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TRUTH IN JOURNALISM

AIR POLLUTION: THE HIDDEN KILLER IN OUR MIDST

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Introduction: A Global Health Crisis

In April 2019, the Health Effects Institute (HEI) published a report entitled *The State of Global Air*,¹ which revealed some alarming statistics: according to 2017 data, over 93% of the world's population now live in areas that exceed the World Health Organization's (WHO's) guidelines² for safe levels of air pollution.

“

Long-term exposure to air pollution has been found to increase our chances of developing life-threatening illnesses, including heart disease, stroke, chronic respiratory disease, lung cancer, lung infections, diabetes, asthma and many other disorders, such as mental illness and obesity... for people living or working near main roads, it is equivalent to smoking 10 cigarettes (half a pack) a day”



In other words, roughly nine in 10 of us are daily inhaling air that's unsafe because it is predominantly a mix of soot — defined in Webster's as “a black substance formed by combustion or separated from fuel during combustion, rising in fine particles, and adhering to the sides of the chimney or pipe conveying the smoke” — and smoke (“the gaseous products of burning materials, especially of organic origin, made visible by small particles of carbon”). Unfortunately, as these small particles — or particulate matter (PM) — are tiny and usually invisible, we may be lulled into a false sense of security concerning the damage they are doing.

This sooty, dirty, smoke-filled air fills our lungs and airways, affecting our ability to breathe properly and greatly reducing our life expectancy. Long-term exposure to air pollution has been found to increase our chances of developing life-threatening illnesses, including heart disease, stroke, chronic respiratory disease, lung cancer, lung infections, diabetes, asthma and many other disorders, such as mental illness and obesity.

City dwellers worldwide often relay the common experience of their air quality being somehow “different” — it's the acrid smell you can actually “taste” or sometimes “catch” in the back of your throat. A simple subway commute or walk along busy streets can irritate your airways, resulting in breathlessness and coughing. At the end of the day when you clean your skin or blow your nose, you may notice a discolored, dirty residue.

Perhaps you also have a persistent cough that won't go away, or your children keep you up at night with their constant sneezing or wheezing.

UK Professor Jonathan Grigg (pictured left), attending a recent Parliamentary event, painted a compelling visual image of the human cost of breathing in all this toxic air. An authority in pediatric respiratory and environmental medicine at Queen Mary's, University of London, he equated people living or working near main roads to smoking around 10 cigarettes (half a pack) per day, a fact also cited in a recent *Times* article.³

¹ <https://www.stateofglobalair.org/health>

² https://apps.who.int/iris/bitstream/handle/10665/69477/WHO_SDE_PHE_OEH_o6.02_eng.pdf;jsessionid=84EAC6D552D31C40628C06973D027ABB?sequence=1

³ <https://www.thetimes.co.uk/article/air-pollution-on-busy-roads-as-bad-as-passive-smoking-10-a-day-60q2pwdgox>

⁴ <https://www.thenational.ae/opinion/comment/why-delhi-dwellers-are-breathing-in-the-equivalent-of-40-cigarettes-a-day-1.793959>



DEATH RIDE: A woman wearing a mask cycles amid heavy smog in Beijing's Guomao area, China, November 30, 2015 (REUTERS)

Some studies put this figure even higher, with Delhi air⁴ being one of the main culprits (last year, their air-quality monitors showed air-pollution readings equivalent to smoking 20–40 cigarettes per day). Grigg joins an ever-growing number of doctors, scientists, researchers, activists and climate activists who advocate for a total ban on diesel; he is also a founding member of pressure group Doctors Against Diesel.⁵

Although it may not always be visible except when it shows up as smog, air pollution's potent mix of toxic chemicals roam freely and widely across the globe. The HEI report cites entire populations living in India, Bangladesh, Pakistan, China, Nigeria, Indonesia and Mexico as living in areas of the world with the densest and most deadly concentrations of air pollution, demonstrating that it is

often the poorer communities that are disproportionately affected.

Additionally, according to the United Nations (UN),⁶ about three billion people depend on burning biomass fuels, coal or kerosene to meet their energy needs, and 3.8 million of them will die each year from exposure to these pollutants.

Poorer communities also often comprise a workforce that is exploited in the name of consumerism and “progress”; while they contribute to their nations' wealth, the people themselves usually work in heavy industries and live next to busy roads. No wonder there is an endemic struggle in some poorer communities to break the cycle of poverty and other health inequalities that stem from it.

Yet while wealthy individuals and nations may kid themselves they are cushioned to its effects by working and living in air-filtered

environments, or perhaps by being able to afford cleaner technology or renewable energy-based solutions to replace fossil fuel-dependent modes of transport or cooking, etc., the harsh reality is that no one is fully immune from pollution's deadly grip while the global air quality remains at dangerous levels.

Because it is everywhere, air pollution is a great leveller — it is no respecter of age, ethnicity, class, status or borders, and so long as we continue to breathe, we are all in danger. There is no reason for the comparatively wealthier West to feel smug, because today roughly 75% of people in the European Union live in areas that exceed World Health Organization (WHO) recommended levels of air pollution⁷ — and sadly, it is our children who are bearing the greatest brunt of this health-limiting situation.

5. <https://doctorsagainstdiesel.uk>

6. <https://www.unenvironment.org/news-and-stories/story/five-reasons-you-should-care-about-air-pollution>

7. <https://www.who.int/airpollution/guidelines/en/>

Air Pollution's Impact on Health and Life Expectancy

Understanding the Science

Greenhouse gases may generate news headlines for causing global warming, but in fact it's the lesser-known particles that make up the compounds that truly impact global health. Not only is global warming harmful to other species and plants, the raised temperature levels and unseasonably warm weather may also increase levels of dangerous particles (particulate matter, or PM) that adversely affect air quality and lead to human health problems.

The concentration of an air pollutant (e.g. ozone) is typically given in micrograms (one-millionth of a gram) per cubic meter of air, which is usually written as $\mu\text{g}/\text{m}^3$. Of the four major air pollutants — PM, ozone (O), nitrogen dioxide (NO₂) and sulfur dioxide (SO₂) — the one identified by WHO as being the most harmful

to human health is PM. Particulate matter, described by its chemical concentrations, such as PM₁₀, PM_{2.5}, PM₁ and PM_{0.1} — typically written as PM₁₀, PM_{2.5}, PM₁ and PM_{0.1} — is defined as the fraction of particles with an aerodynamic diameter smaller than respectively 10, 2.5, 1 and 0.1 μm (1 μm = 1 millionth of a meter or 1 thousandth

of a millimeter). In comparison, the average diameter of a human hair equals 50–70 μm (see diagram on following page).⁸

The larger particles are generally filtered in the nose and throat, and do not cause problems. However, the particles that are smaller than about 10 micrometers (or microns) are referred to as

It is estimated that **long-term exposure to man-made air pollution in the UK** has an annual effect equivalent to:



28,000 to 36,000 deaths

Over the following 18 years a **1 $\mu\text{g}/\text{m}^3$ reduction in fine particulate air pollution in England** could prevent around:



50,900 cases of coronary heart disease

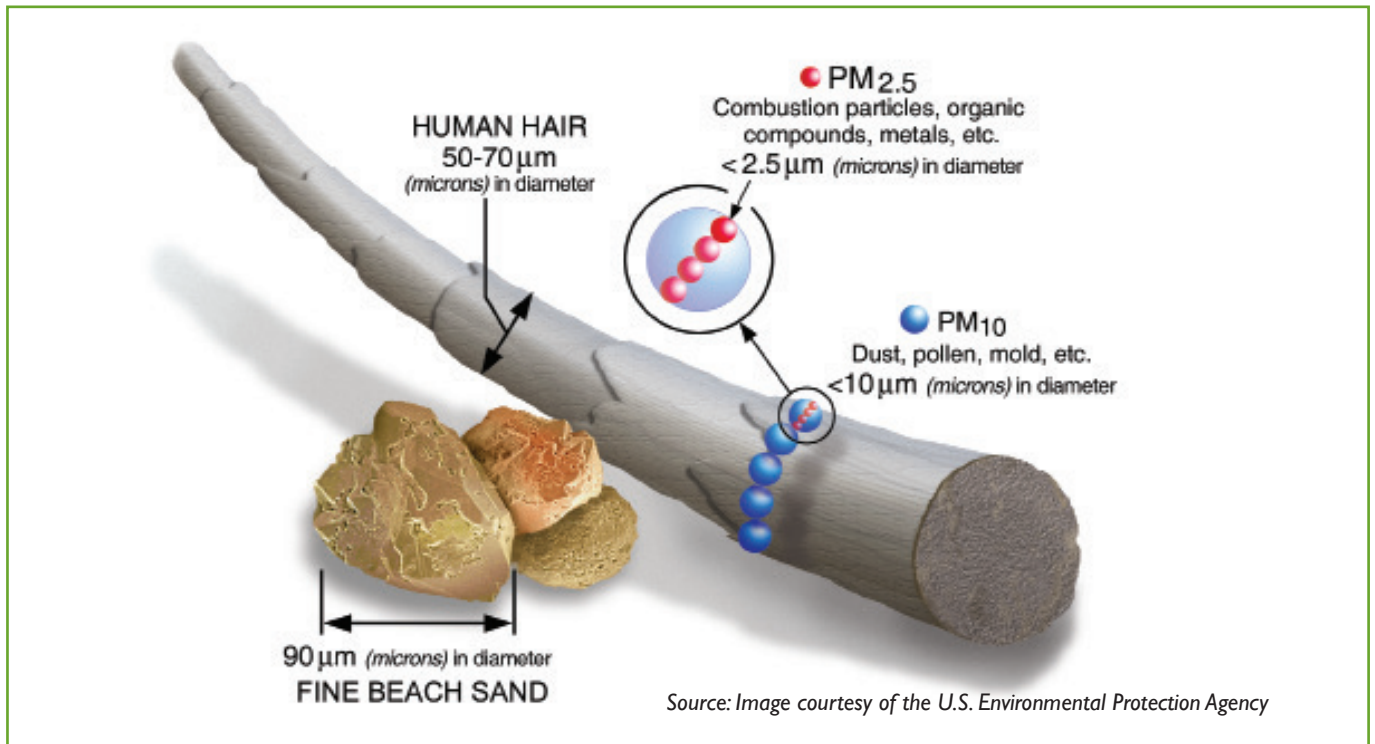
16,500 strokes



9,300 cases of asthma

4,200 lung cancers

SCALE OF THE PROBLEM: Chart showing UK figures for annual deaths and diseases attributable to manmade air pollution (Used with permission from Public Health England — Health Matters: Air Pollution Impacts and Actions³⁶)



SIZE MATTERS: Diagram showing the size of particulate matter (PM) air pollution compared to a human hair and particles of sand that have been magnified. PM_{2.5} particles are 20 times smaller than the width of a human hair (Source: www.irceline.be)

PM₁₀, with PM_{2.5} particles being ones smaller than 2.5 micrometers.

The latter are 20 times smaller than the width of a human hair and are the most damaging to human health because when you breathe polluted air into your lungs, these ultra-fine particles are quickly absorbed into your bloodstream, penetrating deep into the respiratory and circulatory system. These particles are then transported throughout the body, causing damage to the lungs, heart and brain.

The WHO guidelines referred to in this report are based on a now-extensive list of scientific evidence linking air pollution with health consequences. Although there are some gaps, which ongoing research continues to address, the findings obtained since the guidelines' most recent update in 2005 have stipulated that the air we breathe should not contain more airborne PM of toxic air particles such as ozone of more than 2.5 micrograms (one millionth of a gram) per cubic meter of air (10 $\mu\text{g}/\text{m}^3$). In terms of the concentrations of air pollution particles, the WHO has set the limit at PM_{2.5} 10 $\mu\text{g}/\text{m}^3$, or simply PM_{2.5}.

Dr. Gary Fuller from King's College, London, with colleague Professor Frank Kelly, has spent two decades carrying out extensive research into PM for his book *The Invisible Killer*,⁹ which explains the science behind PM. Fuller says today's particulates are substantially derived from heavy industry, road surface,

dust and carbon emissions from engines (meaning small, inhalable particles of metal and rubber released into the air as a result of engine wear and braking). These particles are variable in size, shape, composition and origin, and can sometimes present as solid or liquid molecules suspended in the air.

Other PM sources include materials from building and industry; wind-blown dust — such as the Saharan dust that blew across Europe a few years ago; sea salt; pollens; and soil particles.

Even short-term exposures to these particles on high-pollution days can trigger asthma symptoms and cause spikes in hospitalizations related to respiratory or cardiovascular health. They can also be present in air that may otherwise seem “clean.” When these particles combine with gases such as ozone, the combination is especially toxic. Even relatively low levels of ozone can cause adverse health effects.

Those most at risk include people with chronic heart, cardiovascular and respiratory conditions such as asthma or chronic obstructive pulmonary disease (COPD), high-blood pressure¹⁰ and lung disease. Older people and people who are active outdoors (i.e. children, joggers or other outdoor sportspeople, agricultural and other outdoor workers) also suffer, particularly when ozone levels are high.

Particles are also present indoors. If you use a gas fire, keep warm by turning on the central heating

9 <https://www.penguinrandomhouse.com/books/608009/the-invisible-killer-by-gary-fuller/9781612197838/>

10. <https://www.ncbi.nlm.nih.gov/pubmed/26548310>

or using an open fire or wood-burning stove, a dose of particulates will be added to the air you breathe. Even seemingly innocuous scents in your home — air-freshening sprays, scented candles, household cleaning products and spray-can aerosol deodorants — will increase the number of particulates you inhale. The popularity of cooking outdoors on barbecue grills or using campfires can also have an impact on air quality.

While it's becoming increasingly clear our modern lifestyle choices are limiting our ability to breathe clean air, the problem of air pollution has been around for much longer; as far back as the mid-1600s, coal smoke from industrial and domestic chimneys was visibly prevalent in populous cities such as London, where later the famously thick fog or smog ("a fog or haze intensified by smoke or other atmospheric pollutants") was cited as causing the deaths by respiratory diseases of over 2,000 people¹¹ in 1880. Yet even before that, King Edward I banned the burning of sea-coal in 1272, as the smoke had become a noticeable irritant.

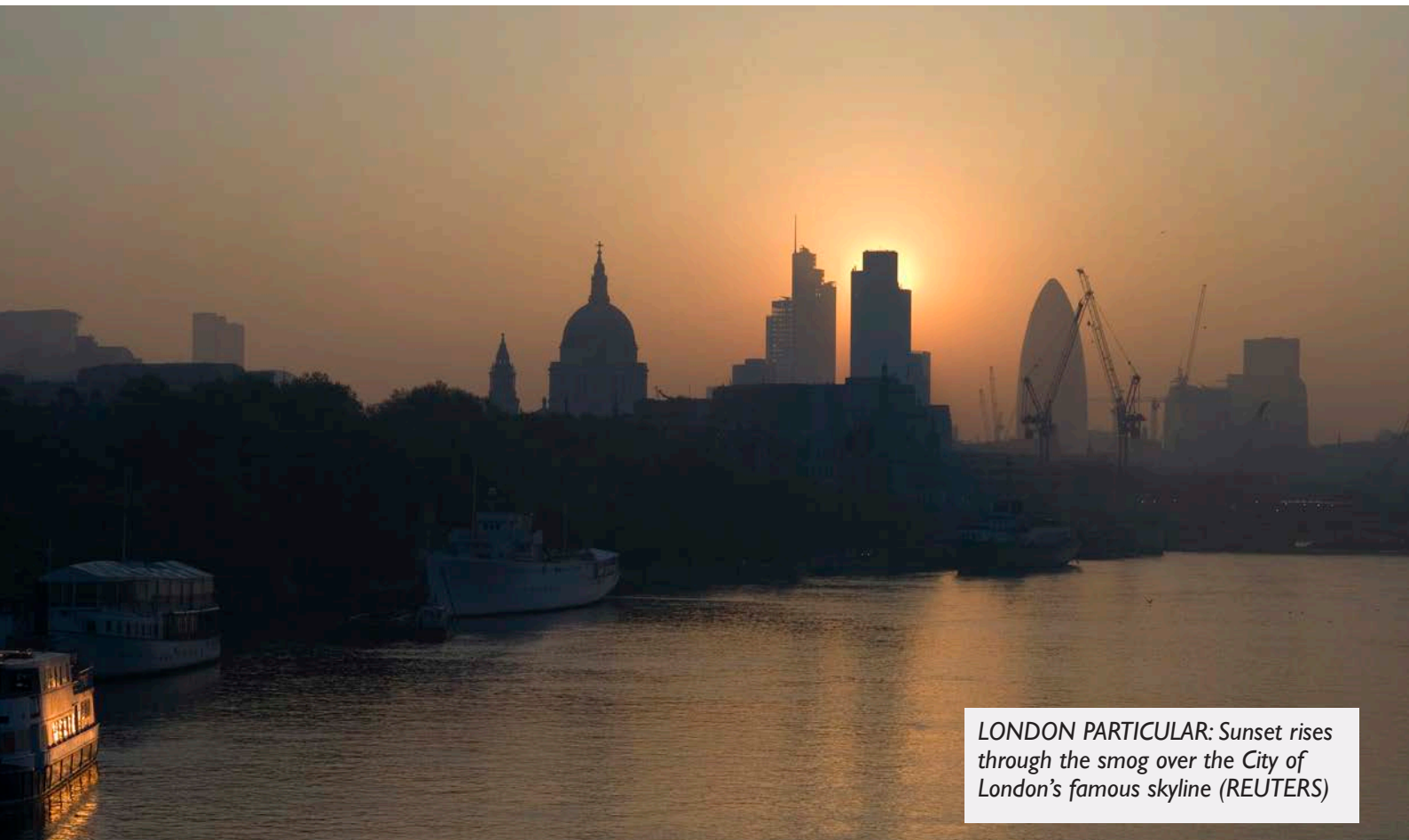
Older generations still living in London or

other UK towns and cities may recall the dense "pea-souper" fogs, so called because the fog was considered as thick as a pea soup, also known as a "London particular."

This famous fog was immortalized in British-American poet T.S. Eliot's famous lines "the yellow fog that rubs its back upon the window-panes," from "The Love Song of J. Alfred Prufrock," which describes a time when the air was visibly filthy (and yellow, as it contained the poisonous gas sulfur dioxide), due to city-dwellers' heavy reliance on burning fossil fuels like coal, gas or oil to keep warm.

The worst incidence of air pollution in London was the Great Smog of 1952, which reportedly killed 4,000 people in city over a few days, with a subsequent related 8,000 deaths.¹² The severity of this event — the worst case of air pollution to date in the city — led to the Clean Air Act of 1956, which proposed limiting air pollution in towns and cities, and switching to "smokeless fuels" from cleaner coals, gas and electricity.

Other cities have also experienced killer-smog events, including New York (1966), Donora, U.S. (1948)



LONDON PARTICULAR: Sunset rises through the smog over the City of London's famous skyline (REUTERS)

¹¹ https://en.wikipedia.org/wiki/Pea_soup_fog

¹² <https://www.newsshopper.co.uk/news/10855166.10-facts-about-the-great-smog-of-london-in-1952/>

BOX 1: Deadly Greenhouse Gases and Their Sources¹³

Carbon dioxide (CO₂): Carbon dioxide is the primary greenhouse gas, responsible for about three quarters of emissions. It can linger in the atmosphere for thousands of years. In 2018, carbon dioxide levels reached 411 parts per million (p.p.m.) at Hawaii's Mauna Loa Atmospheric Baseline Observatory — the highest monthly average ever recorded. Carbon dioxide emissions mainly come from burning organic materials such as coal, oil, gas, wood, and solid waste.

Methane (CH₄): The main component of natural gas, methane is released from landfills, natural gas and petroleum industries, and agriculture (especially from the digestive systems of grazing animals such as cows). While a single molecule of methane doesn't stay in the atmosphere quite as long as a molecule of carbon dioxide — about 12 years — in fact it becomes at least 84 times more potent over two decades. Methane accounts for about 16% of all greenhouse gas emissions.

Nitrous Oxide (N₂O): Nitrous oxide occupies a relatively small share of global greenhouse gas emissions — about 6% — but it is 264 times more powerful than carbon dioxide over 20 years, and its lifetime in the atmosphere exceeds a century, according to the Intergovernmental Panel on Climate Change (IPCC). Agriculture and livestock, including fertilizer, manure, and burning of agricultural residues, along with burning fuel, are the biggest sources of nitrous oxide emissions.

Industrial gases: Fluorinated gases such as hydrofluorocarbons, perfluorocarbons, chlorofluorocarbons, sulfur hexafluoride (SF₆) and nitrogen trifluoride (NF₃) have heat-trapping potential thousands of times greater than CO₂, and remain in the atmosphere for hundreds to thousands of years. Accounting for about 2% of all emissions, they're commonly used to create refrigerants and solvents, and in manufacturing, sometimes occurring as by-products.

Other greenhouse gases include water vapor and ozone (O₃). Water vapor is the world's most abundant greenhouse gas, but it is not tracked in the same way as other greenhouse gases because it is not directly emitted by human activity, and its effects are not well understood. Similarly, ground-level or tropospheric ozone (not to be confused with the protective stratospheric ozone layer higher up) is not emitted directly, but emerges from complex reactions among pollutants in the air.

and Delhi, India (2016–[an ongoing issue]); a recent (2016) study in Beijing¹⁴ has also attributed a third of deaths to smog.

Yet today, even with such extensive historical and global evidence, heavy industry and power plants continue to dominate the urban landscapes across India, China, Indonesia, Pakistan, Bangladesh, Brazil, Mexico and Nigeria.

Beth Gardiner's book *Choked*¹⁵ dedicates a whole chapter to the dangerously high levels of air pollution also pumped out by Poland, one of the most coal-dependent nations on Earth, which “draws 85% of its power and more than 40% of its heat from the fuel.” It is, adds Gardiner, “just one piece of a story unfolding across Eastern Europe and the former Soviet Union, as well as other Baltic countries.”

¹³ <https://www.nationalgeographic.com/environment/global-warming/greenhouse-gases/>

¹⁴ <https://www.scmp.com/news/china/society/article/2056553/smog-linked-third-deaths-china-study-finds>

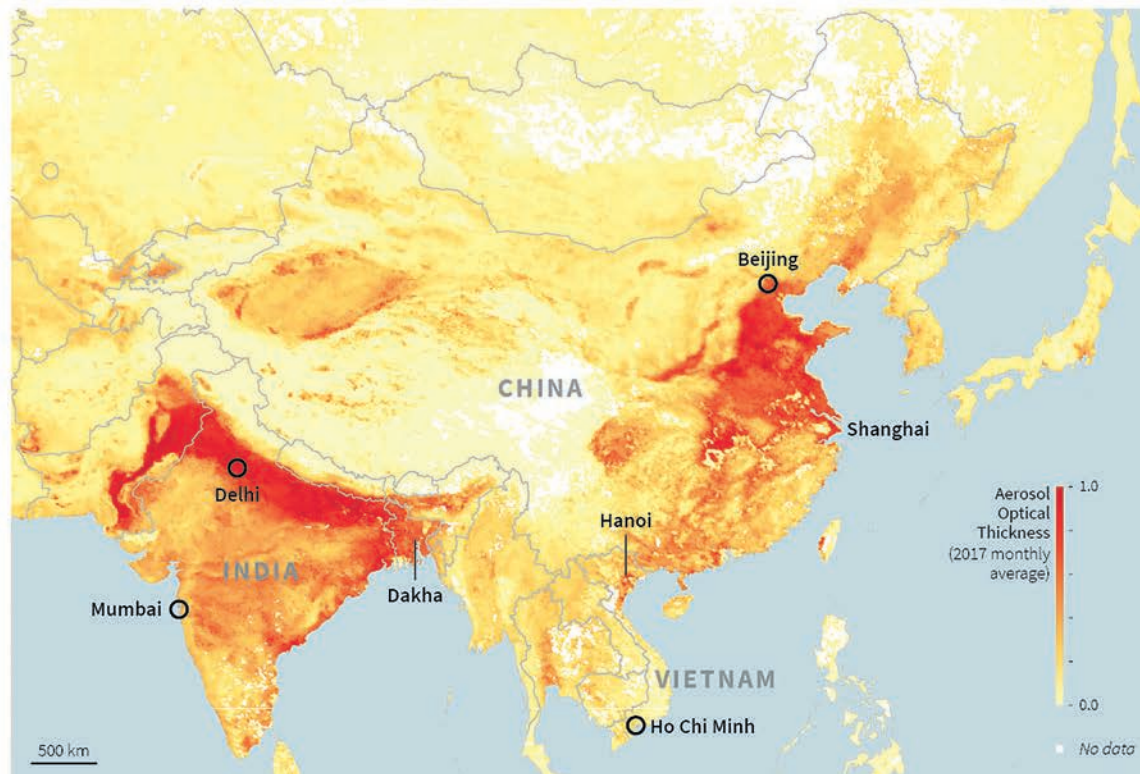
¹⁵ <https://www.press.uchicago.edu/ucp/books/book/chicago/C/bo27863392.html>

Choking cities

The World Health Organization (WHO) called Asia a critical battlefield in the global fight to rein in air pollution. Cities like Beijing, Delhi, Dhaka and Hanoi have seen PM2.5 concentrations far exceeding the WHO guideline.

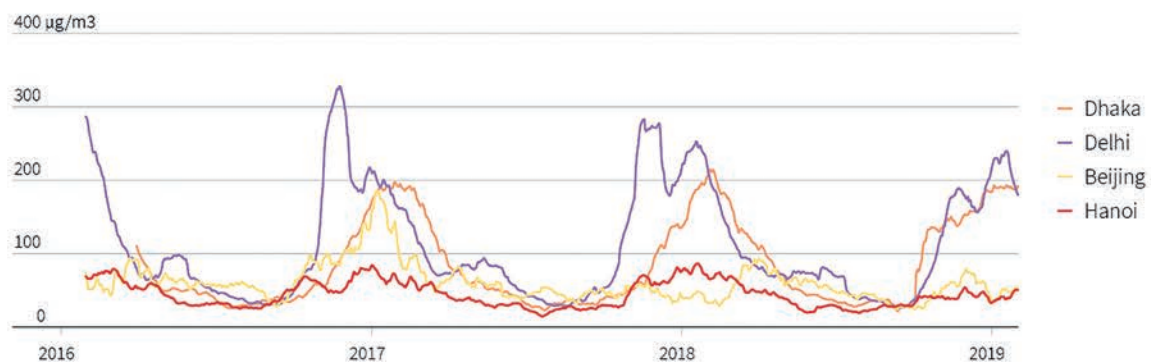
AEROSOL OPTICAL THICKNESS

Aerosols are tiny particles suspended in the atmosphere, such as windblown dust and pollution from factories. An optical thickness of less than 0.1 indicates a crystal clear sky with maximum visibility, whereas a value of 1 indicates very hazy conditions.



PM2.5 CONCENTRATIONS

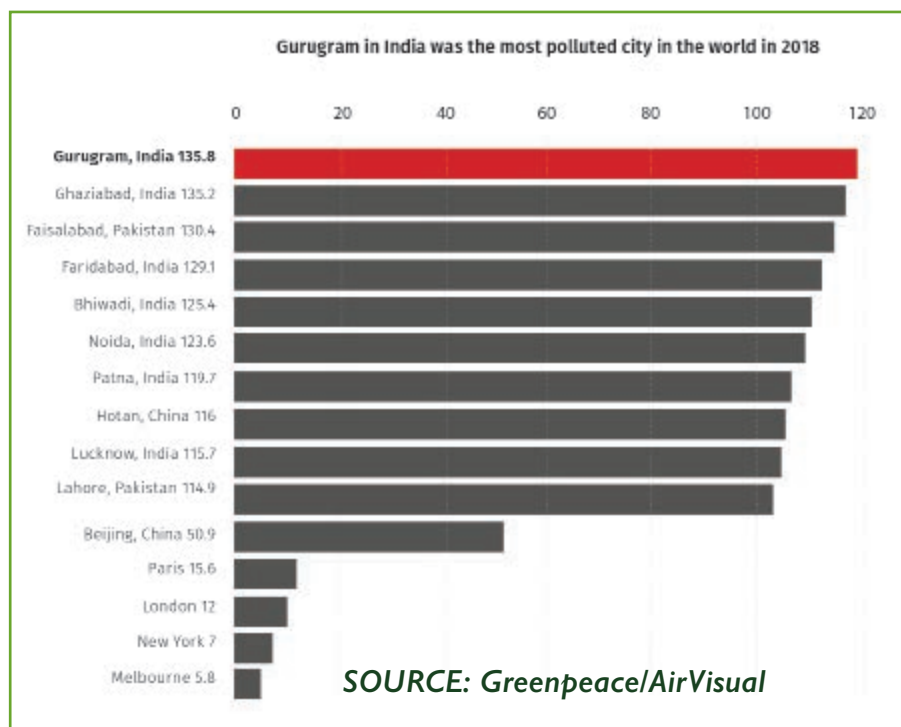
India's Delhi, China's Beijing, Bangladesh's Dhaka and Vietnam's Hanoi are experiencing high levels of fine particulate matter. These tiny particles, known as PM2.5, include dust, dirt, soot and smoke. They can penetrate deep into the lungs and even enter the blood. They've been linked to heart disease, strokes and cancer. Here are 30-day rolling averages of PM2.5 concentrations in micrograms per cubic metre.



Source: NASA's Earth Observatory; AirNow

Staff, 22/02/2019

REUTERS



WORLD'S MOST-POLLUTED:
(Left) India dominates the top of the list of the world's most-polluted cities.

Gurugram (previously known as Gurgaon) is a tech-hub city just to the southwest of Delhi, which is where many international companies, such as Uber and Trip Advisor, are headquartered, ranked the most polluted in the world, with more than 135 micrograms of PM2.5 per cubic metre (µg/m³) average throughout the year. Delhi is ranked 11th¹⁶



DAL-SOUPER: (Below) A man with his face covered walks in front of the India Gate amid smog in the early morning in New Delhi, India, November 8, 2018 (REUTERS)

CASE STUDY 1. The Six Cities Study

The public was first alerted to the dangers of PM_{2.5} pollutants in a groundbreaking report published in 1983 by the Harvard School of Public Health. Commonly known as “The Six Cities Study,”¹⁷ it was the first large-scale study of the effects on human health from fossil-fuel emissions such as sulfur dioxide and PM from soot and diesel exhaust or other fumes.

The report was based on findings over a period from 1974–1977 taken from random samples of adults from six communities in Watertown, Mass., Topeka, Kans., St. Louis, Mo.; Harriman, Tenn.;

Steubenville, Ohio; and Portage, Wisc., all of which are major industrial cities spread across the U.S. The study revealed a strong link between air pollution and mortality risk, paving the way for strengthened U.S. regulations on fine PM.

Douglas Dockery, lead author of the study, explained in 2014 why it was so important: “People in the dirtier cities were dying faster than people in the clean cities. We found that the mortality risk was strongly associated with fine-particulate concentrations (under 2.5 microns in diameter). The differences we

found in life expectancy — two to three years shorter — were remarkable. Those are big numbers in terms of population life expectancy.

“We were astonished that people in the clean cities were living that much longer, just because of where they lived.

“The ‘dirty’ communities were all within air pollution standards at the time — they weren’t defined as ‘unhealthy’ by the Environmental Protection Agency (EPA) — but the Six Cities Study strongly suggested negative health effects in those communities.”

CASE STUDY 2. The Brecon Beacons Soldier Deaths: When Ozone and PM Combine to Deadly Effect

The tragic deaths of three reservist soldiers doing Special Air Service (SAS) trials in the Brecon Beacons (a mountain range in South Wales) in 2013 throws up more questions than it answers — including a link to air pollution that hasn’t yet been widely acknowledged.

The official story is that the men died from hypothermia and heat exhaustion because their bodies were unable to regulate their temperature. However, on the day the three soldiers collapsed, temperatures were in the range of 79° (26.3° Celsius) from midday on the day of the march and had risen to 82.9° (28.3° Celsius) by 4:00 p.m., which is not excessive for those who had previously trained and served abroad, in testing conditions.

The exercise was part of the aptitude phase for selection for

a special military unit. The march was approximately 16 miles (26 kilometers), although those taking part (37 reservists and 41 regular troops) were expected to cover almost 18.5 miles (30 kilometers), which had to be completed to a strict timetable of eight hours and 45 minutes.

Corporal James Dunsby Lance, Corporal Edward Maher and Lance Corporal Craig Roberts were all young, fit and active men with an active service record.

For example, Corporal Dunsby Lance was a qualified combat medic and had served in Afghanistan during 2007 and 2008, whereas Lance Corporal Roberts took part in exercises several times, including a training mission in Texas with the American National Guard. Some of it involved hot weather training in the desert, so replicated

conditions in the Middle East.

The coroner attributed all three deaths to heat exhaustion. However, seasoned clean air campaigner Simon Birkett, who founded the Clean Air in London (CAL) campaign, found that ozone and particle concentrations were unusually elevated during the training period and is aware that these pollutants can adversely effect endurance athletes.

CAL considers it important to know whether, and if so how much, ozone or particle air pollution contributed to the deaths of the three SAS selection soldiers. CAL wrote to the coroner and the Health and Safety Executive accordingly. *N.B. The UK’s Ministry of Defence has been contacted for comment, but simply referred to a previous statement made following the soldiers’ deaths.*

17. <https://www.nejm.org/doi/full/10.1056/NEJM199312093292401>



Air Pollution: Mapping the Health Impacts Across the Whole Body

PLANE STUPID: A Ryanair plane passes over Ratcliffe Power Station, UK (REUTERS). Along with industrial causes, the accelerated use of polluting forms of transport such as airplane travel is a major contributor to health damages caused by air pollution

“

The failure to respect, protect and fulfill the right to breathe clean air is inflicting a terrible toll on people all across the world. The statistics fail to capture the magnitude of human suffering involved. Each premature death, every illness and every disability affect any individual with hopes, dreams and loved ones”

—David Boyd,
UN Special Rapporteur on Human
Rights and the Environment

Nearly every doctor and medical professional across the world is now aware of the growing body of evidence that points to the toxic effect air has on all our health outcomes. This evidence has been cited in over 70,000 scientific papers, according to United Nations (UN) Director of Public Health, Environmental and Social Determinants of Health, Dr. Maria Neira. In the UK, the Department of Environment, Food and Rural Affairs (DEFRA) has appointed a specialist Air Quality Expert Group (AQEG)¹⁸ to monitor this. However, this has yet to filter down into government action to combat it.

Different organizations reference the dangers by providing their own statistics. The WHO, for example, estimate that toxic air results in seven million premature deaths per year,¹⁹ whereas the UN holds the accumulative effects of pollution responsible for one in nine deaths²⁰ worldwide.

Yet another study published in the *European Heart Journal*²¹ doubles previous estimates, meaning toxic air is now killing more

people globally than tobacco smoking.

David Boyd, the UN's Special Rapporteur on Human Rights and the Environment, summarizes the human cost detailed in the *State of Global Air* as: “The failure to respect, protect and fulfill the right to breathe clean air is inflicting a terrible toll on people all across the world.

“The statistics presented [in the present report] depict a public health catastrophe, yet the numbers fail to

18. <https://uk-air.defra.gov.uk/library/aqeg/>

19. <https://www.who.int/airpollution/en/>

20. <https://www.unenvironment.org/explore-topics/air>

21. <https://academic.oup.com/eurheartj/article/40/20/1590/5372326>

capture the magnitude of human suffering involved. Each premature death, every illness and every disability affect any individual with hopes, dreams and loved ones.”

The reason air pollution is so dangerous is because it is systemic, meaning that in addition to its most well-known victim — our lungs — it can also harm “most other organs of the body.”

This was the concluding review of a recent scientific research paper called “Air Pollution and Noncommunicable Diseases,” published in the UK medical journal *Chest* (Feb, 2019).²²

Additional recent studies also link toxic air to degenerative illnesses such as dementia and Alzheimer’s.

What concerns doctors is the fact these once age-associated illnesses are now being diagnosed and seen in a population far younger than previously.

Professor Dean Schraufnagel, from the University of Illinois at Chicago, who led the project, told the *Guardian*: “I wouldn’t be surprised if almost every organ was affected.

“If something is missing [from the review published earlier this year], it is probably because

there was no research yet.”²³

Professor Schraufnagel adds that the main reason air pollution damages our bodies is because of the inflammation that results from our immune system’s response to the particles: “Immune cells think a [pollution particle] is a bacteria, [so they] go after it and try to kill it by releasing enzymes and acids.

“Those inflammatory proteins spread into the body, affecting the brain, the kidneys, the pancreas and so forth. In evolutionary terms, the body has evolved to defend itself against infections, not pollution.”



HITTING THEM YOUNGER: Students and their parents wear masks outside a public school, as classes in over 400 Bangkok schools have been cancelled due to worsening air pollution, in Bangkok, Thailand, January 30, 2019 (REUTERS)

22. [https://journal.chestnet.org/article/S0012-3692\(18\)32723-5/abstract](https://journal.chestnet.org/article/S0012-3692(18)32723-5/abstract)

23. <https://www.theguardian.com/environment/ng-interactive/2019/may/17/air-pollution-may-be-damaging-every-organ-and-cell-in-the-body-finds-global-review?>

An A-Z of Health Problems Caused by Air Pollution

According to a new report from the WHO,²⁴ air pollution is the second leading cause of deaths from noncommunicable diseases (NCDs) — meaning those illnesses not passed from person to person — after tobacco-smoking.


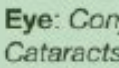











In 2018, the third UN high-level meeting on NCDs recognized household and outdoor air pollution as risk factors for NCDs, along with unhealthy diets, tobacco smoking, harmful use of alcohol and physical inactivity.

In fact, more than 550,000 deaths in the WHO European Region in 2016 were attributable to the joint effects of household and ambient air pollution. The latest figures announced at a WHO meeting in Geneva estimate that seven million deaths worldwide are attributable to pollution-related illnesses.

The *Chest* study provides a comprehensive alphabetical list of all the various diseases affecting the body, which are now shown to have a causal link to air pollution; as new research is done, the list is likely to expand. The list is extensive, covering all parts of the body, including the eyes, brain, heart, bones, skin, liver and brain, etc. It reads like an atlas or Who's Who of the body's physiology.

The alphabetical list of illnesses, allergies and diseases that have so far been shown to be linked to air pollution includes:

- allergic diseases;
- asthma;
- brain diseases and dysfunction;
- bone diseases;
- cancer — lung and all forms;
- cardiovascular diseases;
- cognitive function;
- diabetes;
- endocrine diseases;
- eye diseases;

	Brain: Stroke, Dementia, Parkinson's Disease
	Eye: Conjunctivitis, Dry Eye Disease, Blepharitis, Cataracts
	Heart: Ischemic Heart Disease, Hypertension, Congestive Heart Failure, Arrhythmias
	Lung: Chronic Obstructive Pulmonary Disease Asthma, Lung Cancer, Chronic Laryngitis, Acute and Chronic Bronchitis
	Liver: Hepatic Steatosis, Hepatocellular carcinoma
	Blood: Leukemia, Intravascular Coagulation, Anemia, Sickle Cell Pain Crises
	Fat: Metabolic Syndrome, Obesity
	Pancreas: Type I and II Diabetes
	Gastrointestinal: Gastric Cancer, Colorectal Cancer, Inflammatory Bowel Disease, Crohn's Disease, Appendicitis
	Urogenital: Bladder Cancer, Kidney Cancer, Prostate Hyperplasia
	Joints: Rheumatic Diseases
	Bone: Osteoporosis, Fractures
	Nose: Allergic Rhinitis
	Skin: Atopic Skin Disease, Skin Aging, Urticaria, Dermographism, Seborrhea, Acne

SOURCE: Chest, op. cit.

24. http://www.euro.who.int/__data/assets/pdf_file/0005/397787/Air-Pollution-and-NCDs.pdf?ua=1

- genito-urinary diseases;
- hayfever;
- hematologic diseases;
- immunologic diseases;
- liver diseases;
- mental illness;
- neurologic diseases;
- obesity;
- renal diseases;
- respiratory infections and diseases; and

- skin diseases (see diagram for specific details of the various diseases referred to here).

However, the main NCDs associated with air pollution include ischemic heart disease, stroke, chronic obstructive pulmonary disease (COPD) and lung cancer; we will now look in depth at a few of these illnesses and how their alarmingly substantial increase in cases around the world relates to air pollution.

Asthma's Deadly Toll

One billion people worldwide are now affected by chronic respiratory diseases, with asthma being a leading contender, according to *The Global Asthma Report* (2018).²⁵ This rapid advance is also showing little sign of decreasing. The burden of asthma is especially prevalent in Asia, and yet many cases remain underdiagnosed and undertreated. Asthma deaths in South Africa also remain among the highest in the world.

Asthma is described by Asthma UK²⁶ as a long-term condition that affects the airways — the tubes that carry air in and out of your lungs. Asthma usually causes symptoms such as coughing, wheezing and breathlessness. Potential triggers include pollution (indoor and outdoor fumes); exposure to cigarette smoking, whether active or passive; pollen; mold; and fungi. Such triggers can make asthma symptoms far worse, and may even bring on an acute asthma attack (a sudden worsening of asthma symptoms caused by the tightening of muscles around your airways, otherwise known as a bronchospasm).

During an asthma attack, the lining of the sufferer's airways becomes swollen or inflamed, and much thicker excess mucus — more so than normal — is produced. According to Asthma UK, around three people die from an asthma attack **every day** in the UK; sadly, many of these deaths are preventable, especially if a good asthma-management care plan is in place, is adhered to and regularly reviewed.

In recent years, medics have noticed the rise in rates of childhood asthma occurring globally, with a corresponding rise in airborne allergies that exacerbate the condition, which may also cause hayfever.²⁷ A recent study blames vehicle pollution for the estimated four million child asthma cases a year, which are equivalent to 11,000 new cases every day.

These findings, recorded in the *Lancet Planetary Health*,²⁸ represent the first global assessment of the impact of traffic fumes on childhood asthma based on data examining high-pollution areas. The key pollutant, nitrogen dioxide, is produced largely by diesel vehicles. Children may need to use their asthma-relief inhalers more frequently when pollution levels are high.

Apparently, young Britons head up the European table of asthma mortalities.²⁹ Some recent data from King's College estimates that 4,000 children and young people are admitted to hospital every year in the UK due to asthma (170 of these to Intensive Care Units).³⁰

On average, 23 children aged 0–14 die from asthma every year in the UK, and the King's College data has also linked some of these deaths to air pollution. According to Asthma UK, around 1,200 deaths per year are attributable to asthma in the UK, with Manchester Central and Northern Manchester exceeding even London, showing a level that is twice the national average rate of emergency hospital admissions.

TIJ spoke to Dr. Binita Kane to hear her views on this. “As a respiratory doctor, I believe there is valid research linking air pollution and asthma. Professor Angela Simpson has done some interesting work here in Manchester that has shown that the closer proximity a child is to a main road, the greater the correlation to lung-growth retardation. Even low levels can change the heart — they've found carbon particles in placentas.”

By 2025, an additional 6,000 deaths will have occurred, and the UK doesn't even have the highest world ranking for asthma deaths. (Figure estimated from 2019–2025 based on the annual number of asthma deaths: 1,200.)

25. <http://www.globalasthmareport.org/Global%20Asthma%20Report%202018.pdf>

26. <https://www.asthma.org.uk>

27. <https://www.climate.gov/news-features/climate-and/climate-allergies>

28. [https://www.thelancet.com/journals/lanpla/article/PIIS2542-5196\(19\)30046-4/fulltext](https://www.thelancet.com/journals/lanpla/article/PIIS2542-5196(19)30046-4/fulltext)

29. <https://www.nuffieldtrust.org.uk/research/international-comparisons-of-health-and-wellbeing-in-adolescence-and-early-adulthood>

30. https://www.london.gov.uk/sites/default/files/asthma_kings_report_april_2019_final.pdf

BOX 2: Justice for Ella



Rosamund Kissi-Debrah (pictured above, talking to a PA journalist) and her family know all too well the dangers of air pollution after her daughter Ella Roberta's fatal asthma attack in 2013 aged just nine years old

Ella was a very bright and active child who attended dance and swimming classes, and who dreamed of becoming an air-ambulance pilot. Unfortunately, from the age of six, she began experiencing breathing difficulties. For the next 28 months, she was in and out of hospital. Following her death, an inquest took place that concluded her triggers were airborne, but it never specified what these were.

In January 2019, the Attorney-General agreed to the family's request for a second inquest, which was submitted by Ella's attorney, Jocelyn Cockburn, and was based on new evidence presented by Professor Stephen Holgate, who has studied the impact of air pollution on people's health for many years.

Professor Holgate examined Ella's case and concluded there was a strong association between Ella's symptoms and the family's close geographical location to South London's busy South Circular Road, where fumes from a constant stream of traffic blight the air.

On May 2, 2019, the High Court agreed, with Judge Mark Lucraft QC saying: "In our judgment, the discovery of new evidence makes it necessary in the interests of justice that a fresh inquest be held."

Following the High Court findings, Kissi-Debrah said: "The past six years of not knowing why my beautiful, bright and bubbly daughter died has been difficult for me and my family, but I hope the new inquest will answer whether air pollution took her away from us.

"If it is proved pollution killed Ella, then the government will be forced to sit up and take notice that this hidden but deadly killer is cutting short our children's lives." There isn't a date set for the second inquest hearing at present, but it is likely to start within the next year.

As part of Kissi-Debrah's research for a pressure group she set up recently called @mumsforcleanair, she looked at the statistics of child asthma deaths, and now presents these facts in a compelling and direct manner when speaking publicly.

"My daughter [Ella Roberta, pictured on Rosamund's sweatshirt above] was one of 27 children who died from asthma in 2013. The figure has varied since, but it is still significant.

"Since Ella's death, a further 135 children aged 0–14 have died — that's the equivalent of two-and-a-half classrooms (effectively, half a primary school). Imagine how much higher the figures would be if children younger than five and young people aged 15 and above were added into the equation."

COPD

Chronic obstructive pulmonary disease (COPD) should be considered in any patient who has symptoms of a chronic cough, sputum production, dyspnea (difficult or labored breathing) and a history of exposure to risk factors for the disease. As the disease develops slowly, it is most frequently diagnosed in people aged 40 or over.

A 2016 report³¹ by the Royal College of Physicians explained that patients with COPD have a diminished capacity to clear inhaled material from their lungs, and as a result, may incur a higher-than-normal “dose” at any level of air pollution. In response to elevated levels of

pollution, individuals with COPD experience a greater fall in lung function and a higher risk of admission to hospital than healthy persons of the same age.

Although tobacco smoke is the main contributory factor for COPD in middle- and high-income countries according to WHO data, exposure to indoor air pollution through use of biomass fuels for cooking and heating is the main factor in lower-income countries. This accounts for the high prevalence of COPD among non-smoking women in parts of the Middle East, Africa and Asia. Indoor air pollution resulting from the burning of wood and other biomass fuels is estimated to kill two million women and children each year.

A 2018 study published in *The Lancet Planetary Health* showed a further association between high levels of PM_{2.5} and developing COPD.³² Guo and his research colleagues established the association by recording incidents of COPD at a second visit in patients who did not have COPD at the first visit.

There was an average gap of five years between the visits, in which each patient was given repeated lung-function tests, assessed using numerous parameters, to show internal consistency throughout. The biological plausibility of the relationship between PM_{2.5} and lung health was further supported by a finding of decreased lung function from 590,278 observations.

Other risk factors for COPD include exposure to occupation-related dusts and chemicals (such as vapors, irritants, asbestos and fumes used in cleaning), and frequent lower-respiratory infections during childhood.

“

Exposure to indoor air pollution through use of biomass fuels for cooking is the main factor for COPD in lower-income countries — this accounts for the high prevalence of COPD in women in the Middle East, Africa and Asia”

Diabetes

Doctors have also been surprised by the global increase in cases of diabetes. Researchers working on a study published in *The Lancet Planetary Health* (2018)³³ estimate that pollution contributed to 3.2 million new cases of diabetes worldwide in 2016, about 14% of all the new cases that year.

They established this using the PM_{2.5} index,³⁴ which measures air quality from suspended particles with a diameter of less than 2.5µm in the atmosphere. These interactions ultimately disrupt the body, which it is believed may also alter the

body’s sensitivity to insulin and ability to produce it.

The study also notes that the risk of pollution-related diabetes is much higher in higher-population, rapidly developing countries such as India, China, and Indonesia, which may lack clean-air policies, while those Western countries that have adopted safeguards, including Canada, Australia and New Zealand, have a lower risk.

WHO data also predicts that the surge of diabetes cases is on an upward trajectory of growth; by 2030, it is projected to be the seventh leading cause of death worldwide.³⁵

31. <https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution>

32. [https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196\(18\)30028-7/fulltext](https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(18)30028-7/fulltext)

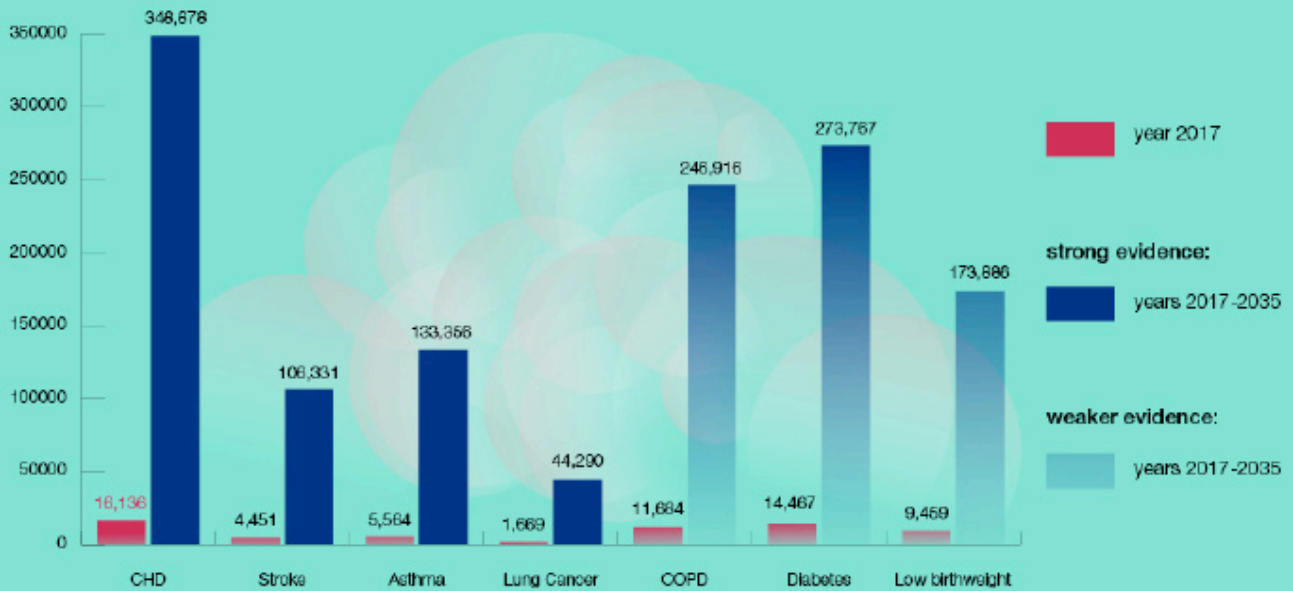
33. <https://www.sciencedirect.com/science/article/pii/S2542519618301402?via%3Dihub#fig2>

34. <https://www.airnow.gov/index.cfm?action=aqibasics.aqi>

35. <https://www.who.int/campaigns/world-health-day/2016/en/>

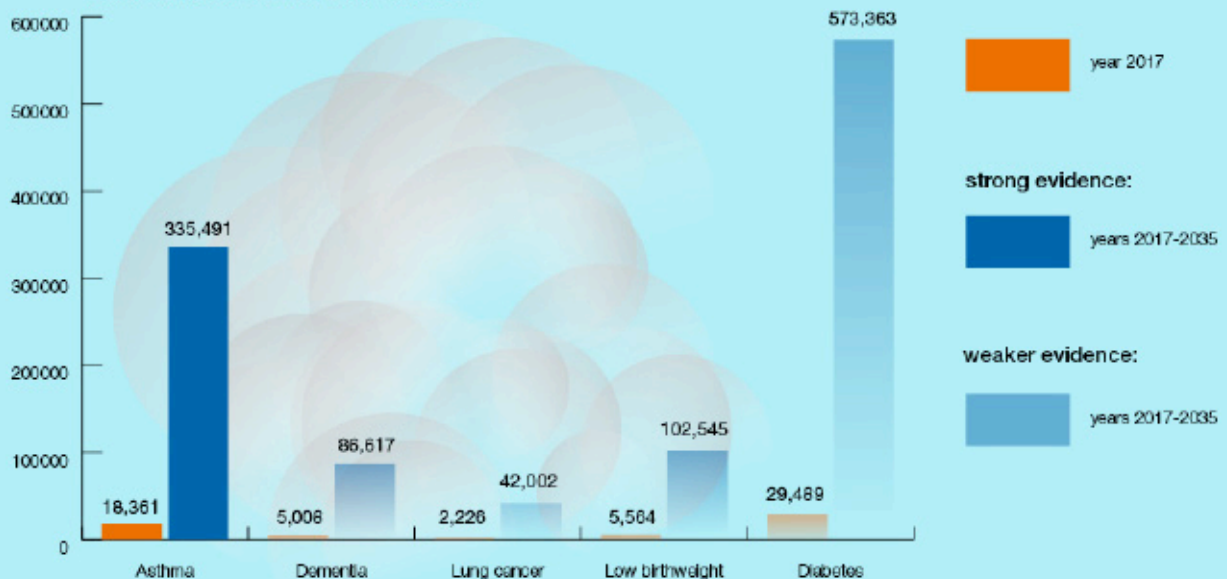
Conditions associated with exposure to PM_{2.5}

Cumulative incidence cases attributable to PM_{2.5} in England by disease and total between 2017 and 2035



Conditions associated with exposure to NO₂

Cumulative incidence cases attributable to NO₂ in England by disease and total between 2017 and 2035



RISK FACTORS: Charts showing the prevalence of conditions such as those reviewed in this section (e.g. asthma, COPD, diabetes, lung cancer, heart disease, etc.) from long-term exposure to particulate matter of 2.5 microns (PM_{2.5}) and Nitrous Oxide (NO₂) (Used with permission from Public Health England — Health Matters: Air Pollution Impacts and Actions³⁶)

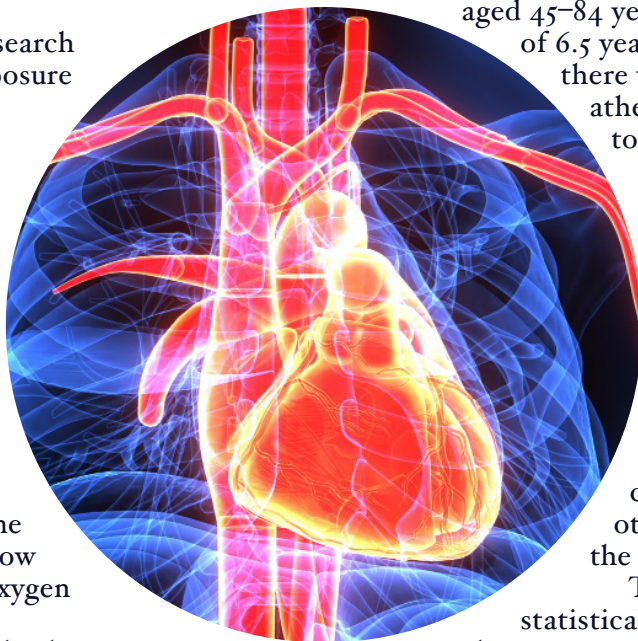
36. <https://publichealthmatters.blog.gov.uk/2018/11/14/health-matters-air-pollution-sources-impacts-and-actions/>

Ischemic Heart Disease and Other Heart Problems

Ischemic heart disease is the term given to heart problems caused by narrowed heart arteries. When arteries are narrowed, less oxygen and less blood reach the heart muscle. This is also called coronary artery disease and coronary heart disease, which can ultimately lead to a heart attack.

Newly published research suggests that chronic exposure to ambient ozone may raise the risk of heart atherosclerosis³⁷ — a condition that occurs when fatty deposits such as cholesterol, fat or cellular waste accumulate inside a person's arteries — and harm arterial health. Atherosclerosis³⁸ causes a buildup of plaque inside the walls of blood vessels, which thickens the arteries, restricting the flow of blood, nutrients and oxygen to the rest of the body.

Atherosclerosis can lead to more



dangerous cardiovascular events, such as coronary heart disease (CHD)³⁹ or peripheral artery disease,⁴⁰ as well as a heart attack⁴¹ or stroke.⁴²

In a recent U.S. study, the *Multi-Ethnic Study of Atherosclerosis*, led by author Leng Wang, researchers clinically followed 6,619 adults, aged 45–84 years old, for a mean period of 6.5 years, to establish whether there was an associated risk for atherosclerosis through exposure to ozone.

The participants were of varied ethnic backgrounds and represented a geographical spread of six cities across the U.S.: Winston-Salem, N.C.; New York City, N.Y.; Baltimore, Md.; St. Paul, Minn.; Chicago, Ill.; and Los Angeles, Calif. None of them had experienced cardiovascular disease or any other heart condition before the study.

The researchers used statistical models to capture whether there were significant associations between ozone exposure and [atherosclerosis]. In concluding his findings, Weng said: “[The model] suggests there is an association between long-term exposure to ozone and progression of atherosclerosis.”

Research also links air pollution to heart and circulatory damage. The British Heart Foundation explains how pollution can affect the normal electrical functioning of the heart and circulation by damaging the inside walls of blood vessels, causing them to become narrower and harder.⁴³ Restricting the movement of blood vessels means the blood is more likely to clot; it can also increase blood pressure and strain the heart.

As people age, these blood-circulation problems can either cause new health conditions or exacerbate existing conditions, leading to an increased risk of heart attacks, stroke, heart failure, heart-valve disease, atrial fibrillation (abnormal heart rhythm) and angina.

“

Newly published research suggests that chronic exposure to ambient ozone may raise the risk of heart atherosclerosis, which can lead to more dangerous cardiovascular events such as a heart attack or stroke”

37. <https://ehp.niehs.nih.gov/doi/10.1289/EHP3325>
 38. <https://www.heart.org/en/health-topics/cholesterol/about-cholesterol/atherosclerosis>
 39. <https://www.medicalnewstoday.com/articles/184130.php>
 40. <https://www.medicalnewstoday.com/articles/188939.php>
 41. <https://www.medicalnewstoday.com/articles/151444.php>
 42. <https://www.medicalnewstoday.com/articles/7624.php>
 43. <https://www.blf.org.uk/support-for-you/air-pollution>



“EVERY BREATH MATTERS”: People pass by an installation of an artificial model of lungs illustrating the effect of air pollution outside a hospital in New Delhi, India, November 5, 2018 (REUTERS)

Lung Cancer

In 2013, the WHO’s International Agency for Research on Cancer (IARC) announced that air pollution was the leading environmental cause of deaths from lung cancer, caused by exposure to high levels of PM_{2.5} pollutants.⁴⁴

About 6,000 non-smoking Britons a year now die of the disease, more than those who lose their lives to ovarian or cervical cancer, or leukemia, according to recent research published in the *Journal of the Royal Society of Medicine*. “If considered as a separate entity, lung cancer in never-smokers is the eighth most-common cause of cancer-related death in the UK, and the seventh most-prevalent cancer in the world,” the authors state.⁴⁵

According to the American Lung Association,

ground-level ozone (a.k.a. smog) damages lung tissue when we breathe it in.⁴⁶ Ozone is a gas molecule that harms lung tissue by chemically reacting to it, and it is produced from the interaction of many different pollutants to sunlight. It is also a cause of asthma and other chronic respiratory illnesses.

Although this condition is thought to take many years to develop, the risk increases as the level of exposure heightens. This explains why exposure in childhood could now be linked to lung cancer in adults.

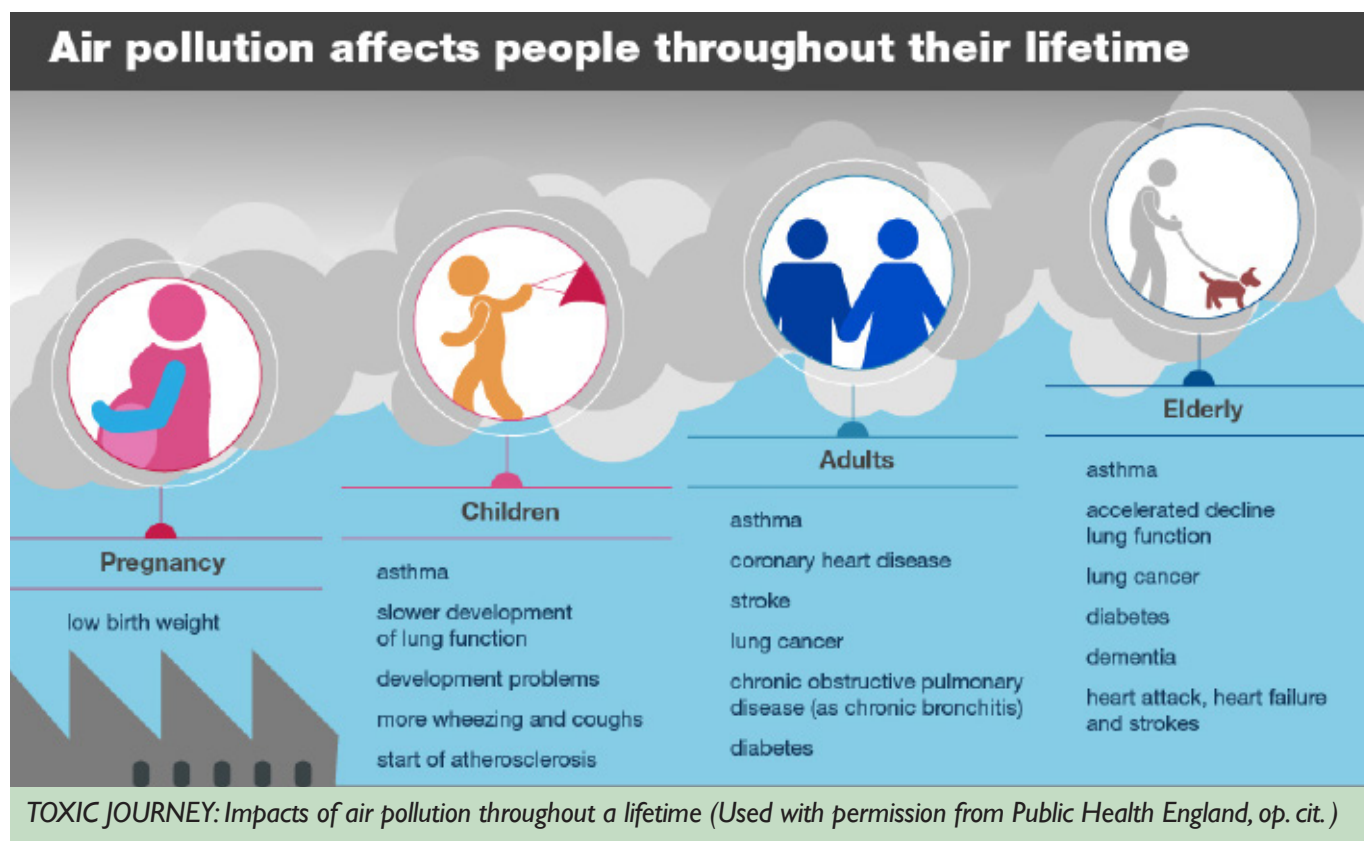
Of course, the illnesses referred to above are not the whole story. The total toll of pollution’s damages to our health is further amplified with a review of the health impacts experienced across an entire human lifespan.

44. https://www.iarc.fr/wp-content/uploads/2018/07/pr221_E.pdf

45. <https://journals.sagepub.com/doi/abs/10.1177/0141076819843654?journalCode=jrsb&>

46. <https://www.lung.org/our-initiatives/healthy-air/outdoor/air-pollution/ozone.html>

Air Pollution: Health Impacts Across an Entire Human Life Span



From the Womb to Newborn Babies and Infants

According to the United Nations Children's Fund, **17 million babies around the world now breathe toxic air.**⁴⁷ However, the toxic overload begins long before birth, while a child is still in the womb.

We are arguably part of the way there by already being aware of the significant body of research linking the adverse effects of maternal smoking on the developing fetus. Yet by cross-referencing Dr. Grigg's point on equating pollution to smoking, you will see why this is a public health crisis of epidemic proportions.

A mother doesn't have to smoke or be near it to harm the fetus: she is already effectively passively smoking simply by breathing.

As the mother inhales polluting particles, these are absorbed into her bloodstream and then passed on to the developing fetus. While even more evidence is needed, it is clear the systemic nature of air pollution, which passes from the lungs and into the blood, can also affect the normal development of the fetus, as well as trigger labor.

Last year, British researchers also found black-carbon particles in

the placentas of pregnant women residing in East London.⁴⁸

Dr. Liu, one of the researchers involved in the study, said: "Our results provide the first evidence that inhaled pollution particles can move from the lungs into the circulation and then to the placenta."

"We do not know whether the particles we found could also move across into the fetus, but our evidence suggests this is indeed possible. We also know that the particles do not need to get into the baby's body to have an adverse effect, because if they affect the

47. <https://www.unicef.org.uk/clean-air-child-health-air-pollution/>

48. <https://www.qmul.ac.uk/media/news/2018/smd/first-evidence-that-soot-from-polluted-air-may-be-reaching-placenta.html>

placenta, this will have a direct impact on the fetus.”

Pollution has also been cited as a main causal factor in miscarriages, pre-term births, infant deaths and the numbers of babies being born underweight. Many doctors cite the *Escape* study (2013),⁴⁹ which details the impact

Journal (2017) found that air pollution significantly increases the risk of underweight babies. Low weight at birth has been proven as leading to lifelong damage to health.⁵⁰

The study analyzed all live births in Greater London over four years over 540,000

lead Mireille Toledano says: “The power of our study is incredible, due to the sheer numbers.”

Additional studies have shown that the average exposure of pregnant women residing in London to fine-particle pollution was 15µg/m³, which is well below UK legal limits, but 5µg/m³ higher than the WHO’s guideline. The researchers estimate that cutting pollution to the WHO guideline could prevent 300–350 babies a year from being born underweight.

Comments Toledano: “We know that [preventing] low birth weight is absolutely crucial. It not only increases the risk of the baby dying in infancy, but it also predicts a lifelong risk of diabetes, cardiovascular disease, etc. — setting in stone the whole trajectory of lifelong chronic illness.”

Given that many cities around the world — such as Delhi, India⁵¹ — suffer far higher levels of toxic air⁵² (see chart on p. 9) than the UK, this study raises concerns of the huge impacts on unborn babies globally where large numbers are at risk of considerable harm.

“

A mother doesn't have to smoke or be near it to harm the fetus: she is already effectively passively smoking simply by breathing”

of pollution on a child’s early development, based on examples taken from across Europe.

The study’s findings showed an 18% increase in the risk of underweight babies at term, as well as an increase in rates of pneumonia for the first two years of life.

A more recent study published in the *British Medical*

in total — and determined the link between the air pollution experienced by the mother and babies being born underweight, defined as less than 5.5 lbs. (2.5 kilograms).

The scientists found a 15% increase in risk of low birth weight for every additional 5µg/m³ of fine-particle pollution. Study

Air Pollution’s Health Impacts on Infants and Toddlers

Infants, toddlers and younger children bear a disproportionate burden from dirty air because being lower to the ground in height, or being transported in their baby carriages along dirty urban or suburban streets, means their exposure to toxic fumes is greater. Their intake of these particulates is enhanced because their physiology means they inhale less effectively through the nose than adults, and they also breathe faster.

The cumulative effects are known to not only stunt growth, but affect a child’s cognitive functioning,

as evidenced in a WHO report (2018)⁵³ linking air pollution with adverse long-term health outcomes for children’s health.

Many doctors are at first reluctant to diagnose asthma at such an early stage, as younger children and babies are naturally prone to various respiratory illnesses. While this is true, Dr. Grigg cites evidence from a 2009 study showing that 42% of children in the Leicester, UK, area alone had demonstrated a preschool wheeze.⁵⁴

When combined with all the evidence contained in the WHO report, this statistic demonstrates

that there is arguably a strong case for suggesting that the onset of childhood asthma may begin at a far earlier age, and therefore current childhood asthma statistics are grossly underestimated.

“

Being lower to the ground means infants and toddlers inhale more toxic fumes”

49. <http://www.escapeproject.eu/publications.php>

50. <https://www.bmj.com/content/359/bmj.j5299>

51. <https://www.theguardian.com/world/2017/nov/07/delhi-india-declares-pollution-emergency-as-smog-chokes-city>

52. <https://edition.cnn.com/2019/03/05/health/100-most-polluted-cities-2018-intl/index.html>

53. <https://www.who.int/ceh/publications/air-pollution-child-health/en/>

54. <https://www.le.ac.uk/ebulletin-archive/ebulletin/news/press-releases/2000-2009/2009/02/nparticle.2009-02-18.html>

Air Pollution's Health Impacts on School-age Children

OUTDOOR DANGERS: Grassroots group @Mumsforlungs is campaigning against pollution from idling cars near schools, which exposes children to dangerous fumes as they play outside (REUTERS)



As children grow, the amount of air pollution they are exposed to accelerates. The systemic changes that began in the womb now affect every part of a child's growing mind and body — and new alarming statistics emerge with each new study.

Gardiner mentions in *Choked* that some schools don't permit their children to take part in outdoor activities at times when the air-pollution levels are so high.

In the UK, grassroots campaign group @Mumsforlungs — one of many such community action groups that have sprung up in London and across the nation — was set up by women seeking to improve their children's health. They are campaigning to prevent drivers from "idling" by switching off their vehicle engines when stationary, as well as closing streets in and around local schools.

Unfortunately, while some schools and nurseries have installed monitors or filled their classrooms with pollution-cleaning plants, the air pollution is still there as soon as the children step outside.

The Lancet conducted a public health study of East London, an area with a large proportion of schools exposed to high levels of air pollution. The study found that these schoolchildren experienced a 5% loss of lung functioning across a five-year period.⁵⁵

The Times's recently launched Clean Air For All campaign advocates traffic bans outside all London schools, citing research that showed nearly 500 schools in London were exposed to illegally high levels of pollution. However, *The Times* article exposed this as a gross underestimation, claiming that every single school in the capital exceeds the WHO's legal limits.

There is also a potential causal link between air pollution and the rising levels of childhood obesity. When children start primary school, one in five of them are overweight, yet the percentage of children who are overweight when starting secondary school age is even more damning: 34.3%, or roughly one in three, according to the latest U.K. government statistics.⁵⁶

While sedentary lifestyles and poor diets are major contributory factors, a reluctance to go outside and exercise due to poor air quality may also be involved.

55. <https://thorax.bmj.com/content/74/5/432>

56. <https://www.ethnicity-facts-figures.service.gov.uk/health/preventing-illness/overweight-children/latest>

Teen Angst

Fast-forward to the teenage years, where young people already face a myriad of health concerns, exacerbated by today's obsession with social media and an overreliance on digital entertainment forms such as video gaming, which draw them away from otherwise "healthy" outdoor pursuits.

Although poor air quality may be a factor in keeping children indoors, it is more often a symptomatic habit or pattern reinforced by current social norms.

Many teenagers experience moderate-to-severe health and emotional/psychological issues that are amplified by factors such as peer pressure, demands from schools and parents, and changing hormone levels — all of which can put them at increased risk of depression, eating disorders, self-harm experimentation, addiction to various substances and other forms of psychological abuse. However, a recent *New Scientist* study has also linked air



TEEN SPIRIT: Two teenage girls at the #FridaysforFuture march in Westminster, London, on February 15, 2019. Air pollution has been linked to teenage psychosis and other disorders

pollution to teenage psychosis.⁵⁷

Fisher and her colleagues concede the effects of noisy traffic may be more significant than air pollution, yet their findings also revealed that 30% of a group of 2,000 18-year-olds reported having had at least one psychotic experience, with an

increased risk for those living in high-pollution areas.

While more studies need to be done in this field to establish a causal link, pollution clearly does have an adverse effect on cognitive development, which makes the link to mental health disorders much more plausible.

Air Pollution's Health Impacts on Young to Middle-aged Adults

In the UK, the aforementioned *Journal of the Royal Society of Medicine* article entitled "Lung cancer in never-smokers: a hidden disease" (2019)⁵⁸ shows an alarming increase in younger women who have never smoked being diagnosed with lung cancer.

The report suggests one of the reasons women may be disproportionately affected is because of the time they spend cooking, which is a form of indoor air pollution. One of the study's lead authors, Paul Cosford, director of Public Health England, was also

diagnosed with lung cancer, despite being a non-smoker.

Summarizing the findings, Cosford says: "For too long, lung cancer has only been thought of as a smoking-related disease. This remains an important association, but, as this work shows, the scale of the challenge means there is a need to raise awareness with clinicians and policy-makers of the other risk factors, including indoor and outdoor air pollution."

In addition to a rise in adult onset asthma rates, doctors have also been surprised by increased

cases of adult onset diabetes; see sections on both for links to air pollution.

According to the British Heart Foundation (BHF),⁵⁹ air pollution is also linked to increases in high-blood pressure, which typically afflicts young to middle-aged adults.

It cites a study of 41,000 people across five different countries over a period from five to nine years, which was conducted by the Center for Health and Society at Heinrich-Heine-University of Düsseldorf⁶⁰ in Germany and

57. <https://jamanetwork.com/journals/jamapsychiatry/article-abstract/2729441>

58. <https://journals.sagepub.com/doi/abs/10.1177/0141076819843654?journalCode=jrsb>

59. <https://www.bhf.org.uk/what-we-do/news-from-the-bhf/news-archive/2016/october/long-term-exposure-to-air-pollution-and-traffic-noise-effects-blood-pressure>

60. <https://www.uniklinik-duesseldorf.de/en/unternehmen/institute/centre-for-health-and-society/>



KILLER ON THE STREETS:

A woman covers her face as she walks near the site of a steam-pipe explosion, containing dangerous amounts of asbestos, in midtown Manhattan during the morning commute in New York July 19, 2007 (REUTERS). A recent study found that one extra per 100 adults living in the worst-polluted urban centers would develop high-blood pressure compared to those in less-polluted areas. Asbestos fumes have been shown to cause mesothelioma, a form of cancer that covers the outer surface of the body's organs⁶¹

published in the *European Heart Journal* in 2016, which found that among adults, nearly one extra per 100 persons living in the worst-polluted urban locations would develop high-blood pressure (hypertension), compared to people of the same age group

living in less-polluted areas.

BHF Associate Medical Director Jeremy Pearson commented: "Air pollution, particularly from small particles in diesel fumes, is known to increase a person's risk of heart attacks and strokes, which is why

managing your blood pressure is so important.

"However, further research is needed to understand exactly how air pollutants can increase blood pressure and how important their effects are on cardiovascular health."

Air Pollution's Health Impacts on Ageing and Elderly Populations

It is often thought the immune system weakens with age, but research indicates the reverse may be true: the immune system actually overreacts as we get older, as the body creates more inflammation when it confronts a virus.⁶² This, in turn, speeds up the ageing process. When you connect it with the effect pollution has on the body, where the body attacks the pollution thinking it is a virus, the increase in inflammation makes sense.

While the body naturally creates more inflammation as it ages, the pollution itself can be inflammatory, thus intensifying the entire inflammatory effect on the body.

While more people are living longer around the world, thanks to advances in science, there is also a growing body of research that suggests the links between air pollution and progressively degenerative illnesses such as Alzheimer's, vascular dementia and Parkinson's Disease.⁶³ This establishes beyond a doubt that extended exposure to air pollution will increasingly damage the cognitive and motor functions

of this booming ageing population. It is estimated that every 10µg/m³ increase in exposure to black-carbon PM is equivalent to two years' cognitive decline through ageing.⁶⁴ Moreover, several studies support the notion that such cognitive effects increase the risk of dementia.

The Alzheimer's Society UK believes the most convincing evidence to date comes from a study of 6.6 million Canadians, which was published in *The Lancet* in January 2017. The study reported a potential link between dementia and living too close to busy roads: those within 54.6 yards (50 meters) of a major road were 7% more likely to develop dementia than those more than 328 yards (300 meters) away, where fine-PM levels are often 10 times lower.⁶⁵

As there are other factors associated with living on a busy road, such as high noise pollution and stress, this study doesn't prove conclusively that air pollution causes dementia. However, it does suggest that the study of air pollution and dementia should be prioritized for future research.



AGE LIMITATIONS: Women receive treatment for respiratory issues at a hospital in New Delhi, India, November 2, 2018 (REUTERS)

62. <https://secure.jbs.elsevierhealth.com/action/getSharedSiteSession?redirect=https%3A%2F%2Fwww.cell.com%2Fcell-host-microbe%2Ffulltext%2FS1931-3128%2F02809%2F02900347-3&rc=0>
63. <https://www.sciencedirect.com/science/article/pii/S231941701830283X>
64. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6138768/>
65. [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(16\)32399-6/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(16)32399-6/fulltext)

Today's Situation: Potential Solutions

Health Dangers of an Unchecked Consumerist Society

So how has the world got into a situation where many are dying prematurely, while others may be living for many years longer than their predecessors, yet with chronic, life-limiting or degenerative illnesses? Are our lifestyles a contributing factor? And how can we address these problems?

Over the past few decades, more people than ever worldwide have had the opportunity, through an increase in their living standards, to become dedicated, choosy consumers. Today's unprecedented freedom of choice reflects a seemingly insatiable thirst for the latest food and fashion trends, the most up-to-the-minute household appliances and technology, and endless options for entertainment and transport modes, with diesel-powered cars leading the latter.

Consumer goods are brought across continents in large, heavily polluting cargo ships, or transported by diesel trains or airplanes that fly in exotic crops from different continents, using highly polluting fossil fuels.

Whereas foreign travel was once seen as an unaffordable luxury, today we casually take long-haul flights as often as short-haul ones, whether for business or leisure. We overconsume our planet's resources with the relentless drive for technology fuelling our desires for newer, faster, lighter products and more exotic goods, all the while thoughtlessly destroying our home and the very things that sustain

life, including the plants that add life-giving oxygen molecules to the polluted air we breathe.

There is also an increase in the populations of people across the planet travelling daily on packed, polluted commuter trains; using highly polluting heating and air-conditioning units and dangerous wood-burning stoves — an increasingly popular status symbol, but a killer (see box). As the pace of life quickens and cities grow, there is a correlative growth in respiratory illnesses.

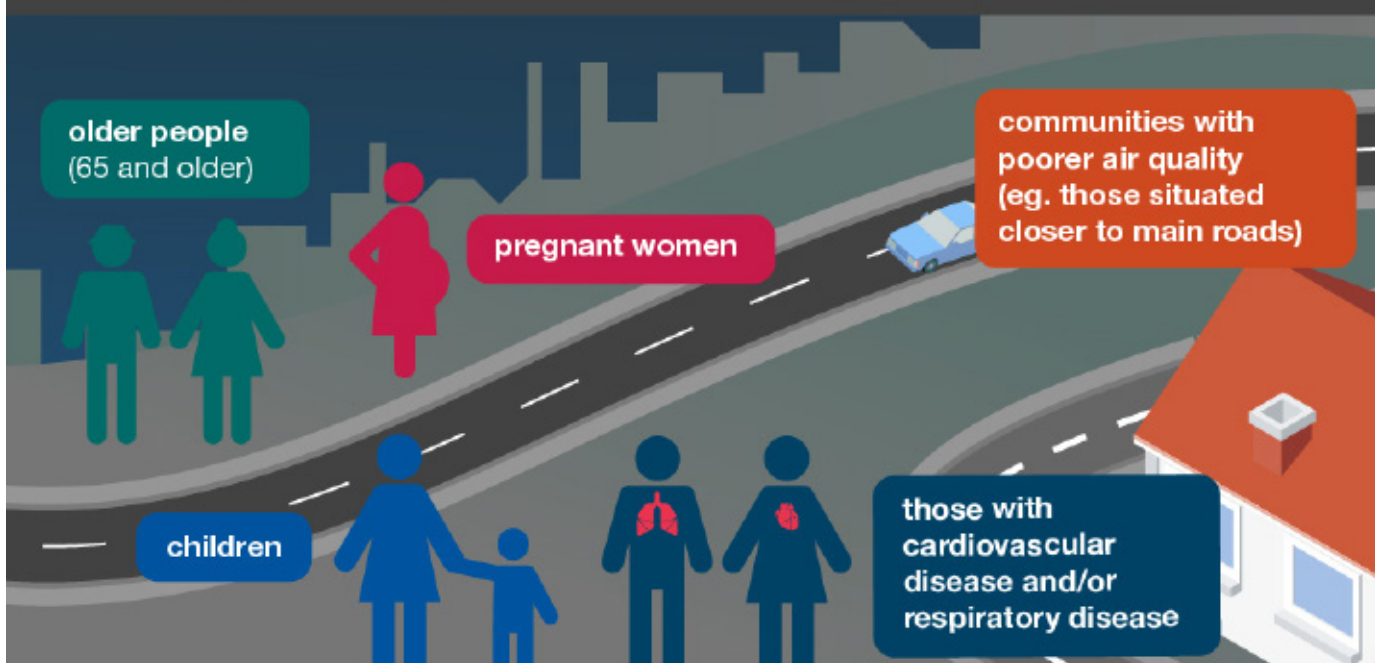
But it's not just cities that are at fault: agriculture also accounts for high levels of pollution. Every year, farmers spread manure on their fields, which means dangerous levels of PM2.5 and ozone combine to dangerous effect.

Yet as the world gets ever more crowded, more wood is burned for fuel or cooking, more land cleared of oxygen-giving forests to create grazing fields for livestock to feed the growing populations of demanding meat consumers, and hotter engines continue to pump out dirty emissions, the levels of harmful particles increase. This toxic accumulation appears unstoppable.

HIGH-WIRE ACT: Camp for Climate Change demonstrators set up their protest site at Blackheath in South London on August 26, 2009 (REUTERS)



Air pollution affects everyone but there are **inequalities in exposure** and the **greatest impact on the most vulnerable**



UNEQUAL IMPACTS: Pollution disproportionately affects the vulnerable (Used with permission from Public Health England, op. cit.)

Although advances in consumer spending are an increasing contributor to air pollution indices in most developed and developing countries around the world, there is also a significant body of work linking socioeconomic deprivation and inequality with the health impacts from poor air quality.

Professor Jon Fairburn (inset, pictured), who heads up the Institute for Environment, Sustainability and Regeneration at the University of Staffordshire, has been studying this issue for two decades, and created the air-quality index that is used as part of the *Index of Multiple Deprivation*. He recently contributed to a paper presented to the five-yearly WHO environmental health conference, which references industrial pollution, green places and air quality, etc. in its review of socioeconomic deprivation and health inequality.

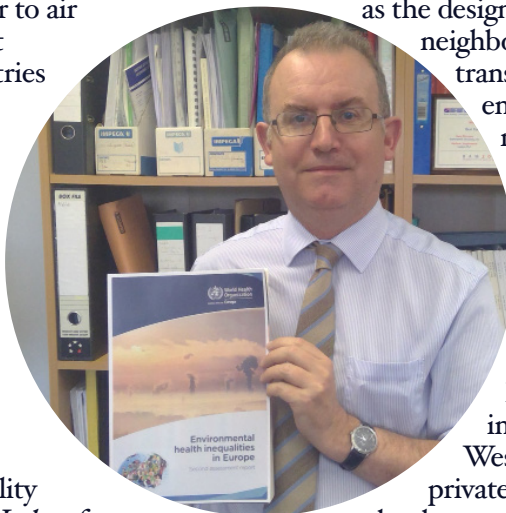
This report on environmental and health inequalities in Europe recommends “an integration of

an inequality perspective into urban planning (such as the design of buildings and activity-friendly neighborhoods, and safe and ecological transport modes)” with “targeted environmental, social and infrastructural measures to protect the most vulnerable [societal] groups.”⁶⁶

Professor Fairburn believes poor people in cities need to be especially targeted for help to mitigate air pollution, as they are often not contributing to the pollution, yet are adversely impacted by it. Others’ lifestyle choices can disproportionately impact their lives — for example,

Western nations tend to elevate having a private car for transport in cities, which may be due to personal choice.

However, as Professor Fairburn observes, this is also often due to poor or non-existent alternatives. He therefore recommends better urban planning to allow different modes of transport, along with a remodelling of the cities to create safe spaces for other modes of transport (such as electric vehicles or bikes).



66. http://www.euro.who.int/__data/assets/pdf_file/0010/157969/e96194.pdf?ua=1



Climate Change and Health: Connecting the Dots

It is becoming increasingly obvious that fossil-fuel combustion is a main driver of climate change, which is also a major contributor to air pollution, with its impact on health — so efforts to mitigate one can improve the other.

Unfortunately, the stark truth is that governments have found it easier to protect those in the fossil-fuel industry who continuously lobby aggressively for their businesses' sakes than to protect their citizens by tackling the health impacts of air pollution and the resultant climate-change impacts. These are aggressively impacting remoter parts of the world such as the Arctic and Antarctica, or the rainforests and jungles of Brazil and Indonesia, which help to regulate air quality and effectively act as the planet's "lungs" by regenerating the clean air we all need to survive.

Although climate protestors around the world, many of whom have been inspired by Swedish teen Greta Thunberg and nonagenarian Richard Attenborough, believe they fully comprehend the scale of human suffering by calling it a climate emergency — based on the Intergovernmental Panel on Climate Change's (IPCC's) October 2018 Special Report⁶⁷ and its stark warning of "just 11 years left"⁶⁸ to avert climate catastrophe — many have yet to connect the dots between climate change and health.

One person who fully comprehends the correlation between climate change and health is Dr. Maria Neira, the WHO's Director of Public Health, Environmental and Social Determinants of Health.

Says Dr. Neira: "The health burden of polluting energy sources is now so high. The true cost of climate change is felt in our hospitals and in our lungs," and advises "moving to cleaner and more sustainable choices for energy supply, transport and food systems [which] effectively pays for itself [in reducing health costs]."



GETTING THE MESSAGE:

(Above) Students hold placards as they take part in a global protest against climate change in Gurugram, India, March 15, 2019 (REUTERS)

RECOGNIZING THE ISSUES:

Students demonstrating at the #Fridaysforfuture strike in London, February 2019. Many students fear climate change, but have yet to grasp the implications for their health

67. https://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf

68. <https://www.un.org/press/en/2019/gai2131.doc.htm>

CARMAGEDDON: Vehicles drive through heavy smog in Delhi, India, November 8, 2017 (REUTERS)

An End to Car Dominion? Some Global Initiatives

Cars were not always the ubiquitous transport of choice, but fossil fuel-powered cars have led the way for decades. As the 21st century dawned, millions became convinced they were buying into cleaner technology by using diesel before #dieselpgate (see p. 30) exposed this as a scandalous emissions-rigging con.

The UK's car-centered urban infrastructure is a joke compared to Europe's — most of its cities' streets were not originally built for cars and so are often very narrow, which increases the amount of congestion and pollution from idling cars.

There are some recent efforts to address this, with some areas in London and other major UK university cities and towns redesigning streets around areas predominantly used by students. Welsh capital Cardiff has slowed traffic down to 20 miles per hour, and it is putting in more routes for cyclists that navigate across the city.

Edinburgh has begun to close its center to cars on the first weekend of every month.

Following suit, London has recently introduced an Ultra-Low Emission Zone (ULEZ) charge⁶⁹ to replace the former congestion charge; this adds a hefty fine to any car or vehicle entering the city that does not meet the recommended emissions levels. However, while King's College predictions for ULEZ suggest London's air could be within legal pollution limits by 2025, many have questioned the accuracy of the modelling used, and prefer an outright ban on diesel.

Banking giant HSBC is

planning to act as a corporate guinea pig by replacing 90% of its staff car-parking spaces in its two new regional centers with bicycle racks and changing rooms. The move is part of an eight-year scheme to get Britons on their bikes, representing a \$101–\$126 million investment in green transport solutions.⁷⁰

The Times' Clean Air For All campaign lists a five-point manifesto to improve air quality, which demands an accelerated ban on sales of new diesel and gas cars from 2030, rather than the more conservative measure of 2040 proposed by the UK Department of the Environment, Fisheries and

69. <https://www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/mayors-ultra-low-emission-zone-london>

70. <https://www.thetimes.co.uk/article/hsbc-invests-in-cycling-with-cuts-to-staff-parking-vdmx29j55>

BOX 3: #Dieselgate

Beth Gardiner's book *Choked* weaves autobiographical detail into her compelling account of travelling the world in search of answers as to why the air we breathe is so polluted.

Prior to moving to London, Gardiner (right, at a TedX talk in London) lived in New York City, where the streets are filled with traffic and its trademark yellow cabs. When she moved to London, she was perturbed to find she could "taste" the pollution in the air more so than in New York City. As no one else seemed to be complaining, she dismissed it for years until a reporting assignment asked her to assess the air quality during London's 2012 Olympics.

Her book reveals in detail the scandal of diesel emissions rigging, also known as #dieselgate, as well as many examples of how clean air regulation is being flouted and/or successfully implemented. Effectively, car manufacturers discovered that they were able to rig their emissions tests by adding a defeat device.

This only came to light when the International Council on Clean Transportation commissioned an examination of pollution on diesel vehicles, comparing what came out of their tailpipes (exhausts) during the lab tests required by law with emissions on the road, under real driving conditions.

When a huge discrepancy came to light, Volkswagen (VW) executives initially blamed it on a technical hitch and began recalling cars in their thousands to update the software. Months later, California ran new tests, and the emissions were still over the limit. It was only when the Environmental Protection Agency (EPA) threatened to withdraw certification for the whole U.S market that VW came clean.

#Dieselgate became, in Gardiner's words, "one of the biggest corporate scandals in history." VW acknowledged that over a decade, they had installed these defeat devices in 11 million cars, with the majority of those in Europe. They weren't alone, however — other car manufacturers had to come clean too, so suddenly the world woke up to the fact the car history had "a rich history of hostility to regulation."

In Europe, this has had devastating consequences, as for decades, successive governments encouraged them to buy diesel vehicles to the extent that when the scandal broke, diesel accounted for half of all car sales. Gardiner cites that in 2015 alone, failure to comply with the rules accounted for 6,800 early deaths — ones that would never have happened had the car industry not so blatantly flouted the law.

As Gardiner sums up, "the people we entrusted with the power to protect us essentially decided not to bother."





EXHAUSTING PROTEST:
An activist is seen wearing a “Diesel Exhaust Kills” mask at a protest outside a meeting of Germany’s federal administrative court in Leipzig, February 2018. The court was meeting to decide if German law provides a legal basis to ban diesel cars (REUTERS)

Rural Affairs’ (DEFRA) *Clean Air Strategy*, published in 2019.⁷¹ It also advocates traffic bans outside all London schools.

However, apart from these initiatives, the UK generally lags far behind other European and world cities in achieving greener and more sustainable transport solutions. Professor Fairburn cites many examples of “good” cities across Europe, with some mass-purchasing electric buses.

For example, in Amsterdam, because children were killed in large numbers back in the 1970s when cars were allowed into the city, the government has invested in developing mass transport, walking streets and car clubs, etc. to curb car use in the city.

Cities such as Copenhagen, Denmark; Amsterdam, Netherlands; Malmö, Sweden; and Utrecht, Netherlands, are reallocating road space from motorized to non-motorized transport, and are investing in new bicycling infrastructure. Protected bicycle highways are being built to connect suburban communities to their city centers are the future, as has been the case for cars for many decades.

Cars are entirely banned from parts of the city centers of Copenhagen and Brussels.⁷² Partial bans are in place in other cities such as Madrid, Spain, and

Ghent, Belgium (although public transport, taxis and other permit holders may be allowed to drive through the city at reduced speeds of up to three miles [five kilometers] per hour).

Although the U.S. is known for its traditional love for and daily dependence on cars, the states of Colorado and California have joined an Alliance of Automobile Manufacturers’ initiative to reduce fuel use and cut carbon emissions. More and more U.S. cities are working hard to popularize walking routes and events, and introduce renewable energy solutions, with Glenwood Springs, Col., becoming the latest U.S. city to be run entirely off renewable energy.⁷³

New-design global urban centers Masdar City in the United Arab Emirates⁷⁴ and China’s Great City⁷⁵ have prioritized walking and public transit over cars, as well as experimenting with electric and driverless vehicles. Their housing developments are being built within a 15-minute walk to basic shops, local services and amenities to create safe spaces for people to walk, making car use unnecessary. The available public transit in both cities frequently runs on renewable energy.

Another great example cited by Prof. Fairburn is the city of Oldenburg, Germany. Nearly everyone in

71. <https://www.gov.uk/government/publications/clean-air-strategy-2019>

72. <https://www.businessinsider.com/cities-going-car-free-ban-2017-8?r=US&IR=T>

73. https://thehill.com/policy/energy-environment/446065-colorado-city-to-become-one-of-the-first-in-the-country-run-on-100?fbclid=IwAR2hhDfa_I9elqym-8Ji8pPNWfOGXfUgxX335xASwhmb7-rVRKsZLKqWTA

74. <https://masdar.ae/en/masdar-city/the-city/mobility>

75. <https://www.wired.co.uk/article/china-great-city>



SMOG CITIES: Top: Singapore's Marina Bay in a polluted haze; bottom left, a general view of Paris cloaked in small-particle haze; bottom right, a helicopter flies through the haze over Manhattan's World Trade Center (REUTERS). Some cities — Masdar City, United Arab Emirates; Oldenburg, Germany; The Great City, China; Copenhagen, Denmark; Glenwood Springs, Colo., U.S.; Utrecht and Amsterdam, the Netherlands; Malmö, Sweden; Madrid, Spain; and Brussels and Ghent, Belgium — are leading the way forward with renewable-energy solutions, electric cars, prioritized walking and bicycle routes, and partial car bans in places

its population of 200,000 uses bicycles to get around, so the city has created bike parks throughout, and most shops feature bicycle racks outside. Prof. Fairburn witnessed 8-10 kids cycling safely to school; when they came to a stoplight, the cars always stopped to let the bikes pass first. The city also replaced all their staff council offices with 70-80 communal bikes for people to travel to/from work.

This contrasts with his own hometown of Stoke-on-Trent, UK, where there were protracted council arguments concerning a decision to free up just two car-parking spaces for a couple of bikes. He believes the senior people making

these decisions are a privileged group who do not understand why they shouldn't be allowed to drive, and signified the problems seen elsewhere in the world where there is a heavily fossil-fuel-dependent bias among the often-more-monied key decision-makers.

Prof. Fairburn stresses that it will take strong political leadership and determined active local community campaigning to drive the much-needed systemic changes that will protect children and other key workers from the dangers of air pollution from cars, and urges key decision-makers to begin the conversations needed to replace cars.⁷⁶

76. <https://theconversation.com/climate-change-we-can-reclaim-cities-from-the-car-without-inconveniencing-people-110917>

Indoor Air Pollution: The Scandal of Killer Wood-burning Stoves

Yet along with the need to curb air pollution caused by cars, we shouldn't omit the consequences of burning wood. There are many experts who consider this form of pollution as having an even greater impact on our health outcomes than diesel, as is evidenced by the following true story.

When Cheryl Evans* first moved to Wales in 2012 to do a master's degree, she had no idea this would change her life and place her health at risk.

The first warning signs came when a U.S.-manufactured, outdoor wood-burning stove used for heating called a Central Boiler⁷⁷ was installed into a neighbor's property.

When appeals to her council about the incessant smoke filtering into her own property fell on deaf ears, she found out the stove had been financed by a UK government grant and the fumes were dismissed by the council environment officer as "just smoke."

She subsequently discovered that any owner of a Central Boiler, which is DEFRA-approved, receives incentives to burn wood

up to a value of \$9,422 (£7,500) per year, which is why the neighbor had it on constantly.

A non-smoker, Evans soon developed a range of symptoms.

suffered a permanent cough, which turned into a chest infection, skin irritation, headaches, eye irritation and depression... I was living in a chemical soup."

“

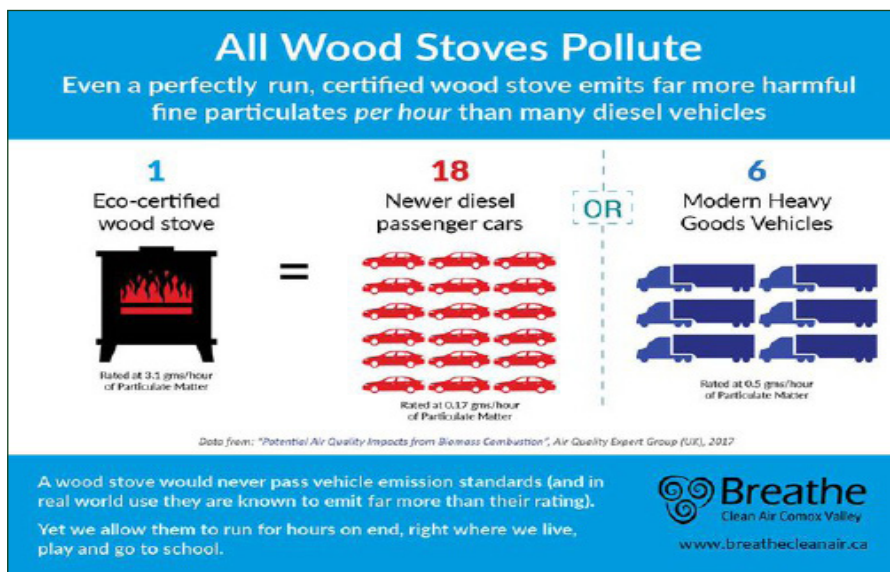
I knew my health was deteriorating — I suffered a permanent cough, which turned into a chest infection, skin irritation, headaches, eye irritations and depression... I was living in a chemical soup”

"I knew my health was deteriorating," she explains. "I

Eventually, after four years of ill health and constant abuse from her neighbor, Evans "was glad to escape with my life" to the Kent Coast. There, her symptoms cleared up after three or four months, but she now campaigns to ban wood-burning stoves. The kickback grant scandal is one of the reasons why.

Evans told *TIJ* that many country homes, hotels and even farmers install two or three of these huge wood-burning stoves to make money. They are polluting entire neighborhoods while making up to \$379, 656 (£300,000), despite DEFRA allegedly knowing about it. They are even flouting inspection regulations.

Her resolve to continue



* Name changed to protect identity

77. <https://centralboiler.com>

78. <https://woodsmokepollution.org/about-us.html>



HOW SMOKY WAS MY VALLEY:
Cheryl Evans's Welsh idyll was ruined by a neighbor's incessant use of his wood-burning stove (REUTERS)

campaigning has continued because she is keen to publicize the dangers of stoves and their production of black-carbon PM.

Evans says wood smoke is the main contributor to PM_{2.5} emissions, responsible for more emissions than road traffic. Air-quality monitoring is inadequate — there are only 10 black-carbon monitors across the UK and Scotland, which falsely gives the impression the air is clean (i.e.,

government that burning wood is carbon-neutral and therefore better for the environment, and that a ban on wood-burning would immediately improve air quality.

However, the Stove Industry Alliance (SIA) is a powerful lobbying force with high-up government connections — for example, Neil Parish, Member of Parliament for Exeter and chair of the Environment, Food and Rural Affairs (EFRA) committee, is a

“Those with wood stoves are living in a very toxic environment — even the ash from the stoves is highly toxic; it causes skin disease and cancers. The research on all this is extensive, but it is not getting out to the public fast enough due to ill-informed government policies.

“We desperately need ‘parent power’ to get involved, or there will be no real improvement in ambient air quality.”

For those who need further convincing of the dangers of wood smoke, Dr. Gary Fuller provides further substantial information in his book *The Invisible Killer*.⁷⁹ He references Switzerland's Paul Scherrer Institute, an air-pollution laboratory whose scientist, André Prévôt, and his team investigated the effects of wood smoke in a large, contained chamber.⁸⁰

Logs were set on fire, then, using lights to simulate the sun, they noticed the wood smoke began to change. The gases and particles in the smoke reacted to create pollution particles, increasing the overall concentration of harmful particles by 60%–90%.⁷³

Fuller says that while traffic pollutants are expected to decrease, “these improvements are likely to be offset by wood-burning, so by around 2030, particle pollution in UK cities will be much the same as it was in 2015, bringing progress to a halt.”

“

In winter, half of London's PM_{2.5} air pollution is caused by domestic stoves. This is an emissions scandal far more serious than #Dieselgate because it is our own government that is causing it”

a hot spot will not be recorded, due to there being inadequate monitor coverage).

Evans's concern is shared by Doctors and Scientists Against Wood Smoke Pollution (DSAWSP),⁷⁸ an international coalition of non-profits, doctors, scientists and other professionals who are dedicated to reducing harm to human health and our climate by decreasing wood-burning activities.

Evans also believes the timber industry has wrongly advised the

farmer who has two wood-burning stoves and happily promotes wood as a “crop” to be subsidized by the government. He even used his position to throw a launch party for the Arava Stoves company at the Houses of Parliament.

Evans says: “In winter, half of London's PM_{2.5} air pollution is caused by domestic stoves. This is an emissions scandal far more serious than ‘Dieselgate’ because it is our own government that is causing it.

79. <https://www.penguinrandomhouse.com/books/608009/the-invisible-killer-by-gary-fuller/9781612197838/>

80. https://www.researchgate.net/publication/273768722_Sources_and_contributions_of_wood_smoke_during_winter_in_London_Assessing_local_and_regional_influences

Advocating for Air-Quality Monitoring

UK clean-air activist Simon Birkett has been advocating for a widespread and proactive public sharing of advisory information on days when levels of PM or ozone are moderate or high. He began campaigning in 2006 and quickly ran into a dispute with DEFRA over its failure to warn people properly.

DEFRA publishes advice on the levels of air pollution and provides recommended actions and health advice through its Daily Air Quality Index.⁸¹ The index is numbered from 1–10 and divided into four bands, from low (1) to very high (10), to provide detail about air-pollution levels in a similar way to the sun or pollen indexes. Its advisory alerts warn when the air quality is poor and a danger to health, especially on either hot and sunny or cold, still days when particulates and gases combine to reach unhealthy levels.

However, these alerts are hard to find, and Birkett believes the UK government should warn the public when levels of pollution are a health risk. For example, in summer 2018, hospital Accident and Emergency departments across London were reputedly inundated with admissions for respiratory or other conditions attributable to the raised temperature levels.

Birkett now publicizes air-quality advisory alerts himself via Twitter @cleanairlondon ahead of big expected episodes or events such as the London Marathon and football matches.⁸² He speaks at international clean-air summits to share his knowledge and spread the message that we need to build public understanding of the dangers of air pollution, and provide people with advice on mitigation and adaptation.

London Mayor Sadiq Khan supported a recent King's College experiment with children carrying backpacks with inbuilt air-quality sensors to help monitor the air.⁸³ Around 250 kids from five primary schools took part in the experiment for a week to measure PM and NO₂ levels.

Although a small initiative, many of the participants have been empowered to implement other measures such as closing nearby streets to cars at school pick-up and drop-off times. In early 2019, the mayor also supported a new initiative he claims is the “world’s largest” air-quality monitoring network, which uses Google’s Street View cars to help monitor the air via air quality sensors, taking readings every 33 yards (30 meters).⁸⁴



ALERTING THE PUBLIC: Clean-air activist Simon Birkett

81. <https://uk-air.defra.gov.uk/air-pollution/daqi>

82. <https://twitter.com/cleanairlondon?lang=>

83. <https://www.bbc.co.uk/news/uk-england-london-47622493>

84. <https://www.bbc.co.uk/news/uk-england-london-46878067>

BOX 4: How Accurate is Air Monitoring?

EU law stipulates there should be no more than 18 occasions a year when people are exposed to levels higher than 200µg of NO₂ per cubic meter of air within an hour (that's 25 and 40µg/m³ for PM 2.5 and PM 10, respectively).⁸⁵

Unfortunately, the monitors that measure air quality are often old, sensitive and expensive machines, prone to breakage. Many are simply not usable. The Brixton Road monitor is a case in point.

In 2018, Brixton Road exceeded the legal limit on 17 different occasions during the first month of the year. Prior to this, the breach occurred over a three-year period on a variable timeline of just days into the new year up to the month's end. This year, the breach occurred in March. While many people were happy to credit this to an improvement in air quality, the reality was somewhat different.

Investigations revealed this monitor was out of action from August 2018 until March 2019, then broke again just three or four days after the fix.

Lambeth Council reputedly blamed the initial breakdown on flood and contractor issues. However, after the first fix, further damage was uncovered that needed rectifying to ensure accurate readings. Jeffrey Smith, who monitors air quality for the WHO and has co-contributed a paper on the subject,⁸⁶ believes even these readings don't convey an accurate picture. So how do we gain an accurate picture of air quality?

Smith suggests monitoring pollution via satellite might be the key to achieving accurate air-quality monitoring in the future, but even so, the technology does not currently provide consistently accurate readings. However, it is hoped that "low-cost and satellite air-quality monitoring, together with open-data platforms and tools, will translate to civil society, non-profit, academia, regulatory, and policy-maker collaboration and action to reduce emissions. This awareness will increase the number of participants from all sectors (governments, industry, academia and civil society) [working together] to protect the environment and public health."

Government Inaction — and the Rise in Citizen Action

In September 2017, UN Special Rapporteur Baskut Tuncak said he had found that "air pollution continues to inflict grave harms on the rights of children, women, older persons and people with disabilities, with limited

accountability for perpetrators globally."⁸⁷

The choice of the words "continues" and "limited accountability" are evidentially correct, as well as damning. Governments worldwide have had

access for years to the evidence of the harm pollution causes to health through the Six Cities report and thousands of subsequent studies, yet they have chosen to ignore it. The interests of industrial manufacturers, fossil-fuel lobbies

85. <http://ec.europa.eu/environment/air/quality/standards.htm>

86. https://www.researchgate.net/publication/331160492_The_proliferation_of_environmental_data_and_visualization_sharing_platforms_and_their_impact_on_the_awareness_of_air_pollution

87. <https://www.ohchr.org/AR/NewsEvents/Pages/DisplayNews.aspx?NewsID=22061&LangID=S>



MAJOR EXTINCTION EVENT: Extinction Rebellion activists staged a “Bees on Bikes” protest around London followed by a mass “die-in” at the Tate Modern on April 27, 2019

and car-industry manufacturers have been prioritized above protecting public health through powerful lobbying groups’ money-generation.

Undoubtedly, those in political power are watching the climate-change protest marches with interest to see where the public mood is heading, although perhaps they are breathing a collective sigh of relief that even powerful actions by grassroots movements such as the Moms Clean Air Force in the U.S.⁸⁸ or the worldwide Extinction Rebellion marches⁸⁹ to demand clean air action have yet to see legislative changes materialize.

This is surprising, as isn’t it reasonable for the public to hold the government to account and ask why haven’t they done more to encourage vehicle manufacturers to shift production to cleaner and affordable technology? To insist that measures are put in place to protect us from other key pollutants generated from the agriculture, shipping and airline industries? Does protecting these industries really take precedence over citizens’

health? Has their failure to act more expediently not only endangered our health, but our very existence?

According to a recent *Times* article, there’s a reason behind the seeming public nonchalance about such dangers: “The political class seems to have calculated that there is a broad tolerance of toxic air and no sense of popular outrage that would push policy change.”⁹⁰

Although the UK government has been quick to voice their support for *The Times’* Clean Air For All campaign, their inaction paints a more accurate picture. Updated measures were promised by the Environment Secretary Michael Gove, but the Environmental Bill has seemingly been postponed indefinitely.

UK leaders talk about commissioning more studies into the effects of air pollution on health, yet these same leaders seemingly ignore the overwhelming body of medical evidence already existing. Are they simply biding their time until a new leader comes along post-Brexit, as a means of blame-shifting?

It’s clear sustainable choices to support our lifestyles are needed, but the political will and ability to fight big businesses to achieve change are often lackluster, to say the least. Governments may pay lip service to curbing emissions, but lack concerted effort to put health above the interests of big business.

In the U.S., the Green New Deal is gaining in popularity, but climate denier President Trump threatens to derail it all.

The UN believes meeting the goals of the Paris Agreement to combat climate change could save a million lives a year worldwide by 2050 through reductions in air pollution alone.⁹¹


The economic benefits from tackling air pollution are also significant: in the 15 countries that emit the most greenhouse gas emissions, it is estimated that the health impacts of air pollution cost more than 4% of GDP. It is clear inaction is not an option, but governments seem to lack the will to treat this as public health emergency.

88. <https://www.momscleanairforce.org>

89. <https://rebellion.earth/international-rebellion/>

90. <https://www.thetimes.co.uk/article/the-times-view-on-clean-air-suffocating-cities-spo8x8ot3>

91. <https://www.downtoearth.org.in/news/climate-change/cop24-world-can-save-1-million-lives-by-meeting-paris-goals-on-air-pollution-62392>



CLEANVS. DIRTY: As a coal-burning chimney in Teeside, UK, dirties the air, the fight to enshrine clean air as a basic human right gathers pace (REUTERS)

The UK-wide Call for a New Clean Air Law

Many UK Parliamentary members are calling for the human right to breathe clean air to be enshrined in a new Clean Air Act, including the Green Party's House of Lords member Jenny Jones. Jones has introduced the Clean Air (Human Rights) Bill, which could achieve this. The campaign has cross-party support, as well as wide support from the *Times*' Clean Air For All campaign.

According to Simon Birkett, the key wording in the Bill is that "Everyone has the right to breathe clean air, and the Human Rights Act 1998 is to be read as though this were a Convention right." This would mean that, overnight, air pollution — including greenhouse gases — would have to be considered by every UK government body in every decision, in much the same way equalities are now considered. Birkett and Jones would both like this act to be called "Ella's Law."

Birkett and Jones are not alone in their thinking. An organization called ClientEarth are intent on holding not just the UK government, but also its councils to account.⁹² The organization, comprising environmental lawyers and campaigners, believes the health of the planet is intrinsically linked to our own health. ClientEarth has defeated the government three times in the High Court over the inadequacy of its national action plans to clean up the air — and they have written to the government to warn them to address the illegal levels of pollutants measured on some of the UK's roads.

Andrea Lee, Senior Campaigner for the Green Air team, explained to a Parliamentary meeting that these legal limits should originally have been met by the government in 2010, but after nearly a decade,

the government still seems incapable of producing a credible plan of action.

ClientEarth is also now on a mission to fine councils who don't keep their emissions low. It has issued mandates to produce a plan of action to 41 local authorities. It criticizes the actions of some councils in declaring climate emergencies without translating this into actionable solutions, as if something is identified as needing action, by law councils are required to implement a plan to tackle it. Unfortunately, many local authorities are not adhering to this; London, Leeds and Birmingham are among the few.

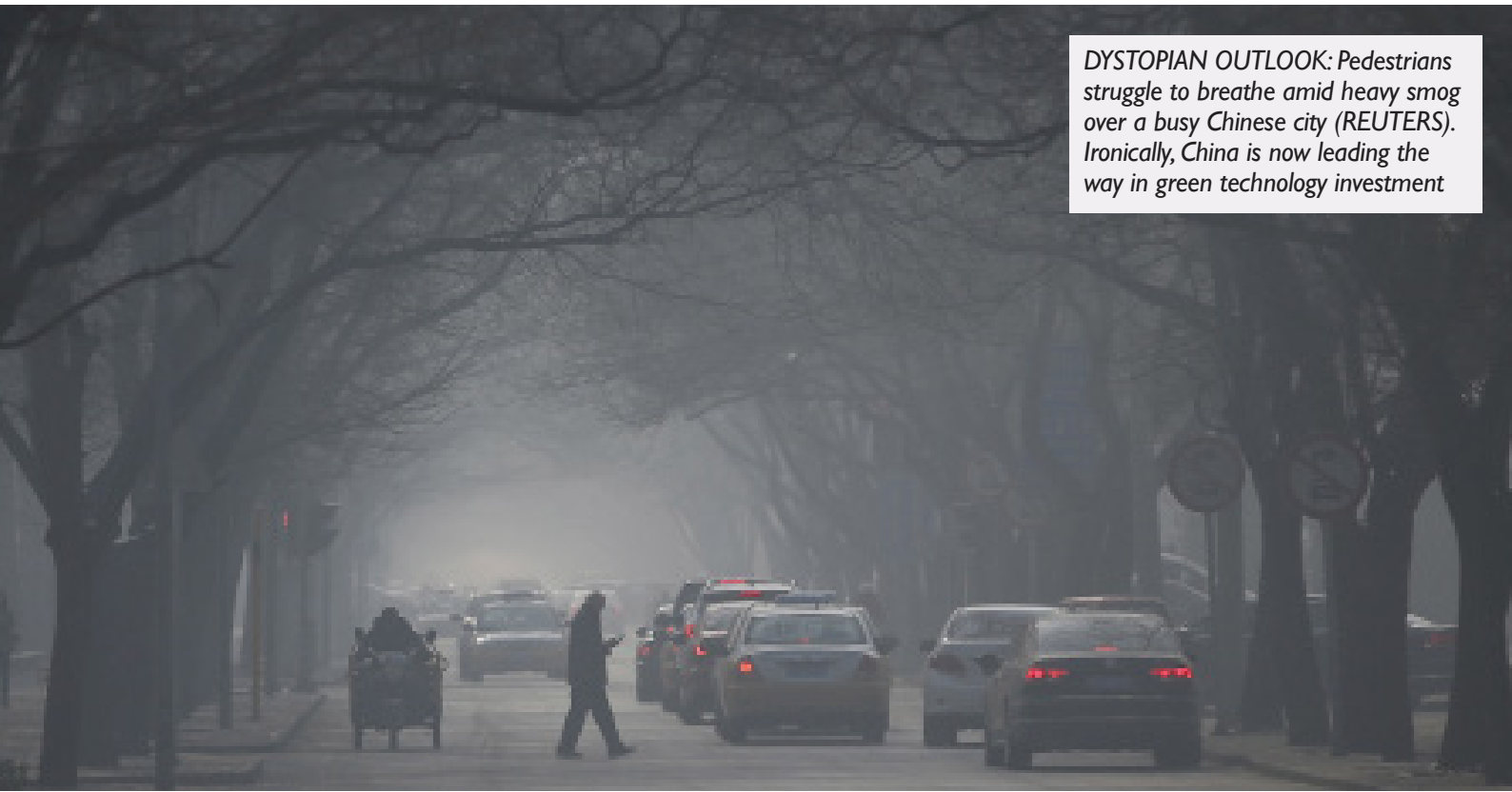
Lewisham is a prime example of a council declaring a climate emergency without a robust plan of action. Their desire to provide homes to the homeless and welcomes refugees is laudable, but undermined by unwise decisions, such as granting planning permission for a school extension with the entrance near a busy main road.

The council also gave consent to a housing development in Deptford they know is in an area of significantly poor air quality. Although they advised the residents not to open their windows, a loophole in the planning law that says the development is permissible when an air-filtration system is installed enabled them to effectively "get away with it."

But how do you stop residents breathing in filthy air as soon as they walk outside their front door? And who or what is behind all these air-filtration companies making money from loophole laws and selling to unsuspecting and overstretched schools keen to protect their children's health? How do parents protect their children's future in an increasingly unsafe world?

92. <https://www.clientearth.org>

Conclusion: Is There Any Hope for the Future?



DYSTOPIAN OUTLOOK: Pedestrians struggle to breathe amid heavy smog over a busy Chinese city (REUTERS). Ironically, China is now leading the way in green technology investment

Currently, one in seven children worldwide suffers from potentially lethal asthma, and the figures are rising. Yet the expensive medication they need would be unnecessary if the air was clean.

The question must be: do we go on risking living in a world where we all have to wear face masks, and more and more children are prevented from going outside to play because the air quality is so poor?

Many health professionals fear this means that unless action is taken now, more children will face life-limiting illnesses. And the scandal is that many of these deaths are preventable. The evidence is clearly there, and yet governments around the world are addressing this public health emergency as something to think of in the future, rather than the here and now.

UN Special Rapporteur David Boyd agrees. He believes we must not accept this scenario: “Air pollution is preventable. Solutions — laws, standards, policies, programs, investments and technologies — are known. Implementing these will entail large investments, but the benefits of fulfilling the right to breathe clean air for all of humanity are incalculable.”⁹³

ClientEarth’s Andrea Lee concurs that the UK and other countries need Clean Air legislation

that enshrines the right of every citizen to breathe clean air as a basic human right. She argues that the UK and other governments should offer more help and support to businesses and individuals to choose cleaner fuel options; that governments, local councils and communities need policies with implementable deadlines; and that local authorities should be made legally responsible for implementing clean-air zones.

Many have suggested making the polluters pay to fund research into solutions to clean up the air, such as in Germany, where auto makers have committed nearly a third of a billion dollars (a quarter billion euros) to a clean-air fund. Germany also plans to close huge swathes of cities and autobahns to polluting diesel cars.

As individuals, we can make a difference by consuming less, walking instead of driving for short trips, eating less meat, and cooking and heating our homes with alternative systems. The UK Health Alliance on Climate Change supports this holistic approach to health, encouraging its members to eat healthier and live more active lives. And as citizens we can also help spread awareness of how bad air quality really is.

93. <https://www.ccacoalition.org/ru/node/3007>

BLOWING IN THE WIND: The world desperately needs to act fast in implementing renewable-energy solutions such as wind turbines (REUTERS)



Rays of Hope: Renewables and Citizen-led Action

Ironically, notes Gardiner in a recent TedX London talk, one of the world's biggest polluters is also the biggest investor in green tech. China is now leading the way in terms of technology advances in wind and solar power, as well as electric vehicles.⁹⁴ The rest of the world will need to catch up fast with the urgent need to find and implement workable renewable solutions.

While electric cars and other forms of transport are not necessarily the solution, they are only a start — although PM_{2.5} levels will significantly reduce because the fossil-fuel element is removed, brakes and tires will still emit them, and batteries will plunder the Earth's resources. Additional downsides are there is no battery standardization and recharging points are in short supply. But if this system was changed, it could make a difference.

Dr. James Heydon, a lecturer in criminology at the University of Lincoln, believes that as we move toward a post-combustion future, only a lack of infrastructure could hinder progress. Heydon cites examples of forward-thinking technology in places such as Milton Keynes, where the buses have electric plates attached to the bottom of their vehicles and can recharge every time they stop. He also mentions the idea of placing charging points in lampposts for citizens switching to electric vehicles, making it an accessible way to recharge, rather than having to always locate an electric charging point elsewhere.

As citizens, more of us need to be aware of our individual choices and the impact climate change has on our health. We must resist fossil fuel-sponsored, government-led initiatives such as airport expansion, fracking, open coal mines, the creation of new homes and schools in polluted zones, allowing polluted cruise ships into city centers, etc., and refuse to let politicians make decisions that will ruin our health.

The electoral success of the Green Party in the European elections in cities such as Bristol and Newcastle offers some hope that more citizens are waking up to environmental issues.

Citizen-led local community action is increasingly making a difference, as evidenced by parent advocacy groups Mums for Lungs, Mums For Clean Air and Mothers Rise Up. Mums for Lungs co-founder Celeste Hicks describes her experience of shock when, as a first-time expectant mother, a test showed she had high levels of carbon monoxide in her bloodstream. She felt “disempowered and frightened” because she didn’t smoke and used her bike a lot.

Celeste believes pressurizing politicians and amplifying citizen voices has contributed to the group’s success in creating the School Streets Initiative’s temporary closure of streets near schools at drop-off and pick-up times, which is now extending across London.⁹⁵ “I urge everyone to reach out to their political representative to make sure they know climate

94. <https://www.ccacoalition.org/ru/node/3007>

95. <http://schoolstreets.org.uk>

96. (p. 41) <https://www.fridaysforfuture.org>

change matters. The end of diesel needs to be now, not 2040–2045. Fossil-fuel investment can be moved to support renewable energy.”

Politicians and parents shouldn’t underestimate the power of the younger generation’s voices, either. Increasingly, they are speaking out. Boldly, 9-year-old Daphne asked the adults in the room at a recent Parliamentary debate on air pollution: “Don’t you care about your children or grandchildren? We will carry on protesting until you start to listen to us.”

Expect to hear more echoes evoking Greta Thunberg’s passionate plea for urgent climate action in living rooms all over the world, which will multiply as more and more children wake up — not just to the potential destruction of the planet through climate change, but to the impact air pollution is having on their health.

Citizen action may be one of the only ways to

progress the call for clean air. As more people join the dots linking air pollution to the impact on health and begin to advocate for change, it will become possible.

Imagine what a difference it could make if all the young people joining in the #Fridaysforfuture marches ⁹⁶ worldwide joined forces with the Extinction Rebellion protestors in demanding change?

According to Joss Garman, a senior figure at the European Climate Foundation and a seasoned campaigner, “It has to feel authentic — politicians will take more notice of an authentic voice rather than a professional organization that is paid to lobby them.”

It is hard to think of anything more authentic than the plaintive cry of a broken-hearted mother. As Ella Roberta’s (pictured above, from the Ella Roberta Trust) distraught mother Kissi-Debrah says, “I want people to get angry. I want people to act.”



Penny Hosie

Penny Hosie is an established journalist who has edited numerous health and lifestyle magazines for prestigious clients including Forte, Hertz and a leading UK health club. She was also the launch editor of an online health and beauty magazine.

Penny’s most recent role was Managing Editor at Pavilion Publishing, where she edited two eminent peer-reviewed healthcare journals. This developed her passion for health and social care, and also introduced her to the topic of clean air as a key public health issue.

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