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Air Pollution: The Economics

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1. INTRODUCTION

Ambient air pollution has been a risk in urban centres across the UK, particularly London, since the Industrial Revolution. Back in the 50's it was the great smogs and black fumes from coal fires, power plants and heavy industry that caused thousands of deaths, but also lead to legislative reform. Nowadays, our iconic skyline is clear and the city is thriving – but what is behind the facade?

Modern day air pollution is in fact more immediately irritating and long term damaging to human health than ever before, despite the huge advances in technology. It causes 29,000 premature deaths a year in the UK alone, increasing the risk of lung cancer, cardiovascular diseases and respiratory illnesses and decreasing cognitive function and neurodevelopment – to name a few. While the science is strong and increasing, air pollution is still lacking a platform and strong voice, allowing the public to comprehend the issue and for Government's to recognise it's importance.

For this reason, this report shall detail the economic argument for reducing ambient air pollution. The focus shall primarily be on the associated health care costs, but there will also be a brief mention of other potential economical effects.

This report has been written at a crucial time for London and the UK. Following the European Court of Justice's ruling stating that the UK must act to clean up illegal levels of air pollution "as soon as possible" and the publication of the WHOs latest estimates of the economic cost of health impacts of air pollution in Europe – the evidence has never been stronger and the need never greater.

The content will be focused around the latest research and publications. We do not yet know the full cost of ambient air pollution in the UK and globally, but the evidence is accumulating, allowing some concrete conclusions to be drawn and other strong assumptions to be made.

The format of the report shall firstly look into the concrete conclusions we are able to draw about the UK. This shall be primarily from the latest WHO report, and while this provides valuable information, it is not the entire picture. To further the understanding about the issue in its entirety; next will be 3 case studies. The first case study will be of the USA and what we can learn from that body of research, the next 2 will look into the specific illnesses of asthma and lung cancer. Finally, the conclusion will set out what this all means for the UK, what the recommendations are.

2. Concrete Conclusions

2.1 Air pollution in Europe and costing mortality rates

A relatively successful, if imperfect, regulatory regime on air quality in Europe has resulted in substantial progress, with the WHO European Region achieving a 12% reduction in premature deaths between 2005 and 2010 from air pollution. This is all in the absence of a complete pricing system. However, it is still a persistent problem in Europe with huge deleterious impacts on health and the economy.

According to the UK Government, an estimated 29,000 premature deaths a year is caused by outdoor air pollution, and when costing that up – it is said to be a burden of £16 billion a year (2007 Air Quality Strategy[1]) in health costs. This figure is in fact nearly twice that of physical inactivity, (estimated to be £10.7 billion per annum) and comparable to the cost of alcohol misuse (estimated to be £12-£18 billion per annum)[2].

While this is shocking, the WHO 2015 publication[3] on air pollution costs in Europe believes this to be woefully lacking. According to the latest research, the figure is approximately £53 billion per year. This is now a higher figure than obesity (£47 billion per year) and only just surpassed by smoking (£57 billion per year).

It is important to explain why there is a difference between these amounts. Firstly, in the past few years there has been a substantial accumulation of new evidence on health, the economic costs and therefore the cost/benefit ratio of policy initiatives. Also, there have been several critical breakthroughs in the following fields:

- The technology and methods of epidemiological investigation
- Continuing advances in toxicology
- Improvements in the clinical knowledge of diseases
- Advancement in monitoring methods (including remote-sensing satellites)

All of this means that our understanding of the issue and finding causal relationships has drastically improved.

This isn't the full picture

Even though the numbers quoted above are extreme – this still may not be the end of the story. Firstly, this is only looking at the effects of particulate matter – it does not consider the potential effects of other pollutants such as nitrogen dioxide or ozone. Secondly, the methods to quantify morbidity are still to be refined and agreed upon. Finally, it is stated by the WHO that it cannot be ruled out that continuing improvements in knowledge will result in more evidence, therefore an increase in the magnitude of the estimated burden of disease.

3. Intelligent Assumptions

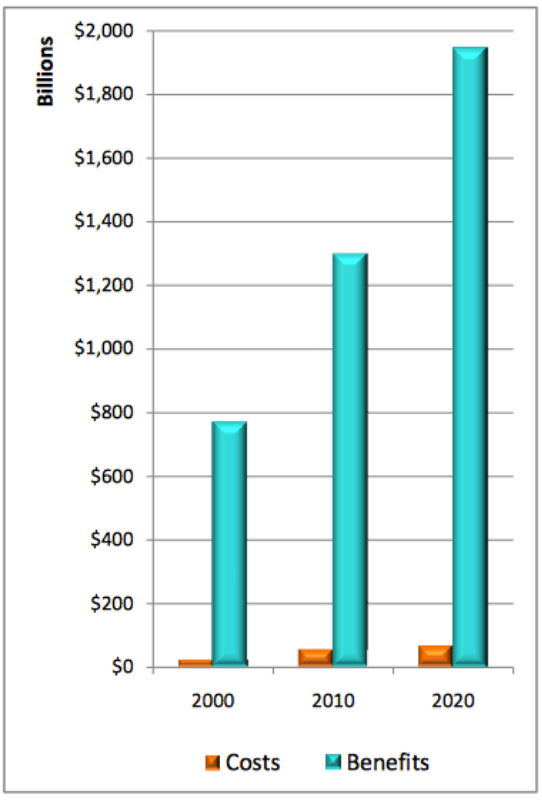
3.1 Economics of Air Pollution: A US case study

While we can learn a lot from the research summarised by the WHO, there are still a lot of gaps in terms of accurate cost-benefit analysis of policy, of productivity effects and other health care costs such as pharmaceuticals. What we are able to do however is take the US as a case study.

In the US, any standard or regulation that costs more than $100 million requires a complete cost-benefit analysis of alternative regulatory strategies to ensure the most effective strategy is chosen[4]. Under this, the Clean Air Act requires the US Environmental Protection Agency (US EPA) to periodically review the National Ambient Air Quality Standards to ensure they are adequate to protect public health. For this reason therefore, there is a lot of information available – both evaluating the overall costs of adhering to air quality standards, but also the cost when those standards aren't met.

One study published by the US EPA in 2011[5] evaluated the benefits and costs of the Clean Air Act from 1990-2020. Here they calculated that by 2020 the overall cost of implementation would be $65 billion, but the total benefit savings would be $2 trillion (Figure 1). This is a 30-to-1 ration, and the benefits coming from:

- A reduction in air pollution related premature deaths and illnesses
- Improved economic welfare of Americans
- A better environment



Health Effect Reductions (PM2.5 & Ozone Only)	Pollutant(s)	Year 2010	Year 2020
PM2.5 Adult Mortality	PM	160,000	230,000
PM2.5 Infant Mortality	PM	230	280
Ozone Mortality	Ozone	4,300	7,100
Chronic Bronchitis	PM	54,000	75,000
Acute Bronchitis	PM	130,000	180,000
Acute Myocardial Infarction	PM	130,000	200,000
Asthma Exacerbation	PM	1,700,000	2,400,000
Hospital Admissions	PM, Ozone	86,000	135,000
Emergency Room Visits	PM, Ozone	86,000	120,000
Restricted Activity Days	PM, Ozone	84,000,000	110,000,000
School Loss Days	Ozone	3,200,000	5,400,000
Lost Work Days	PM	13,000,000	17,000,000

Exhibit 8. Differences in key health effects outcomes associated with fine particles (PM2.5) and ozone between the *With-CAAA* and *Without-CAAA* scenarios for the 2010 and 2020 study target years. (In number of cases avoided, rounded to 2 significant digits). The table shows the reductions in risk of various air pollution-related health effects achieved by 1990 Clean Air Act Amendment programs, with each risk change expressed as the equivalent number of incidences avoided across the exposed population.

Another piece of legislation which has come under evaluation was the NOx Budget Program from 2003, which was set up to reduce both NOx and Ozone levels. The results of this evaluation[6] found that:

- The number of summer days with high ozone decreased by 25%
- 1.9% reduction in expenditure on prescription pharmaceuticals
- Summer mortality rate declined by 0.5%, saving 2,200 premature deaths

If were you monetise these saving, it would result in a saving of $900 million per year.

A more localised evaluation[7] was conducted by the RAND Corporation in 2010 on the cost of pollution-related medical care attributed to the failure of meeting federal clean air standards across California. Between 2005 and 2007, it was calculated that 30,000 hospital admissions and Emergency Room visits could have been avoided. From this, it was calculated that the additional health care costs of this was approximately $193 million, with $132 million of that coming from Medicare and Medicaid – which are the state run initiatives.

While these papers are a mere snapshot of the information available, we are able to conclude that while it does indeed cost the economy to adhere to air quality standards – the benefits reaped from those are enormous, and the costs of not adhering could be equally deleterious.

3.2 Illness case studies

Up until now, the focus of this report has been on the overall costs of air pollution. As was stated in the introduction, where there is a now standardised way to measure mortality – there is yet to be the same for morbidity. Currently, the WHO cost it at 10% of the mortality cost figure – which they admit, is likely to be lacking. This next section will discuss 2 specific illness case studies – demonstrating where the costs could come from and how much they could potentially be.

Illness case studies: Asthma

While the science behind air pollution increasing the overall prevalence of asthma is debated, it is widely recognized as a trigger for attacks and worsening symptoms. A survey conducted by Asthma UK[8] found that 2/3 of asthma suffers say that traffic fumes make their condition worse and 1/3 stated that reductions in air pollution would make the most difference to their lives.

In terms of figure, asthma is a huge problem in the UK, with 5.4 million people currently being treated for it. This equates to 1.1 million children (or 1 in 11) and 4.3 million adults (1 in

12)[9]. According to Asthma UK, 1,167 people died from asthma in 2011 and 90% of these deaths were preventable. Furthermore, 75% of hospital admissions are avoidable, it costs the NHS £1 billion a year and between 2008-2009, 1.1 million working days were lost due to breathing or lung problems.

If air pollution levels were less or even if patients had better access to air quality alerts – the savings on hospital admissions, lost work days or even deaths could be substantial.

Illness case studies: Lung Cancer

Unlike asthma, lung cancer has been proven (without doubt) to be a side effect of air pollution exposure, with it being formally classified as carcinogenic. In 2013, the ESCAPE Project[10] was published, which was the largest of its kind thus far, combining data from 17 cohort studies in 9 European countries and almost 313,000 people.

The major conclusions were that a moderate increase (5 ug/m3) in PM2.5 increased the risk of lung cancer by 18% and a moderate increase (10ug/m3) in PM10 increased the risk by 22%. They also found that there was no threshold of risk, meaning that there are potential effects at all levels of exposure.

To further the case the WHO (2004) summarised[11] that 8% of lung cancer cases worldwide were from air pollution exposure, and recently there has been a shift in the frequency of different types of lung cancer. The shift is from squamous cell carcinoma to adenocarcinoma, which is interesting in that the squamous cell is typical in smokers and the adeno is non-smokers. This means that the effects of air pollution can be separated from that of smoking, reducing the risk of it being a confounding variable.

According to Cancer Research UK and a study published in 2013 by Oxford University, lung cancer costs the economy £2.4 billion a year, with each patient costing about £9000[12] [13].

If we now relate these figures to the potential increase in risk from ambient air pollution, we can start to understand the exact economic effect air pollution may have.

3.3 Other Economic Costs to Air Pollution

Even though 94% of non-climate-change costs of air pollution are said to be health-related[14] – it is important to explore where the other costs can come from.

One such example is the incidence of low birth weight (which has been linked to air pollution exposure) has been associated with high health care costs and long-term issues such as reduced educational attainment and earnings[15].

It has also been linked to employment and productivity. For example a study in California[16] found that elevated ozone concentrations (even at levels well below the current federal air quality standard) has an effect on the labour market and worker productivity. The overall conclusion was that a moderate decrease (10ppb) in ozone, increased worker productivity by 4.2%. This was the first systematic review of productivity relating to ambient air pollution.

Other environmental impacts, which should also be considered, are:

> The effects on the built environment

> Animal and plant health (which could have further consequences on productivity of agricultural and forestry resources)

> Larger ecological systems impact

From this it is clear that there is still a long way to go to fully assess the impacts on productivity, ecosystem services and the built environment, but it could be significant.

4. Conclusions

4.1 Conclusion

Air pollution, like 50% of all illnesses in the UK, is preventable. Despite this, the NHS budget for preventions is only 4%[17]. The costs detailed throughout this report and the case study from the US has made a solid case for air pollution to be taken more seriously in the UK.

When asking the question: 'what are the major burdens on the NHS' – how many people would mention urban air pollution? It is the risk that affects everyone, and yet very few people are talking about it, we at Deliver Change are hoping to change this.

4.2 What Are We Doing About It?

According to the WHO, the most desirable ways to combat the issue of ambient air pollution is to fill the existing knowledge gap and the correct distortions in taxes and subsides[18]. For this reason, Deliver Change is creating a geographically dense network of urban air quality monitors (of our own design) – to visualise it down to individual street level. There will be 10,000 individual AirSensa units in London alone, with discussions already happening in other urban centres in the UK. Schools will be able to have an AirSensa for free; Universities will have access to the data for free, as will Local Authorities.

In addition to this, we are also launching a new initiative: Lets Make Air Pollution Visible. This will be a call-to-action, encouraging all sectors of society to recognise the issue and allow it to feed into their decision-making – be it simple avoidance, reducing air pollution levels, creating/editing legislation or increasing the research.

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