Public Health England

Protecting and improving the nation's health

Air pollution & health

1st March 2019

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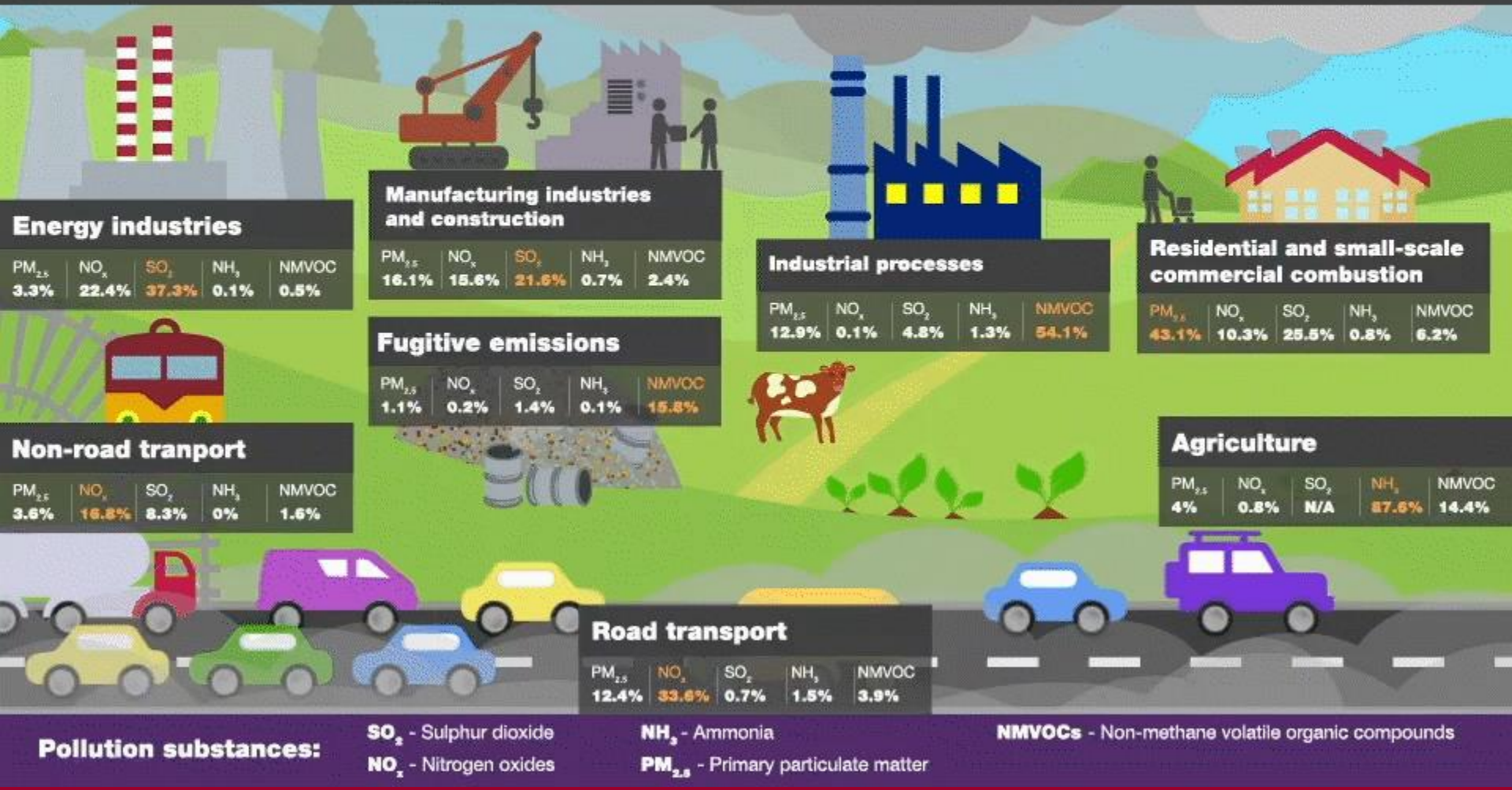
Sources of air pollution



Pollution substances:

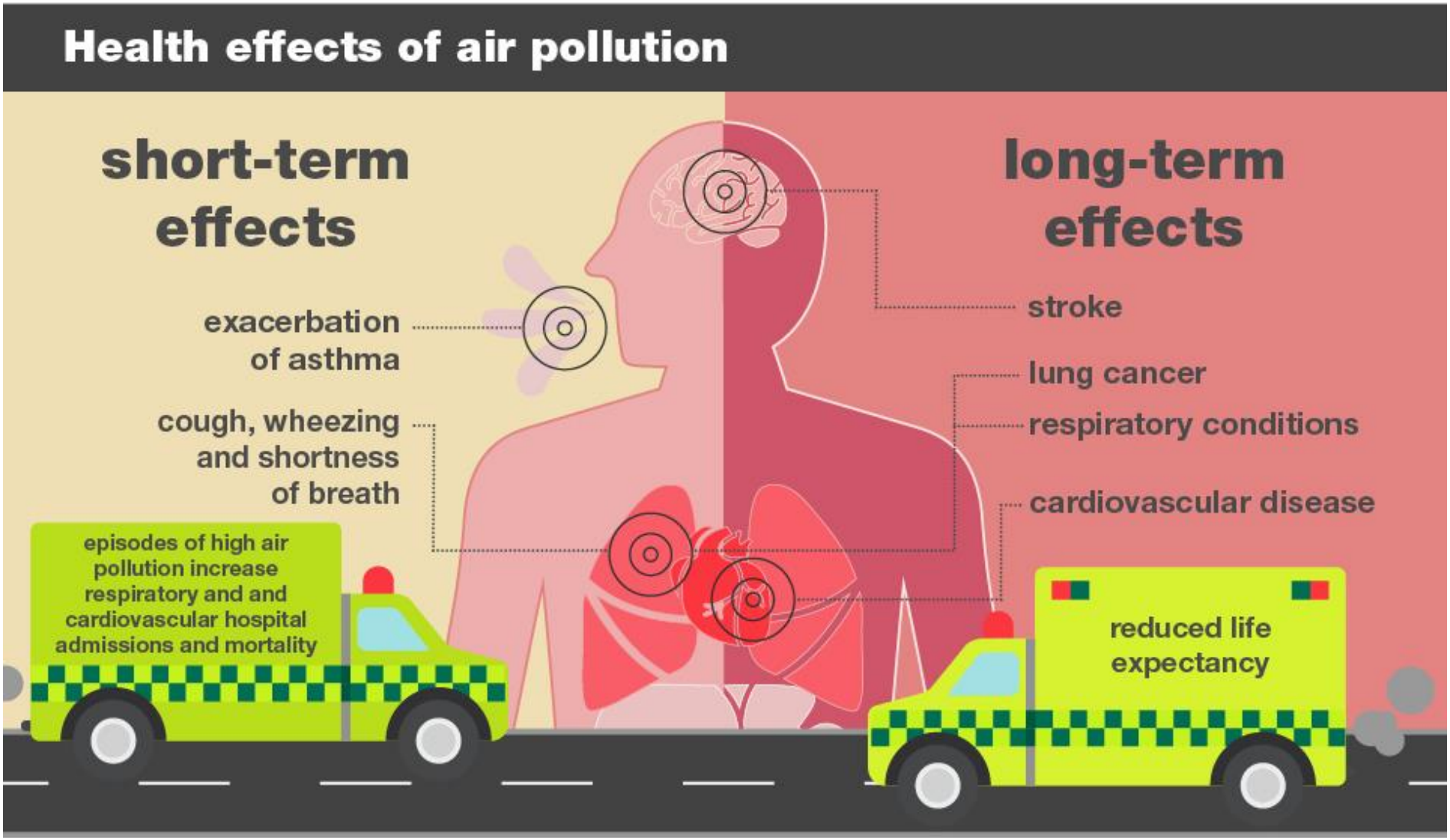
SO_2 - Sulphur dioxide

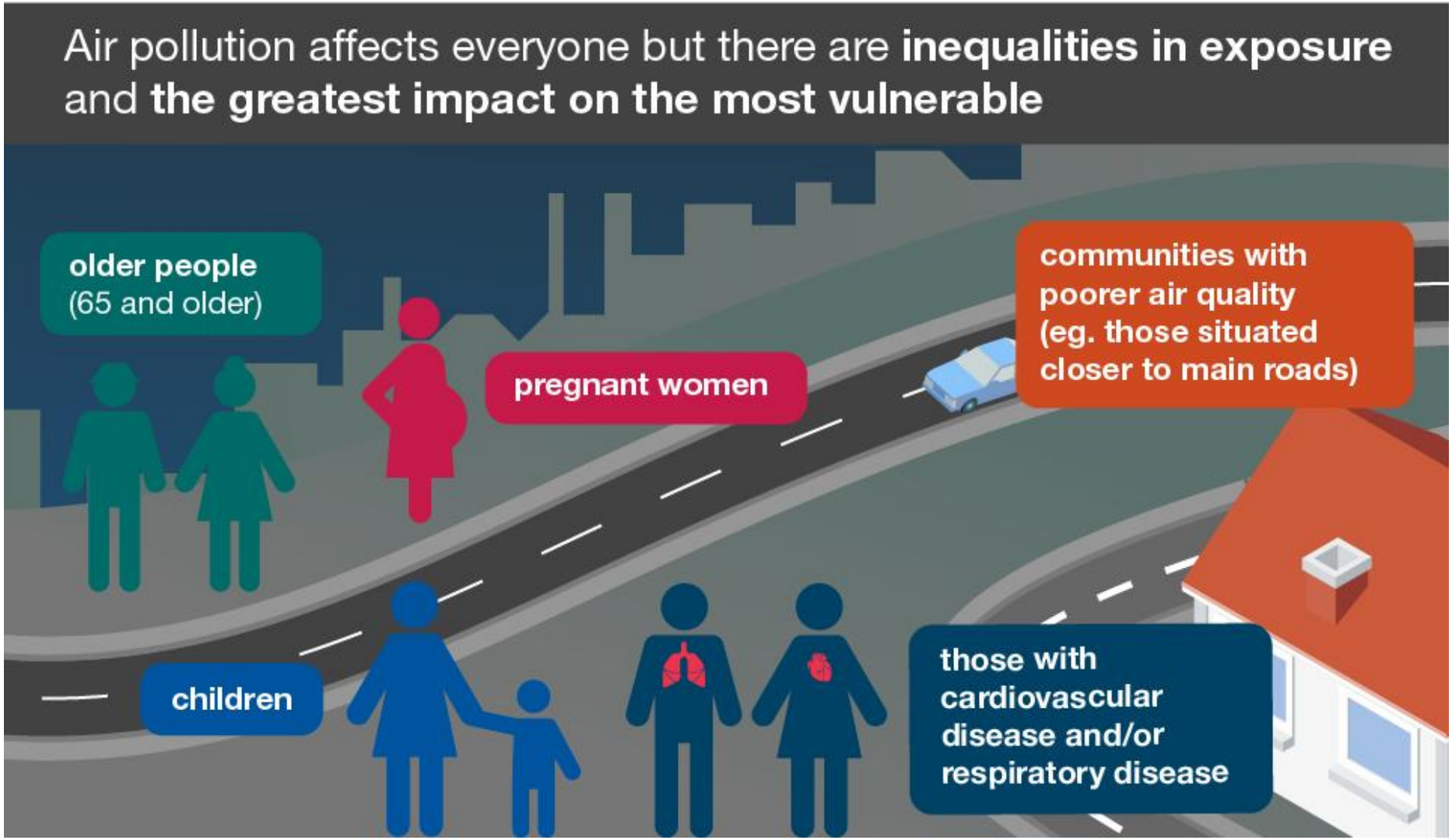
NO_x - Nitrogen oxides

NH_3 - Ammonia

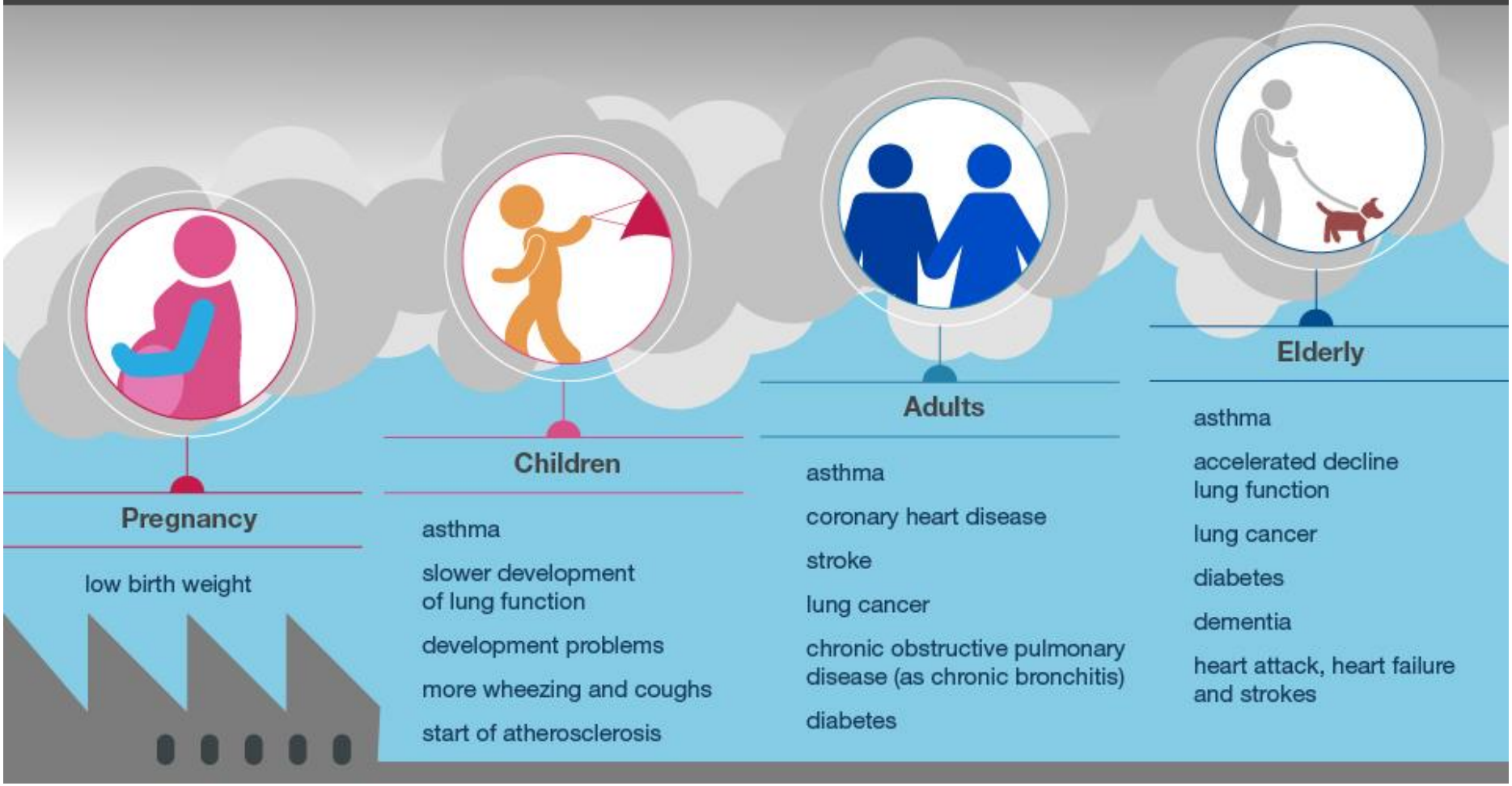
$PM_{2.5}$ - Primary particulate matter

NMVOCs - Non-methane volatile organic compounds

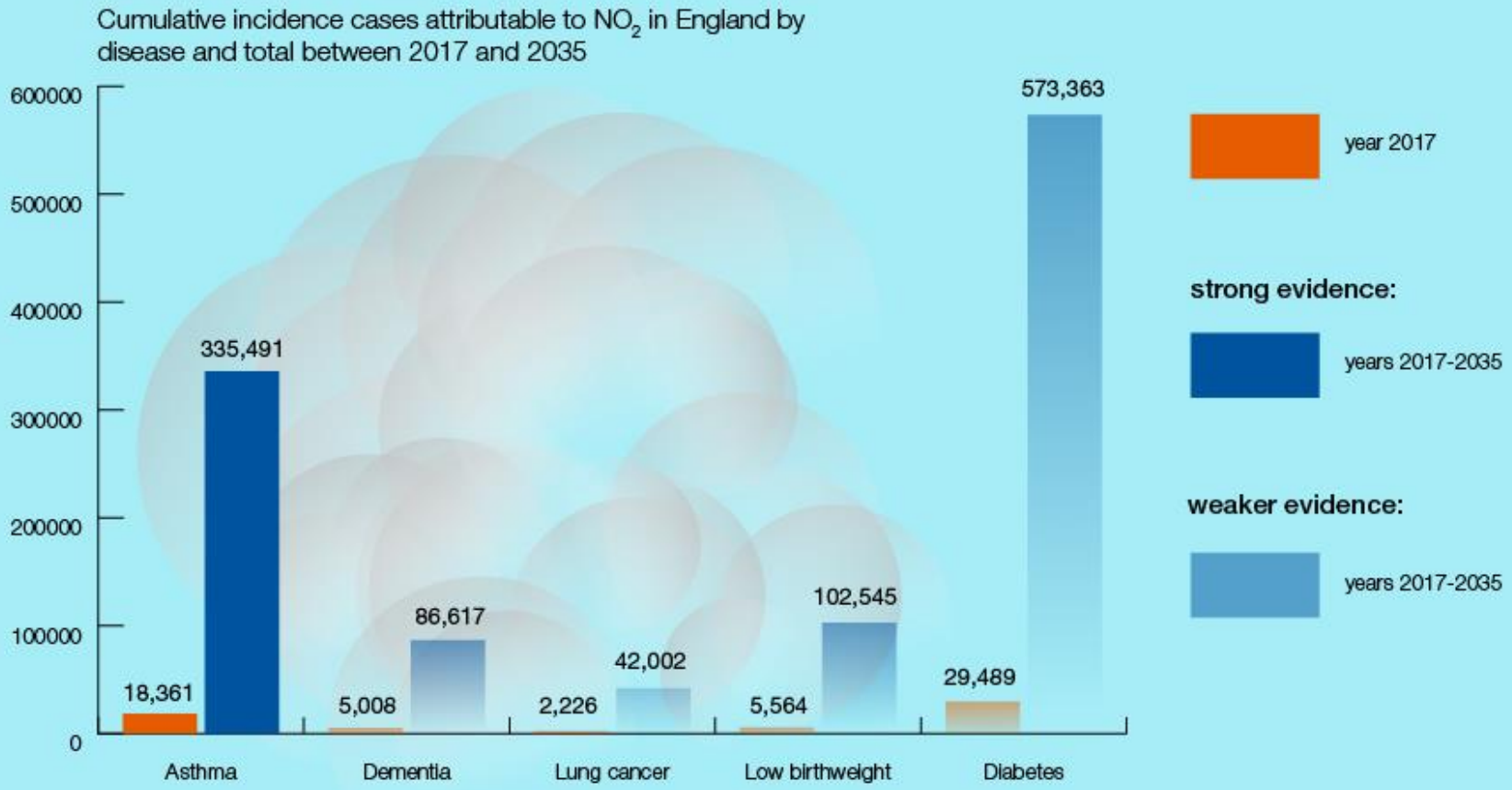

Health effects of air pollution
short-term effects
exacerbation of asthma
cough, wheezing and shortness of breath
episodes of high air pollution increase respiratory and and cardiovascular hospital admissions and mortality
long-term effects
stroke
lung cancer
respiratory conditions
cardiovascular disease
reduced life expectancy


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

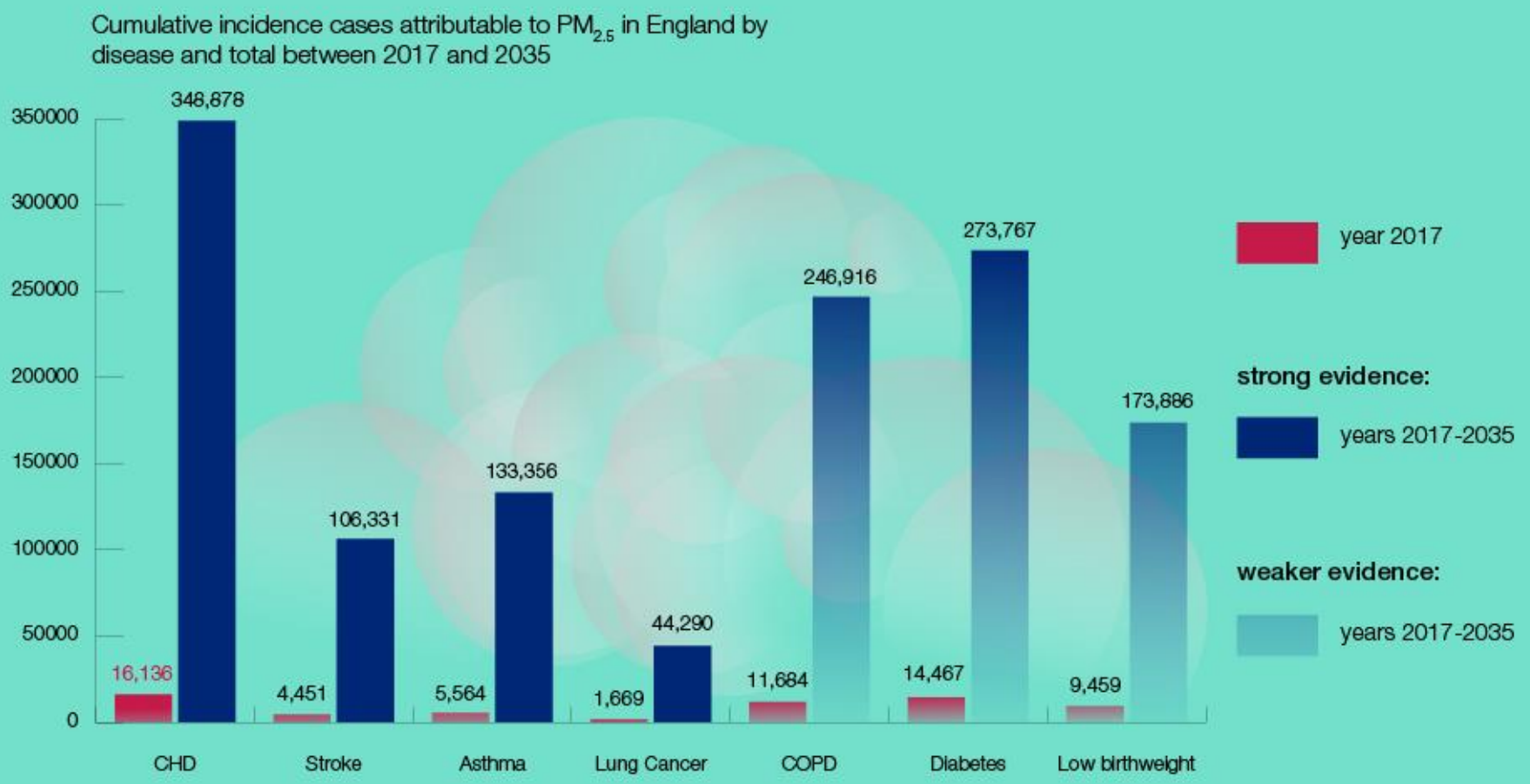
Air pollution affects people throughout their lifetime



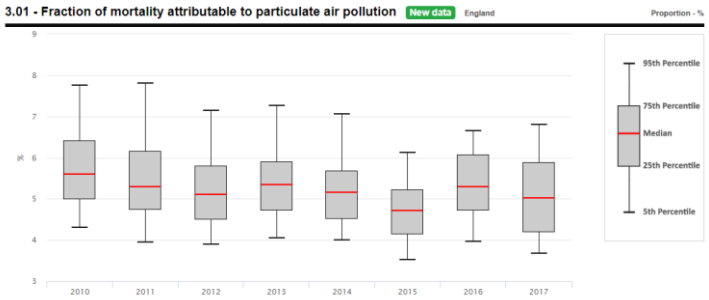
Conditions associated with exposure to NO_2



Conditions associated with exposure to $PM_{2.5}$



Local mortality burdens



Public Health Profiles

3.01 - Fraction of mortality attributable to particulate air pollution 2017

Proportion - %

Area	Count	Value	95% Lower CI	95% Upper CI
England	-	5.1	-	-
North East region	-	3.7	-	-
County Durham	-	3.4	-	-
Darlington	-	3.7	-	-
Gateshead	-	3.6	-	-
Hartlepool	-	3.8	-	-
Middlesbrough	-	4.2	-	-
Newcastle upon Tyne	-	3.7	-	-
North Tyneside	-	3.7	-	-
Northumberland	-	3.2	-	-
Redcar and Cleveland	-	4.0	-	-
South Tyneside	-	3.8	-	-
Stockton-on-Tees	-	4.0	-	-
Sunderland	-	3.8	-	-

Source: Background annual average $PM_{2.5}$ concentrations for the year of interest are modelled on a 1km x 1km grid using an air dispersion model, and calibrated using measured concentrations taken from background sites in Defra's Automatic Urban and Rural Network (http://uk-air.defra.gov.uk/interactive-map.) Data on primary emissions from different sources and a combination of measurement data for secondary inorganic aerosol and models for sources not included in the emission inventory (including re-suspension of dusts) are used to estimate the anthropogenic (human-made) component of these concentrations. By approximating LA boundaries to the 1km by 1km grid, and using census population data, population weighted background $PM_{2.5}$ concentrations for each lower tier LA are calculated. This work is completed under contract to Defra, as a small extension of its obligations under the Ambient Air Quality Directive (2008/50/EC). Concentrations of anthropogenic, rather than total, $PM_{2.5}$ are used as the basis for this indicator, as burden estimates based on total $PM_{2.5}$ might give a misleading impression of the scale of the potential influence of policy interventions (COMEAP, 2012).

TABLE 1 England: baseline population, modelled population-weighted mean concentrations (μg m^{-3}) and estimated effects on annual mortality in 2010 of anthropogenic $PM_{2.5}$ air pollution

Area	Population age 25+ (x 10^3)	Deaths age 25+	Mean anthropogenic $PM_{2.5}$ (μg m^{-3})*	Attributable fraction† (%)	Attributable deaths‡ age 25+	Associated life-years lost§
ENGLAND	**35878.0**	**458743**	**9.9**	**5.6**	**25002**	**264749**
NORTH EAST	**1795.3**	**26090**	**8.1**	**4.6**	**1199**	**12336**
County Durham UA	355.3	5231	7.5	4.3	223	2268
Darlington UA	70.6	1044	8.0	4.5	47	481
Hartlepool UA	62.3	920	8.3	4.7	43	451
Middlesbrough UA	91.4	1363	8.8	5.0	68	695
Northumberland UA	227.0	3254	6.9	3.9	128	1284
Redcar and Cleveland UA	96.9	1368	7.8	4.5	61	664
Stockton-on-Tees UA	131.0	1662	8.2	4.6	77	872
Tyne and Wear (Met C)						
Gateshead	135.3	2031	8.6	4.9	99	962
Newcastle upon Tyne	180.6	2553	8.6	4.9	124	1320
North Tyneside	141.5	2112	8.4	4.8	101	998
South Tyneside	107.4	1675	8.8	5.0	84	864
Sunderland	196.1	2874	8.7	5.0	143	1477

Gowers et al, 2014 https://www.gov.uk/government/publications/estimating-local-mortality-burdens-associated-with-particulate-air-pollution

Scale of the problem

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 µg/m³ 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

The economic costs of air pollution

- **Overall cost of health impacts**: likely to exceed estimates of **£8-20 billion** a year (EAC, 2010)
- **Costs to the NHS and social care system** between 2017-2025 due to health impacts: ***£1.60 billion*** *in England for* $PM_{2.5}$ *and* NO_2 *combined (PHE, 2018)*
- **Costs due to reduced economic productivity**: ***£2.7 billion*** *in 2012 (Defra, 2015)*

Pollutant Emitted	2018 Damage Costs (£/t) National Averages (2017 prices) Latest figures
NO_x	**6,199**
SO_2	**6,273**
NH_3	**6,046**
VOC	**102**
$PM_{2.5}$	**105,836**

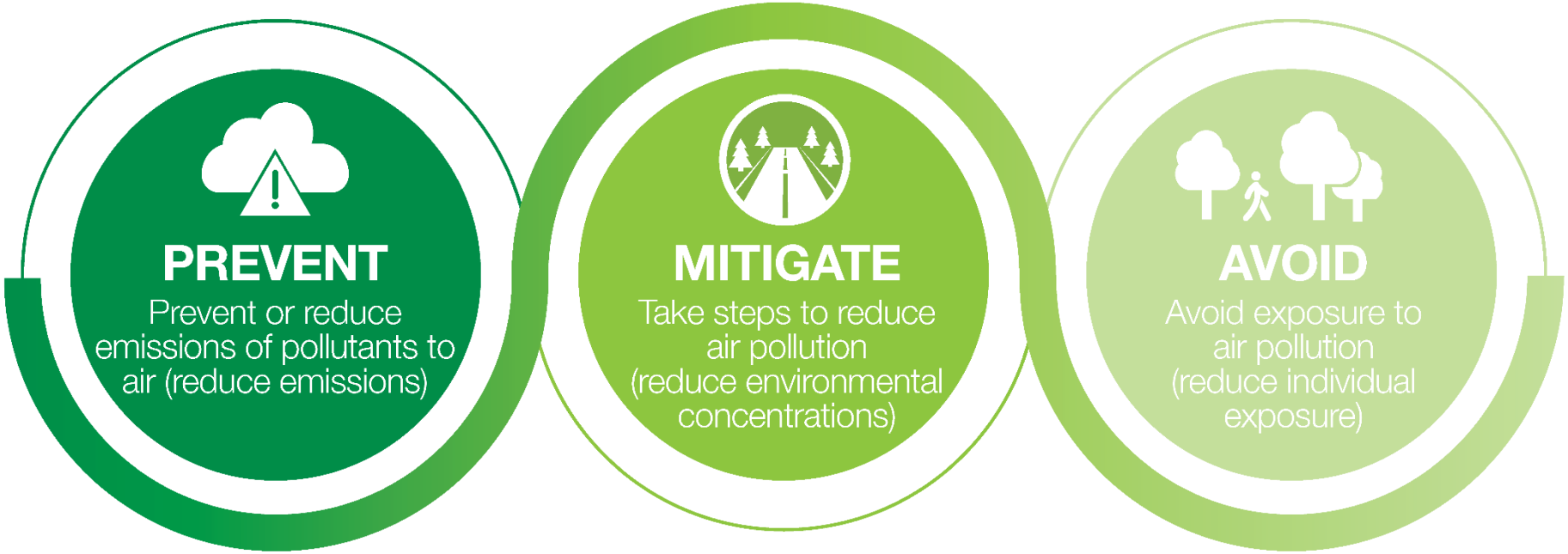
- Improving air quality reduces impacts and associated costs and has health and economic benefits

Why go beyond standards?

- For particulate matter and nitrogen dioxide, there is no clear evidence of a threshold below which adverse health effects do not occur
- The International Agency for Research on Cancer (IARC) has classified PM from outdoor air pollution as carcinogenic to humans
- Exposure can affect health, even at low concentrations below air quality standards – so **improving air quality and reducing air pollution will always benefit people's health**

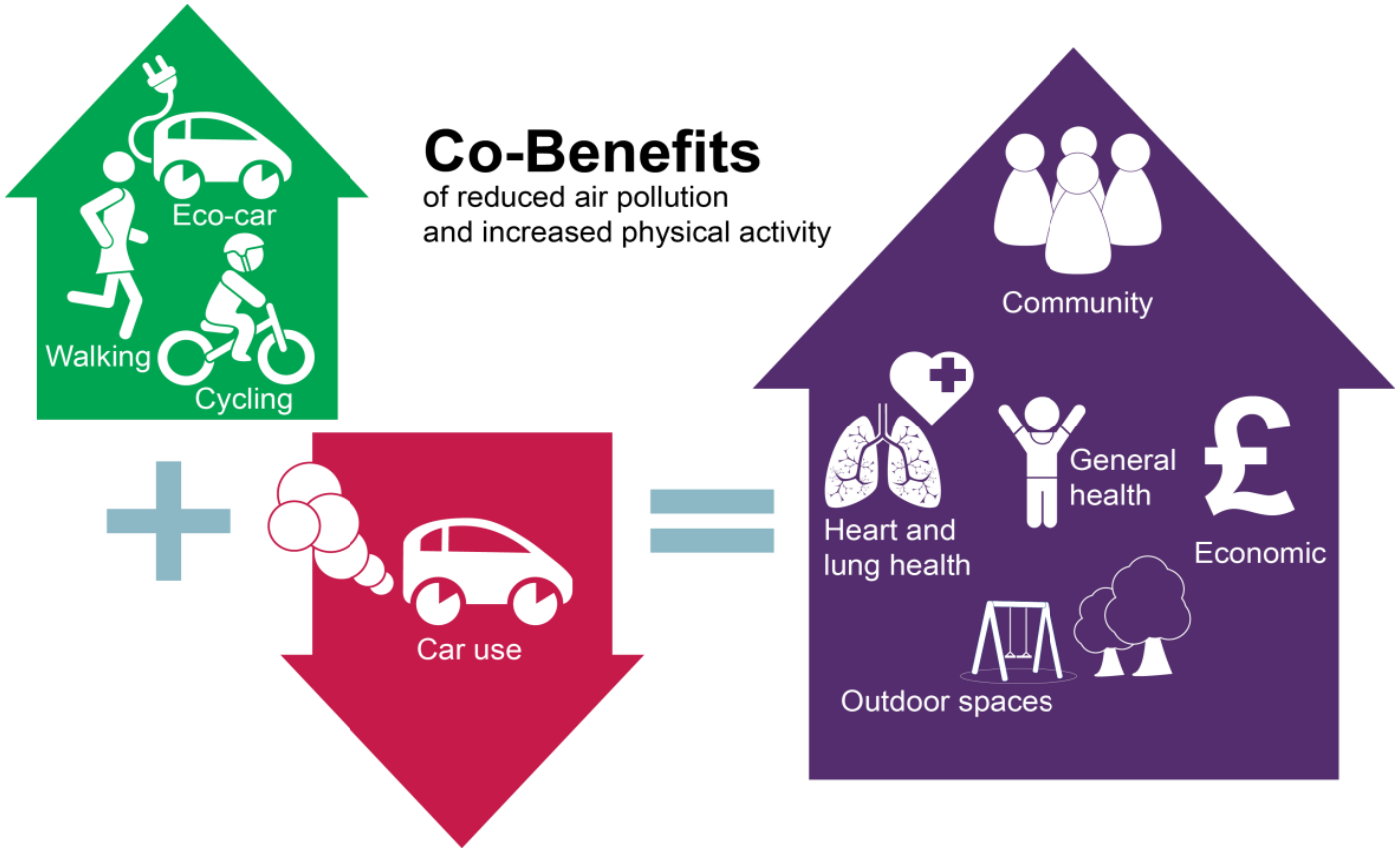
Interventions

- A focus on preventing or reducing emissions can reduce everyone's exposure
- Every little counts: the cumulative benefits of local action are significant



Co-benefits

- Actions that improve air quality can have co-benefits (eg, environmental, economic, or improving physical and mental health)



Create opportunities and promote active travel

Addressing air pollution by providing **good quality infrastructure** and **public transport** and encouraging people **to walk** and **cycle** rather than drive can help people to become fitter and healthier.

Guiding principles

- Consider overall harm from all air pollutants and tackle pollutants together (including greenhouse gases)
- Introduce targeted interventions to address specific local sources or issues
- Prioritise interventions that prevent or reduce emissions over those that address pollution once it has occurred
- Reduce the use of pollution sources in populated areas
- Systematically evaluate all interventions