

UNIVERSITY OF  
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# Assessing Health and Economic Impacts of Air Pollution in the West Midlands Region

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WM-AIR  
CLEAN AIR SCIENCE FOR  
THE WEST MIDLANDS



# AQ-LAT Release

- Free toolkit for assessing health and economic impacts of air pollution
- User guide and bespoke advice and support available
- Available for free download:

<https://wm-air.org.uk/project/health/>

The AQ-LAT User Guide can be viewed here >>

Please send AQ-LAT feedback to: [wmair@contacts.bham.ac.uk](mailto:wmair@contacts.bham.ac.uk)

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**AQ-LAT**  
**Air Quality Lifecourse**  
**Assessment Tool**  
**Download**

To obtain the AQ-LAT please sign up using this form.

Email address

First name

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Company or organisation

Interest in this briefing note

I agree to WM-Air using my information to

### AQ-LAT features

#### WM-Air AQ-LAT

Step One: Select District, Ward, Discount Rate and Time Horizon

- 1 District: Birmingham
- 2 Ward: Balsall Heath West
- 3 Time Horizon: 15 years (Maximum: 30 years)
- 4a Discount Rate Costs: 2.5% (Default: HM Treasury Green Book rate 3.5%)
- 4b Discount Rate QALYs: 1.5% (Default: HM Treasury Green Book rate 1.5%)
- 5 Balsall Heath West  
PM2.5 annual average concentration at baseline (2021): 10.38 µg/m<sup>3</sup>  
NO<sub>2</sub> annual average concentration at baseline (2021): 22.90 µg/m<sup>3</sup>

Step Two: Either customise local air quality target, OR use a pre-selected scenario

- 6a PM2.5 Target (µg/m<sup>3</sup>): 10.37 (Values change automatically if scenario selected)
- 6b NO<sub>2</sub> Target (µg/m<sup>3</sup>): 22.21 (Values change automatically if scenario selected)
- 7 Target Population (%): 100% (Values change automatically if scenario selected)

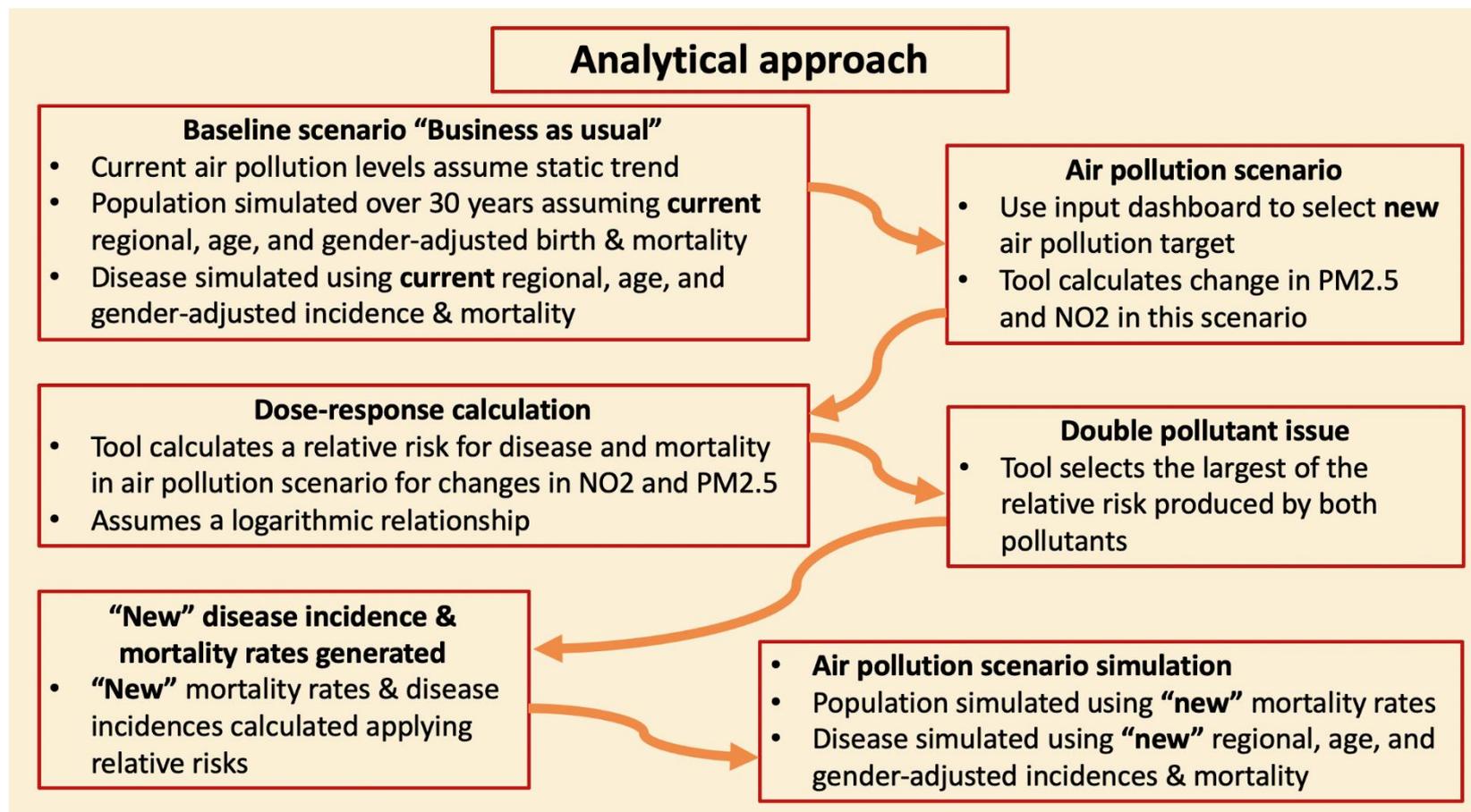
OR

- 8 Pre-selected air pollution scenarios: 2030 Electric Vehicle targets: 24% CAR 25% BUS 9% HOV  
\*Pre-selected scenarios apply to entire ward  
override with slider if required  
Confirm pre-selected scenario selection
- 9
- 10 Step Three: Run your calculations

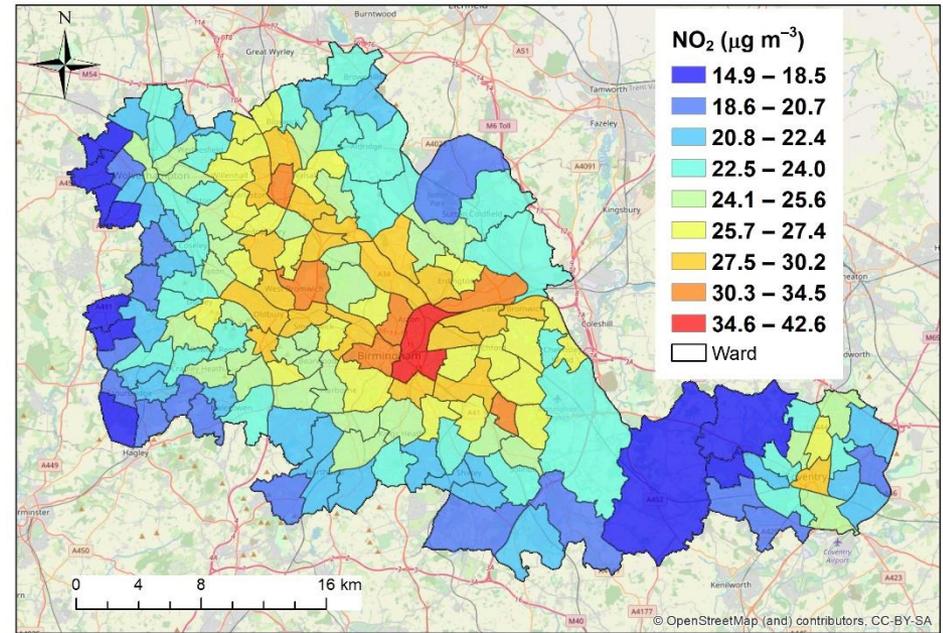
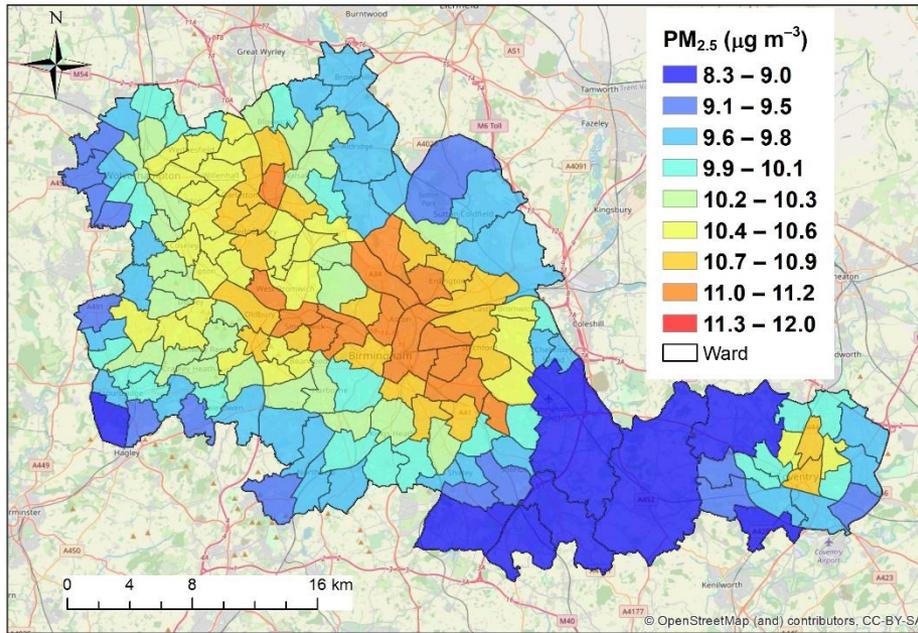
# AQ-LAT Application

- **Health Impact Assessment:** Estimate ward-level impacts of  $PM_{2.5}$  &  $NO_2$  exposure on morbidity (child and adult asthma, coronary heart disease (CHD), stroke, lung cancer) and mortality
- **Scenario/Policy Appraisal:** To assess the health and economic benefits of future scenarios (hypothetical or proposed)
- **Example:** *What would be the health and economic benefits delivered by achieving WHO 2021 Global Air Quality Guidelines (annual average concentrations) for  $NO_2$  ( $10 \mu g/m^3$ ) and  $PM_{2.5}$  ( $5 \mu g/m^3$ ) in the WMCA area?*

# Analytical approach



# Geography of existing air pollution exposure



# AQ-LAT Dashboard - Overview

## WM-Air AQ-LAT

### Step One: Select District, Ward, Discount Rate and Time Horizon

District	Birmingham		▼
Ward	All Birmingham wards		▼
Time Horizon	10 years	◀ [Slider] ▶	Maximum: 30 years
Discount Rate Costs	3.5%	◀ [Slider] ▶	Default: HM Treasury Green Book rate 3.5%
Discount Rate QALYs	1.5%	◀ [Slider] ▶	Default: HM Treasury Green Book rate 1.5%

All Birmingham wards	
PM2.5 annual average concentration at baseline (2021)	10.10 µg/m3
NO2 annual average concentration at baseline (2021)	20.41 µg/m3

### Step Two: Either customise local air quality target, OR use a pre-selected scenario

PM2.5 Target (µg/m3)	5.00	◀ [Slider] ▶	Values change automatically if scenario selected
NO2 Target (µg/m3)	10.00	◀ [Slider] ▶	Values change automatically if scenario selected
Target Population (%)	100 %	◀ [Slider] ▶	Values change automatically if scenario selected

OR

<b>Pre-selected air pollution scenarios</b>	WHO AQG Guideline level (annual average) NO2 (10µg/m3) & PM2.5 (5µg/m3)
*Pre-selected scenarios apply to entire ward override with slider if required	<input type="button" value="Confirm pre-selected scenario selection"/>

### Step Three:

# AQ-LAT Output Dashboard

## All Birmingham wards

£36,906,000	10 year NHS cost savings
£13,093,000	10 year indirect cost savings*
£31,260,000	10 year Social care cost savings
2086	Deaths prevented over 10 years
8913	QALY gains over 10 years worth(£)
£178,263,718	

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4645	Asthma cases prevented over	10	years
1346	CHD** cases prevented over	10	years
276	Lung Cancers prevented over	10	years
1118	Strokes prevented over	10	years

Distribution of NHS costs		
£935,974	Primary Care costs averted over	10 years
£32,947,100	Secondary Care costs averted over	10 years
£3,000,481	Prescription costs averted over	10 years

2021 Annual Attributable Incident Cases	
Annual Asthma Cases	874
Annual CHD** cases	262
Annual Lung Cancers	59
Annual Strokes	231

139287	Days off work averted over	10	years
£30,946,000	Discounted NHS cost savings over	10	years
7109	Discounted QALY gains over	10	years

\*Indirect costs reflect the time off work owing specifically to death-related absence, does not include productivity and care costs

\*\*Coronary Heart Disease

# Baseline health impact assessment

Local Authority	Pop Size 2019 (100s)	Annual new disease cases (2019) attributable to air pollution exposure (NO <sub>2</sub> and PM <sub>2.5</sub> )					Total mortality attributable to air pollution exposure (2019)
		Child Asthma	Adult Asthma	Coronary Heart Disease	Lung Cancer	Stroke	
<b>Birmingham</b>	1,140	575	298	262	59	231	<b>567</b>
<b>Coventry</b>	379	135	81	82	19	64	<b>164</b>
<b>Dudley</b>	322	137	84	103	20	80	<b>213</b>
<b>Sandwell</b>	329	156	83	88	21	78	<b>168</b>
<b>Solihull</b>	217	83	52	65	12	43	<b>113</b>
<b>Walsall</b>	286	138	74	82	18	68	<b>127</b>
<b>Wolverhampton</b>	264	113	61	73	15	69	<b>166</b>
<b>WMCA total</b>	<b>2940</b>	<b>1337</b>	<b>733</b>	<b>755</b>	<b>164</b>	<b>633</b>	<b>1614</b>

# Health gains associated with achieving 2021 WHO Global AQ Guidelines

Local Authority	20-year cumulative incident cases saved				Mortality avoided over 20 years
	Asthma	Coronary Health Disease	Lung Cancer	Stroke	
<b>Birmingham</b>	8993	2663	503	2131	<b>3641</b>
<b>Coventry</b>	1881	772	149	545	<b>1038</b>
<b>Dudley</b>	1880	911	150	651	<b>1219</b>
<b>Sandwell</b>	2455	913	181	740	<b>1250</b>
<b>Solihull</b>	1044	519	78	314	<b>683</b>
<b>Walsall</b>	2018	775	142	585	<b>1047</b>
<b>Wolverhampton</b>	1538	682	117	588	<b>926</b>
<b>WMCA total</b>	<b>19809</b>	<b>7235</b>	<b>1320</b>	<b>5554</b>	<b>9804</b>

# Quality Adjusted Life Years (QALYs) as measure of morbidity and mortality

- Combines a measure of quality of life lost to disease and length of life lost to mortality

$$\text{QALY} = \text{QUALITY OF LIFE} \times \text{DURATION OF LIFE}$$

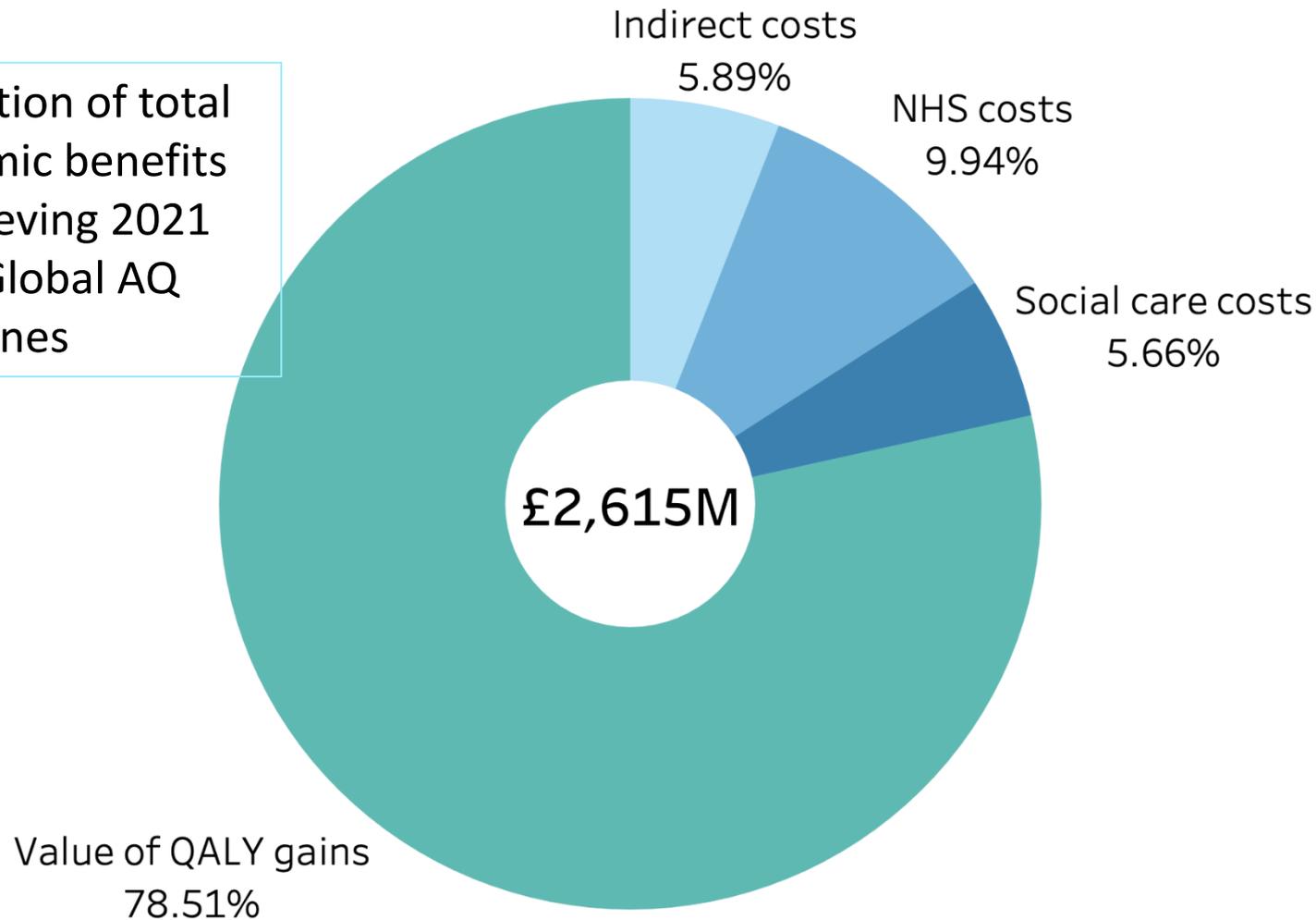
- Can be converted into monetary value using £20,000/QALY as per National Institute for Health and Care Excellence (NICE) guidance

# Economic benefits associated with achieving 2021 WHO Global AQ Guidelines

Local Authority	NHS costs (£m)	Indirect costs (£m)	Social care costs (£m)	QALYs gained	Value of QALYs gained (£m)	Total benefit (£m)
Birmingham	£101	£63	£57	38882	£778	£999
Coventry	£26	£15	£15	10616	£212	£268
Dudley	£30	£17	£17	12587	£252	£316
Sandwell	£34	£20	£20	12947	£259	£333
Solihull	£16	£9	£8	7061	£141	£174
Walsall	£28	£16	£16	11053	£221	£281
Wolverhptn	£26	£14	£16	9496	£190	£246
<b>WMCA total</b>	<b>£260</b>	<b>£154</b>	<b>£148</b>	<b>102,642</b>	<b>£2053</b>	<b>£2,615</b>

# Importance of Quality Adjusted Life Years as contributor to economic benefit

Proportion of total economic benefits of achieving 2021 WHO Global AQ Guidelines



# Summary Points

- Mortality in the WMCA area could be reduced by 2-3% over 20-years by improving air quality to within WHO (health-based) guidelines
- Lives saved and QALYs gained form a significant part of the total benefit of air pollution mitigation measures
- Direct NHS cost savings are less significant
- Broader trade-offs / costs of interventions not included in totals

# Summary Points

- The AQ-LAT is a novel tool for health impact assessment, policy evaluation and options appraisal
  - The tool provides strong user accessibility and utility
- Potential for wide range of uses in policy and practice.
  - Predictive AQ modelling capability a key strength
  - Feedback and suggestions welcome

# Acknowledgements

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# Limitations

- Limited to ward and local authority boundaries
- Conservative estimates (other diseases, broader benefits, other analytical methods)
- Reliance on annual average ambient air quality exposure data
- Mobility & migration not included
- Short-term acute effects excluded, including acute hospital admissions