

Air Pollution and Noise: their effects on human health and social inclusion - a review of recent literature

Executive Summary

This review of recent papers looks at the growing body of evidence of how environmental factors, and particularly road-traffic related air pollution, affect health. Some of the most recent studies focus on the effects of small particulates which penetrate to the lungs and their adverse effects on cardiovascular disease, coronary heart disease, and stroke. Other studies have highlighted the disproportionate burden of environmental degradation, particularly air quality and noise, on deprived communities, with consequent impacts on increasing social deprivation.

Impacts of air pollution on health

Pollutant	Effects related to short-term exposure	Effects related to long-term exposure
Particulate matter	<ul style="list-style-type: none"> • Lung inflammatory reactions • Respiratory symptoms • Adverse effects on the cardiovascular system • Increase in medication usage • Increase in hospital admissions • Increase in mortality 	<ul style="list-style-type: none"> • Increase in lower respiratory symptoms • Reduction in lung function in children • Increase in chronic obstructive pulmonary disease • Reduction in lung function in adults • Reduction in life expectancy, owing mainly to cardiopulmonary mortality and probably to lung cancer
Ozone	<ul style="list-style-type: none"> • Adverse effects on pulmonary function • Lung inflammatory reactions • Adverse effects on respiratory symptoms • Increase in medication usage • Increase in hospital admissions • Increase in mortality 	<ul style="list-style-type: none"> • Reduction in lung function development
Nitrogen dioxide (in ambient air, NO ₂ serves as an indicator for a complex mixture of mainly traffic-related air pollution)	<ul style="list-style-type: none"> • Effects on pulmonary function, particularly in asthmatics • Increase in airway allergic inflammatory reactions • Increase in hospital admissions • Increase in mortality 	<ul style="list-style-type: none"> • Reduction in lung function • Increased probability of respiratory symptoms

Source: World Health Organization, 2004, p7

Children (and the unborn foetus) are especially vulnerable to the effects of air pollution, because their lungs, metabolic and immune systems are still developing, they have higher rates of respiratory infections, and have activity patterns which lead to higher exposure. The effects in childhood and foetal development can include:

- aggravation of asthma
- increased cough and bronchitis
- low birth weight
- infant deaths (due to respiratory and Sudden Infant Death Syndrome)
- pre-term births
- birth defects

leading to effects throughout adult life:

- premature ageing
- higher risk of infection
- susceptibility to tobacco smoke
- susceptibility to occupational exposure.

Air pollution has been associated with a range of health impacts, including:

- aggravating and causing respiratory disease (including asthma, bronchitis, emphysema, etc.)
- increased risk of cardiovascular disease and death
- increased risk of coronary heart disease and death
- increased risk of stroke
- eye disease
- DNA damage.

Many studies have tried to assess both how much air pollution contributes to ill health, and how much that ill health costs.

Quantifiable human health impacts of air pollution

Effect	
Chronic effects on:	
Mortality	Adults over 30 years Infants
Morbidity	Bronchitis
Acute effects on:	
Morbidity	Respiratory hospital admissions Cardiac hospital admissions Consultations with primary care
Physicians	Restricted activity days Use of respiratory medication Symptom days
Acute effects on:	
Mortality	
Morbidity	Respiratory hospital admissions Minor restricted activity days Use of respiratory medication Symptom days

Source: Holland et al, 2005, p3.

Examples of the costs of air pollution from Europe, the UK and Sheffield

European Union	<ul style="list-style-type: none"> • kills 370,000 people per year • reduces life expectancy by up to 9 months on average • costs between €427 billion and €790 billion per year
United Kingdom	<ul style="list-style-type: none"> • 6,500 deaths brought forward (in 2002) • 6,400 hospital admissions (in 2002) • A 1 µg/m³ decrease in PM_{2.5} would give between 1.5 and 3.5 extra days of life per person • NOx damage per tonne emission for 2010 €3,900 (low estimate) • PM_{2.5} damage per tonne emission for 2010 €37,000 (low estimate) • SO₂ damage per tonne emission for 2010 €6,600 (low estimate)
Sheffield	<ul style="list-style-type: none"> • 6% coronary heart disease deaths • 11% stroke deaths • Annual health costs of £48.1m (low estimate) based on: <ul style="list-style-type: none"> – 8,000 tonnes per annum NOx emissions (£20.9m) – 1,480 tonnes per annum SO₂ emissions (£6.5m) – 1,190 tonnes per annum PM₁₀ emissions (£20.7m - costs estimated on PM_{2.5} being 70% of PM₁₀) • Estimated annual cost benefits of introducing a Low Emission Zone between £1.8 million and £11.4 million per year (compared with inner relief road, costing £59m capital costs, bringing annual cost benefits of £0.03m to £0.2m)

Noise and health

As well as the adverse effects of air pollution on health, road traffic generates noise which affects health in the following ways:

- annoyance
- sleep disturbance
- quality of sleep
- ischaemic heart disease
- impaired performance by school children
- some evidence to suggest that it may cause low birthweight in babies and psychiatric disorders.

Conclusion

The growing body of evidence would suggest that bolder and more effective measures should be taken to reduce people's exposure to air pollution and noise attributable to road-traffic and thus reduce their risk of disease and mortality due to cardiovascular, respiratory, and other symptoms. The evidence suggests that there is no safe level of exposure to particulate matter, and especially to very small particles (PM_{2.5}) which penetrate into the lungs. Many studies highlight the possible under-estimates of the health effects of traffic-related air pollution and noise, due to problems in isolating these from other effects on health.

The most deprived communities experience the worst environmental degradation. The implications for policy therefore would seem to be to target measures to reduce air pollution in deprived areas and highly populated urban areas, where the relatively small individual health benefits can make a big impact because they reach a large population. Concerns about the U.K.'s ability to meet current targets to reduce air pollution, particularly in urban areas, further emphasise the need for reducing motor vehicle traffic but at the same time enhancing alternatives such as walking, cycling, and public transport.

Report prepared by
Barbara Rimmington, Research Officer
East End Quality of Life Initiative
10 Montgomery Terrace Road
Sheffield, S6 3BU
Tel: 0114 285 9931
Fax: 0114 278 7173
Email: barbara@sheffielddct.co.uk

Revised January 2006