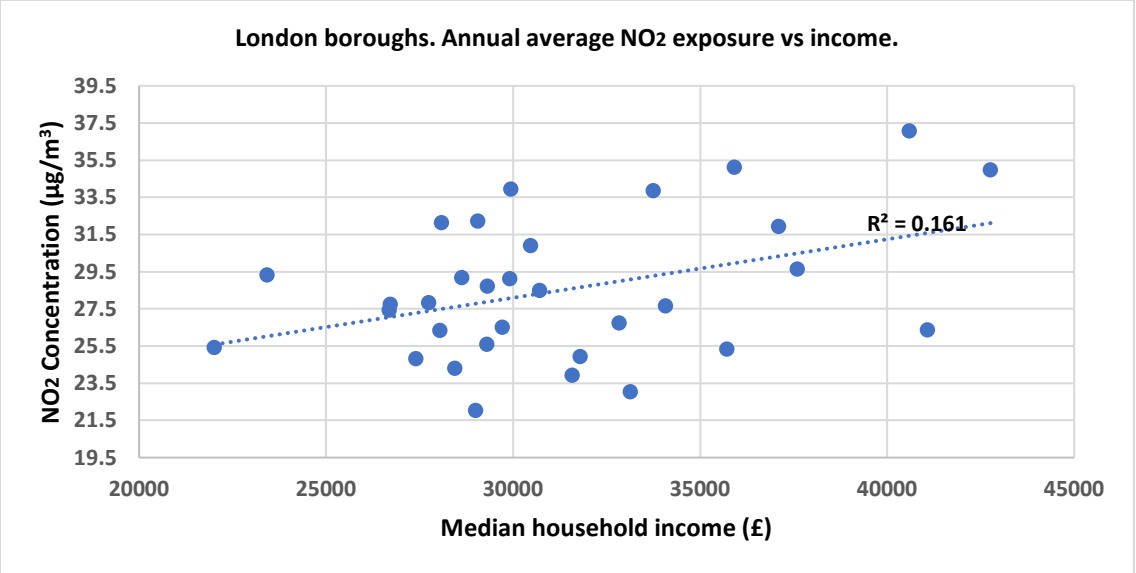
household income and healthy life expectancy, local authorities' emphasis on the relatively weaker association between air pollution and life expectancy is a remarkable failure, suggestive of a political agenda being put before genuine concern for public health. LTNs and similar schemes may well have the opposite effect to that which is intended, and this effect is very likely to be imposed on the lower-waged, as well as reducing opportunities for the unemployed.

Housing and other considerations

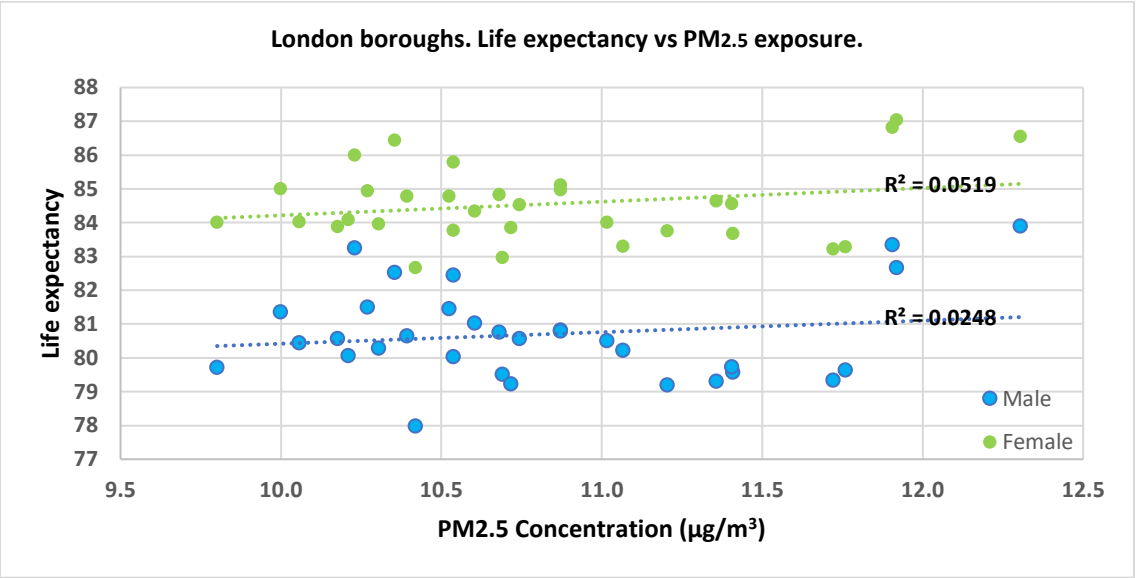
One critical response to the above section might be that poorer people often live in closer proximity to roads and other sources of air pollution, as has been claimed by air pollution campaigning organisations. However, at the level of London boroughs, this claim is contradicted by evidence. The following charts compare data at the level of London borough for air pollution, life expectancy, and household income.

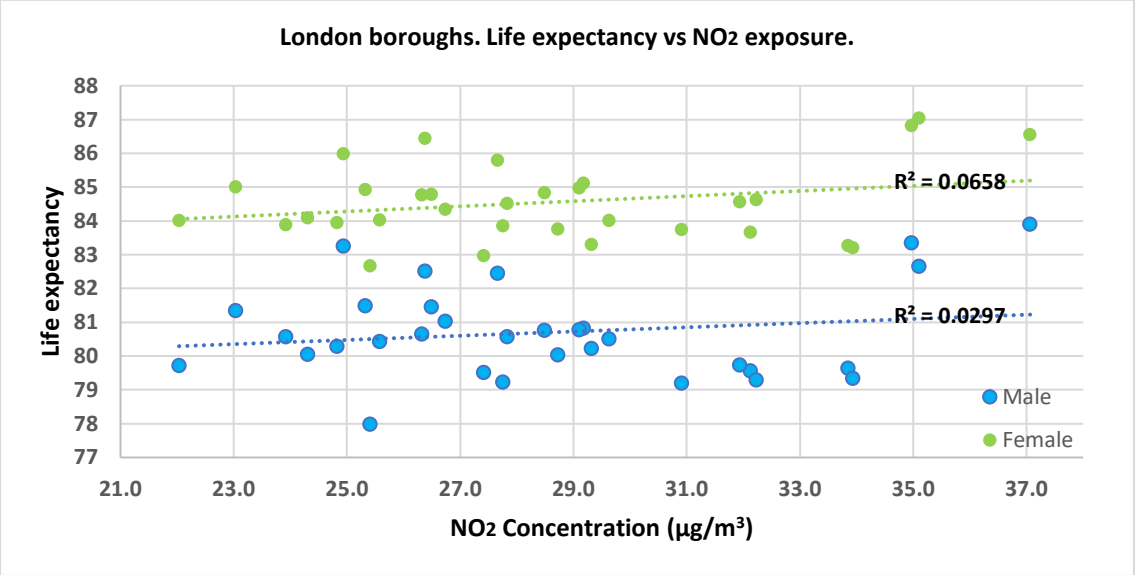
The most surprising result is that air pollution correlates with increased household wealth – London boroughs with the highest median incomes tended to be more exposed to air pollution.



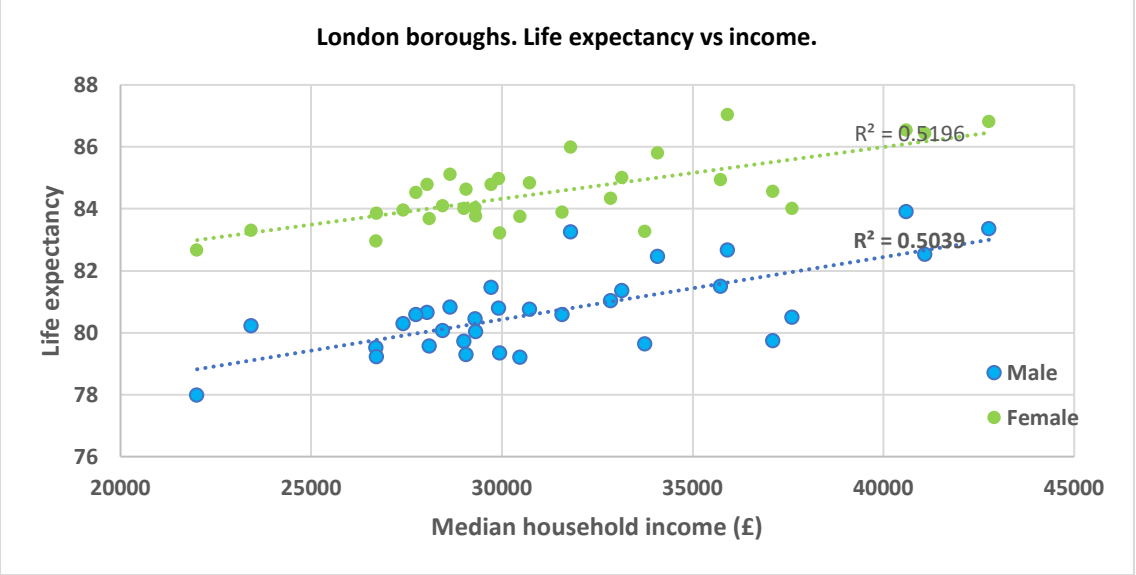


Exposure to air pollution is extremely weakly correlated with life expectancy, with marked differences between sexes. This result is likely to be regarded as not statistically significant.





By far the strongest correlation, as is suggested above, is the relationship between household income and life expectancy. This correlation is ten times the strength of the correlation between air pollution exposure and life expectancy for females, and twenty times the strength of the correlation between air pollution exposure and life expectancy for males.



One reason for the inequality in health outcomes is very likely to be insufficient supply of adequate housing, which, though associated with *indoor* air pollution, is fundamentally a question of wealth. House prices and rents have risen across the country in recent years, driven by a failure to permit development, with the obvious consequence that housing is inadequate for growing families' needs.

A recent government analysis found that in England, 11 per cent of homes in the private rented sector and 4 per cent of socially-rented homes had problems with damp and mould, vs. 2 per cent of privately owned homes. This is almost certainly a greater problem than traffic-related air pollution, and is an issue which recently, though only briefly, hit the news headlines, following the death of two-year-old Awaab Ishak, whose family lived in a one-bedroom social-housing flat in Rochdale. The child was found by the coroner to have died as a result of *'Environmental mould exposure'*, and that *'the development of Awaab's severe respiratory condition which led to him going into respiratory arrest was entirely due to the prolonged exposure he had to mould in his home environment'*.

Despite the above information being in the public domain, and the stark differences in the quality of evidence between housing and air pollution issues, it is air pollution, not the supply, quality and affordability of housing that dominates policy agendas and news headlines.

The influence of special interest lobbying organisations

A number of special interest civil society organisations have helped push air pollution up the policy agenda and have influenced scientific evaluations of this issue. Of particular concern is the influence in national and local policymaking of philanthropic funds with an interest in the environmental policy sphere: The European Climate Foundation (ECF), and The Children's Investment Fund Foundation (CIFF), and Bloomberg Philanthropies. CIFF was established by British billionaire hedge fund manager Sir Christopher Hohn, and in 2021 made grants worth over $200 million to environmental campaigning organisations, including $43 million to ECF. Bloomberg Philanthropies, under the direction of its founder and funder, news tycoon Michael Bloomberg, donated €11 million to ECF in 2020.

A fuller account of these philanthropic foundations' arguably undue influence in UK environmental policymaking, especially in their close relationships with the Mayor or London and other local authorities, and academic research organisations involved in advancing LTNs and similar policies, will be considered in greater detail in a forthcoming article. However, a number of issues arise out of

these philanthropists' interventions, of consequence to this discussion about the science underpinning air pollution policy-making and the broader perception of a 'crisis'.

In 2020, the CIFF website revealed that it had made a grant of $1,080,000 '*To fund the legal costs - and associated supporting costs - for the family of Ella Adoo-Kissi-Debrah to cover the fresh inquest into her death*', citing the ECF as a partner in this project. At just nine years old, Ella Roberta Adoo-Kissi-Debrah had died in 2013 as a consequence of respiratory failure caused by severe asthma – a condition for which she had received emergency treatment on many occasions. The Adoo-Kissi-Debrah family were unhappy with an initial coroner's finding on the death and believed that air pollution from traffic on the roads near her home was a cause. Following the family's campaigning, a new inquest was held in 2020, which found air pollution to have been *'a significant contributory factor to both the induction and exacerbations of her asthma'*, and that levels of air pollution that exceeded permissible limits had *'possibly contributed to her death'*. The coroner made a statutory Report to Prevent Future Deaths, which stated that:

> There was no dispute at the inquest that atmospheric air pollution is the cause of many thousand premature deaths every year in the UK. Delay in reducing the levels of atmospheric air pollution is the cause of avoidable deaths.

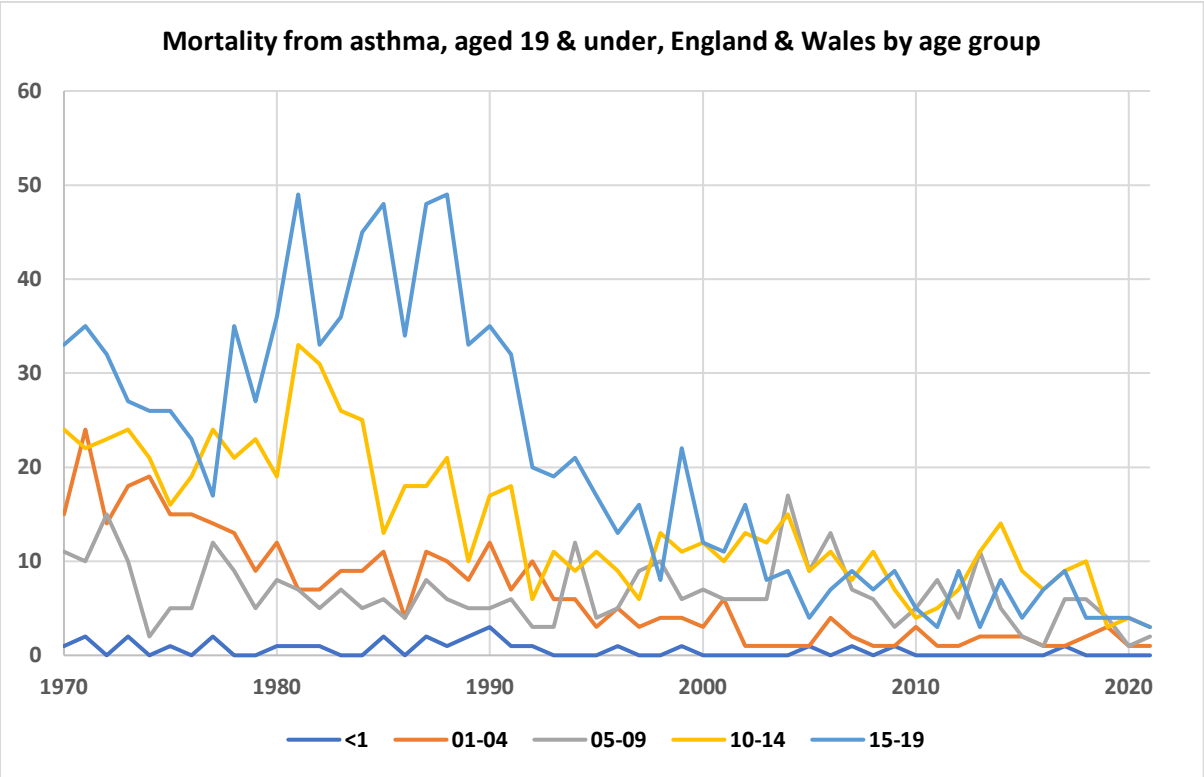
and that:

> The national limits for Particulate Matter are set at a level far higher than the WHO guidelines. The evidence at the inquest was that **there is no safe level for Particulate Matter** and that the WHO guidelines should be seen as minimum requirements. Legally binding targets based on WHO guidelines would reduce the number of deaths from air pollution in the UK.

In the western world, the death of a child is a tragedy without parallel. Accordingly, we believe it is wholly inappropriate to comment further on the individual technical details of the Adoo-Kissi-Debrah family's loss. Nonetheless, we also believe there is good evidence that the death of a child is being used to sway the public perception of the necessity of air pollution policies by extremely well-funded and well-resourced and emotive political campaigns, with clearly ideological agendas that are not in the public's interest, to dissuade critical debate about policy. The family cannot and must not be criticised for seeking justice for their daughter, but it is not for billionaires and their lobbying organisations and activist lawyers or experts either to decide which coroners' verdicts should be overturned to achieve radical political change, or to use their inexhaustible resources to overwhelm due democratic process and the open, transparent, rational public debate it requires, with emotionally-charged and misleading claims.

Moreover, an inquest into the death of a child is also clearly an inappropriate forum in which to make policy recommendations, precisely because the Court in question prevented the opportunity to hear alternative perspectives on the evidence given to the coroner. An application by the Alliance of British Drivers (ABD) – a group representing motorists – to give evidence was denied on the basis that the ABD spokesman was 'not an interested party', thereby preventing a challenge to the evidence and testimony heard by the coroner at the second inquest. The fact that there was, in the coroner's words, '*no dispute*' of the claim that *'air pollution is the cause of many thousand premature deaths every year in the UK'* in the 2020 inquest does not mean no dispute exists – as we have shown above, there clearly are disputes within science on the question of the relationship between air pollution and mortality risk, including with the UK government's own expert committees. It means merely that the coroner refused to hear it.

Concern about asthma is both legitimate and understandable, and must be considered in debates about public health. But childhood deaths from asthma are extremely rare in the UK. Mortality statistics from the 20th and 21st centuries show significant falls in deaths from asthma in the 0-19 year old age groups in England and Wales. In 2021, 9 deaths of individuals aged 19 or under were attributed to asthma, equivalent to a rate of one per 1.5 million of the population, in a total population of 13.7 million of this age group. 40 years earlier in 1981, 97 deaths in England and Wales were caused by asthma – a rate ten times higher than today, at 1 in 150,000.

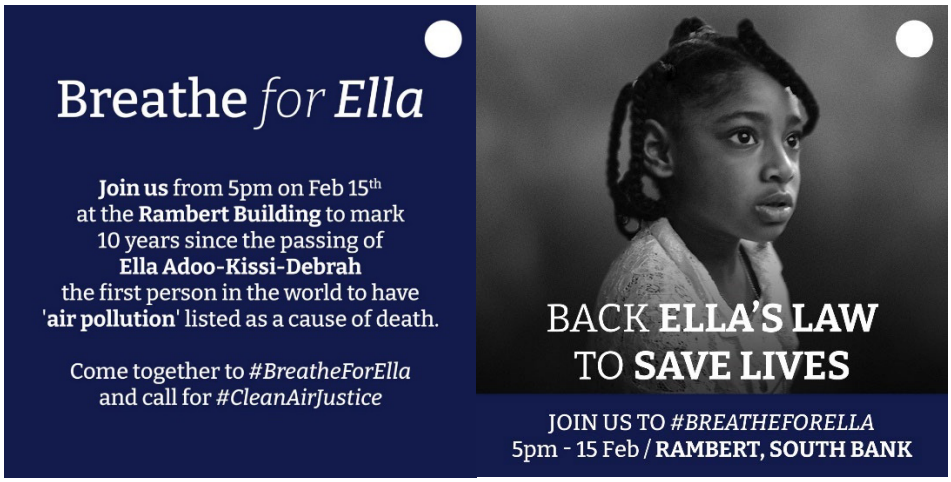


Contrasting the low mortality rate for children and young people, the condition is extremely common, affecting over five million people according to Asthma UK – roughly 8 per cent of the population. Asthma mortality is significantly higher in much older age groups, predominantly in the over-85s – 502 deaths in England and Wales were recorded in this cohort in 2021, among 1,129 deaths across the entire age range. But again, statistical perspective is essential to understanding the problem. In 2021, ONS reports 585,899 deaths in England and Wales, including 225,052 deaths among the over-85s. Thus, asthma was the cause of death of 0.22 per cent of the deaths recorded among the most vulnerable population.

Mortality is not the only significant metric of a relationship and low mortality rates are not cause for inaction. But historical and social statistical context is essential to the direction of limited public resources and to inform sound policymaking, as well as formulating cost-benefit analyses of policies that will cause a significant loss of utility to many millions of people, also with significant likely consequences for health. Given the widespread incidence of asthma and the very low mortality rates in young people, there would seem to be evidence that current levels of air pollution are not at all strongly statistically linked with mortality.

However, in the wake of the coroner's findings, a campaign has been launched to increase the powers of the government to limit air pollution levels. Launched by Green Party peer, Baroness

Jenny Jones, a bill dubbed 'Ella's Law', supported by green NGOs and MPs from all parties, will be heard in the House of Commons this year.



Through such emotive campaigning, green organisations may have misled public perception that many asthma deaths are caused by air pollution from traffic, and are a growing problem, making policy an urgent priority. This pressure has not been countered by politicians, courts and experts, who have failed to explain that this understanding is not at all clear either from the data or the scientific literature, including that compiled by committees convened by government to consider these questions, but which urge caution against making such conclusions.

The CMO's failure to communicate scientific knowledge and uncertainty is political

It is not possible for the CMO to be unaware of the substantial problems that this article has discussed:

- The difference between linear and logarithmic axes on charts.
- Guidance from both the UKHSA and COMEAP to present estimates of mortality risk to policymakers and the public with great caution.
- The explicit ethical advice to frame mortality risk in terms of 'life years lost', not 'deaths'.
- The extreme difference between mortality risk expressed as deaths (tens of thousands) and the putative benefits of air pollution-reduction policies (days of hypothetical increased life expectancy).
- The weakness of the scientific evidence, and the fact of scientific debate, evidenced by COMEAP experts' dissociation from its report's findings.
- The weak evidence of a statistical relationship between air pollution and mortality at the population level.
- The far-greater significance of economic factors in determining health outcomes.
- The political atmosphere created by powerful green campaigning organisations.

This leaves only two possibilities. Either the CMO was negligent in his duties, or he ignored scientific caution in order to exaggerate seemingly scientific claims, hence misleading policymakers and the public into supporting particular policies.

The CMO's failures are made all the more prominent by the fact that he makes a small and inadequate attempt to draw a distinction between the everyday understanding of a death and estimates of mortality risk expressed as 'deaths'. He could not have been unaware that extremely alarming statistics, of 'tens of thousands of deaths' being used by politicians to communicate with

the public, to drive support for radical policies. As the most senior public servant charged with bringing sound scientific and medical knowledge to policymaking, he, more than any other person in the country, was the best placed to bring a rational perspective to the policymaking process.

It is important to bear in mind that the work produced by the agencies referred to by the CMO is not 'science'; it is, at best, judgement by people who are as likely to be involved in political campaigning as they are involved in science. As a matter of fact, caused by the government convening expert panels in the absence of strong evidence of an association between air pollution and mortality risk, this judgement *requires* subjective interpretation of weak science and data, which shows wide disagreement, much of which is produced by statistical modelling from proxies, rather than scientific discovery of causal association between air pollution and mortality. And through this extremely bureaucratic, multi-agency process, which is probably vulnerable to political influence from the government itself and campaigning organisations, scientific caution has been lost by degrees, leaving only seemingly alarming claims influencing decisions made by courts and policymakers.

Conclusions

Emphasis on air pollution is politically motivated and distracts public attention from much more significant problems that require public debate. Given the far stronger relationship between socio-economic factors and health outcomes, than the poorly-evidence hypothesised relationship between air pollution and mortality, the consequences of radical pollution-mitigation policies must be considered. In the past, clean air legislation has been created without causing great loss of utility to the public. But now, and despite radically different levels of air quality compared to even the very distant past and equally radical improvements in health compared to just decades ago, many local authorities and the UK government are in the process of severely limiting private transport, with profound consequences for millions of people.

The loss of utility represents a far greater risk to health than the elimination of air pollution represents potential benefits. It was shown that a modest increase in household income is associated with much greater health benefits than can be achieved even by virtually eliminating air pollution. The converse must also be true: limiting car use will affect many people's ability to earn an income, with widespread health impacts. Evidence suggests that preventing people from either getting to work, or finding work appropriate for themselves, or preventing them from carrying out their trades, will likely have a far greater health impact than exposure to current levels of air pollution in Britain's cities.

Science has been used to shut down rather than inform debate. This report is not a scientific evaluation of the claims made in support of local and national policies. It does, however, reveal facts that suggest those claims do not emerge from normal science. There has not been adequate scientific research or debate on the putative association between air pollution and mortality. Debate and dissenting opinion have been excluded, as the putative evidence has moved via the CMO from the expert committees to courts and political decision makers and into the public domain. Moreover, extremely poor-quality and alarmist statistical claims have been made to elevate the issue in the public's consciousness, further precluding rational public debate, in favour of emotive rhetoric.

Democracy has been denied. The public has no representation in these decision-making processes, against extremely well-resourced campaigning organisations and a cross-party political consensus working at national and local levels, to impose these policies without democratic process. Extremely poor science seems to be being used to circumvent democracy.

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