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Regional Health Impact related to Air Quality: The Air Quality Lifecourse Assessment Tool (AQ-LAT) for the West Midlands Combined Authority (WMCA) area

Dr James Hall on behalf of Dr Suzanne Bartington, Dr Jian Zhong, Prof. Sue Jowett and the WM-AIR team



UNIVERSITY OF BIRMINGHAM

WM-AIR
CLEAN AIR SCIENCE FOR
THE WEST MIDLANDS

Health Economic impacts of poor air quality

- **Air pollution shortens life expectancy, increases chance of dying or getting a chronic disease**
- Estimated to contribute **26,000 - 38,000 annual premature deaths** in England
- **Key pollutants of public health concern are:**
 - Nitrogen dioxide (NO₂) primarily from vehicle emissions
 - Particulate matter (PM) from industry, domestic combustion, and transport
- **Associated downstream consequences**
 - More hospital admissions and use of primary care services
 - Higher burden of social care
 - Economic losses from time off work



Rationale for the AQ-LAT

- **Health impact assessment** formal requirement for most clean air investment
- Existing Tools available but use **national rather than local data** for air pollution exposure and health outcomes
- Developments in air quality modelling allow for **quantitative assessment at localised level** across various policy sectors
- 2021 Environment Act includes both **limit values** and **population exposure reduction targets**
- Policy landscape motivates **need for local health impact assessment tools**

Air Quality Life Assessment Tool interface

All Birmingham wards

Step One	£40,853,000	10 year NHS cost savings	
District	£18,404,000	10 year indirect cost savings*	<div style="border: 1px solid black; padding: 10px; width: fit-content; margin: auto;"> Return to front page </div>
Ward	£20,522,000	10 year Social care cost savings	
Time Horizon	2405	Deaths prevented over 10 years	
Discount Rate Costs	13315	QALY gains over 10 years worth(£)	
Discount Rate QALYs	£266,305,938		

4620	Asthma cases prevented over	10	years
1361	CHD** cases prevented over	10	years
272	Lung Cancers prevented over	10	years
1113	Strokes prevented over	10	years

Distribution of NHS costs			
£1,058,425	Primary Care costs averted over	10	years
£36,309,052	Secondary Care costs averted over	10	years
£3,461,103	Prescription costs averted over	10	years

2021 Annual Attributable Incident Cases	
Annual Asthma Cases	874
Annual CHD** cases	267
Annual Lung Cancers	60
Annual Strokes	235
Annual mortality	716

195787	Days off work averted over	10	years
£33,274,000	Discounted NHS cost savings over	10	years
10462	Discounted QALY gains over	10	years

Step Two: Either c
PM2.5 Target (µg/m3) NO2 Target (µg/m3) Target Population (%)
Step Three:
Run your calculations

Pre-selected air pollution s

*Pre-selected scenarios apply to
override with slider if requi

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



AQ-LAT Methods paper - Environmental Pollution

Environmental Pollution 356 (2024) 123871



Contents lists available at [ScienceDirect](#)

Environmental Pollution

journal homepage: www.elsevier.com/locate/envpol



Regional impact assessment of air quality improvement: The air quality lifecourse assessment tool (AQ-LAT) for the West Midlands combined authority (WMCA) area[☆]

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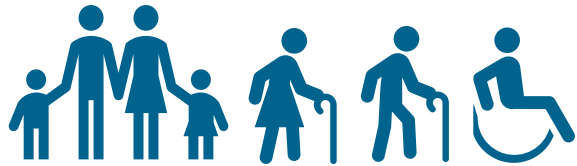
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<https://doi.org/10.1016/j.envpol.2024.123871>

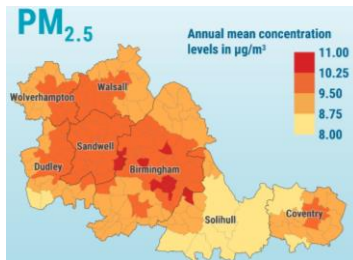


AQ-LAT methodological advantages

- Modelling disease-related air quality burden is **more informative** than air pollution concentration maps alone for health insights



Population modelling not only quantifies impact of air pollution on health but community **vulnerability** to poor air quality



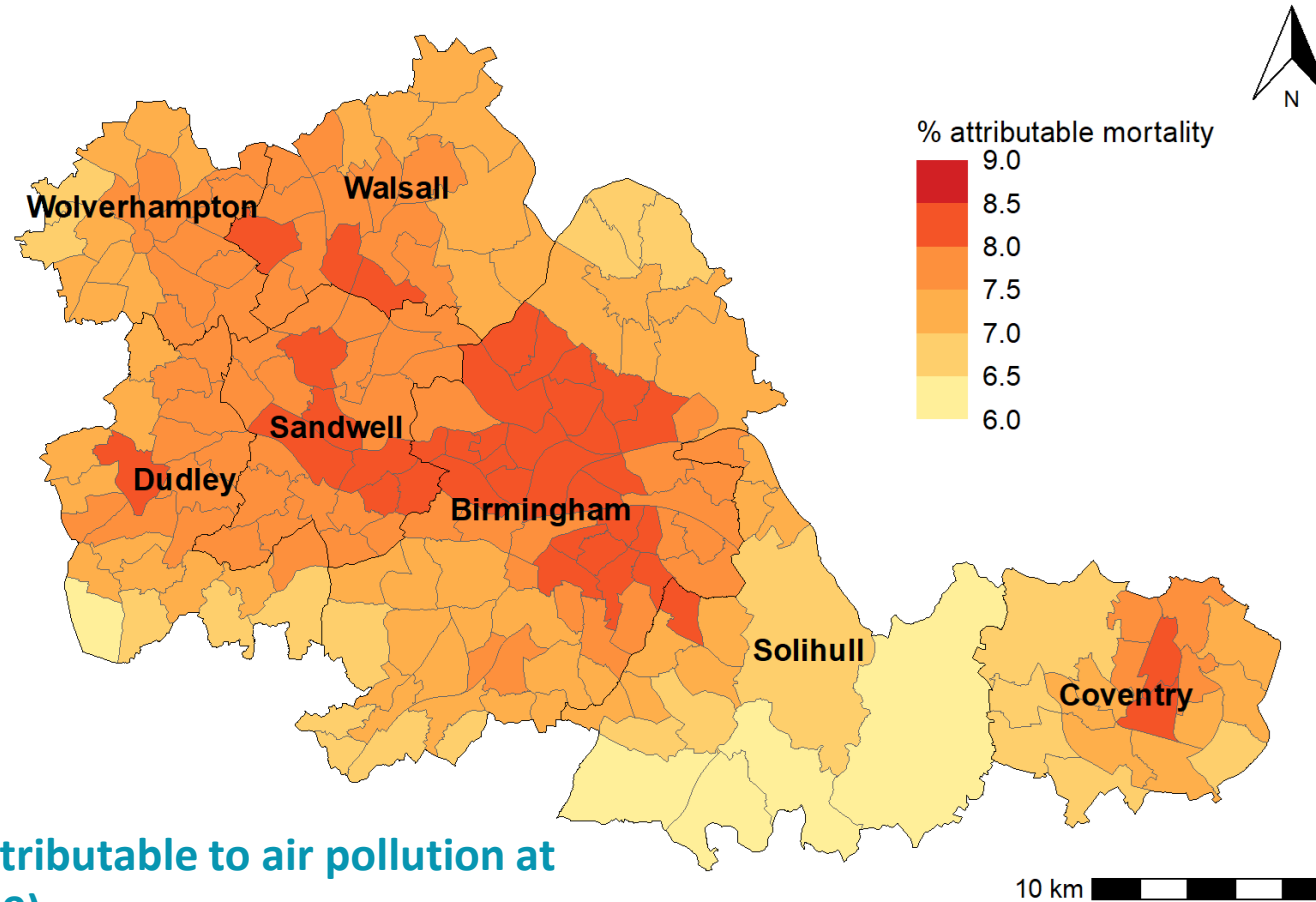
ADMS-Urban **air quality modelling** estimates local air quality dynamics coupled with predictive analysis of **air quality scenarios** across **variety of policy sectors**



Health Economic models power **comprehensive estimation** of impacts to **NHS, local authority** via social care, and lost productivity to the broader **economy**



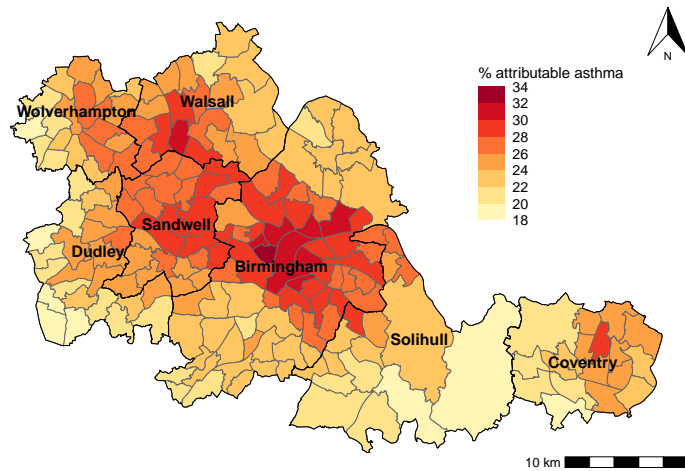
AQ-LAT informing air quality policy decisions



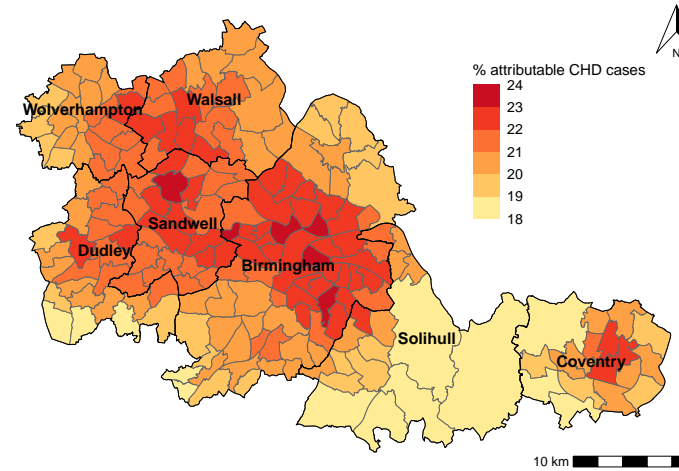
Percentage of early deaths attributable to air pollution at ward level in the WMCA (2019)

AQ-LAT informing air quality policy decisions

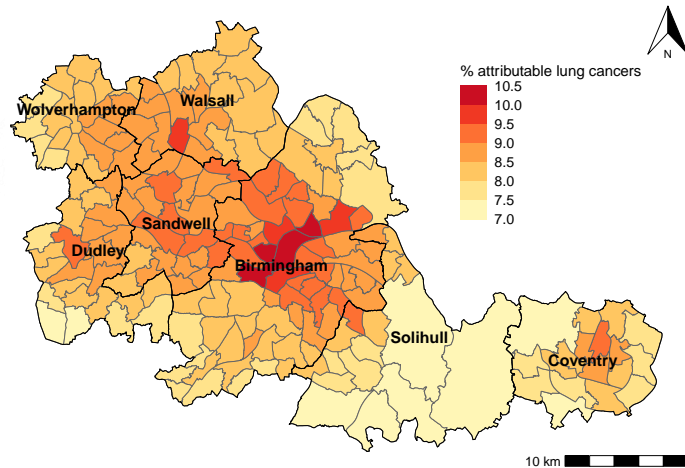
% of Asthma cases attributable



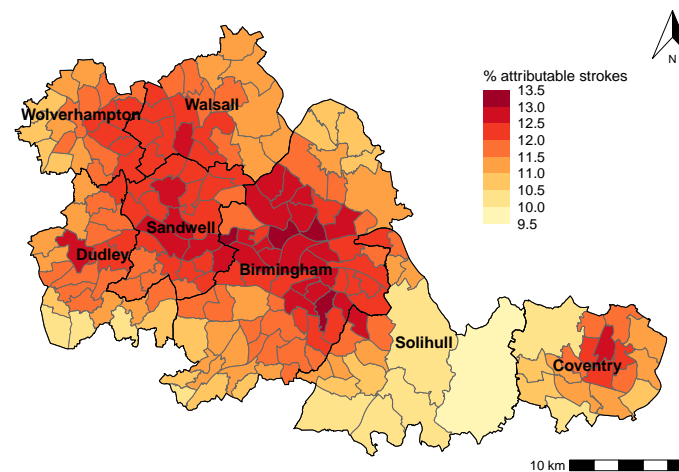
% of Coronary Heart Disease cases attributable



% of Lung Cancer cases attributable



% of Stroke cases attributable

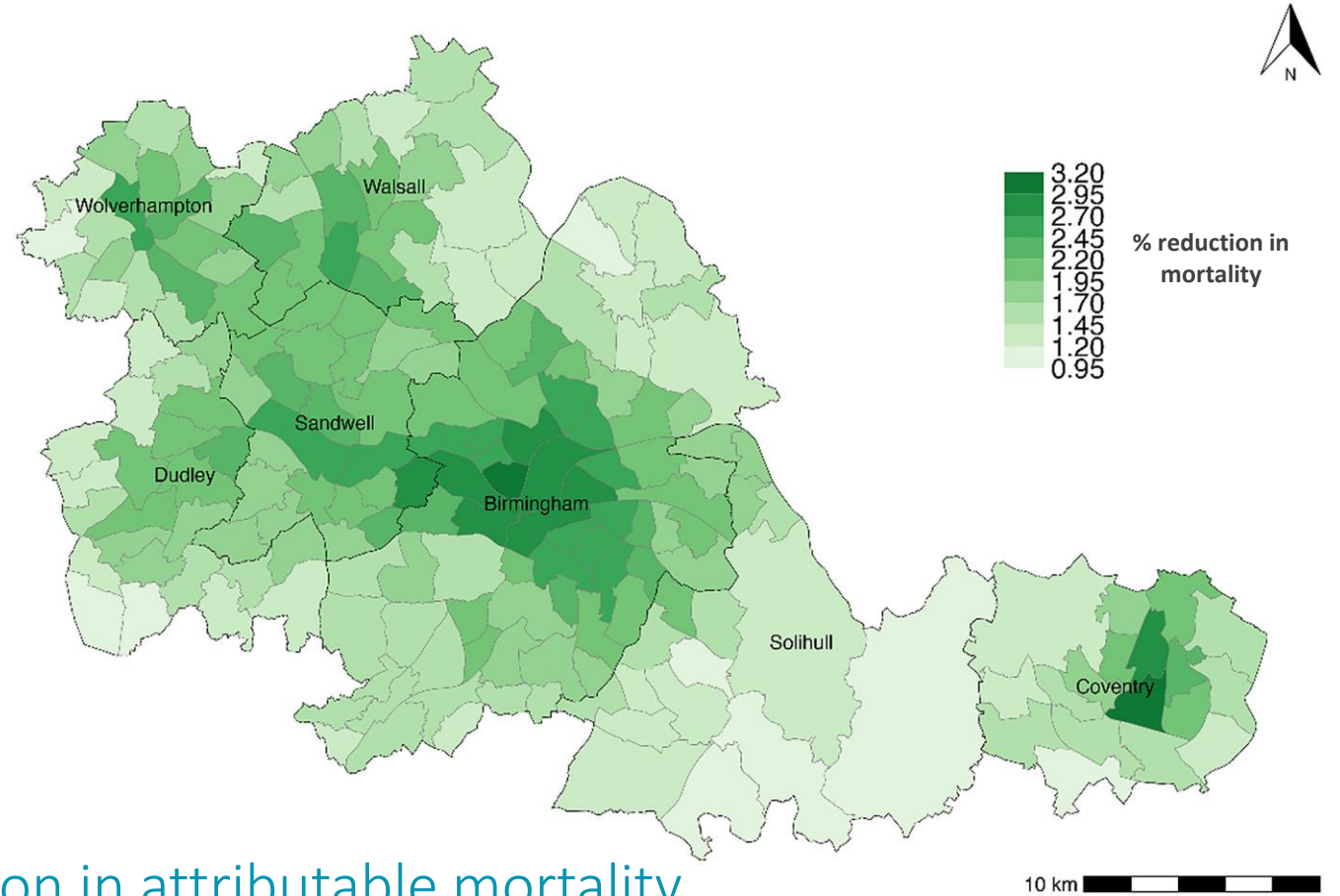


AQ-LAT policy-ready analyses

- Smaller-scale **single-sector** interventions can have **limited impact upon health outcomes**
- **Unpublished health impact assessment over 5-years for Birmingham clean air zone***
 - 37 asthma and 1 lung cancer case prevented
 - 4 deaths averted
 - 12 Quality Adjusted Life Years (QALYs) gained
 - £30,000 NHS cost savings
 - £1.7M benefit from life years gained

AQ-LAT policy-ready analyses

- **Multi-sector** interventions across **larger geographical areas** more likely to have **significant health impacts**
- AQ-LAT can help estimate **scale and distribution** of health impacts



% reduction in attributable mortality in complying with 2021 WHO Global Air Quality Guidelines in WMCA

What next ? Expand coverage

Oxfordshire AQ-LAT

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

District	Cherwell		
Ward	Cherwell all wards		
Time Horizon	20 years	<input type="range"/>	Maximum: 30 years
Discount Rate Costs	3.5%	<input type="range"/>	Default: HM Treasury Green Book rate 3.5%
Discount Rate QALYs	1.5%	<input type="range"/>	Default: HM Treasury Green Book rate 1.5%

Cherwell all wards

PM2.5 annual average concentration at baseline (2022)	7.28 $\mu\text{g}/\text{m}^3$
NO2 annual average concentration at baseline (2022)	7.37 $\mu\text{g}/\text{m}^3$

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

PM2.5 Target ($\mu\text{g}/\text{m}^3$)	5.00	<input type="range"/>	Values change automatically if scenario selected
NO2 Target ($\mu\text{g}/\text{m}^3$)	6.00	<input type="range"/>	Values change automatically if scenario selected
Target Population (%)	100 %	<input type="range"/>	Values change automatically if scenario selected

OR

Pre-selected air pollution scenarios <small>*Pre-selected scenarios apply to entire ward override with slider if required</small>	WHO AQG level (annual average) PM2.5 (5 $\mu\text{g}/\text{m}^3$)
Confirm pre-selected scenario selection	

Step Three: [Run your calculations](#)





•What next ?

WM-NET ZERO CLIMATE-LAT

A toolkit to estimate the **health and economic impacts of net zero scenarios**

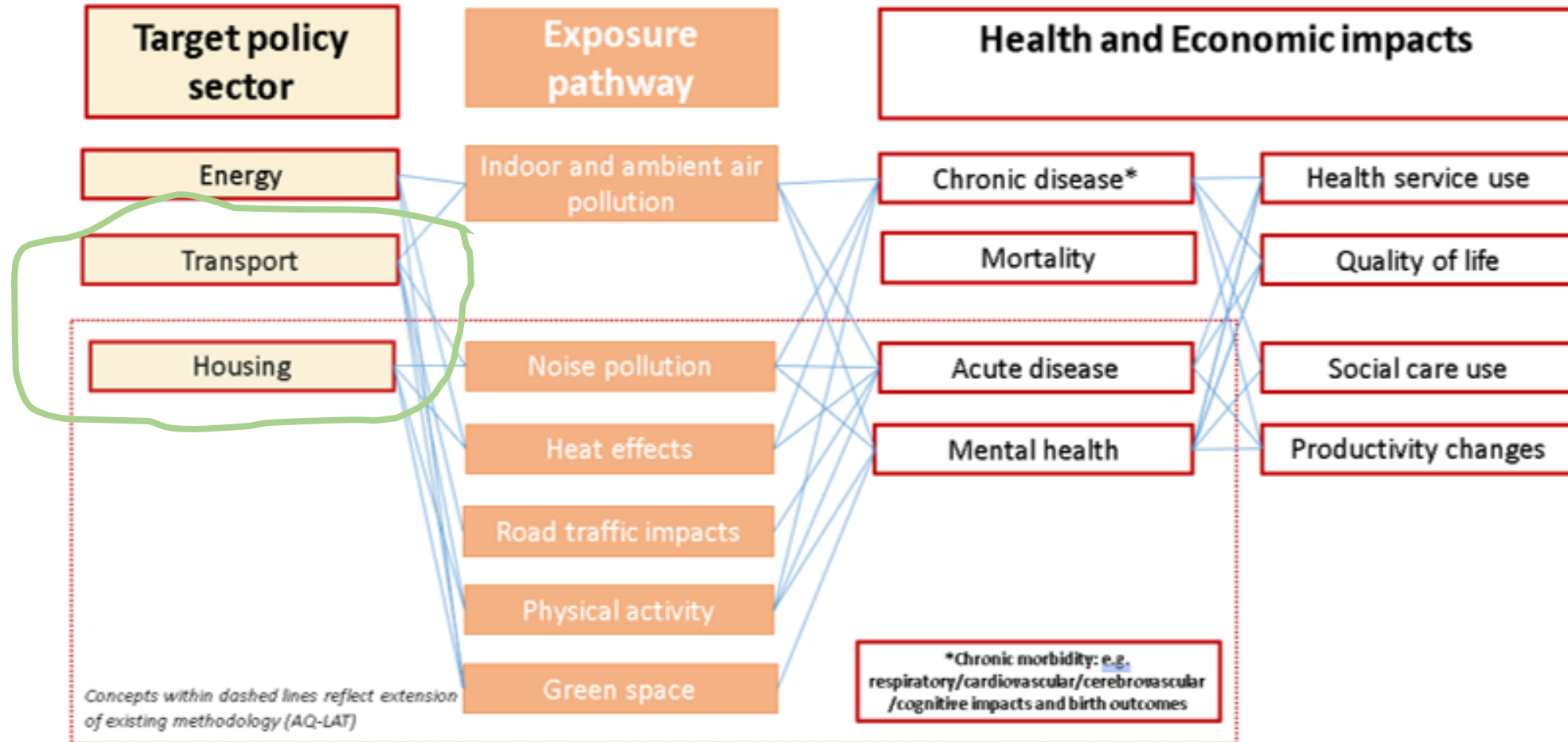


WM-NET ZERO

A Health-centred Systems Approach
towards Net-Zero: Transforming
regional climate mitigation policies

<https://wm-netzero.org.uk/>

Proposed methodology



Thank you for listening

Thanks to the following:

The WM-Air research team and study partners led by Professor William Bloss

Dr Pelham Barton, now retired formerly Health Economics Unit UoB

Anita Charlesworth CBE and Dr James Shearer (Health Economics Study Group)

Alex Jones, Air Quality Framework Programme Lead (WMCA)

Karen Exley (UK Health Security Agency)

CERC (Cambridge Environmental Research Consultants)

All stakeholders and academics who have had input into WM-Air and AQ-LAT development

WM-Air is a Natural Environment Research Council Regional Impact from Science of the Environment (RISE) initiative [grant number NE/S003487/1]. Research also supported by Clean Air Programme and TRANSITION Clean Air Network (NE/V002449/1).

