

Presented by

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# Environmental Justice and Air Pollution

## Clean Air Day

*Unequal Air: structural racism, environmental injustice, and the disproportionate burden of pollution*

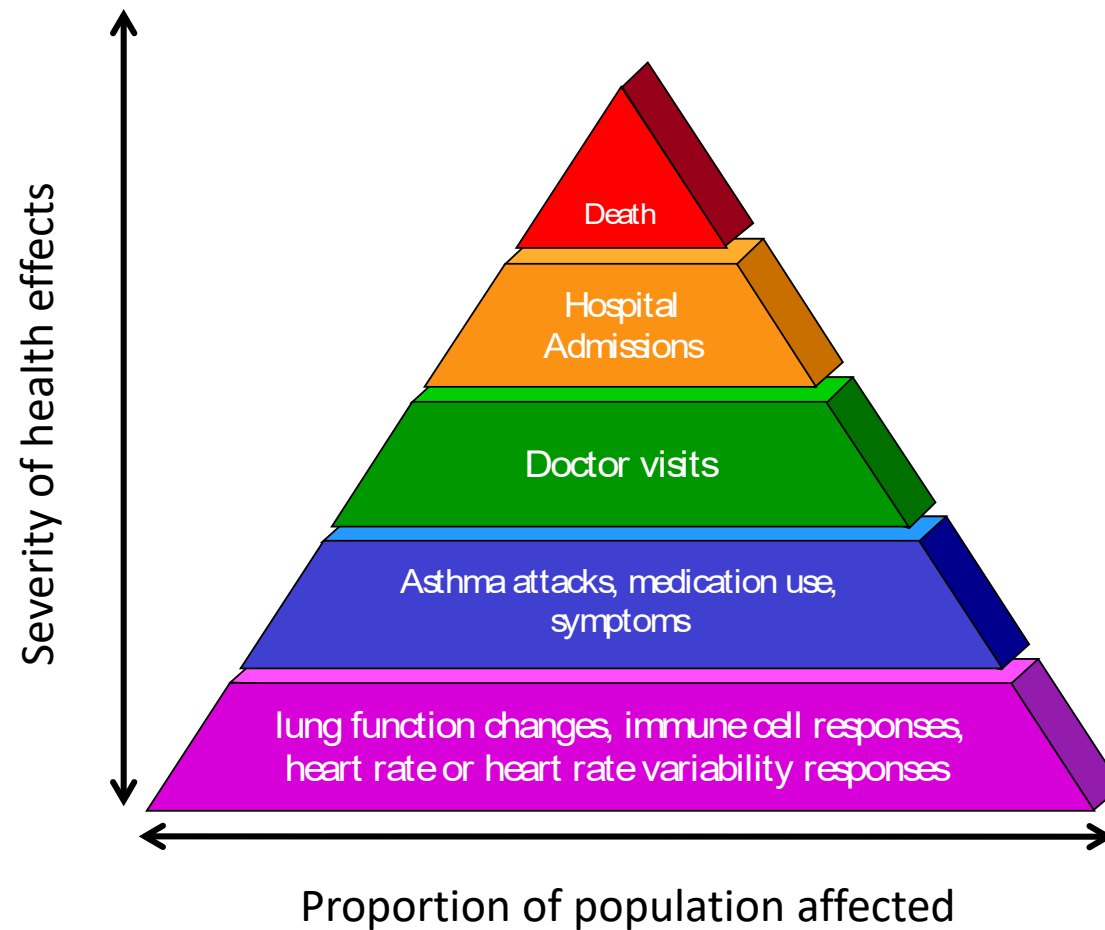
*#CleanAirDay @cleanairdayuk @aqmrcUWE @jobarnes\_UWE*

# UK Annual Toll of Death and Ill Health

- Air quality is the largest environmental health risk in the UK.
- Most recent data suggesting that between **28,000 and 36,000** people die prematurely each year, principally associated with exposure to fine particles (PM<sub>2.5</sub>) and nitrogen dioxide (NO<sub>2</sub>).
  - [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/734799/COMEAP\\_NO2\\_Report.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/734799/COMEAP_NO2_Report.pdf)
- Public Health England estimate the 2017 costs of air pollution to the NHS and social care in England as about **£157 million**.
  - [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/708855/Estimation\\_of\\_costs\\_to\\_the\\_NHS\\_and\\_social\\_care\\_due\\_to\\_the\\_health\\_impacts\\_of\\_air\\_pollution\\_-\\_summary\\_report.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/708855/Estimation_of_costs_to_the_NHS_and_social_care_due_to_the_health_impacts_of_air_pollution_-_summary_report.pdf)



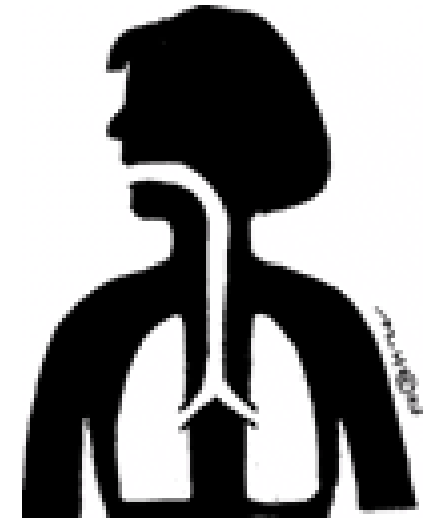
# Health Effects of Ambient Pollution



Source: KCL. Originally based on a diagram in United States Congress Document N° 92-241, 1972 and subsequently WHO (1972)

# How does air pollution affect health?

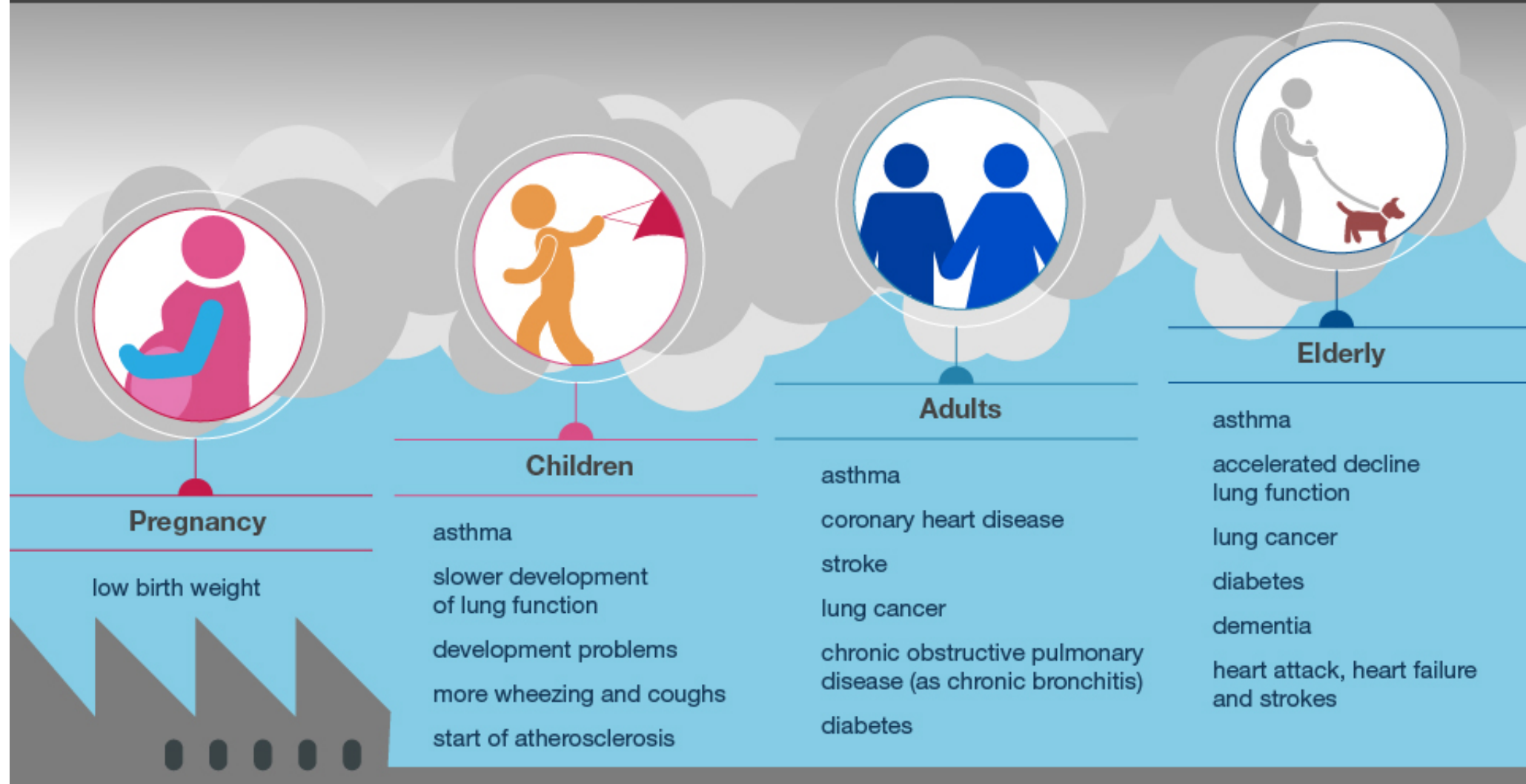
- Pollutants with the strongest evidence for public health concern, include particulate matter (PM), ozone (O<sub>3</sub>), nitrogen dioxide (NO<sub>2</sub>) and sulphur dioxide (SO<sub>2</sub>).
- The health risks associated with PM<sub>10</sub> and PM<sub>2.5</sub> are especially well documented.
- PM is capable of penetrating deep into lung passageways and entering the bloodstream causing cardiovascular, cerebrovascular and respiratory impacts.
- In 2013, PM was classified as a cause of lung cancer by WHO's International Agency for Research on Cancer (IARC). It is also the most widely used indicator to assess the health effects from exposure to ambient air pollution.



# How does air pollution affect health?

- In children and adults, both short- and long-term exposure to ambient air pollution can lead to reduced lung function, respiratory infections and aggravated asthma.
- Maternal exposure to ambient air pollution is associated with adverse birth outcomes, such as low birth weight, pre-term birth and small gestational age births.
- Emerging evidence also suggests ambient air pollution may affect diabetes, neurological development in children, psychiatric disorders, dementia, Parkinson's, Alzheimer's, multiple sclerosis, glaucoma and even baldness!
- Growing evidence suggests the burden of disease from ambient air pollution is expected to greatly increase.

# Air pollution affects people throughout their lifetime



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

**older people**  
(65 and older)



**pregnant women**



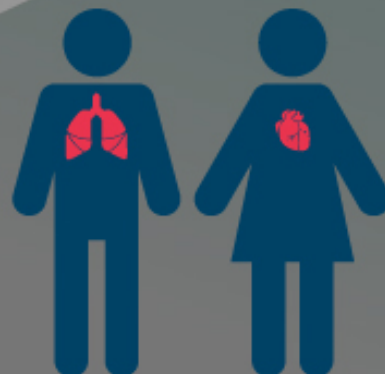
**communities with poorer air quality**  
(eg. those situated closer to main roads)



**children**

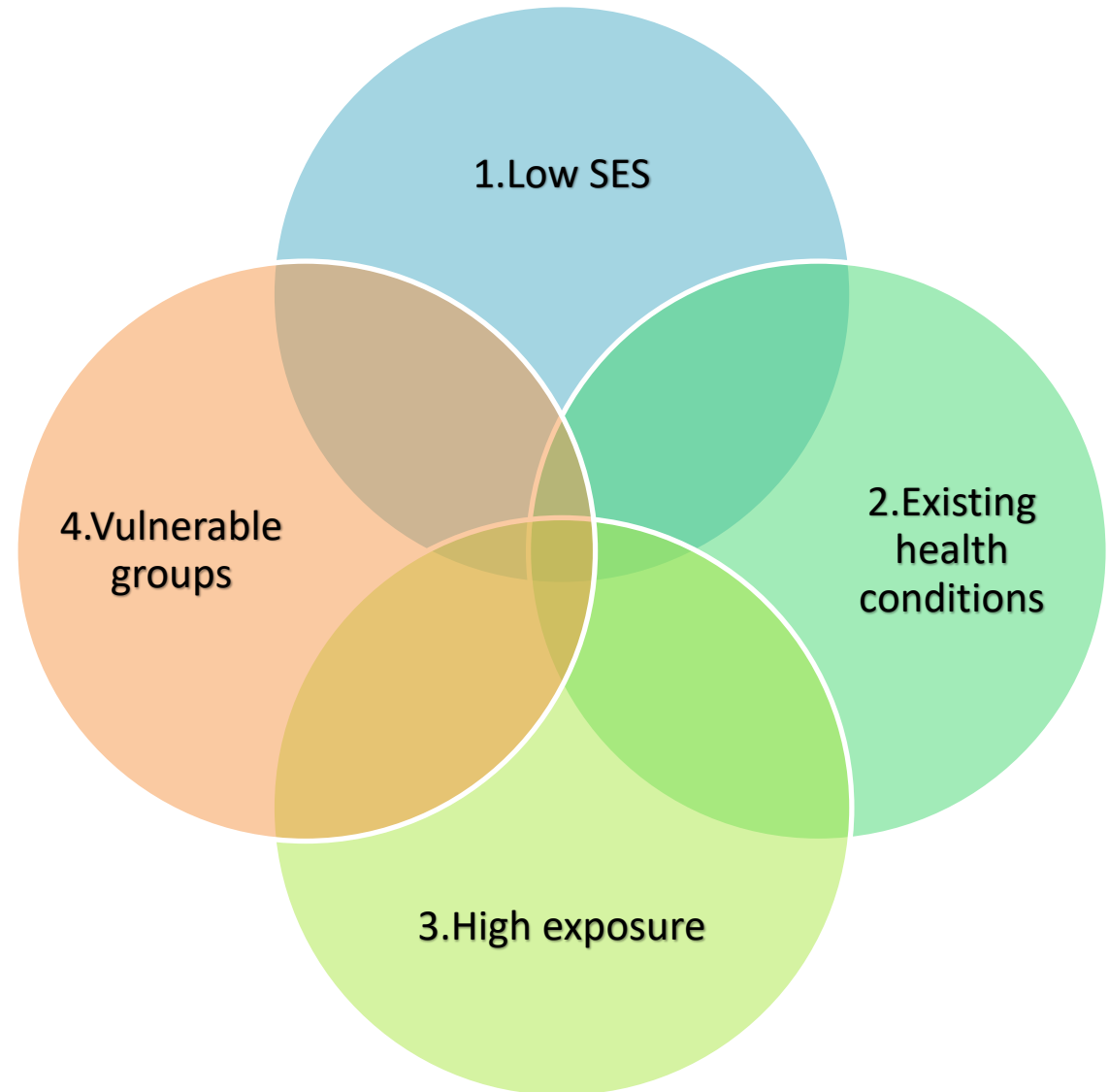


**those with cardiovascular disease and/or respiratory disease**



# Quadruple Jeopardy Effect

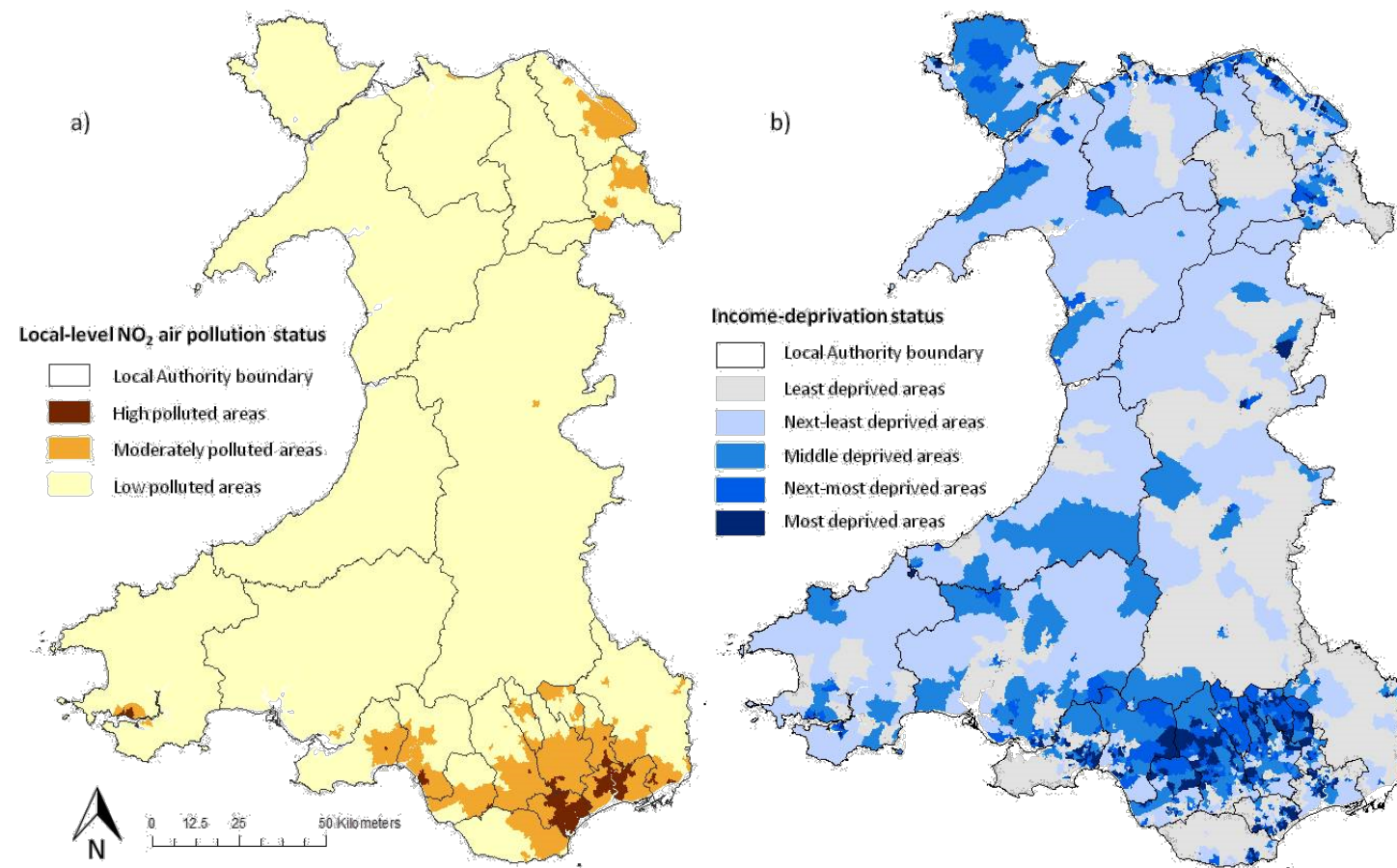
1. Low socio-economic status (SES),
2. Health impacts commonly associated with low SES,
3. Increased exposure to air pollution  
AND
4. Additional susceptibility of being sensitive to the effects of exposure.



Developed from the 'triple jeopardy effect'  
(Jerrett et al., 2001)



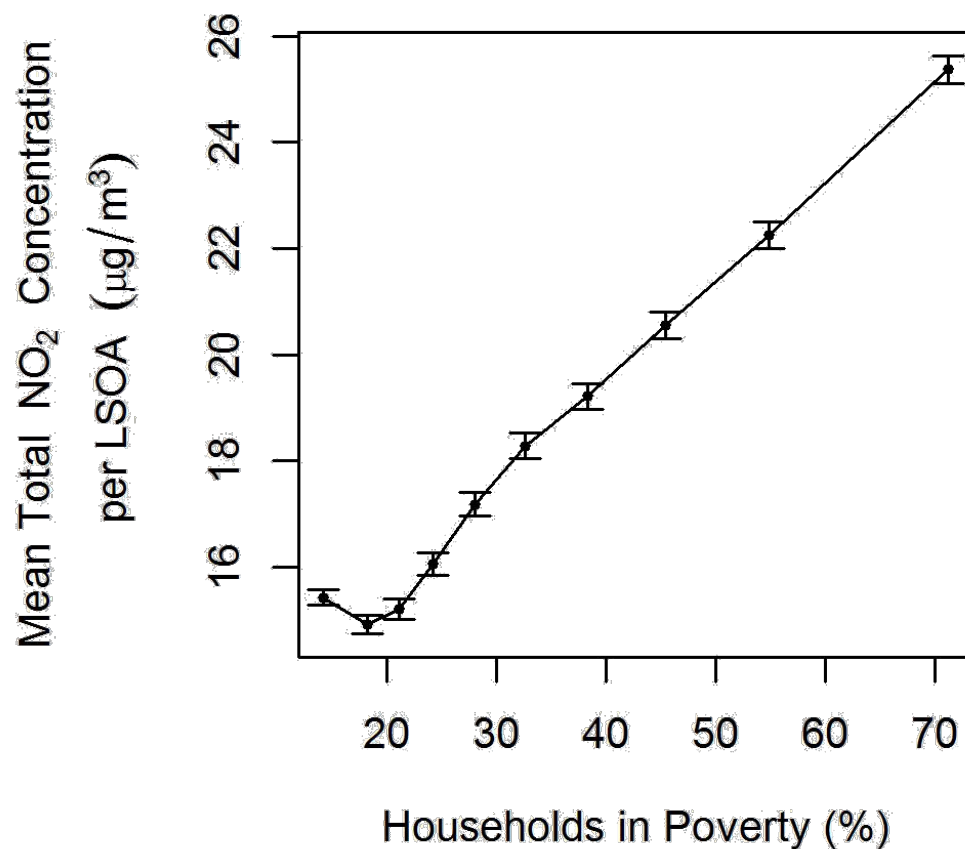
# Air pollution, deprivation and health



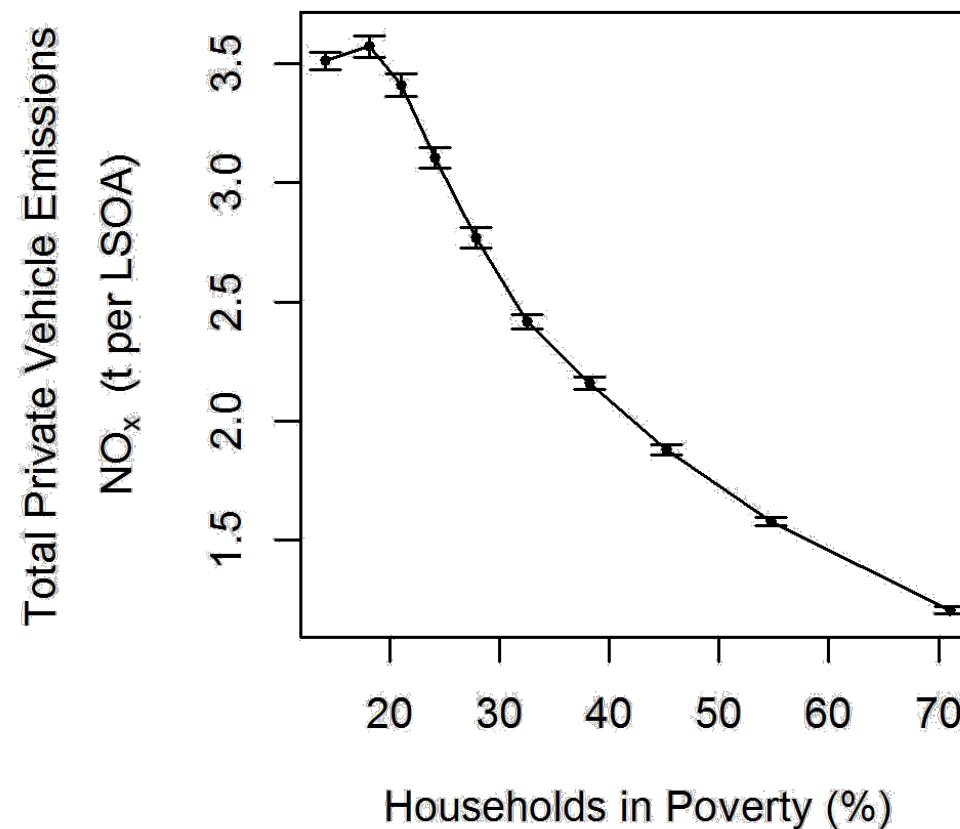
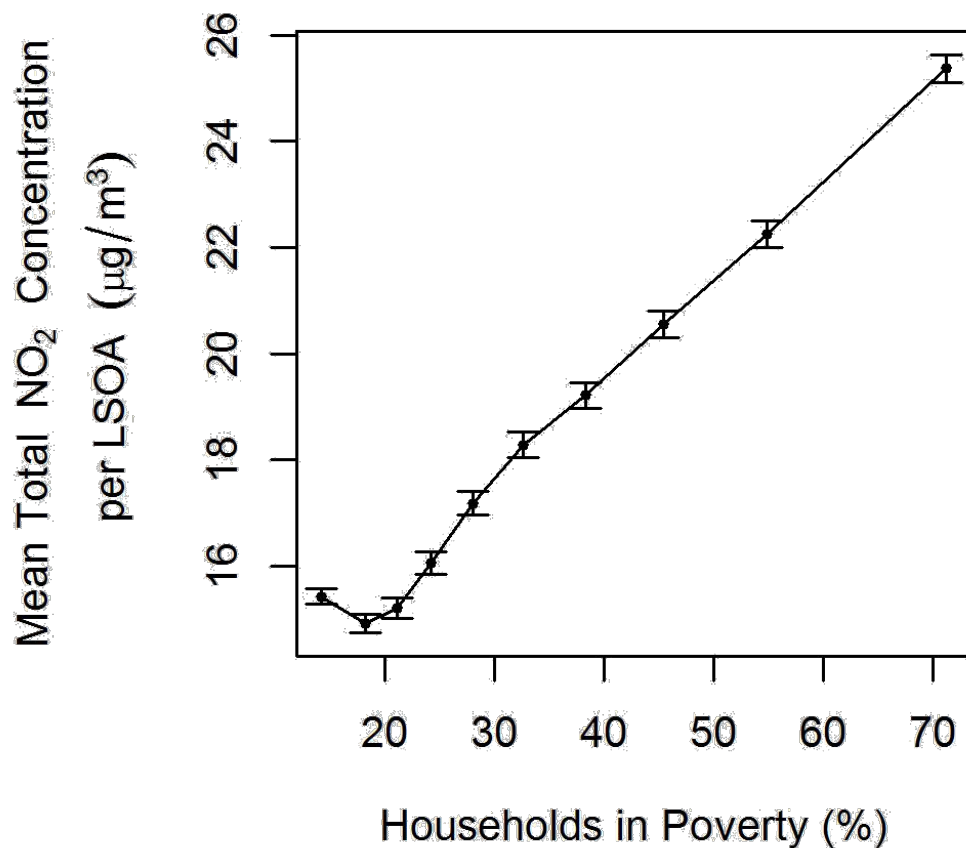
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Considered simultaneously, air pollution and deprivation **modified and strengthened** associations with all-cause and respiratory disease mortality, especially in ‘most’ deprived areas where most-vulnerable people lived and where health needs were greatest.

# NO<sub>2</sub> concentrations against poverty



# NO<sub>2</sub> concentrations vs NO<sub>x</sub> emissions against poverty



# Environmental injustice of traffic pollution

- UK census areas with more households in poverty have:
  - lower total private vehicle emissions per household
  - higher levels of non-car ownership /fewer multiple-car households
  - lower average vehicle NOx emission factor per household
  - fewer diesel vehicles per household
  - drive less (total distance)
  - have vehicles on average only just over a year older than households in the least poor areas
- But,
  - are exposed to the highest concentrations of traffic-related pollution!



# Increasing inequalities

Annual mean NO<sub>2</sub> concentrations have fallen more in more affluent areas.

PM<sub>10</sub> concentrations have increased more in poorer areas.

(Mitchell, Norman and Mullin, 2015)

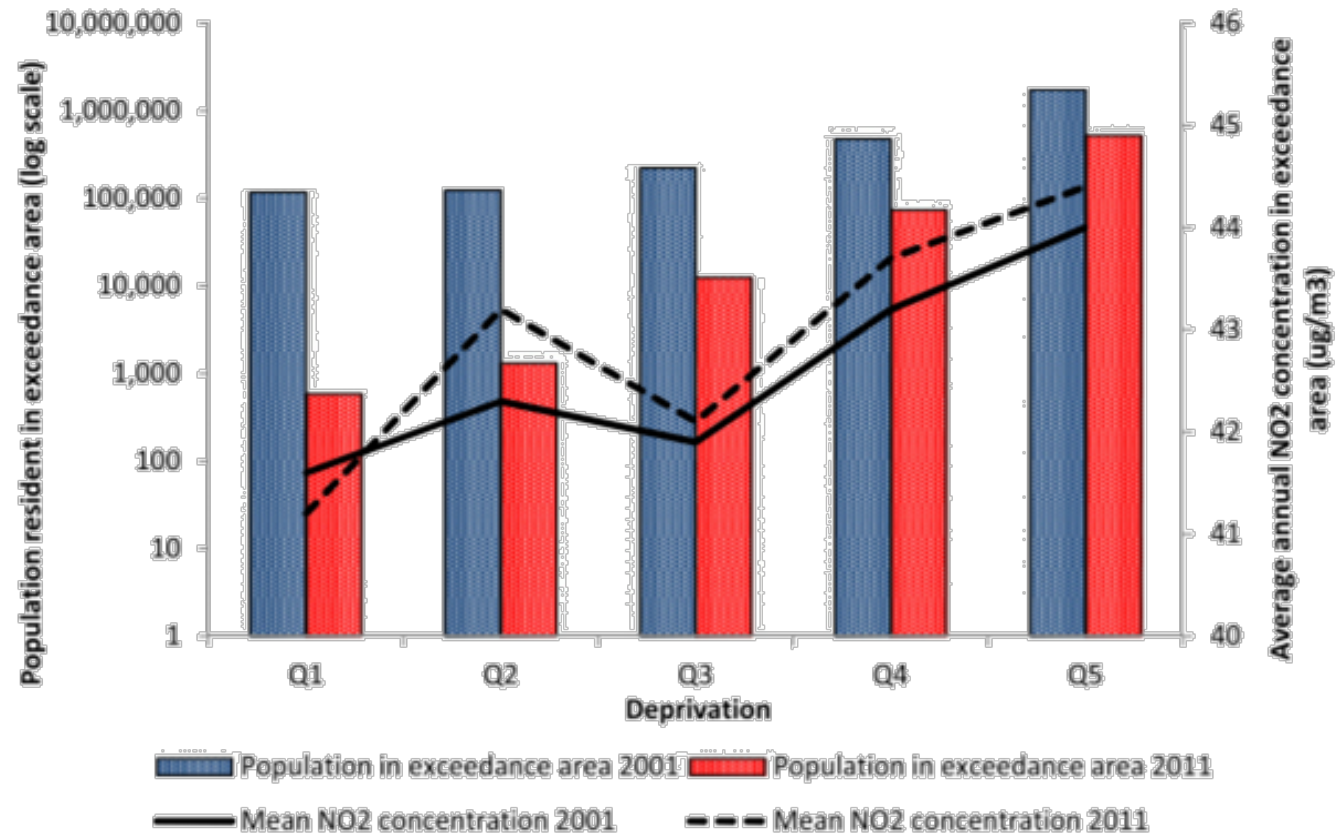


Figure 4. GB population in lower super output areas (LSOAs) where NO<sub>2</sub> exceeds the 40 µg m<sup>-3</sup> annual average limit value. Q1 is the least deprived quintile, Q5 the most deprived quintile. Concentration values are the mean of annual average concentrations for LSOAs where NO<sub>2</sub> concentration >40 µg m<sup>-3</sup>.

# Air pollution, noise, heat & socioeconomic status

- Unequal exposure and unequal impacts: social vulnerability to air pollution, noise and extreme temperatures in Europe <https://www.eea.europa.eu/highlights/protect-vulnerable-citizens>
- In-depth Report from Science for Environment Policy ‘Links between noise and air pollution and socioeconomic status. [http://ec.europa.eu/environment/integration/research/newsalert/pdf/air\\_noise\\_pollution\\_socioeconomic\\_status\\_links\\_IR13\\_en.pdf](http://ec.europa.eu/environment/integration/research/newsalert/pdf/air_noise_pollution_socioeconomic_status_links_IR13_en.pdf)
- See also: Barnes, J. , De Vito, L. , Blanes Guàrdia, Núria, Fons Esteve, J. , van Kamp, I. , Marín Puig, A. , Hayes, E. T. and Michalec, A. (2019) *Qualitative assessment of links between exposure to noise and air pollution and socioeconomic status*. Technical Report. University of the West of England. Available from: <https://uwe-repository.worktribe.com/output/869590>

Unequal exposure and unequal impacts: social vulnerability to air pollution, noise and extreme temperatures in Europe

ISSN 1977-8449



# Summary

- Air pollution has significant effects on health and quality of life as well as on mortality.
- Different health impacts from air pollution throughout the life-course.
- Pregnant women, young children, the elderly and those with pre-existing health conditions are most vulnerable.
- Areas with high levels of deprivation/low socioeconomic status are more likely to have high levels of air pollution.
- Deprivation and air pollution exposure can combine to intensify/exacerbate health effects.
- Households living in poverty generate much less traffic-related air pollution than households in more affluent areas.
- Disparities are increasing as concentrations improve more slowly or even worsen in poorer areas.
- Air pollution is just part of a complex mix of health determinants affecting those in low SES.