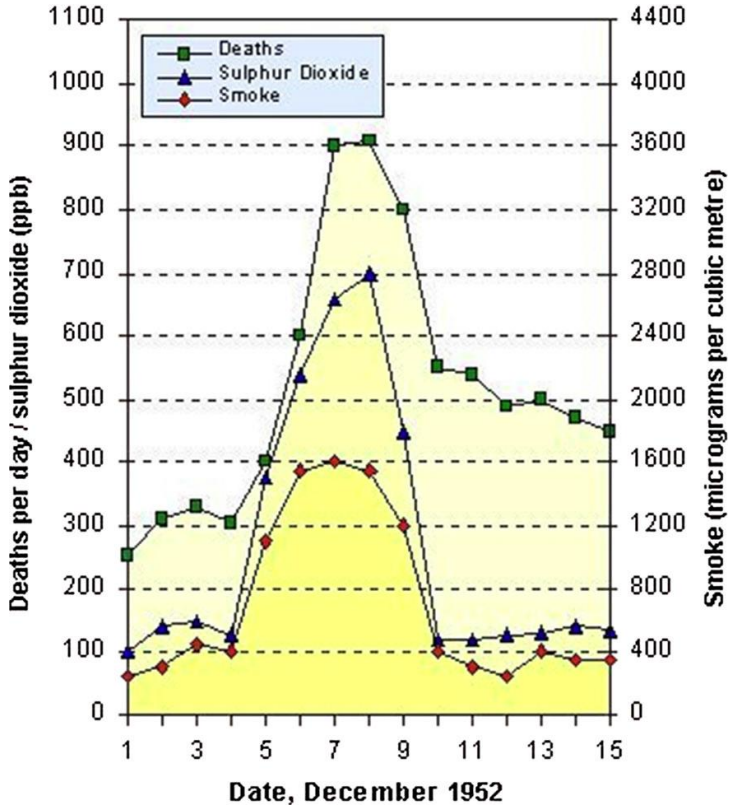
Health Effects of Air Pollution in Birmingham

Historical Air Pollution

- Typified by acute increases in smoke and SO_2
- 1952 London smog
  - Worst air pollution disaster in UK history
  - Enormous increase in respiratory and cardiovascular complications
  - 4000–12,000 deaths



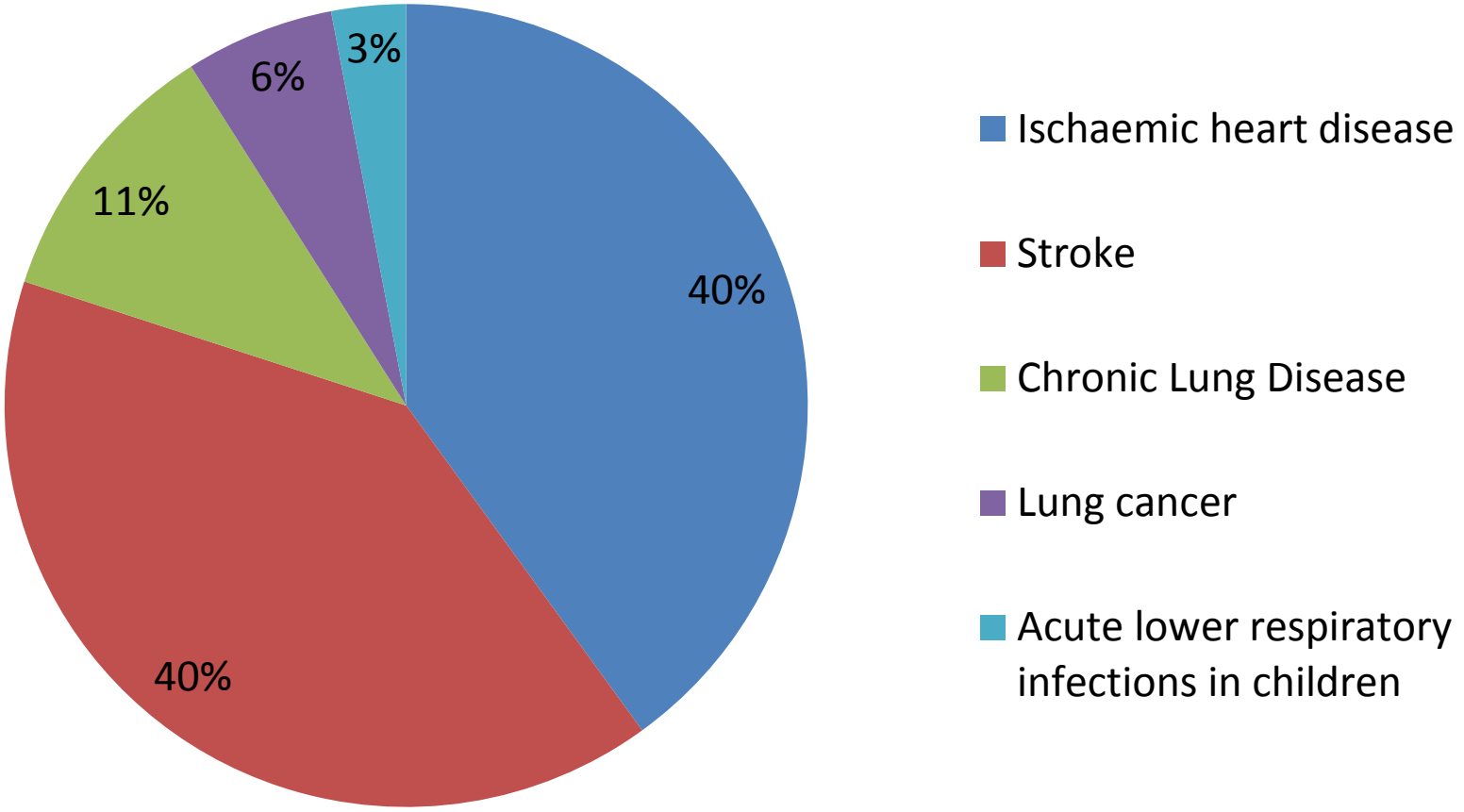
Modern-day Air Pollution

- Acute smog events can still occur
  - Exacerbate chronic conditions
- Concern now is invisible pollutants, indiscernible at ground level. Those with most evidence of health harm are:
  - Nitrogen oxides
  - Ozone (O_3)
  - Exceptionally small particulate matter (PM_{10} and the more abundant $PM_{2.5}$)
- Outdoor air pollution largely due to road traffic
  - UK road traffic 10 times higher in 2012 than 1949
  - Increased use of diesel vehicles from 14% to 50% between 2000 – 2014 in the UK
- Smaller particles are more complicated! (temperature, micro-climate, etc..)

Global Impact of Air Pollution

- Air pollution has overtaken poor sanitation and a lack of drinking water to become the main environmental cause of premature death
- In 2012, approximately 3.7 million people died from outdoor air pollution (WHO 2014)
- In Europe, air pollution is the biggest environment risk factor behind premature death (EEA 2014)
- Indonesia fires – 100,000 XS deaths in 2015!

Air Pollution Deaths



Air Quality Standards

- There are standards set for a number of pollutants
  - SO_2, NO_X, PM, Pb, CO, Benzene, Ozone
- The main focus is on:
  - NO_2 – basis of the Clean Air Zone
  - $PM_{2.5}$ – linked to mortality in the Public Health Outcomes framework
- Vehicle emissions are the major source of both NO_2 and $PM_{2.5}$
- Both are linked to a range of health effects

Impact on Health

- In the UK $PM_{2.5}$ air pollution by itself is responsible for at least 29,000 premature deaths
- UK wide estimated some 23,500 deaths annually on the basis of NO_2 concentrations
- A 10 µg/m^3 reduction in ambient $PM_{2.5}$ pollution would have a larger impact on life expectancy in England and Wales than eliminating road traffic accidents or passive smoking (IOM 2006).

BIRMINGHAM

WORKING TOWARDS A HEALTHY CITY, HEALTHY PLACE

Birmingham City Council

Public Health, August 2016
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EFFECTS OF AIR POLLUTION

IN 2010/11

891

DEATHS

linked to man-made air pollution

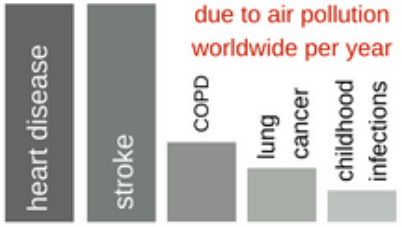
EACH YEAR

LINKED TO

* Cancer * Diabetes * Asthma * Obesity * Stroke * Dementia * Heart Disease *

Deaths

due to air pollution worldwide per year



affects the **vulnerable** and **deprived** areas most

exposed to 21% higher levels of pollution

33.9 % travel to work by car

LINKED TO

* Low birth weight * premature deaths * still births* infant deaths * organ damage*

CHILDREN in HIGH POLLUTION AREAS are 4x more likely to have reduced lung function when they become adults

BUS & TAXI DRIVERS are exposed to **3x more** pollution than anyone else

Data sourced from: Public Health Outcomes Framework (PHE), "Every Breath We Take - the lifelong impact of air pollution" (2015 RCP & RCPCH), Marmot Cold Homes. Active Travel Survey 2015

Cardiovascular & Respiratory Disease

Strong evidence for impact of short and long-term exposure to $PM_{2.5}$ on cardiovascular health:

- Reduced lung function
- Heightened severity of symptoms in individuals with:
  - Asthma
  - COPD
  - **Ischaemic heart disease**
  - **Stroke**
- **Remarkably similar to harm caused by tobacco smoke**

Emerging evidence for $PM_{2.5}$

- Exposure in pregnancy
  - Airway inflammation
  - Increased susceptibility to respiratory infections
- Exposure in childhood
  - Increase in asthma symptoms
  - Low lung function
  - Vulnerability to COPD in adulthood

New Health Outcomes

- Emerging evidence linking long-term exposure to $PM_{2.5}$ with:
  - Adverse birth outcomes
    - Low birth weight at term
    - Small for gestational age
    - Preterm birth
    - Neurodevelopmental harm
    - Miscarriage
  - Diabetes
  - Obesity
  - Cognitive function (?Dementia)
  - Social isolation

NO_2 Health Outcomes

An independent effect of NO_2 has also been found that is additional to $PM_{2.5}$ effects and has both immediate and long term effects:

- Acute exposure:
  - respiratory morbidity,
  - hospital admissions and emergency visits for cardiovascular and/or cardiac diagnoses,
  - mortality due to the effect of associated compounds
- Chronic exposure;
  - Reduced lung function in children and adults
  - Respiratory infections in early childhood including bronchitis
  - Cancer incidence
  - Adverse birth outcomes

Potential Vulnerable Groups

Some groups are at higher risk of exposure to outdoor air pollution:

- Certain professional groups:
  - Taxi and bus drivers are exposed to 3x more pollution than anyone else
  - Urban based traffic police
  - Street cleaners
- Deprivation

Potential Susceptible Groups

Some groups are more susceptible to adverse outcomes following exposure:

- Pregnant women and the unborn child
- Children in high pollution areas are 4x more likely to have reduced lung function when they become adults
- Older adults: risk of death from PM_{10} exposure twice that of younger populations
- Adults with pre-existing medical conditions
  - Aggravate asthma
  - Increase risk of adverse health events

Safe Levels

- There are none
  - There is no threshold below which there would be no impact on mortality

- Every 10µg/m^3 increase in NO_x is associated with 2.5% increase in all cause attributable mortality

- Every 10µg/m^3 increase in PM_{10} is associated with 6% increase in all cause attributable mortality

Estimated Direct Health Effects of Current Air Pollution in Birmingham

- $PM_{2.5}$: **520** deaths in 2010
  - 6.4% deaths attributable to this form of anthropogenic air pollution
  - 5,707 years of life lost
- NO_2: **371** deaths in 2011
  - Range of 2.9% to 8.7% deaths attributable to NO_2 alone (independent of effect with $PM_{2.5}$)
- Combined effect **891 deaths per year**, over half that due to tobacco

Potential Benefits of Reducing Air Pollution

Strong evidence for:

- Increased life expectancy
- Reduced health inequalities
- Reduced morbidity for people living with respiratory and cardiovascular conditions

Potential Benefits of Reducing Air Pollution

Evidence for:

- **Increased productivity** (GDP, workforce productivity)
- **Improved school attainment** (through reduced school absence, improved concentration, reduced behavioural disorders)
- **Reduced use of health care** (most research looked at hospital admissions)
- **Reduced obesity and sedentary behaviour; increase in physical activity** (evidence for children living with asthma and evidence regarding obesity in adults)

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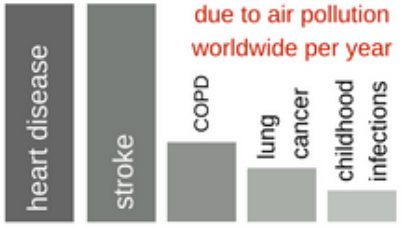

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