Public Health England
Yorkshire and the Humber Transport and Health Conference
Thursday 8th March 2018

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# Health Impacts of Transport Policy


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# Transport Policy & Health

## Process

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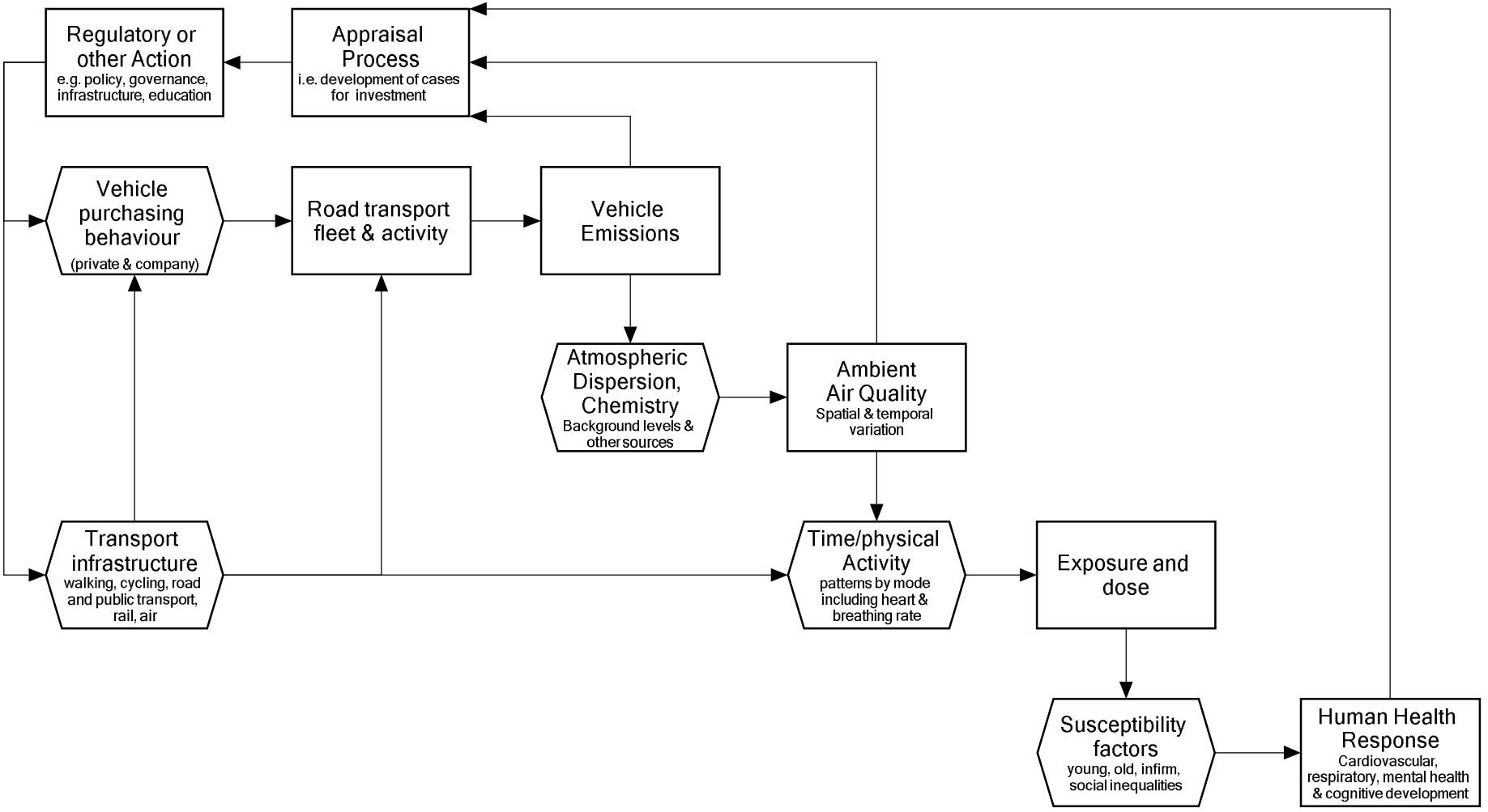
Adapted from: Health Effects Institute. 2003. Assessing Health Impact of Air Quality Regulations: Concepts & Methods. HEI Comm 11 Sept 2003



# Transport Policy & Health

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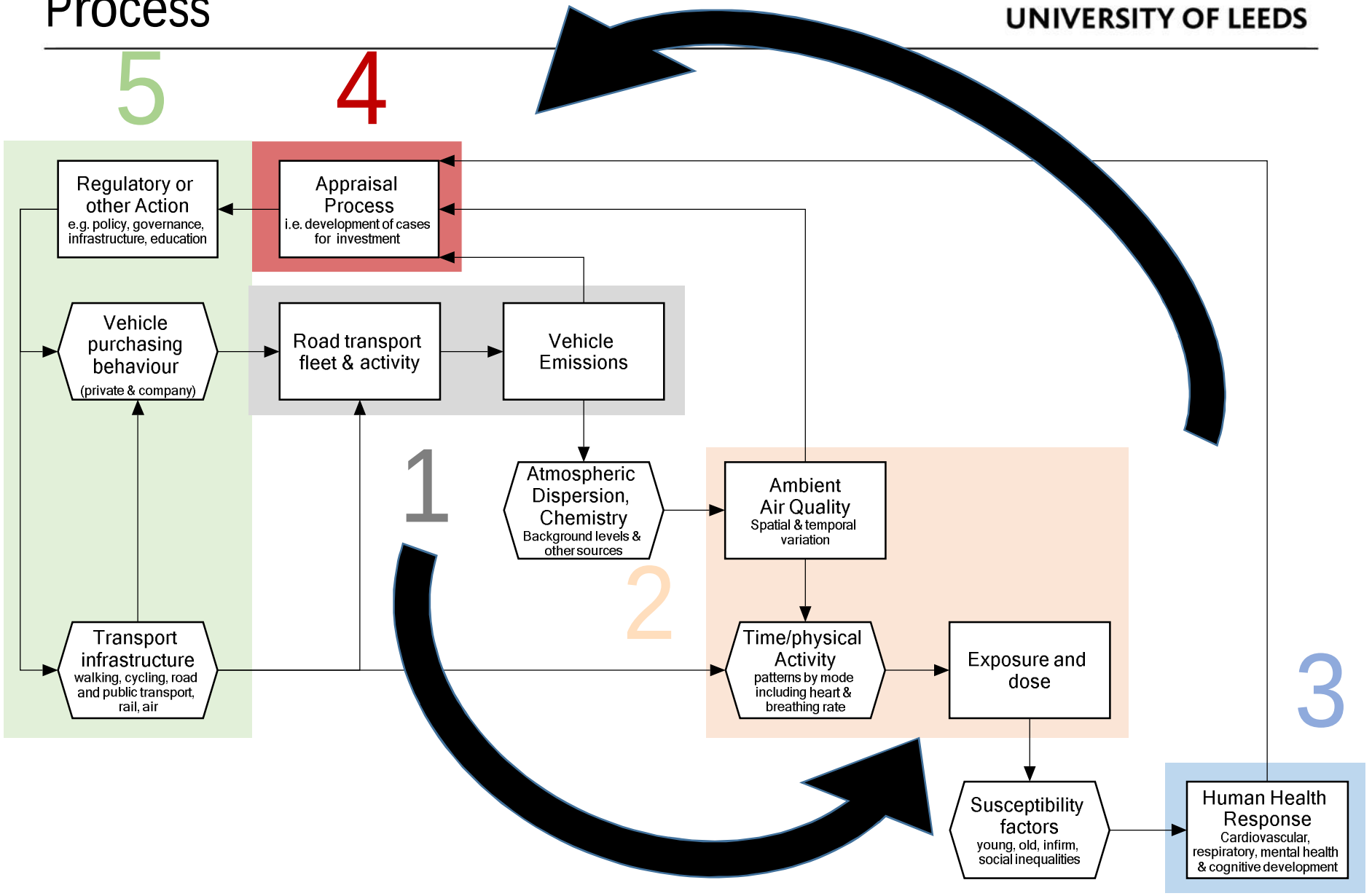
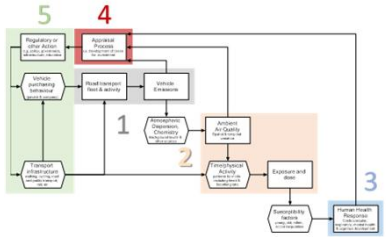
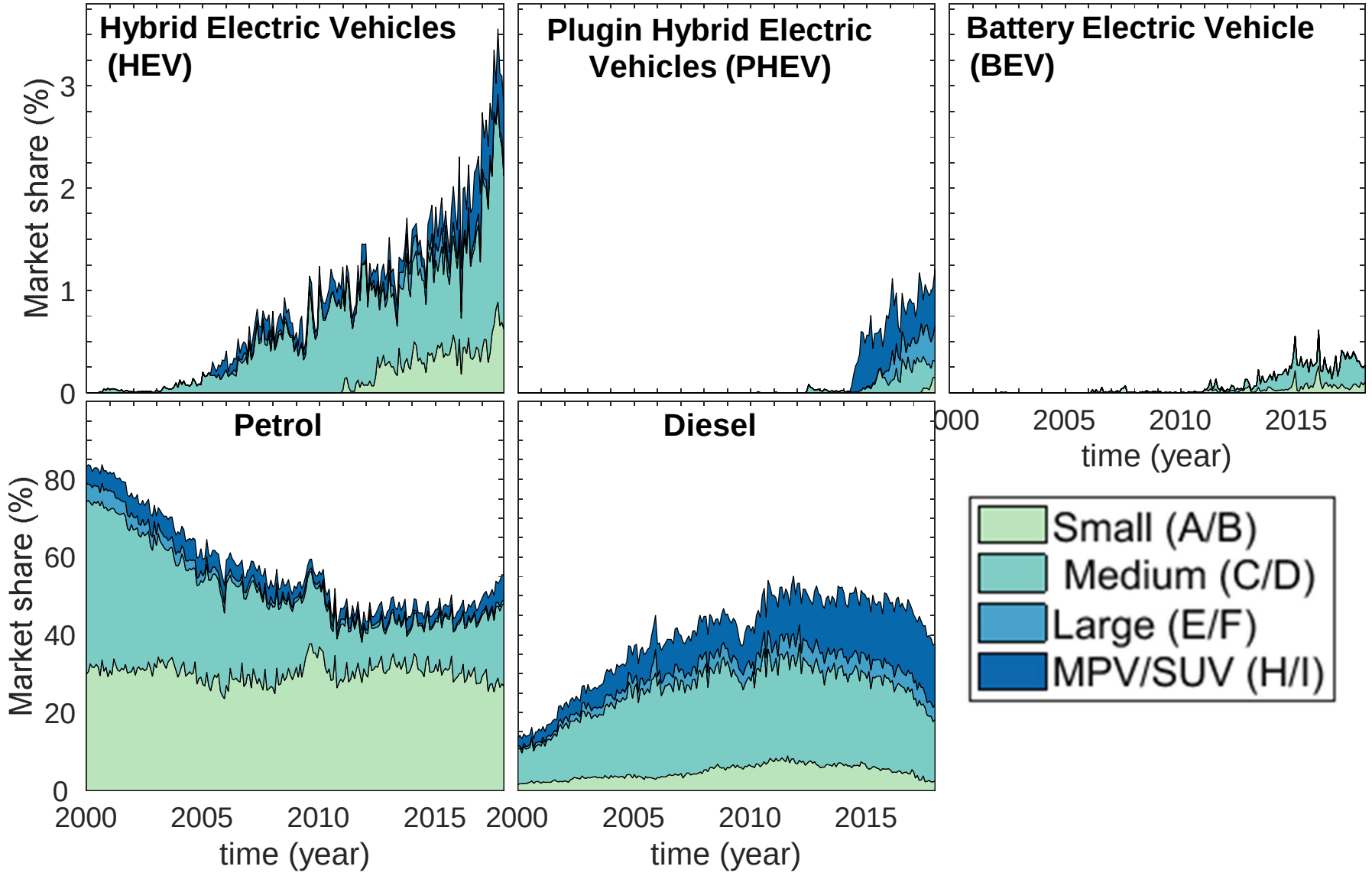


# 1. UK passenger car fleet sales

## Monthly 2000-17 SMMT



**Electric, hybrid and low-emission cars**

# Electric cars already cheaper to own and run than petrol or diesel – study

**Exclusive: Pure electric cars cost less over four years than petrol or diesel cars in the UK, US and Japan, researchers say, but China is set to lead the market**

**Damian Carrington**
*Environment editor*
@dpcarrington
Fri 1 Dec 2017 17.00 GMT




Guardian | 1st December 2017 https://goo.gl/uwXenw

Palmer, K., Tate, J., Wadud, Z., Nellthorp, J. 2018. Total cost of ownership & market share for hybrid & electric vehicles in the UK, US & Japan. Applied Energy, 209, pp108-119, doi:10.1016/j. apenergy.2017.10.089

# Air Quality & Health

## Standard Approach

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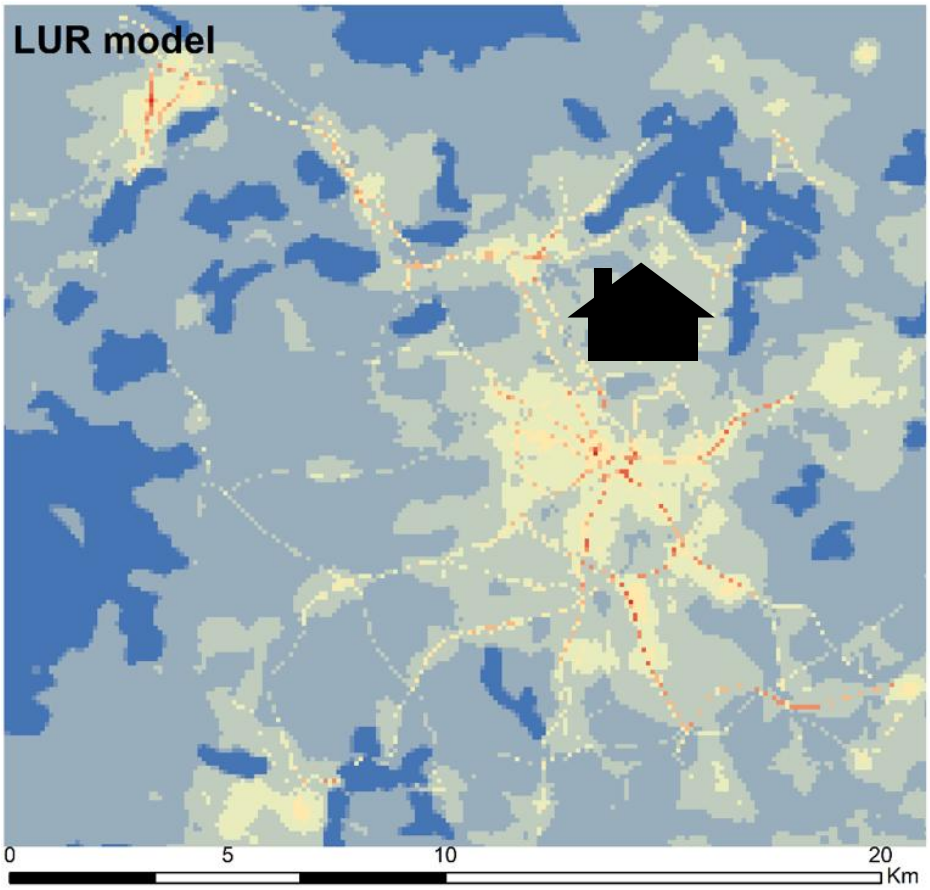



Spatial Distribution of $NO_X$ ($\mu g/m^3$) across Bradford 2015

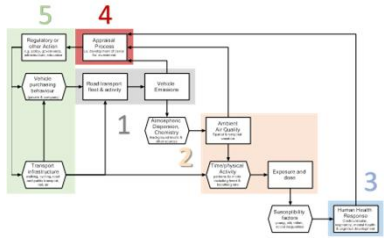
Khries, H. 2018. Early-Life Exposure to Traffic-Related Air Pollution and Risk of Development of Childhood Asthma. ITS, University of Leeds, PhD Thesis, March 2018.

Annual average air pollution concentration map (modelled e.g. LUR, dispersion)

- Home location
- Postcode areas
  e.g. LSOAs
- Work location?
- Health outcomes

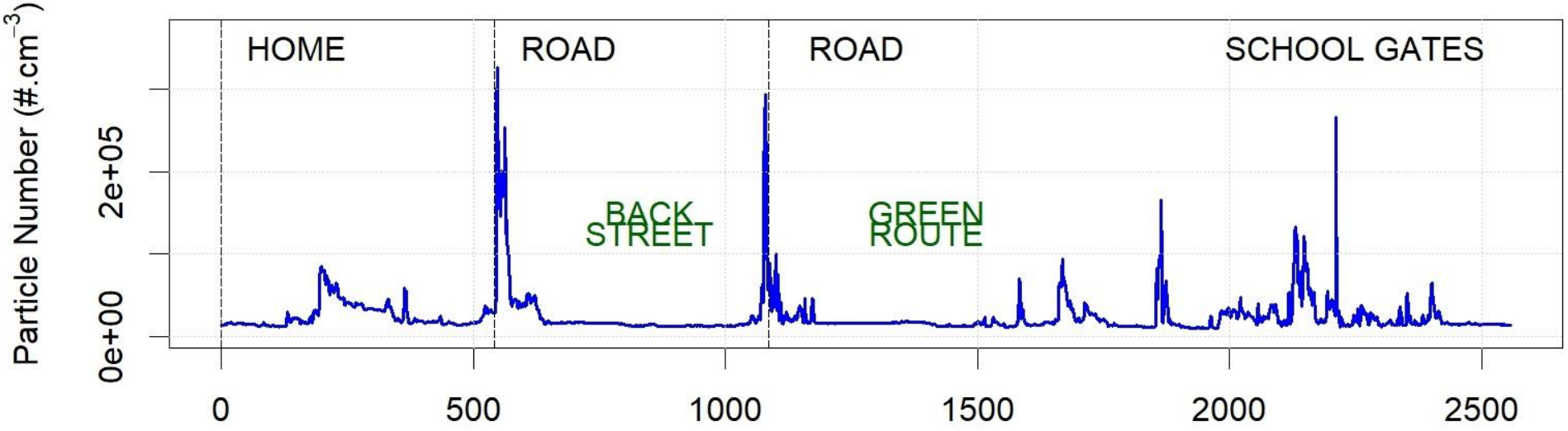
# 2. Air quality & Transport

## Short-term Exposure & dose



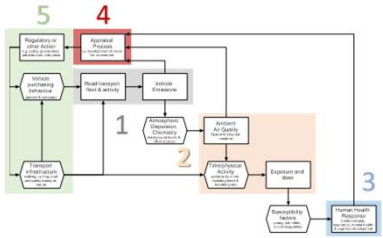

<u>Walking</u>
Cycling
Car
Bus
Rail

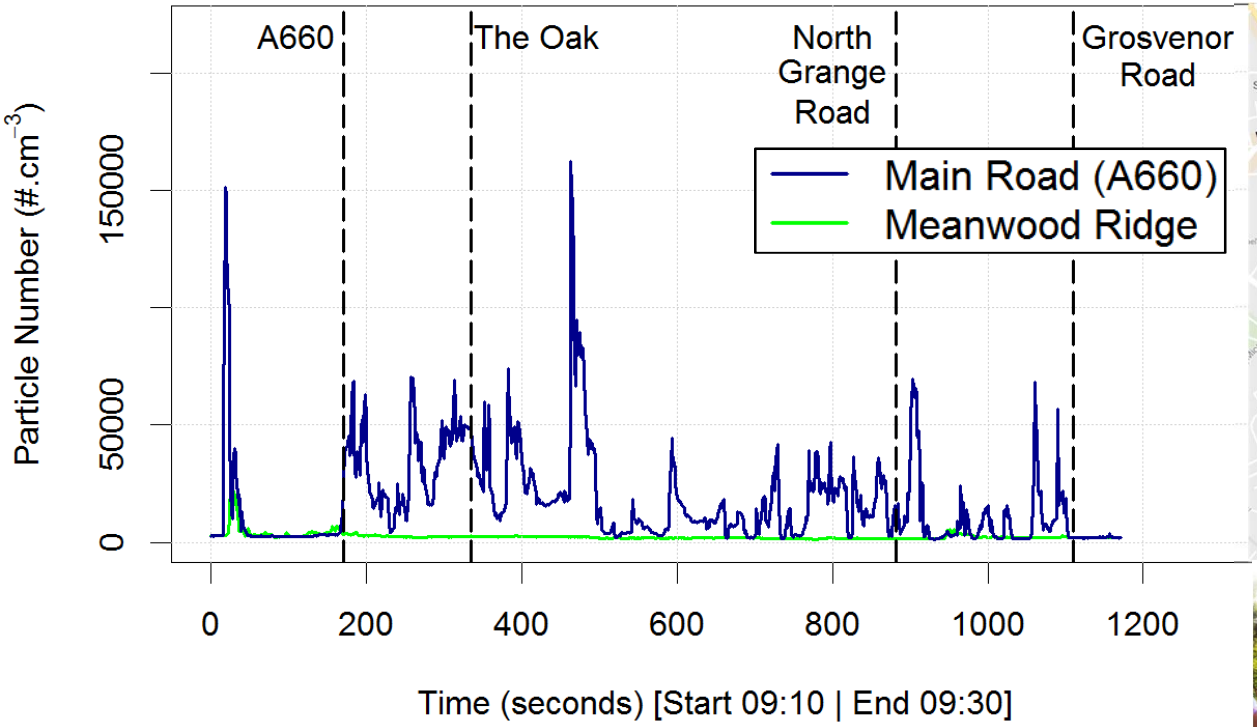

BBC Breakfast
#soicanbreathe
6th March 2017

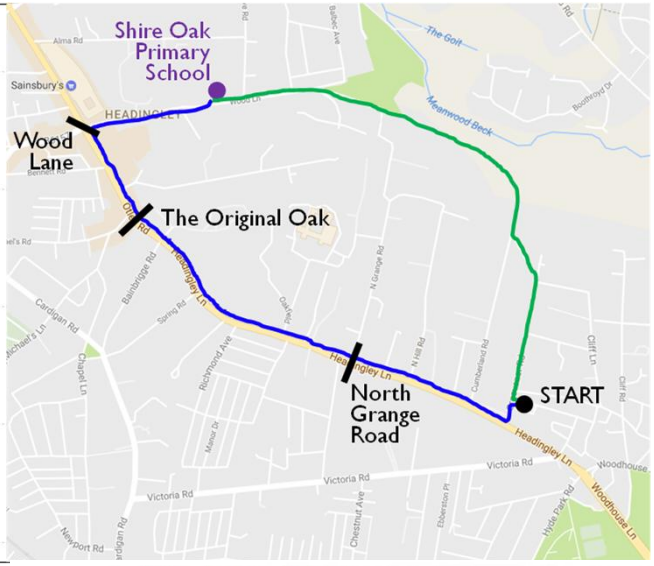


# 2. Air quality & Transport

## The walk to school

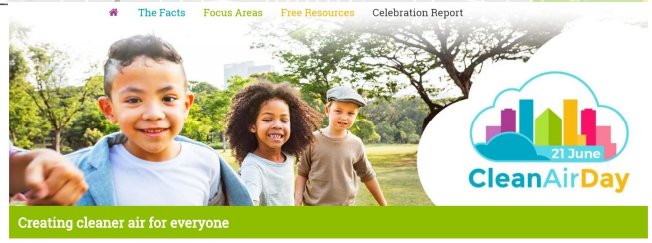



| | Main Road (A660) | Meanwood Ridge |
|---|---|---|
| Mean | 11586 | 2744 |
| Max | 171511 | 14086 |
| SD | 15049 | 1130 |

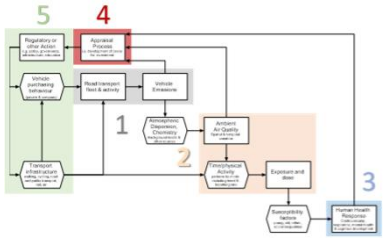
Particle Number Count (PNC) 10 - 1000nm | #.cm$^{-3}$




National Clean Air Day
June 15th 2017

https://www.cleanairday.org.uk/news/cleaner-air-in-leeds

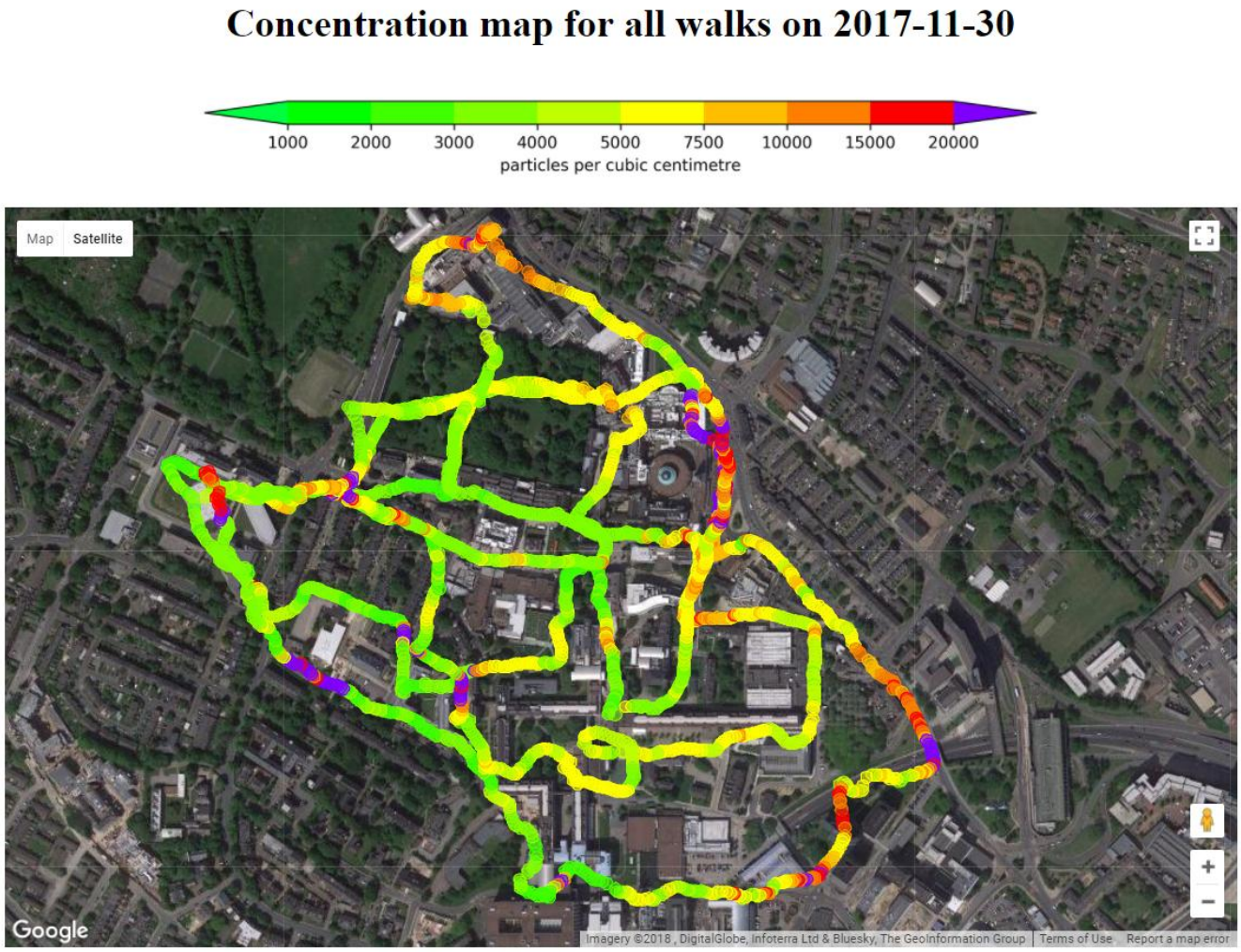
# 2. Air quality & Mobility




## Walking across campus: The Living Lab.

SURVEYS SPRING 2018: COMMUTING

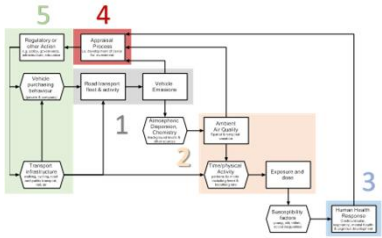
- Walking
- Cycling
- Car
- Bus

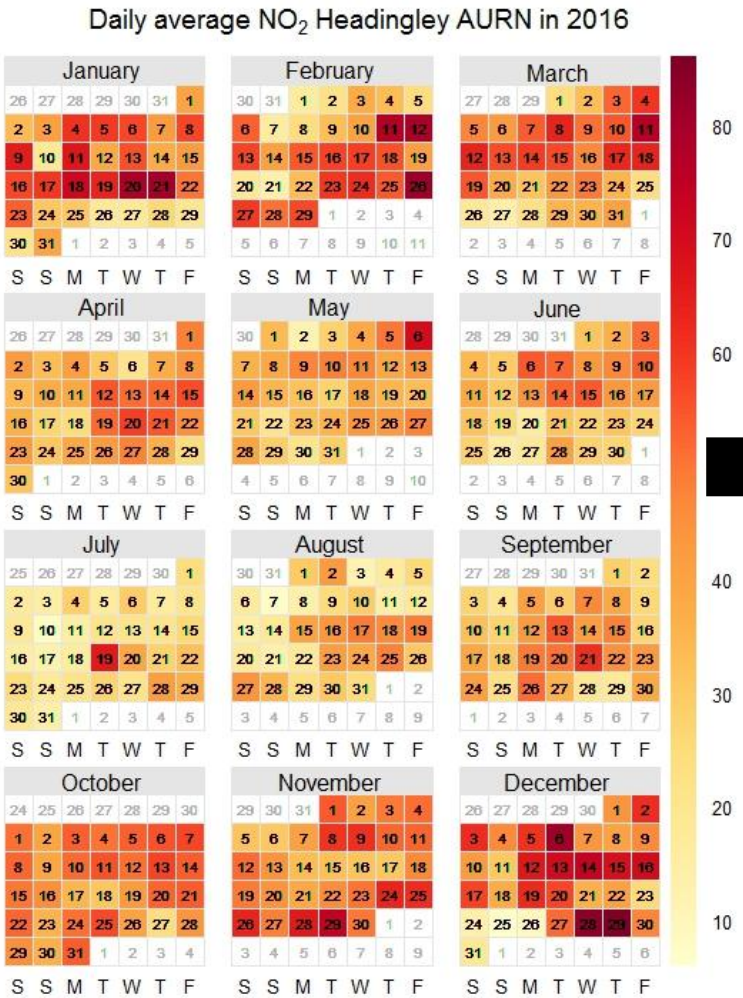

Team: Stephen Arnold, Thomas Cooper, Marco-Felipe King, James O'Neill, Jim McQuaid, Kirsty Pringle, Mark Richardson, Cat Scott, James Tate

# 3. Health response

## Pollution episodes + health outcomes?




### MEASURED AMBIENT AIR QUALITY




### ASTHMA ADMISSION STATISTICS (DAILY)

Environment International 100 (2017) 1–31

Contents lists available at ScienceDirect

Environment International

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

Review article

**Exposure to traffic-related air pollution and risk of development of childhood asthma: A systematic review and meta-analysis**

Haneen Khreis [a,*], Charlotte Kelly [a,b], James Tate [a], Roger Parslow [c], Karen Lucas [a], Mark Nieuwenhuijsen [d,e,f]

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[b] Leeds Institute of Health Sciences, University of Leeds, Leeds, United Kingdom
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[d] ISGlobal CREAL, C/Dr. Aiguader 88, 08003 Barcelona, Spain
[e] Universitat Pompeu Fabra (UPF), C/Dr. Aiguader 88, 08003, Barcelona, Spain
[f] CIBER Epidemiología y Salud Pública (CIBERESP), C/Monforte de Lemos 3-5, 28029 Madrid, Spain

ARTICLE INFO

*History:*
d 6 July 2016
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Available online 21 November 2016

*Keywords:*
Asthma
Childhood
Traffic-related air pollution
Meta-analysis
Black carbon
Transport policy

ABSTRACT

*Background and objective:* The question of whether children's exposure to traffic-related air pollution (TRAP) contributes to their development of asthma is unresolved. We conducted a systematic review and performed meta-analyses to analyze the association between TRAP and asthma development in childhood.
*Data sources:* We systematically reviewed epidemiological studies published until 8 September 2016 and available in the Embase, Ovid MEDLINE (R), and Transport databases.
*Study eligibility criteria, participants, and interventions:* We included studies that examined the association between children's exposure to TRAP metrics and their risk of *'asthma'* incidence or lifetime prevalence, from birth to age 18 years old.
*Study appraisal and synthesis methods:* We extracted key characteristics of each included study using a predefined data items template and these were tabulated. We used the Critical Appraisal Skills Programme checklists to assess the validity of each included study. Where four or more independent risk estimates were available for a continuous pollutant exposure, we conducted overall and age-specific meta-analyses, and four sensitivity analyses for each summary meta-analytic exposure-outcome association.
*Results:* Forty-one studies met our eligibility criteria. There was notable variability in asthma definitions, TRAP exposure assessment methods and confounder adjustment. The overall random-effects risk estimates (95% CI) were 1.08 (1.03, 1.14) per $0.5 \times 10^{-5}$ $m^{-1}$ black carbon (BC), 1.05 (1.02, 1.07) per 4 $\mu g/m^3$ nitrogen dioxide ($NO_2$), 1.48 (0.89, 2.45) per 30 $\mu g/m^3$ nitrogen oxides ($NO_x$), 1.03 (1.01, 1.05) per 1 $\mu g/m^3$ Particulate Matter <2.5 μm in diameter ($PM_{2.5}$), and 1.05 (1.02, 1.08) per 2 $\mu g/m^3$ Particulate Matter < 10 μm in diameter ($PM_{10}$). Sensitivity analyses supported these findings. Across the main analysis and age-specific analysis, the least heterogeneity was seen for the BC estimates, some heterogeneity for the $PM_{2.5}$ and $PM_{10}$ estimates and the most heterogeneity for the $NO_2$ and $NO_x$ estimates.
*Limitations, conclusions and implication of key findings:* The overall risk estimates from the meta-analyses showed statistically significant associations for BC, $NO_2$, $PM_{2.5}$, $PM_{10}$ exposures and risk of asthma development. Our findings support the hypothesis that childhood exposure to TRAP contributes to their development of asthma. Future meta-analyses would benefit from greater standardization of study methods including exposure assessment harmonization, outcome harmonization, confounders' harmonization and the inclusion of all important confounders in individual studies.
*Systematic review registration number:* PROSPERO 2014: CRD42014015448.


Khreis, H., Kelly, C., Tate, J., Parslow, R., Lucas, K., Nieuwenhuijsen, M. 2017. Exposure to traffic-related air pollution and risk of development of childhood asthma: A systematic review and meta-analysis. Environment International, 100, March 2017, pp1-31. doi:10.1016/j.envint.2016.11.012

# 3. Appraisal

## Extending the appraisal process to health impacts

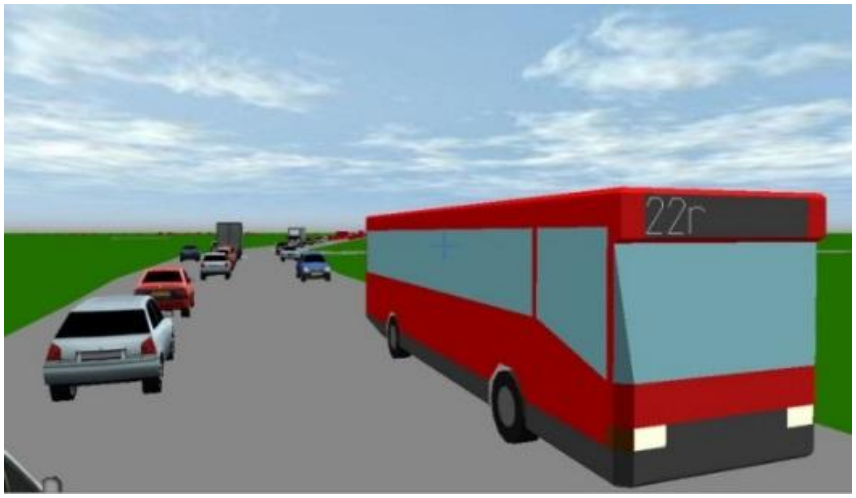
### CASE STUDY: City of York Park and Ride Bus fleet


High frequency services

Fleet 35 Vehicles

Policy test, replace Euro IV fleet:

- Euro VI Diesel
- Electric Vehicles




METHOD

Detailed traffic (microsimulation) and emissions modelling (AM, PM & off-peak including night-time).

Accounts traffic congestion, Buses servicing stops, road gradient etc

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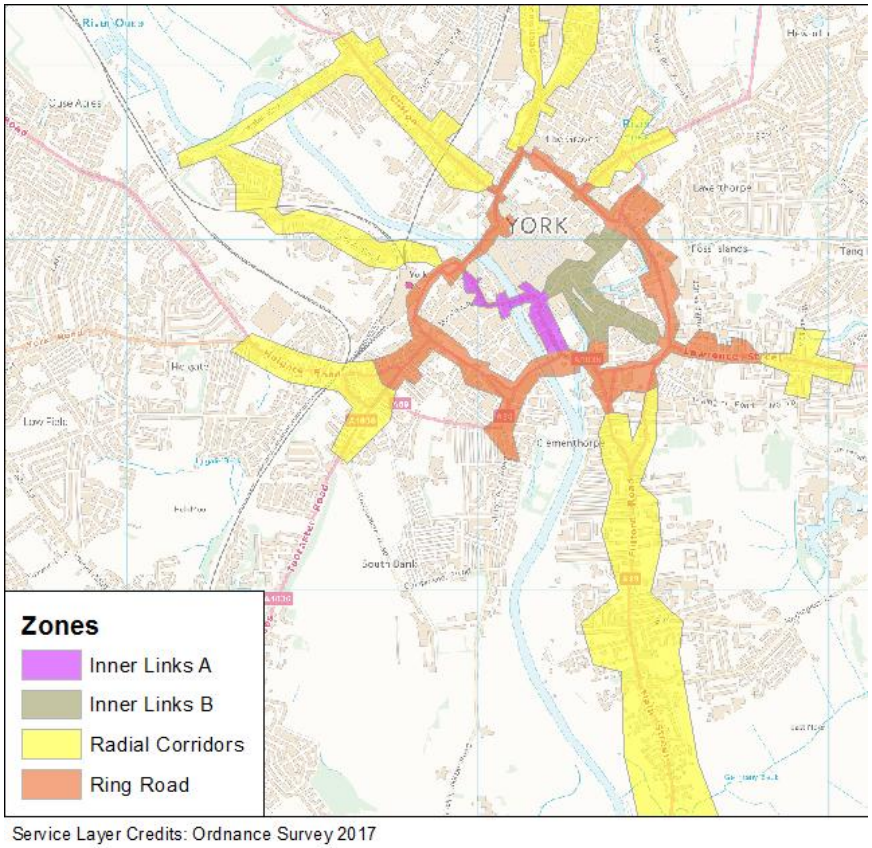


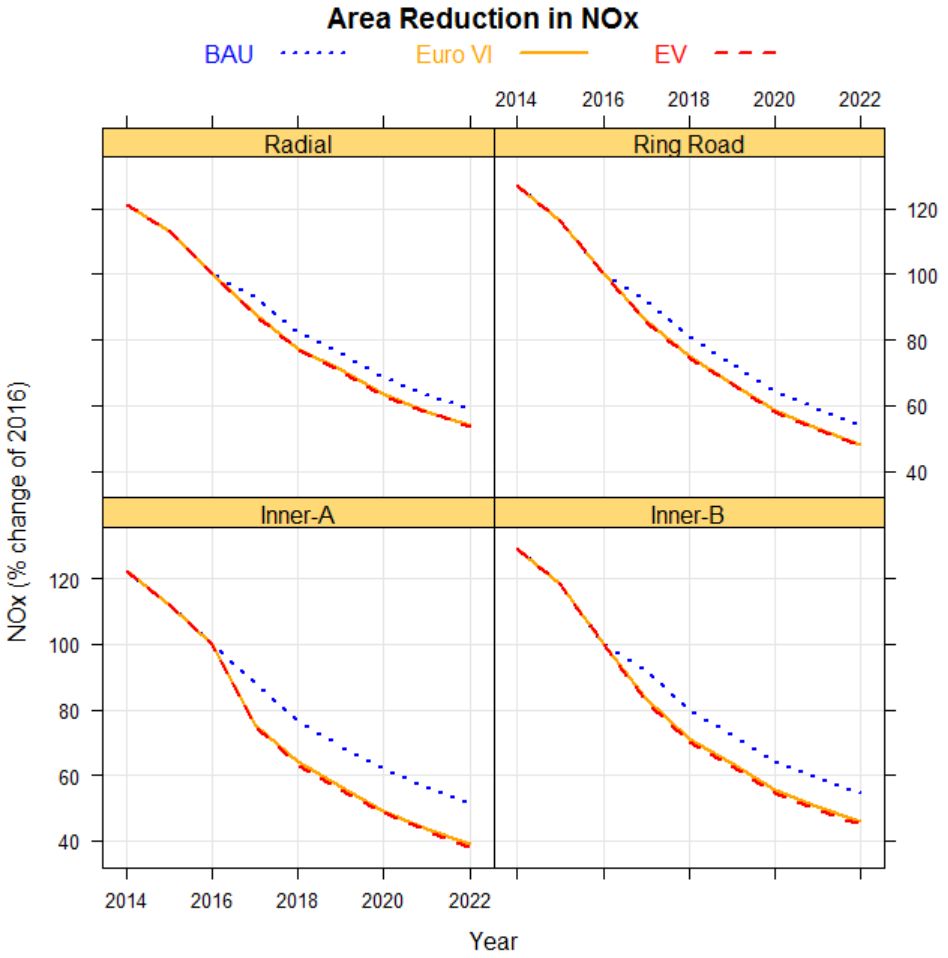


Mason, R. 2016. Microsimulation modelling of Bus Emissions. ITS, University of Leeds, MSc dissertation, September 2016.

# 3. Appraisal

## Extending the appraisal process to health impacts

### CASE STUDY: City of York Park and Ride Bus fleet

Health Impact Assessment:

Cost-effectiveness of Air PolluTiOn Reduction model (CAPTOR) toolkit

Laetitia Schmitt, James Lomas, Gerry Richardson, Laura Bojke

CLAHRC Yorkshire and Humber

CHE Centre For Health Economics

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Capital Cost Buses & [*annual energy*] (millions):

Diesel £6.1+[*0.56*]

BEV £9.8+[*0.15*]

Annual economic health impact due to cutting $PM_{10}$ and $NO_X$ emissions across the city (millions):

Diesel £5.1

BEV £5.5

# Transport Policy & Health

## Opportunities & Priorities

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1. VEHICLE FLEET & EMISSIONS

Accelerate the change in the Fleet

CAZs rightly initially targeting Buses & Taxis 2020

CAZs of 2025 may need to include all (?) Diesel cars

2. EXPOSURE & DOSE

Exposure & physical activity surveys can help educate how to avoid & mitigate pollution hotspots to improve health: Walk to school. Mode choice? Active travel route choice.

3. Health evidence needed for impacts of short-term exposure (respiratory, heart, stroke) DATA

# Transport Policy & Health

## Opportunities & Priorities

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### 4. APPRAISAL

Pressing need to strengthen the evidence base:

- Greater consideration of air quality & health outcomes
  *Higher Spatial & Temporal resolution*
- Benefits of active travel
- How future health benefits can justify investment today

### 5. TRANSPORT POLICY & INTERVENTIONS

Immediate action e.g.

- No Idling & Parking restrictions around schools
- Taxi contracts (NHS, LAs) specify Low Emission Vehicle %
- Change funding landscape to favour EV not Diesel Buses

Track shifting attitudes to transport demand & infrastructure

i.e. impact of quality Cycle infrastructure on use & health benefits

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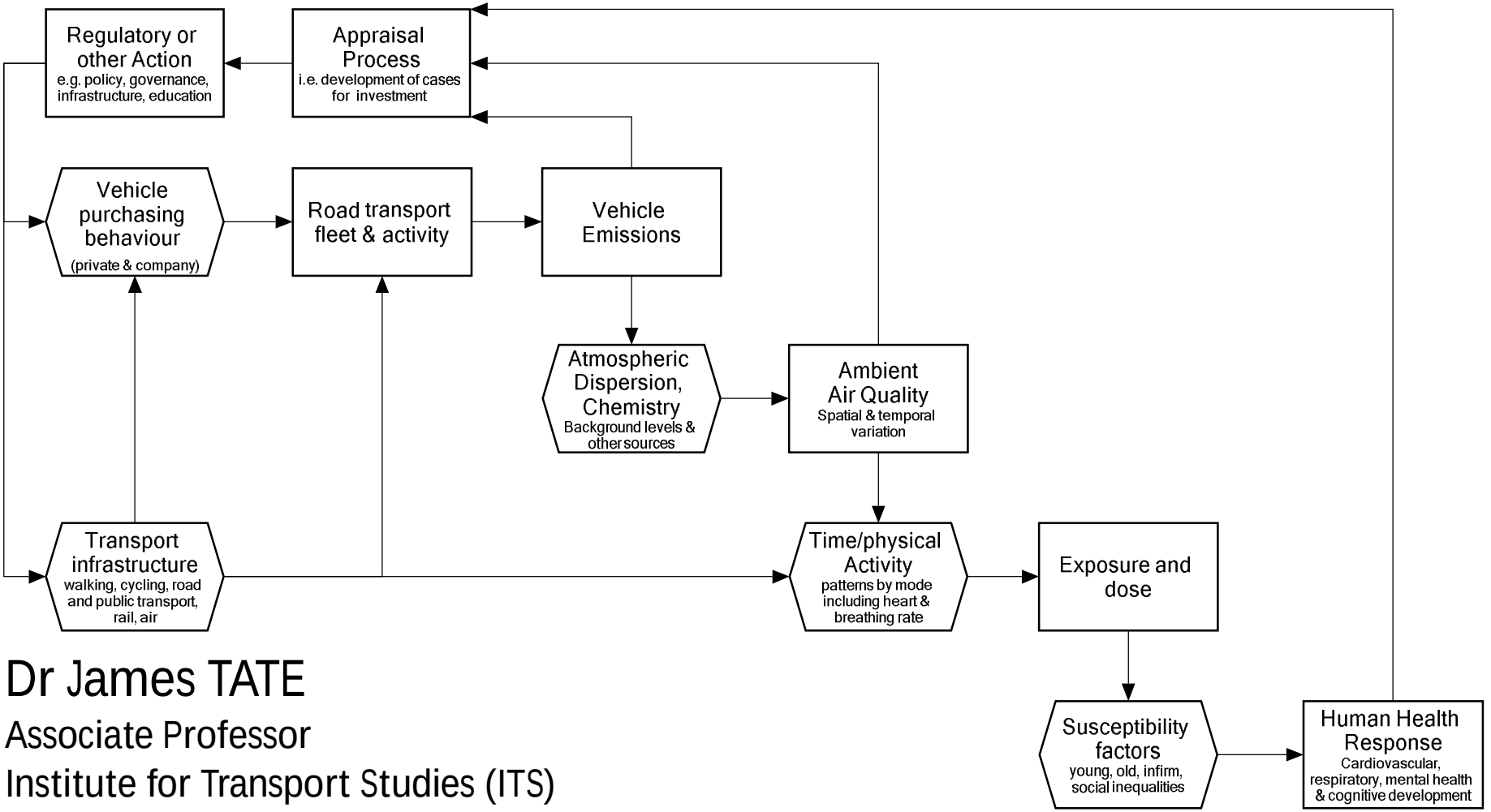



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