



Active mobility and health:

Insights from the PASTA project

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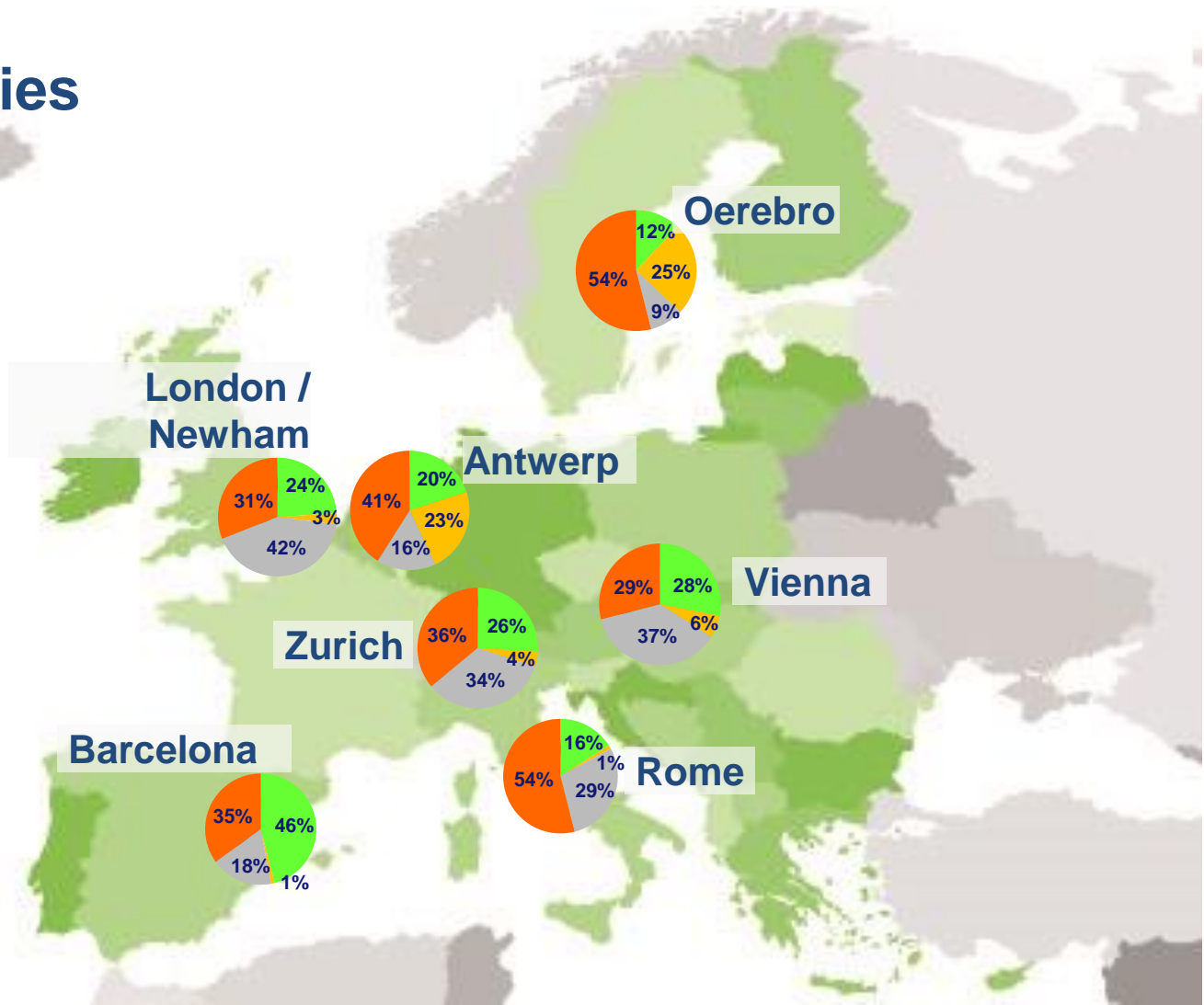
Life platform meeting Barcelona 26-27 September 2017



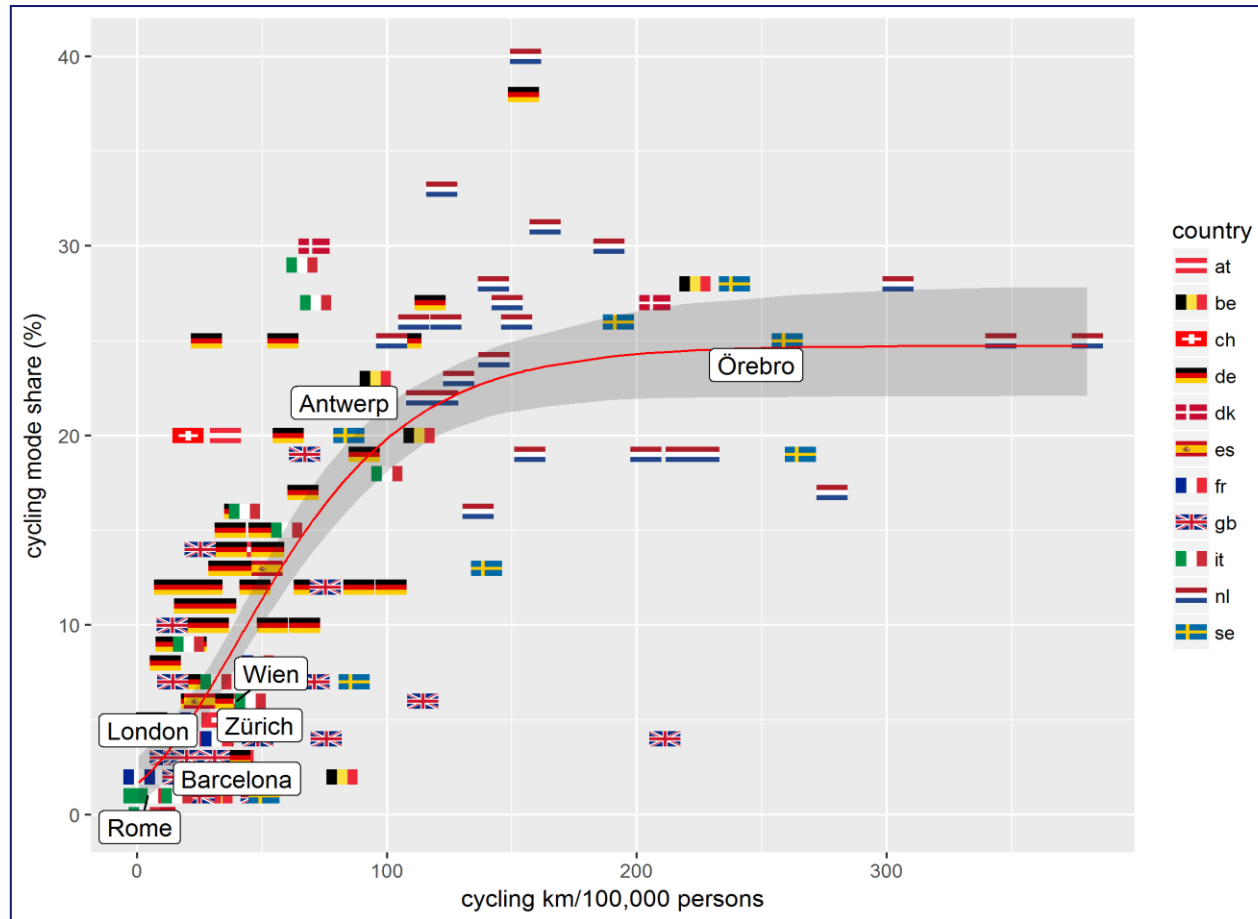
PHYSICAL ACTIVITY THROUGH SUSTAINABLE TRANSPORT APPROACHES

7 Case-study Cities

- Walking
- Cycling
- Public Transport
- Private motorised



Cycling Networks are Associated with Cycling Mode Shares

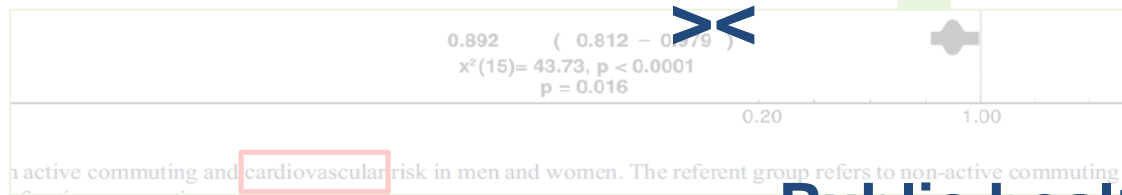


How does Active Travel affect Health?

Individual perspective

How healthy or unhealthy (risky) is AT?

- Compared to driving, wellbeing was higher when using active travel or public transport.



Public health perspective

What is it worth to society?





PHYSICAL ACTIVITY THROUGH
SUSTAINABLE TRANSPORT APPROACHES

Curr Envir Health Rpt (2017) 4:286–295
DOI 10.1007/s40572-017-0149-9



BUILT ENVIRONMENT AND HEALTH (MJ NIEUWENHUIJSEN AND AJ DE NAZELLE, SECTION EDITORS)

Towards a Comprehensive Conceptual Framework of Active Travel Behavior: a Review and Synthesis of Published Frameworks

**Thomas Götschi¹ · Audrey de Nazelle² · Christian Brand³ · Regine Gerike⁴ ·
on behalf of the PASTA Consortium**



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Review of Reviews: Measures to Promote Active Mobility



<http://activelivingresearch.org/ActiveTravelreview>

Buehler, R, Götschi, T, Winters, M. Moving Toward Active Transportation: How Policies Can Encourage Walking and Bicycling. San Diego, CA: Active Living Research; 2016. Available at www.activelivingresearch.org
Winters, Meghan, Ralph Buehler, and Thomas Götschi. "Policies to promote active travel: evidence from reviews of the literature." Current environmental health reports (2017): 1-8.



PASTA DATA COLLECTION & EXPERIMENTS

Evidence based health policy

- How do policy makers know what works?
 - Health recommendations often derived from cross-sectional / observational studies
 - Causality issues
 - Risk of false/reverse associations
 - Observed Effects Biased towards null because of exposure misclassification
 - Risk of ineffective policies & wasted tax money
- => Need for
- Longitudinal studies
 - Experimental studies
 - Accountability studies
- (What effect does a change in exposure* have on health?)
- => Need for accurate (personal) exposure measurement)



Study design

PHYSICAL ACTIVITY THROUGH
SUSTAINABLE TRANSPORT APPROACHES

Open Access

Protocol

BMJ Open Physical Activity through Sustainable Transport Approaches (PASTA): a study protocol for a multicentre project

Regine Gerike,^{1,2} Audrey de Nazelle,³ M Esther Anaya,³ Ione Avila-Palencia,^{4,5,6} Tom Cole-Hunter,^{4,5,6} Evi Dons,^{7,11} Ulf Sonja Kahlmeier,¹³ Michelle Laeremans Francesca Racioppi,¹⁴ Elisabeth Raser, Christian Schweizer,¹⁴ Arnout Standaert Thomas Götschi,¹³ on behalf of the PASTA

Dons et al. *BMC Public Health* (2015) 15:1126
DOI 10.1186/s12889-015-2453-3

BMC
Public Health

STUDY PROTOCOL

Open Access



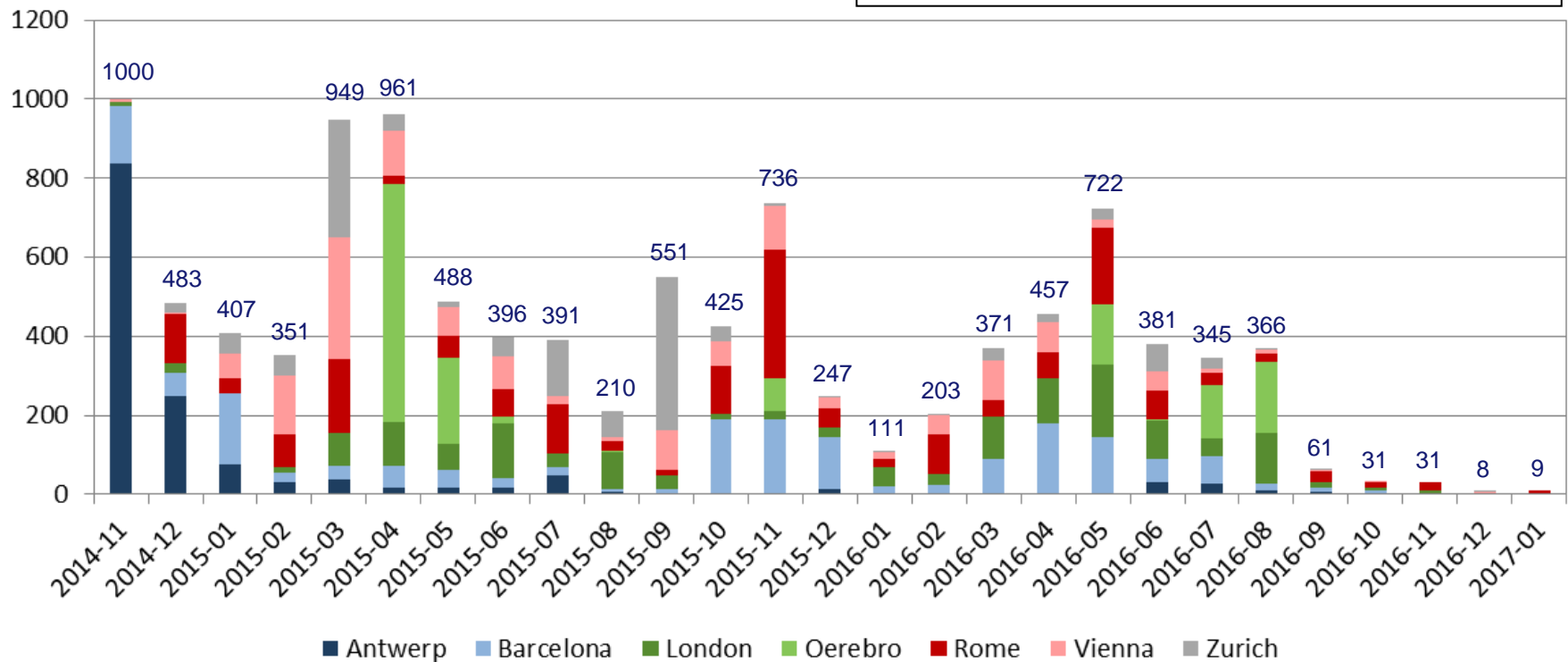
Physical Activity through Sustainable Transport Approaches (PASTA): protocol for a multi-centre, longitudinal study

Evi Dons^{1,2}, Thomas Götschi³, Mark Nieuwenhuijsen^{4,5,6}, Audrey de Nazelle⁷, Esther Anaya⁷, Ione Avila-Palencia^{4,5,6}, Christian Brand⁸, Tom Cole-Hunter^{4,5,6}, Mailin Gaupp-Berghausen⁹, Sonja Kahlmeier³, Michelle Laeremans^{1,10}, Natalie Mueller^{4,5,6}, Juan Pablo Orjuela⁷, Elisabeth Raser⁹, David Rojas-Rueda^{4,5,6}, Arnout Standaert¹, Erik Stigell¹¹, Tina Uhlmann⁹, Regine Gerike^{9,12} and Luc Int Panis^{1,10*}



Recruitment for the online Survey

12,825 registrations



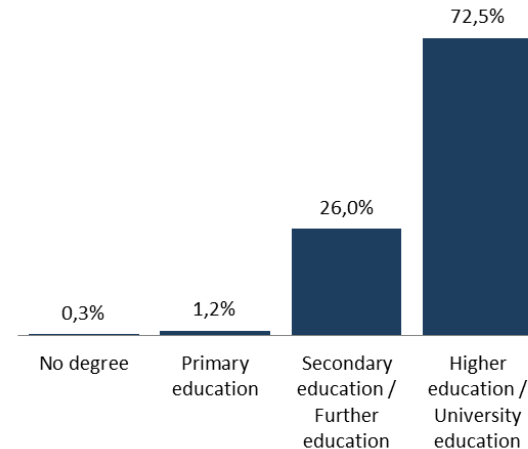
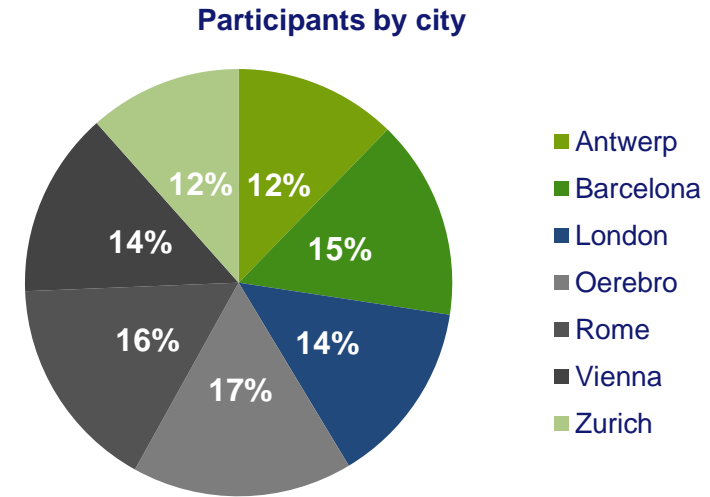
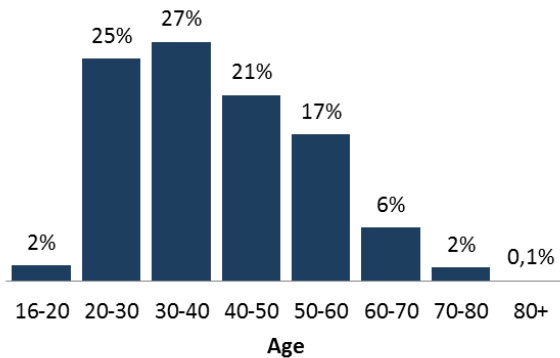


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Sample description



54% **46%**





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Online Survey

Baseline questionnaire Antwerp

2%

Welcome to the PASTA survey!

Completing this questionnaire will take about 10 minutes. At the end of the survey you will be entered in a prize draw.

With many thanks and best wishes from the PASTA team.

5%

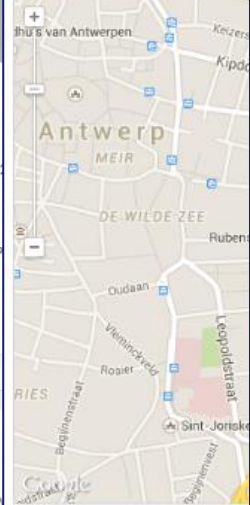
How did you find out about this survey?

- Friends, neighbours or relatives
- News or other media (newspaper, radio, TV, etc.)
- Employer/workplace
- By mail (letter, mailout)


Baseline questionnaire Antwerp

35%

Where do you live? Please be as accurate as possible.



Do you do any moderate-intensity sports, fitness or recreational (leisure) activities for at least 10 minutes per week?



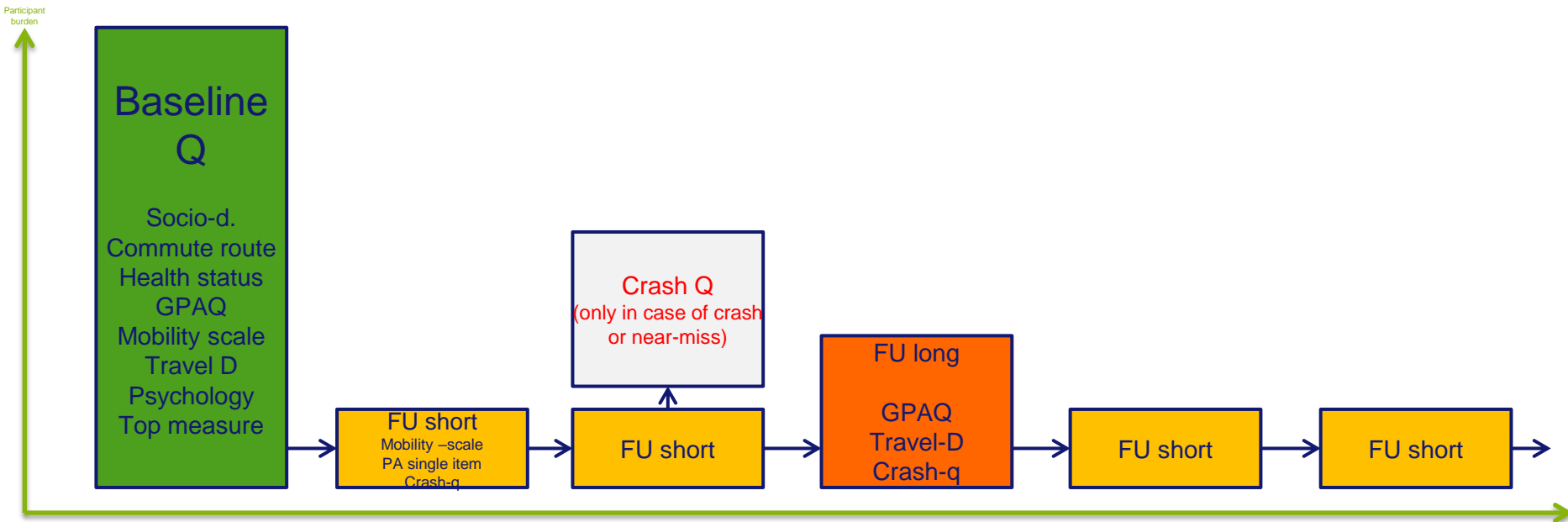
Yes
 No

← Previous

Next →

Longitudinal Online Survey

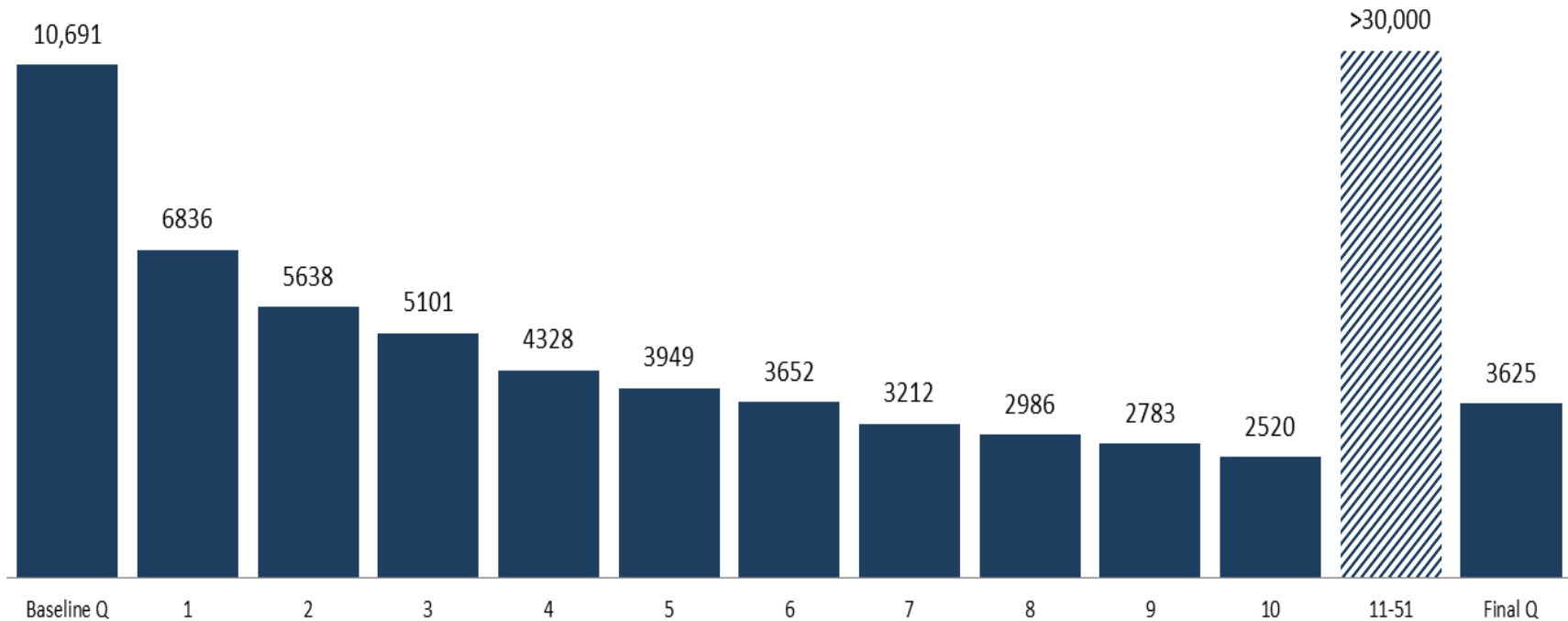
- Before/after, trend evaluation
- Active travel and physical activity vary in time
- Lots of questions to ask



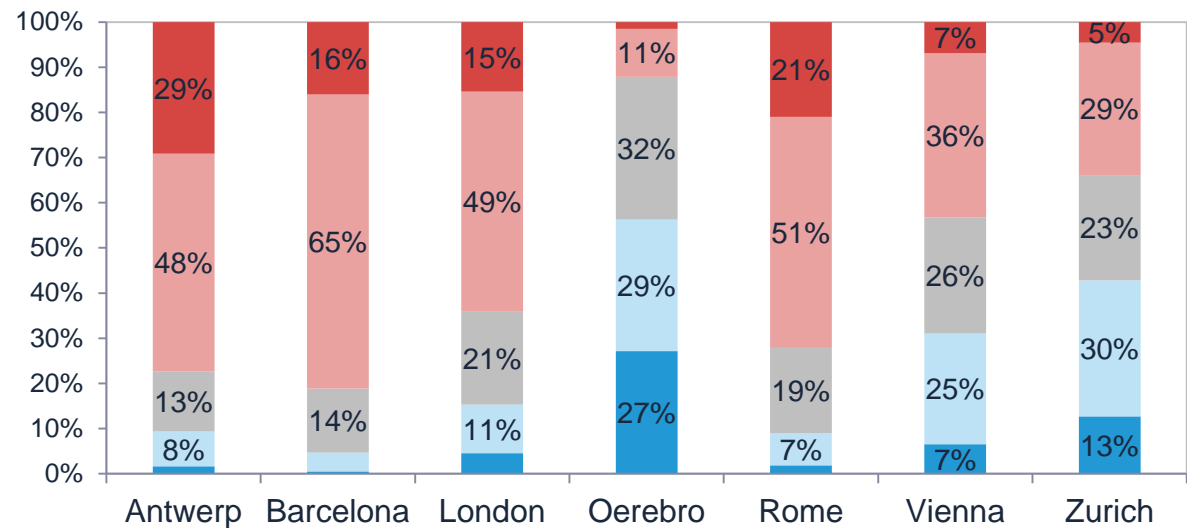
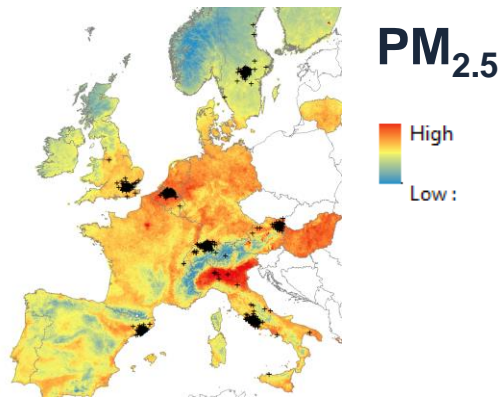
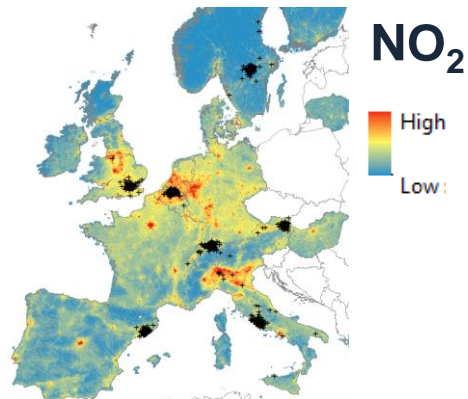


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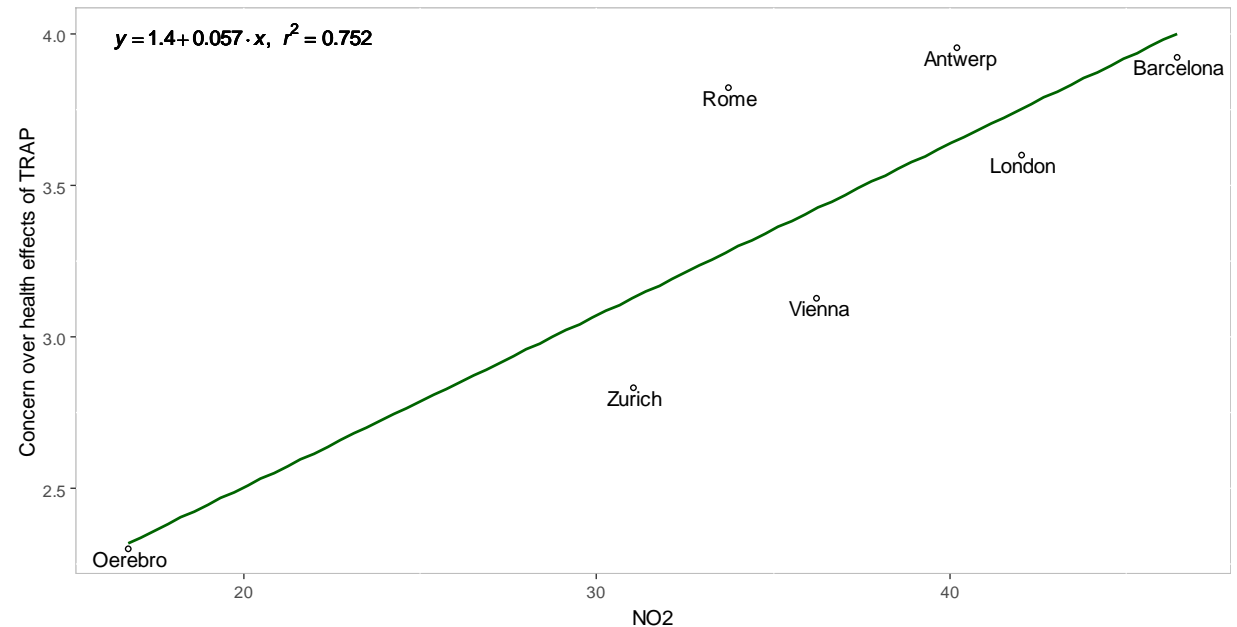
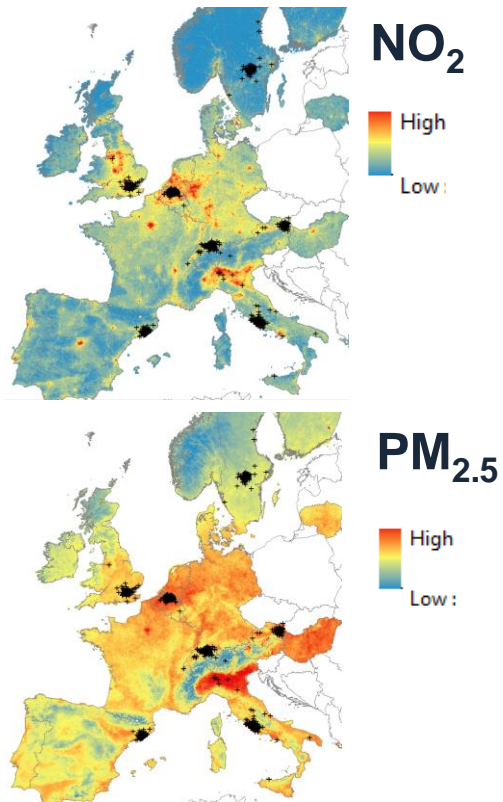
10'000+ Participants, 87'000 Questionnaires



Concern over health effects of air pollution

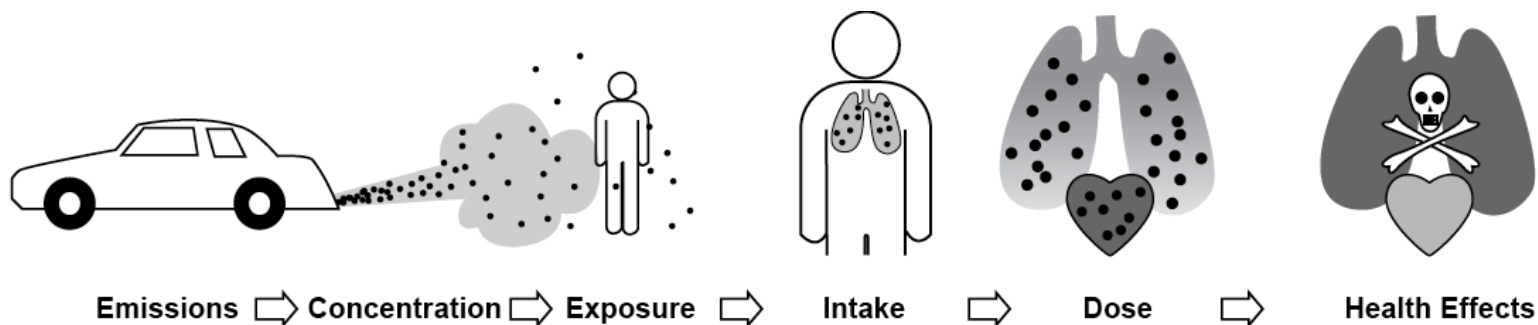


Concern over health effects of air pollution



Being male, having children in the household, being more physically active, and higher NO₂ at the home address → higher concern over health effects of air pollution

AIR POLLUTION: ENVIRONMENTAL PATHWAY



- Current epi studies largely ignore:

- Concentration heterogeneity
- Movement of people
- Indoor/Outdoor
- Inhalation rate

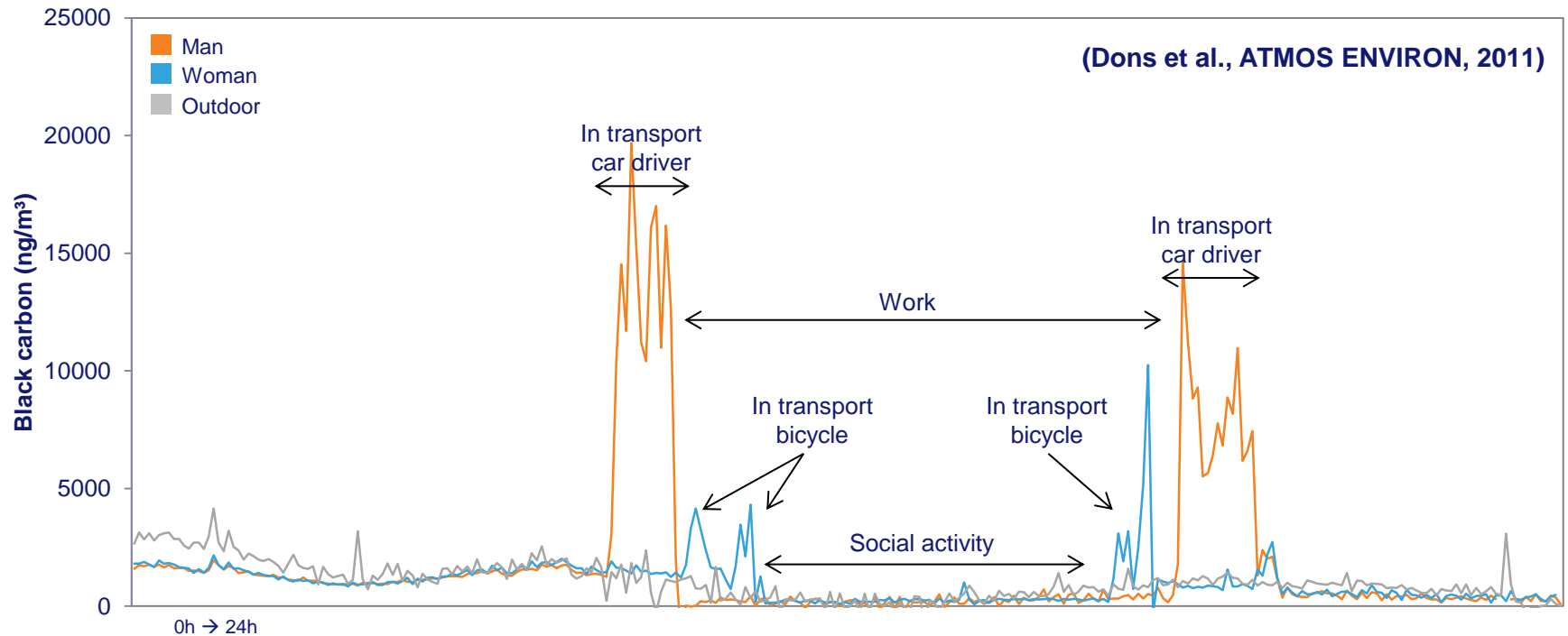
=> Small wearable sensors can potentially solve all of these problems

PEOPLE DON'T SPENT THEIR DAYS ON THEIR DOORSTEP...

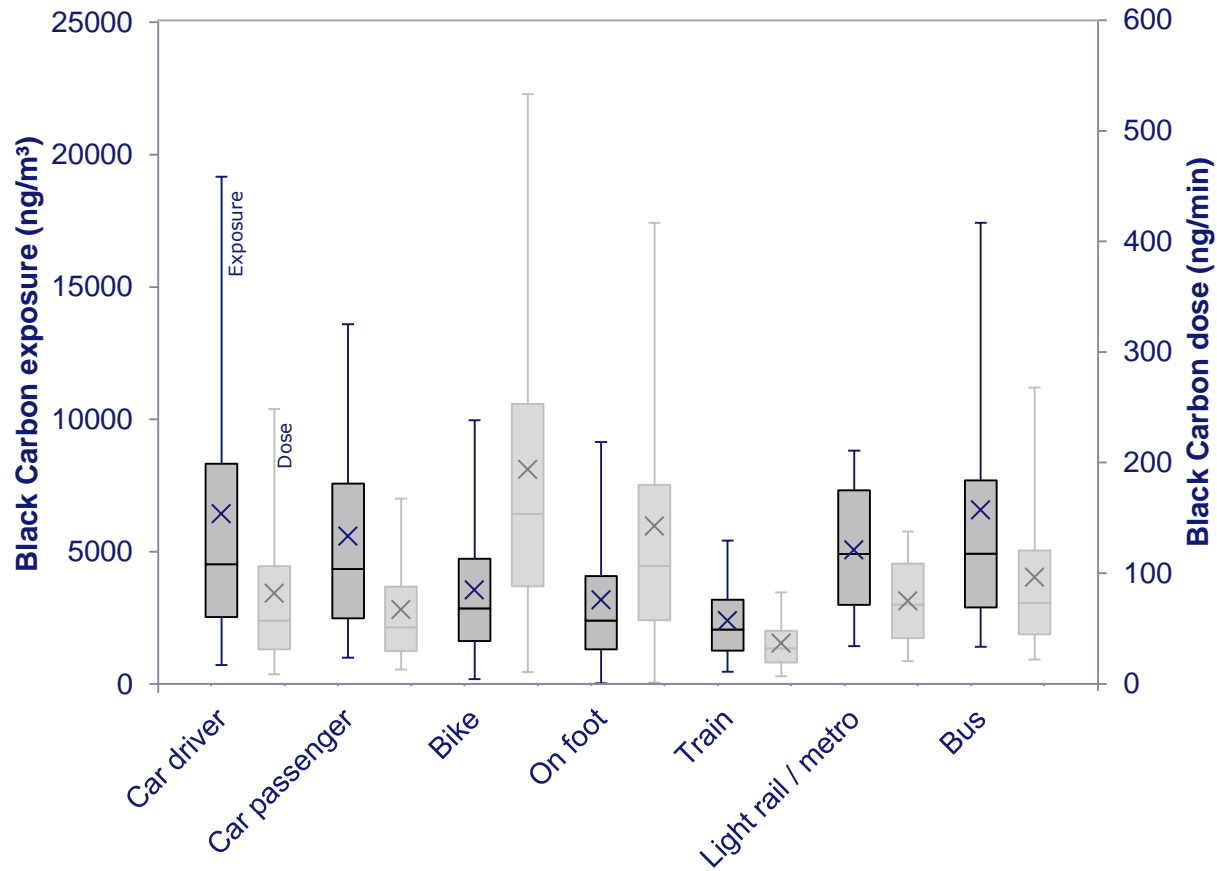


NEED FOR PERSONAL EXPOSURE ASSESSMENT

- Need for portable sensors
- Large temporal/spatial differences in concentrations (esp. BC)
- Large differences in inhalation rate



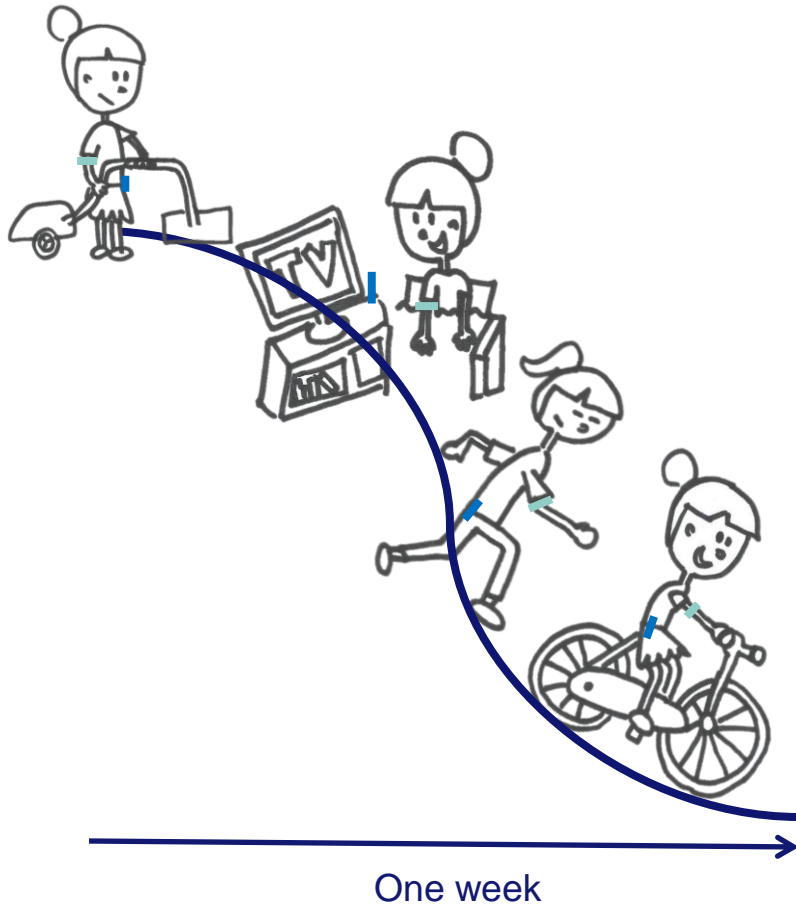
LOWER CONCENTRATION BUT HIGHER DOSES FOR CYCLISTS



Source: PhD by Evi Dons
Dons et al 2011

<https://www.researchgate.net/publication/232070900> Personal exposure to Black Carbon in transport microenvironments

The PASTA experiment



- The Sensewear
- | The micro-Aeth



Our experiment:
 122 participants
 3 repeated measures/participant
 In different seasons
 3 cities
 Integrates multiple biomarkers



What physiological signals did we measure?



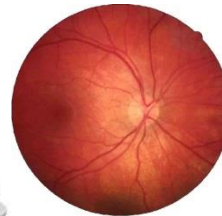
Heart rate
variability



Blood pressure



Retinal pictures



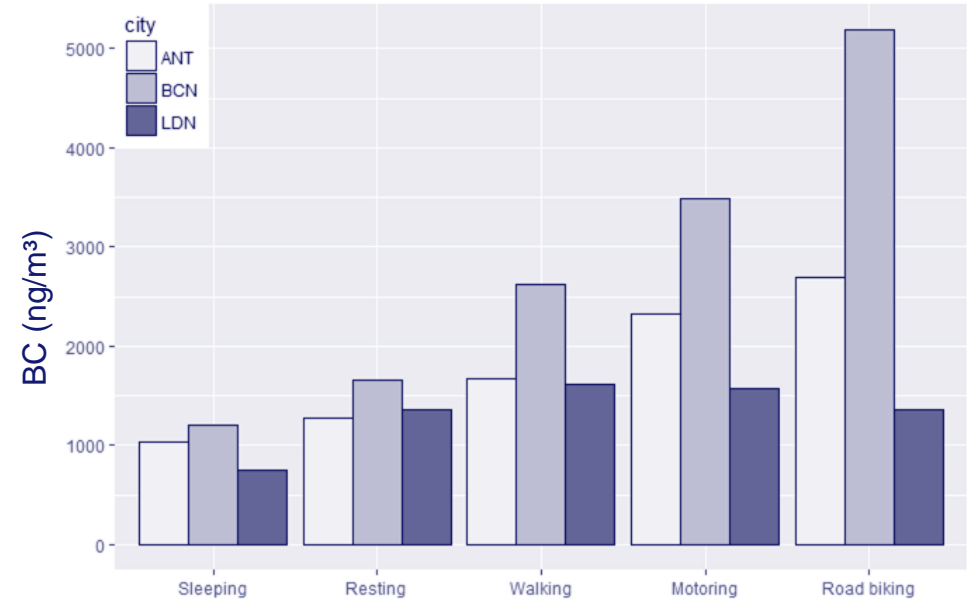
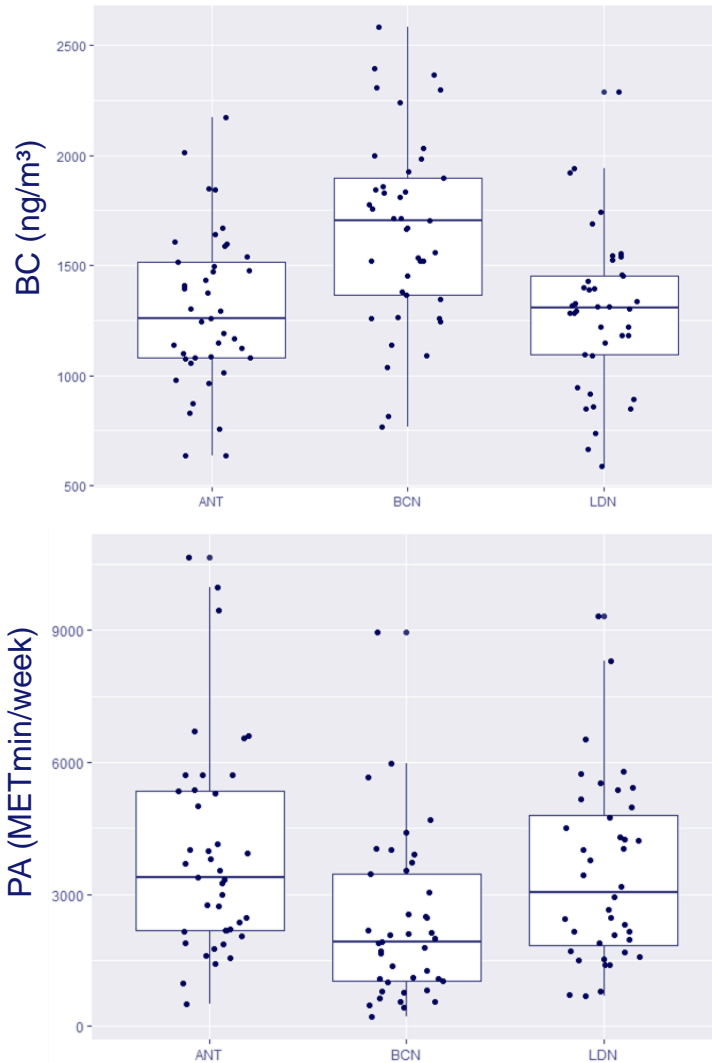
Exhaled NO



Lung function
(spirometry)



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Black carbon levels by activity types and by city.

Physical activity (PA) and black carbon (BC) levels by city. Points represent average levels per individual.



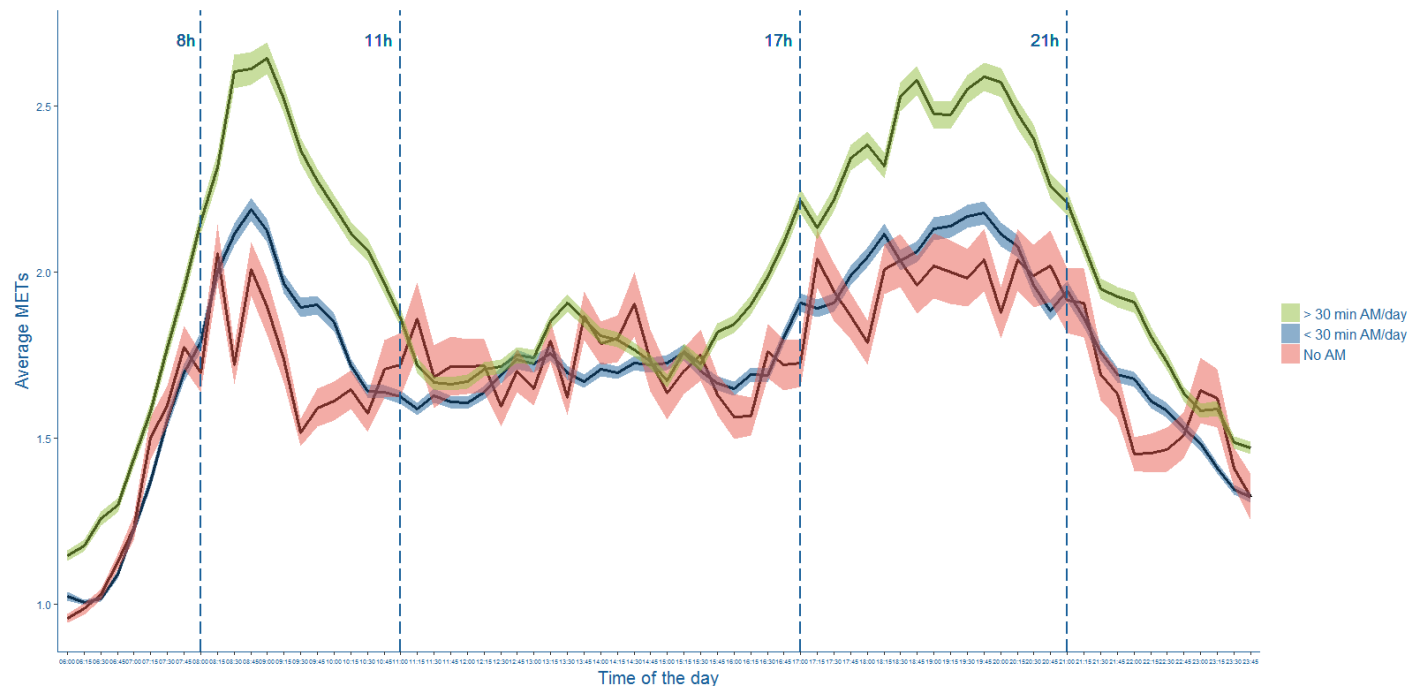


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Key questions in PASTA

Does an increase in walking and cycling translate into more physical activity?

YES: active mobility helps to increase physical activity levels

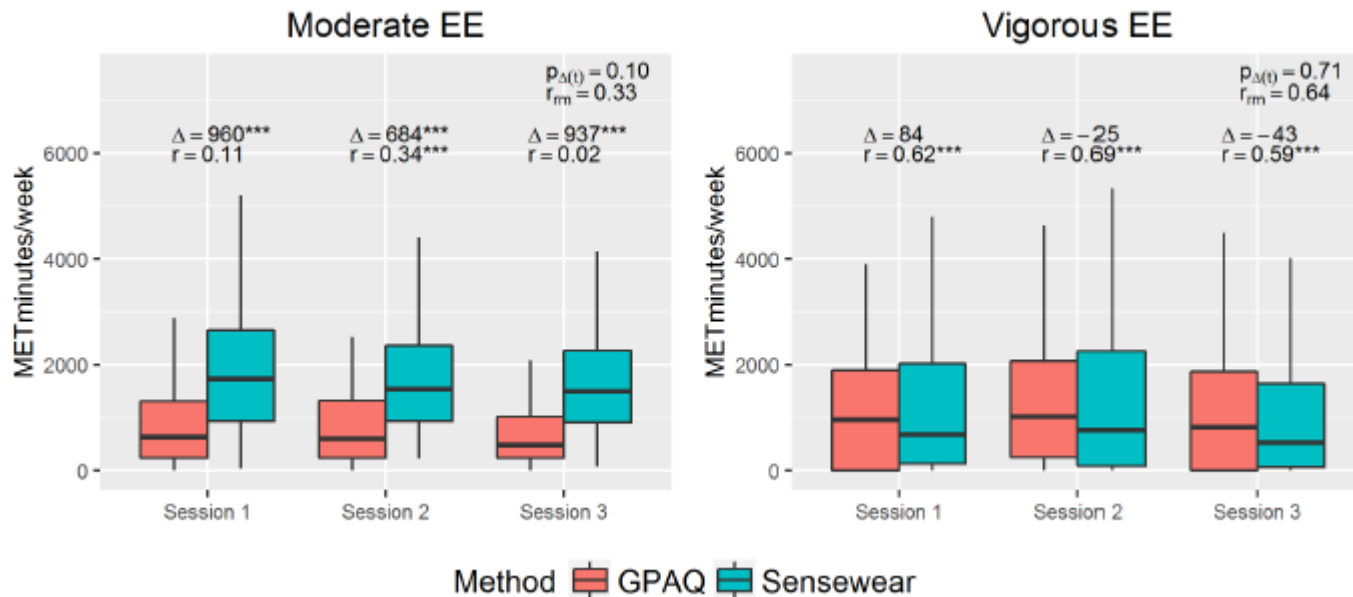


Is self-reported PA reliable?

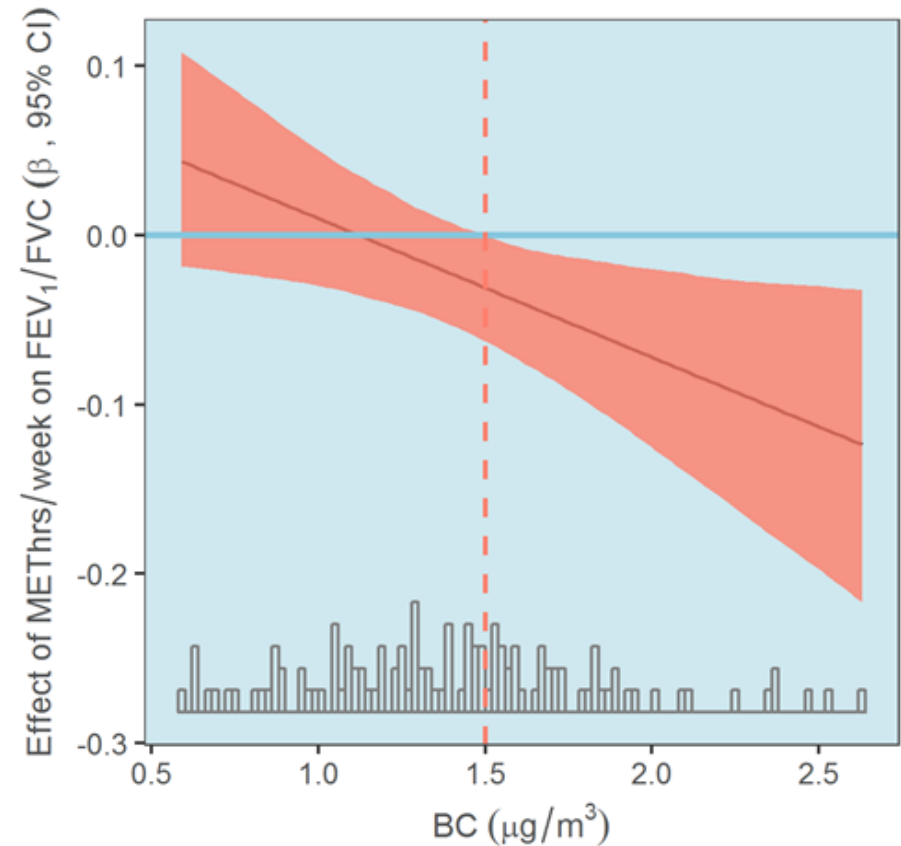
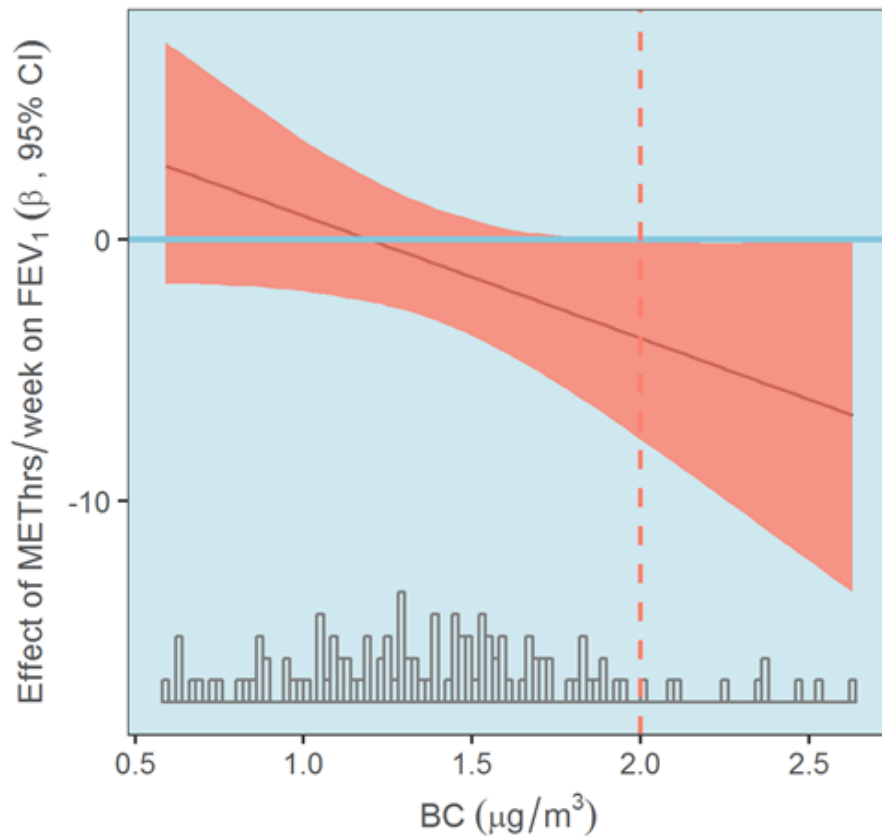
Vigorous-intensity PA: YES
Moderate-intensity PA: underestimated
Sedentary time: inaccurate



SenseWear vs. GPAQ



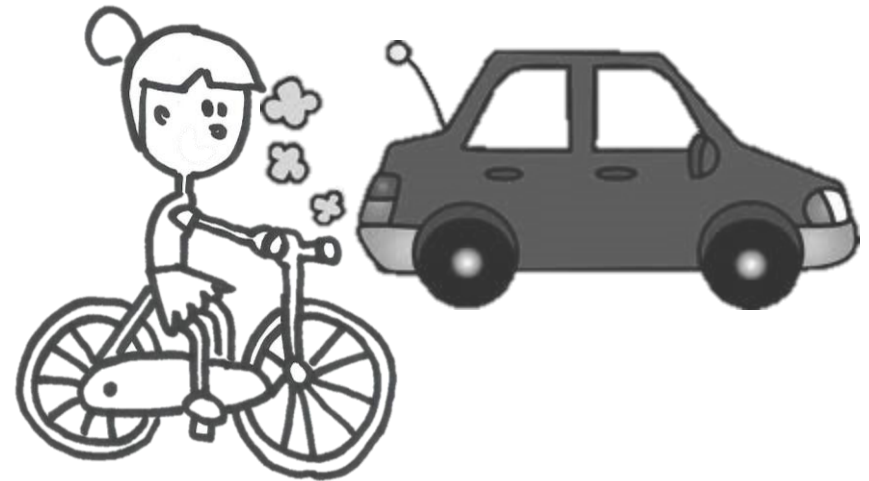
The beneficial effect of physical activity decreases with increasing black carbon concentrations



Long term: physical activity benefit on the respiratory system decreases with air pollution levels



Lung function ~ FEV^*_1



Lung function ~ FEV_1



FEV_1 = Forced Expiratory Volume
in the 1st second

The benefit of additional hour of physical activity per week on FEV1 tends to zero, in black carbon concentrations of $1.5 \mu\text{g}/\text{m}^3$.

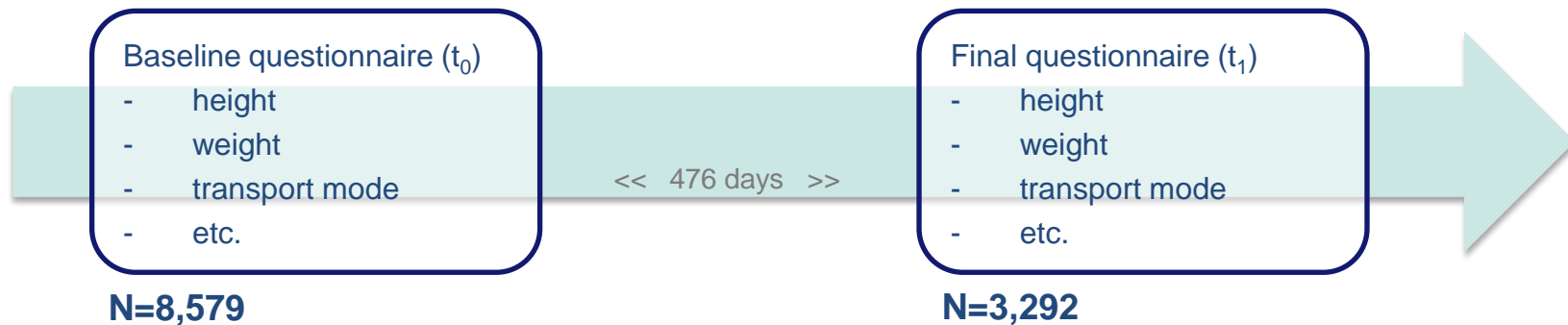


In case of all-cause mortality, most studies report that physical activity benefits outweigh the risks. However, the *respiratory system* might need some additional attention.



BMI analysis

What happens when you start cycling?



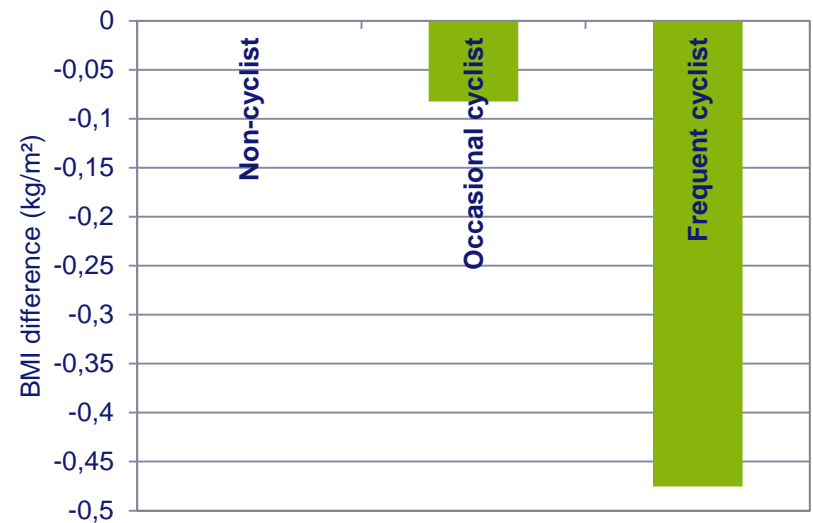
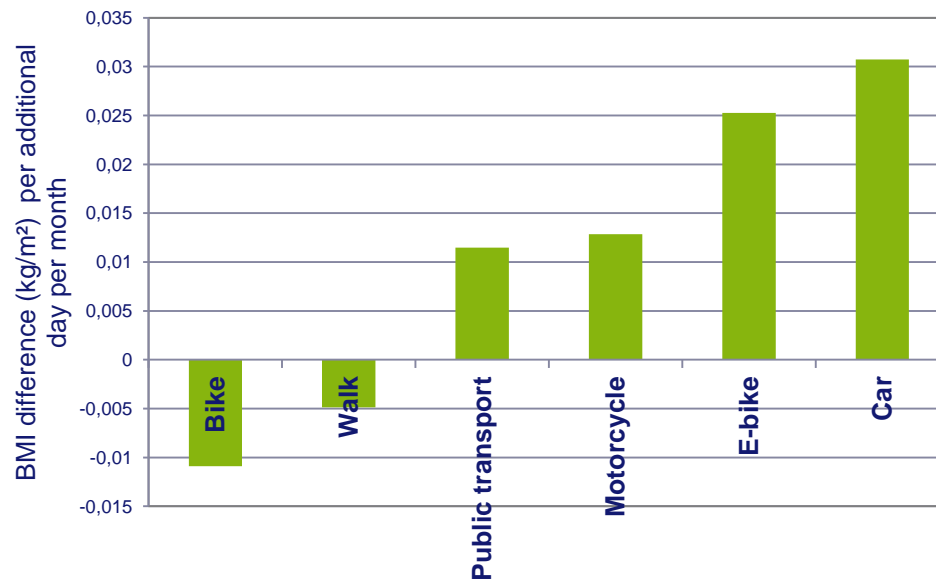
Key gaps addressed:

- Cross-sectional analysis vs. longitudinal analysis
- Taking into account important covariates like leisure-time PA
- Many participants using many different modes
- Multicentre study



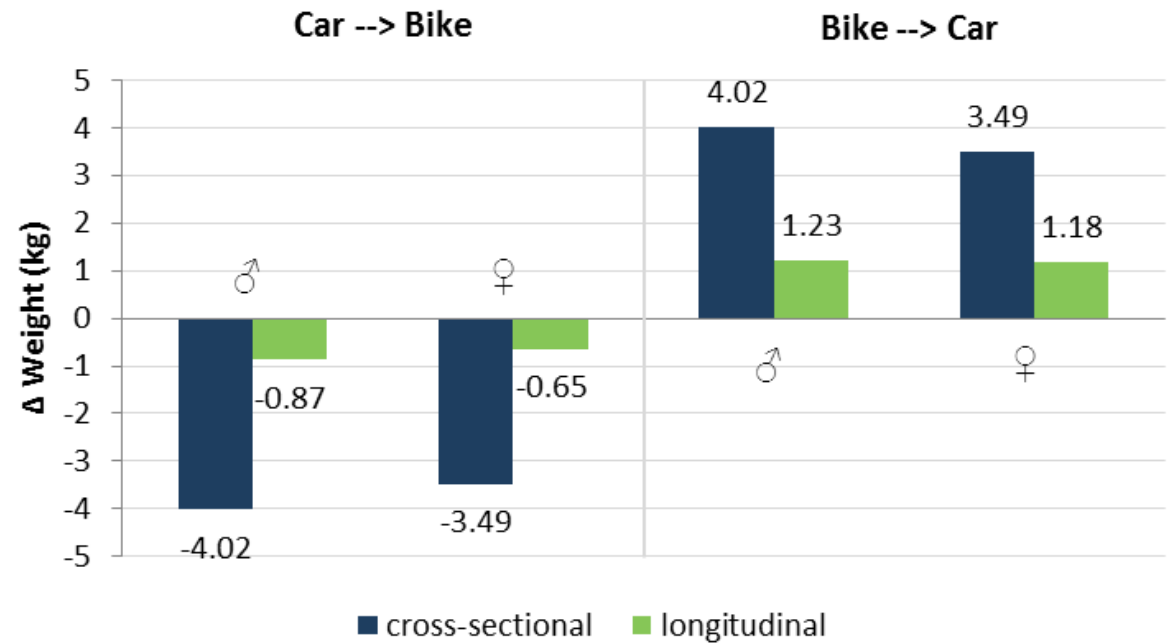
BMI analysis

Results from the cross-sectional analysis



BMI analysis

- Translate BMI in kilograms.
- Reverse causality.





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Antwerp Cycling Highway



Cost-benefit ratios indicate that the benefits of the 25 km cycling highway Antwerp-Mechelen (Belgium) are 2 to 14 times higher than the initial investment.

Impact factor	euro
Physical activity (reduced mortality)	1.2×10^7
Physical activity (reduced morbidity)	2.3×10^6
Reduced air pollution society (mortality)	7.4×10^4
Air pollution active mobility	-8.9×10^5
Crash risk	-1.4×10^6
Total	$+1.2 \times 10^7$
Infrastructure construction costs	-6.0×10^6
Benefit:cost ratio	2.0



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Health impact model for modal shift from car use to cycling or walking in Flanders: application to two bicycle highways

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ABSTRACT

In Flanders, a European hot spot for air pollution, alternatives to car transport are put in place to increase the daily level of physical activity (PA) among the population and reduce air pollution and global warming. To evaluate the economic impact of increased PA (cycling and walking), a health impact model was developed for a given volume of PA, relative to car use, within a defined population in Flanders. Flanders is an interesting region because of the combination of high air pollution, high cycling volumes and good data availability e.g. on crashes and PA. The model uses two health indicators: external costs and DALYs. Considered impacts in the model are: mortality and morbidity related to increased PA, air pollution exposure for society and active individuals and crash risks. In addition to health, external costs for CO₂ emission, congestion and noise exposure can be considered. The model was applied to the new bicycle highways Antwerp–Mechelen and Leuven–Brussels, which were built near important traffic axes to provide the densely populated region with an alternative to car use. Different sensitivity analyses with a variable number of cyclists and travelled distances were elaborated to check the robustness of the results. Overall, the conclusion was that increased PA outweighed other impacts. The benefit:cost ratio

Take-home message

**Keep on promoting active mobility &
use the PASTA study to
highlight the need for better (urban) air quality**



Health economic assessment tools (HEAT) for walking and for cycling



Methodology and user guide

ECONOMIC ASSESSMENT OF TRANSPORT INFRASTRUCTURE AND POLICIES



Introduction

HEAT for cycling

HEAT for walking

Current Assessment

Previous Assessments

Acknowledgements

More information

What data do I need?

To produce an assessment, you need to provide data on the number of people walking or cycling, and the amount of walking they are doing (or are projected to do).

[more...](#)



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