

# benefits of outdoor exercise and the health risks from air pollution.

**Audrey de Nazelle**

Senior Lecture, Centre for Environmental Policy, Imperial College

Welsh Air Quality Webinar October 2020

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## Active travel: Risks and benefits?



## Travel microenvironments, air pollution, and health

- **Travel microenvironments**

- (Barcelona sample, de Nazelle et al. 2013):

Time  
traveling

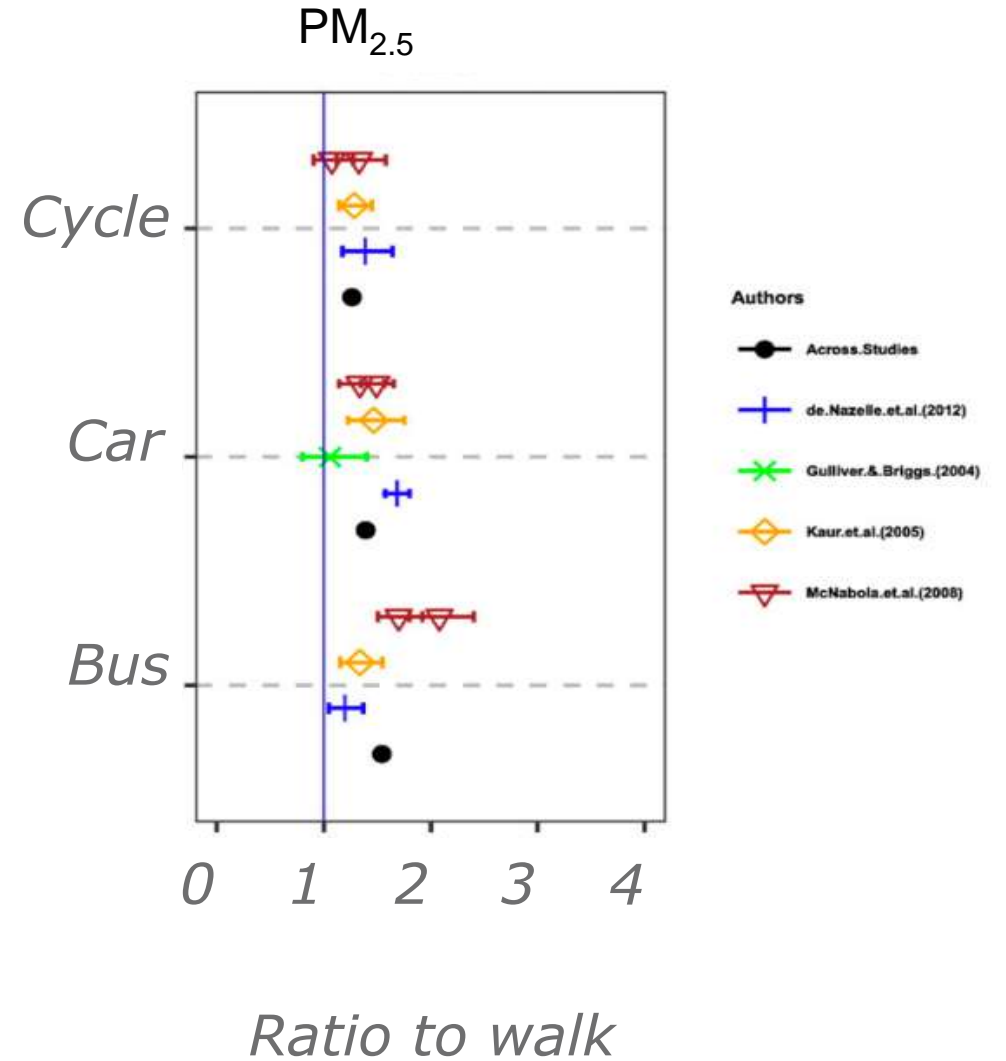
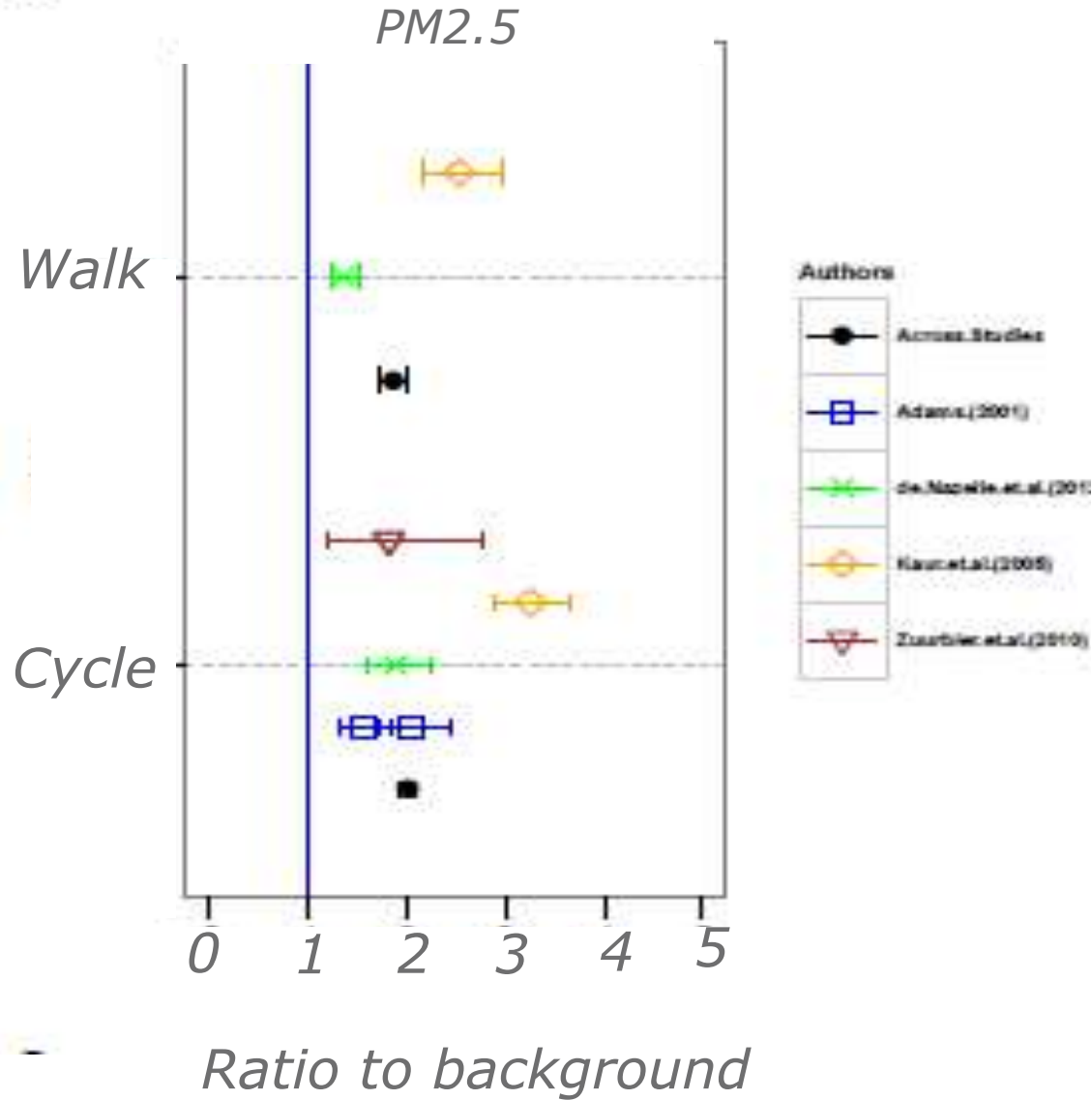
% contribution  
to NO<sub>2</sub>  
exposure

% contribution to  
NO<sub>2</sub> inhalation

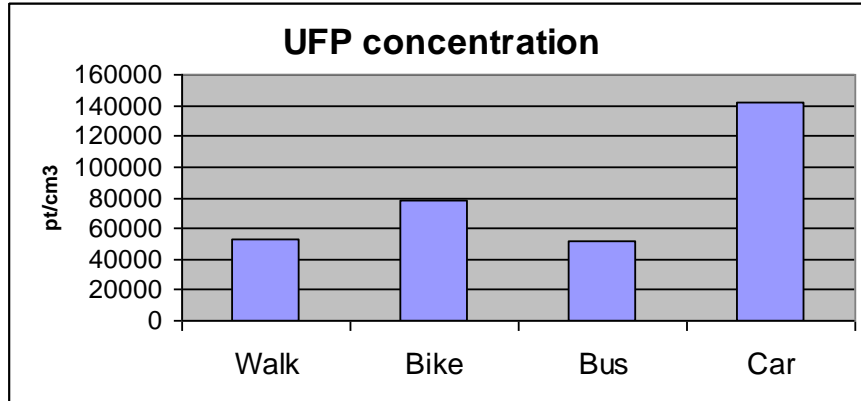
- Onset of myocardial infarctions ([Peters et al., 2013](#))
- Sub-clinical effects ([Adar et al., 2007](#); [McCreanor et al., 2007](#); [Strak et al., 2009](#); [Weichenthal et al., 2011](#), [Kubesch et al., 2014a,b](#) )

# Exposures in travel microenvironments: Literature review on exposure contrasts in different modes in Europe

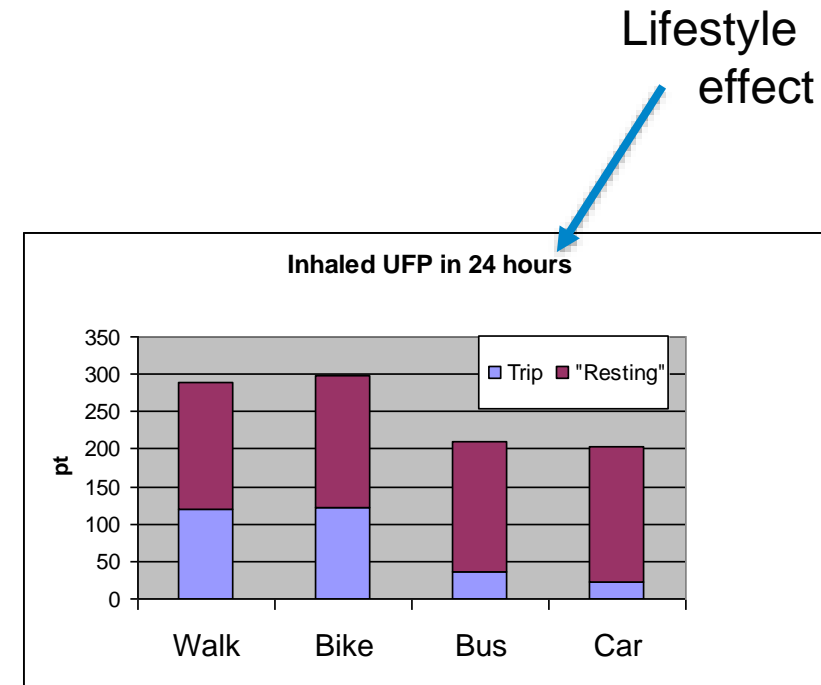
**A**



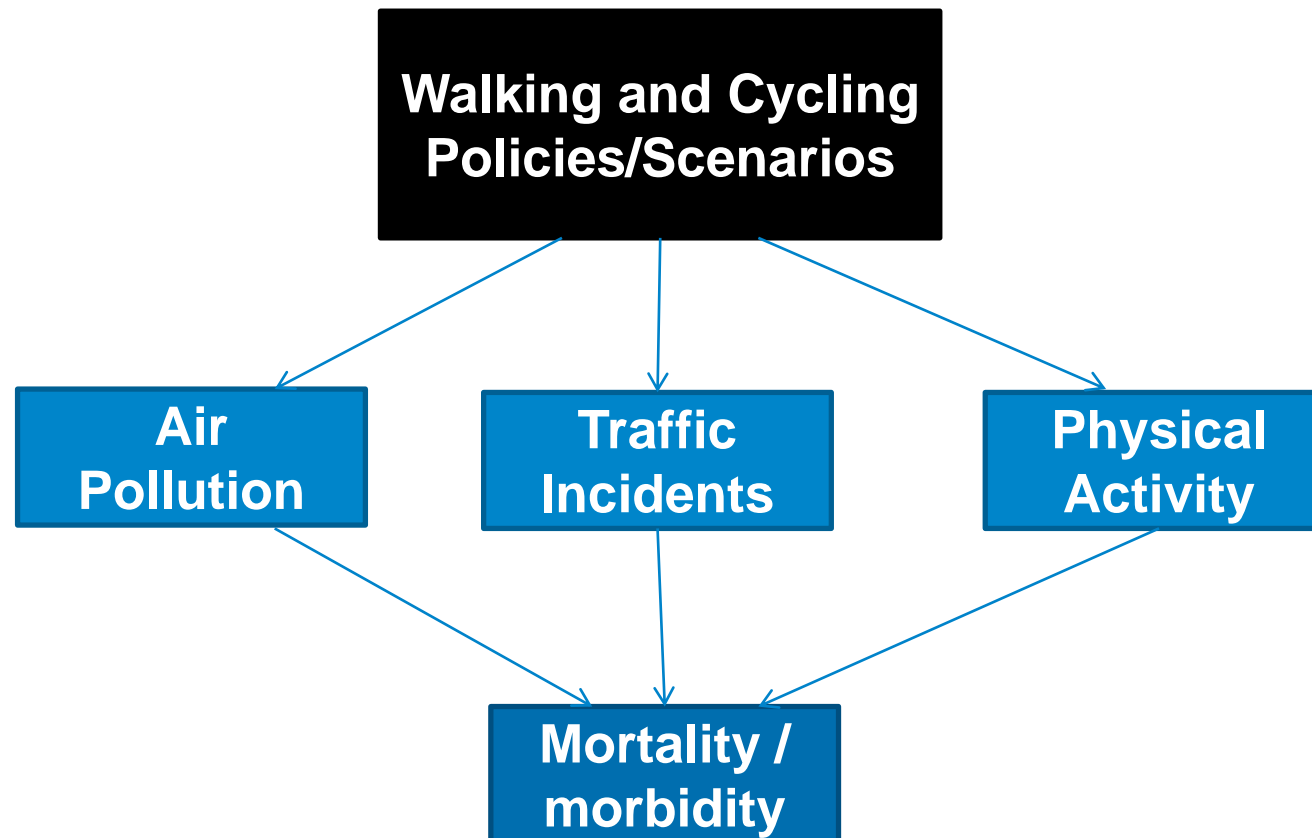
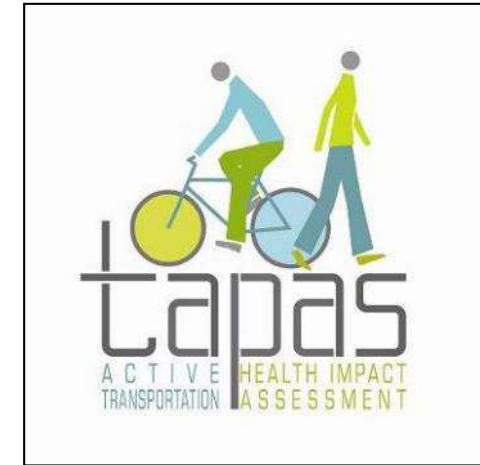
Average concentrations and inhaled doses



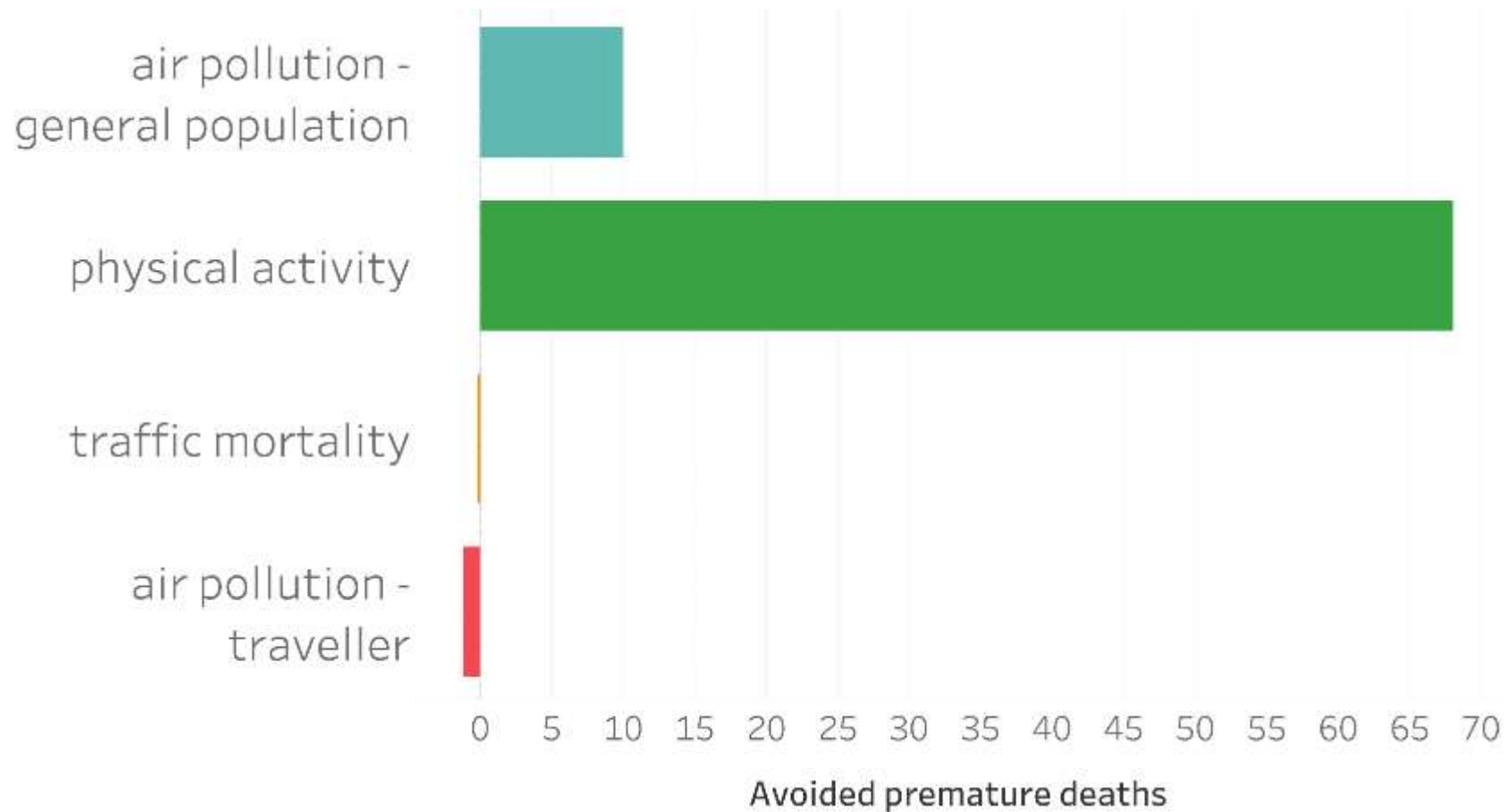
	IR (L/min)	Trip time (min)
Walk	23	49
Bike	37	24
Bus	10	34
Car	10	28



# Health impact assessment models of active travel



## Impacts of mode shift from cars to active travel (Barcelona, Spain)





Contents lists available at ScienceDirect

## Preventive Medicine

journal homepage: [www.elsevier.com/locate/ypmed](http://www.elsevier.com/locate/ypmed)



### Brief Original Report

## Can air pollution negate the health benefits of cycling and walking?



Marko Tainio <sup>a,\*</sup>, Audrey J. de Nazelle <sup>b</sup>, Thomas Götschi <sup>c</sup>, Sonja Kahlmeier <sup>c</sup>, David Rojas-Rueda <sup>d,e,f</sup>,  
Mark J. Nieuwenhuijsen <sup>d,e,f</sup>, Thiago Hérick de Sá <sup>g</sup>, Paul Kelly <sup>h</sup>, James Woodcock <sup>a</sup>

<sup>a</sup> UKCRC Centre for Diet and Activity Research, MRC Epidemiology Unit, University of Cambridge School of Clinical Medicine, Institute of Metabolic Science, Cambridge, UK

<sup>b</sup> Centre for Environmental Policy, Imperial College London, London, UK

<sup>c</sup> Physical Activity and Health Unit, Epidemiology, Biostatistics and Prevention Institute, University of Zurich, Zurich, Switzerland

<sup>d</sup> Center for Research in Environmental Epidemiology (CREAL), Barcelona, Spain

<sup>e</sup> Universitat Pompeu Fabra (UPF), Barcelona, Spain

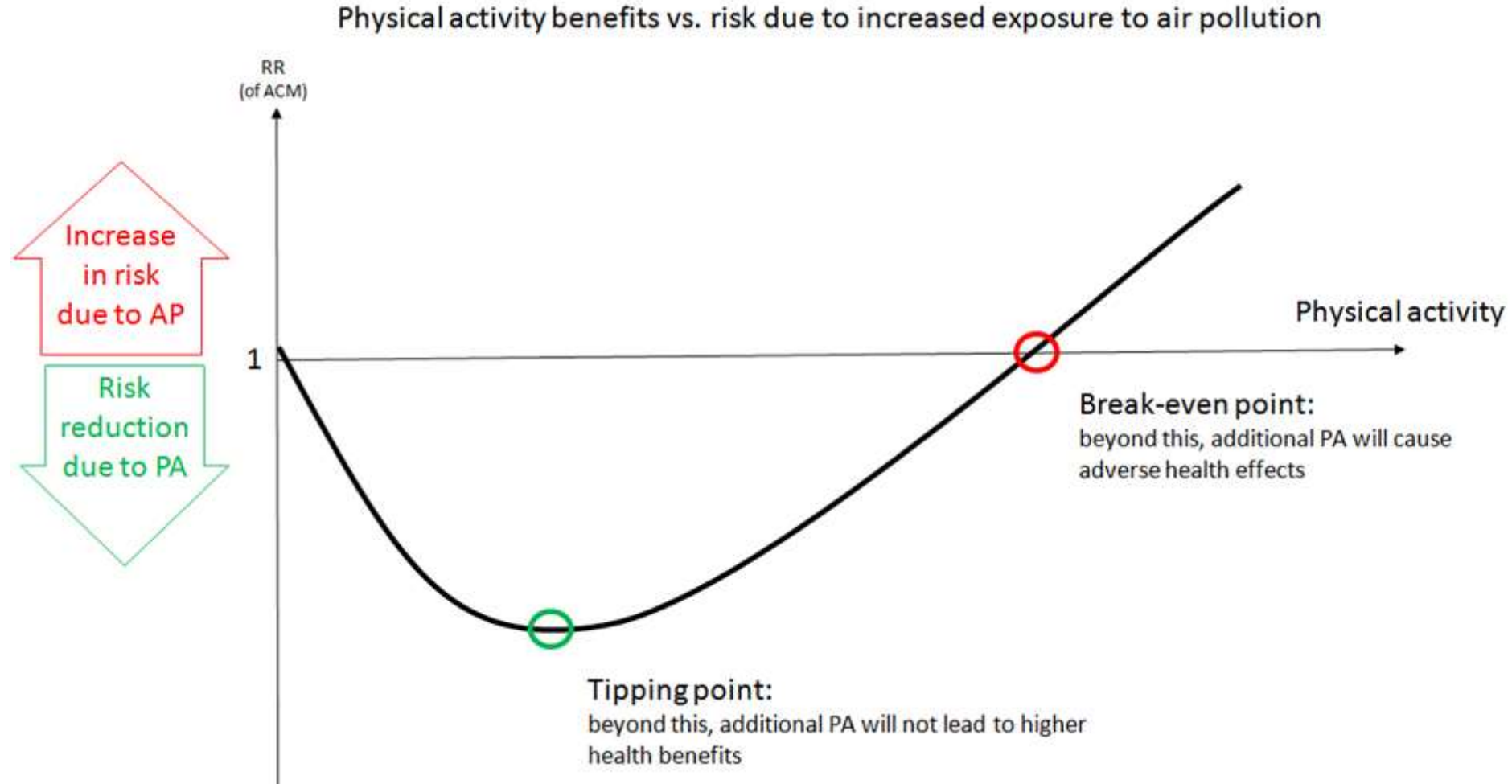
<sup>f</sup> Centro de Investigación Biomédica en Red de Epidemiología y Salud Pública (CIBERESP), Madrid, Spain

<sup>g</sup> Centre for Epidemiological Research in Nutrition and Health, School of Public Health, University of São Paulo, São Paulo, Brazil

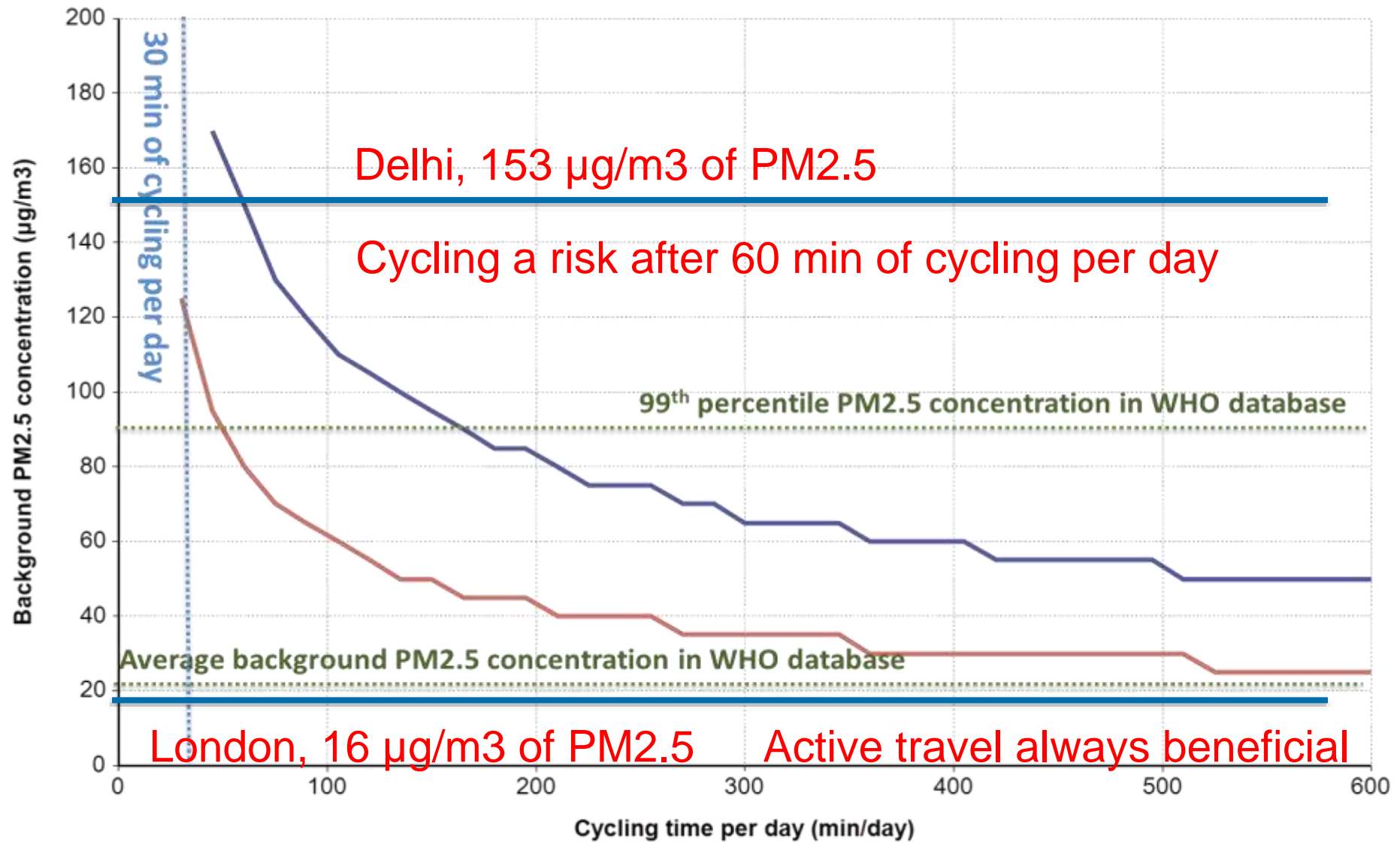
<sup>h</sup> Physical Activity for Health Research Centre (PAHRC), University of Edinburgh, UK



For a given level of air pollution, is there a tipping beyond which additional physical activity does not bring additional benefits, and a “break-even” point beyond which additional physical activity brings greater risks?



## When risks become higher than benefits: Cycling



Delhi, 153 µg/m<sup>3</sup> of PM2.5

Cycling a risk after 60 min of cycling per day

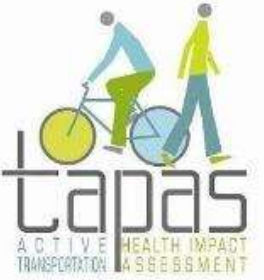
99<sup>th</sup> percentile PM2.5 concentration in WHO database

Average background PM2.5 concentration in WHO database

London, 16 µg/m<sup>3</sup> of PM2.5

Active travel always beneficial

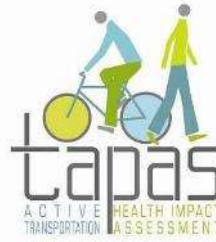
# Air pollution and physical activity: Epidemiology



- TAPAS epidemiologic analysis (Andersen et al. 2015 Environmental Health Perspectives):
  - Danish Diet Cancer and Health Cohort (52 061 members, NO<sub>2</sub> concentration at home address)
  - **Benefits of outdoor physical activity outweigh risks associated with air pollution exposure**
  - **Some benefits may be attenuated when exposed to high levels of NO<sub>2</sub>** (respiratory mortality: benefits of physical activity halved @ high vs low air pollution, but still beneficial to be physical active)







(Kubesch et al. 2014 European Journal of Preventive Cardiology; Kubesch et al. 2014 Occupational Environmental Medicine; Cole-Hunter et al. 2015 J of Exposure Science and Environmental Epidemiology; Matt et al. 2016 Environment International )

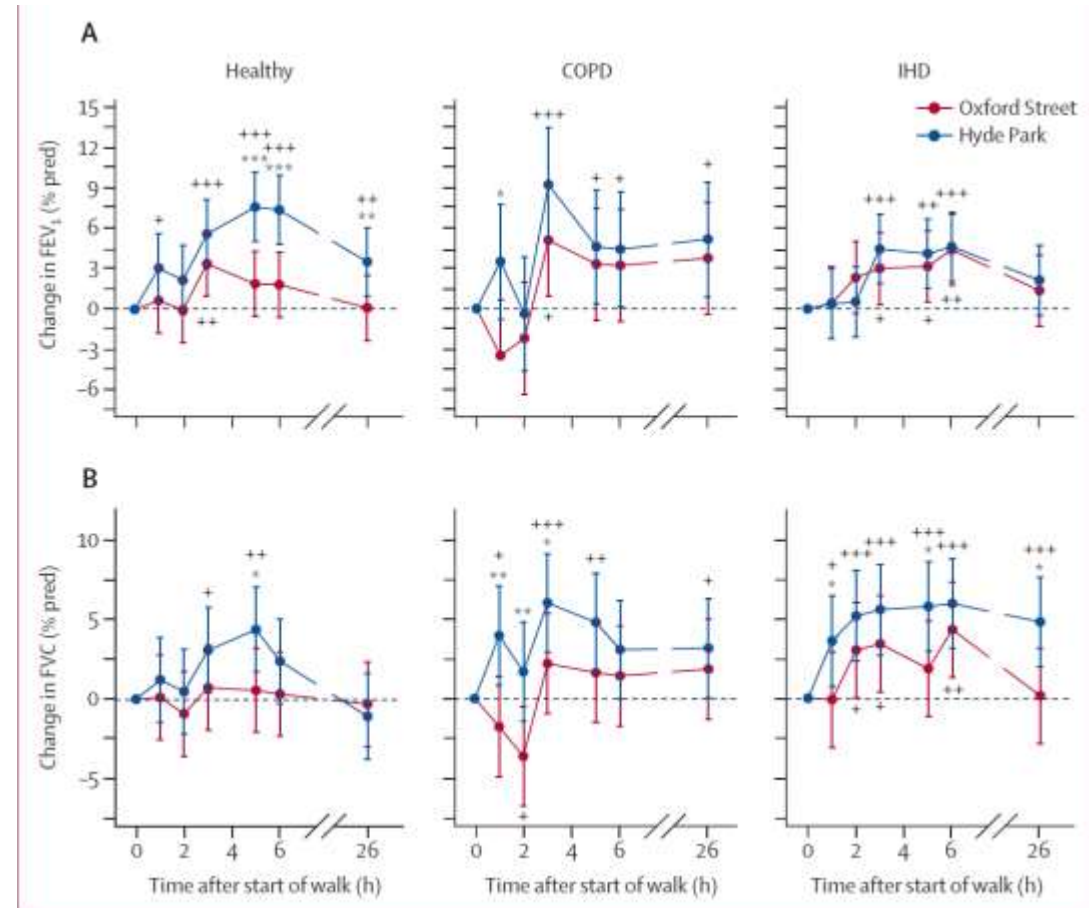
## AP and PA: Experimental studies

- TAPAS experimental study Case crossover, 28 volunteers
- Benefits of cycling on respiratory and cardiovascular outcomes even at high air pollution levels
- Exercise may protect against acute adverse effects of air pollution
- Difficulty of disentangling effects



Exercise improves the same physiological mechanisms that air pollution deteriorates

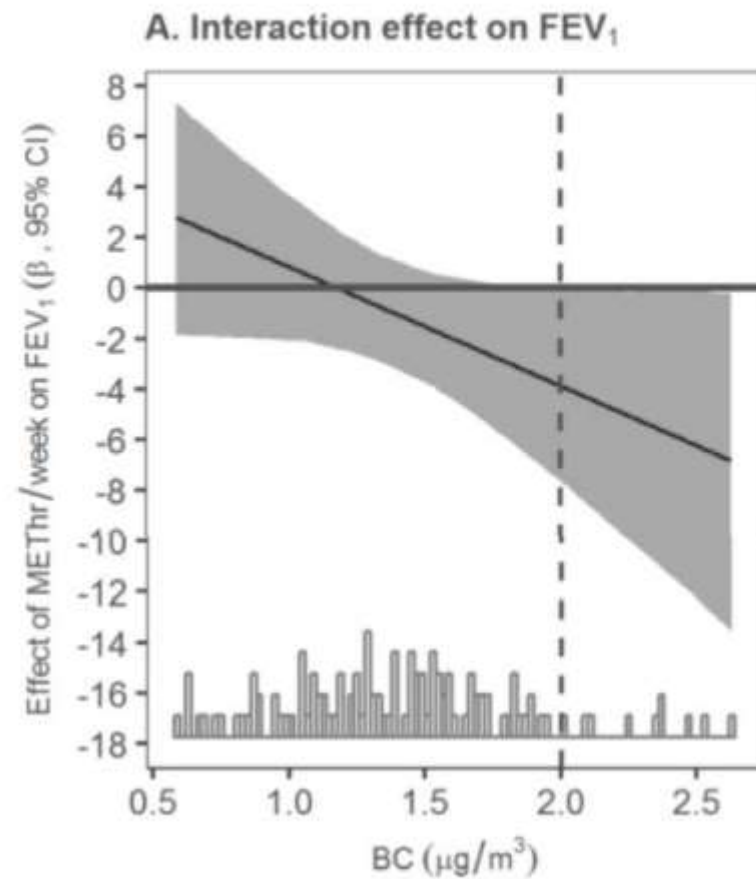
# London air pollution cancels positive health effects of exercise in over 60s



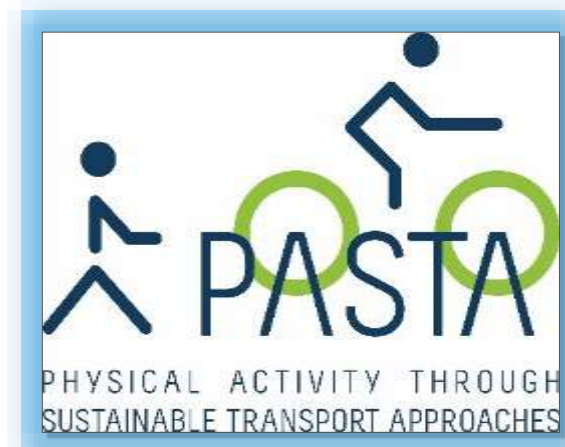
Experimental study comparing health effects of a walk in Hyde park vs Oxford St  
Synharay et al. The Lancet 2017

## Medium-long term effects

Black carbon reduces de PA effect on Lung Function



115 healthy adults  
3 European cities



Laeremans et al, 2018

# URBAN TRANSPORT: HOLISTIC THINKING

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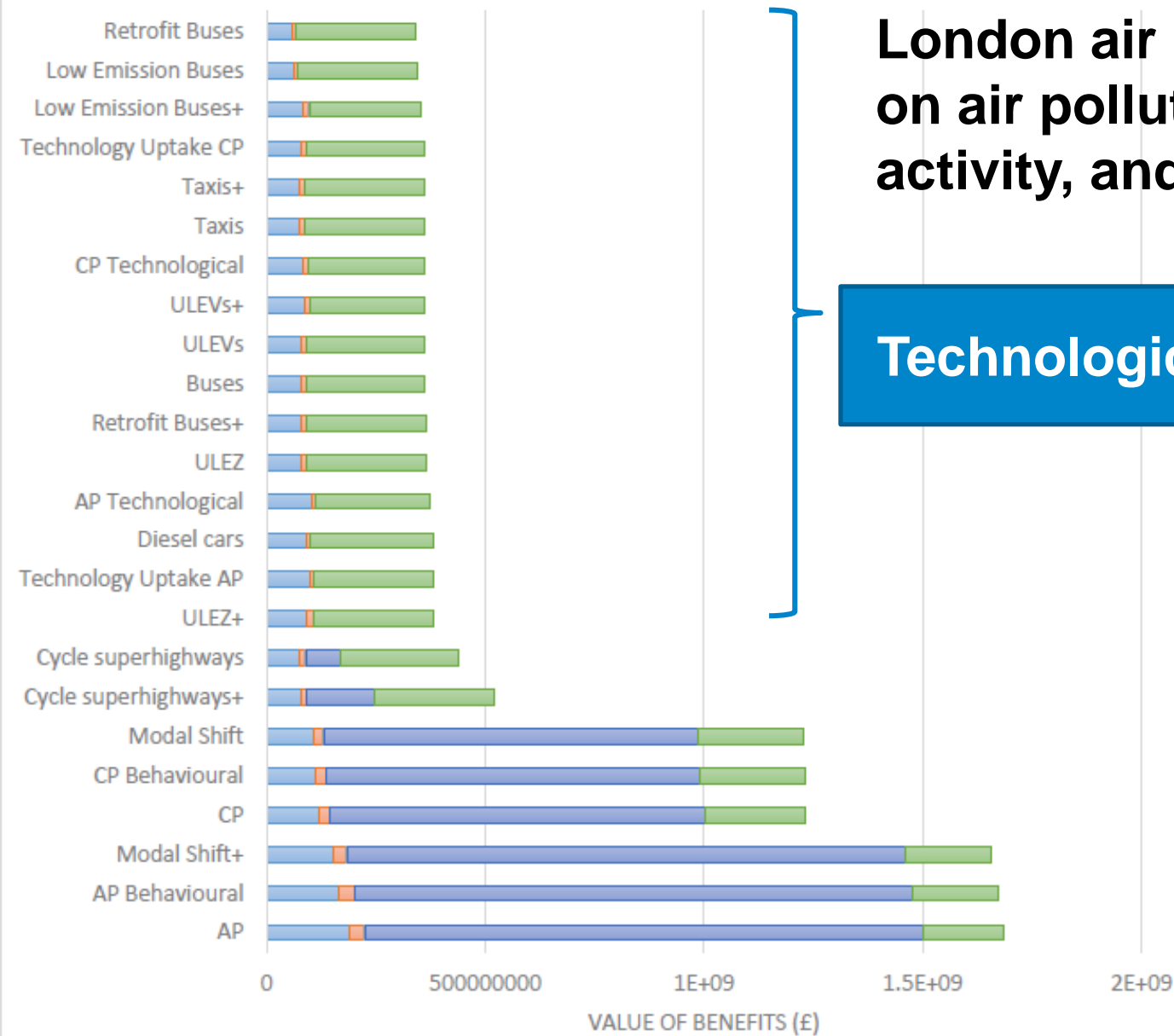




# London air quality strategies: impacts on air pollution mortality, physical activity, and CO2 emissions (£)

**Technological solutions**

**Behavioural solutions  
(mode shifts)**



■ NO2 Mortality (VSL)      ■ PM2.5 Mortality (VSL)  
■ Respiratory Hospital Admissions      ■ Cardiovascular Hospital Admissions  
■ Physical Activity      ■ CO2

- J. Sykes MSc thesis 2016 (+ M. Ristic-Smith thesis 2016 + ongoing PhD work by A.Calderon)



de Nazelle et al. 2011  
Improving Health  
through Policies that  
Promote Active Travel  
*Environment  
International* v37,  
issue 4







Arlo age 4: "I want #CarFreeDay to never end"





- Multiple impacts of urban transport on health
- Risks associated with air pollution exposures while travelling (actively)
- Most evidence:
  - benefits walk/bike > risks
- Some evidence of air pollution attenuating benefits of physical activity
- Co-benefits of active travel-related policies
- Holistic visions and assessments are needed



Photo: Gil Garcetti



**Thank you!**

Audrey de Nazelle - [anazelle@imperial.ac.uk](mailto:anazelle@imperial.ac.uk)

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