Mitigating transport emissions by encouraging non-motorised transport

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22nd June 2018

Content

- Transport emissions and walking and cycling

- Stats and trends

- Interventions to encourage walking and cycling

- Challenges

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Non-motorised transport and transport emissions

Non-motorised travel is not a direct polluter

Motor vehicles produce roughly:
50% of pollutants like VOCs, nitrogen oxide and particulate matter
75% of carbon monoxide.

When the complete life cycle of the following modes are taken into account, the carbon emissions for each are:

- Bicycle: 21 g CO_2/passenger/km travelled

- Electric-assist bicycle: 22 g CO_2/passenger/km travelled

- Passenger car: 271 g CO_2/passenger/km travelled

- Bus: 101 CO_2/passenger/km travelled

ECF (2011) Cycle more Often 2 cool down the planet !
Quantifying CO2 savings of cycling

Active travel produces little noise

Road traffic noise is today the second worst environmental pollutant in Europe with at least 1 million healthy life years lost each year (WHO, 2011).

Advantages & disadvantages

By pedestrians/cyclists

Does not pollute (air pollution and noise)

Compared to other modes of transport, little risk for other road users
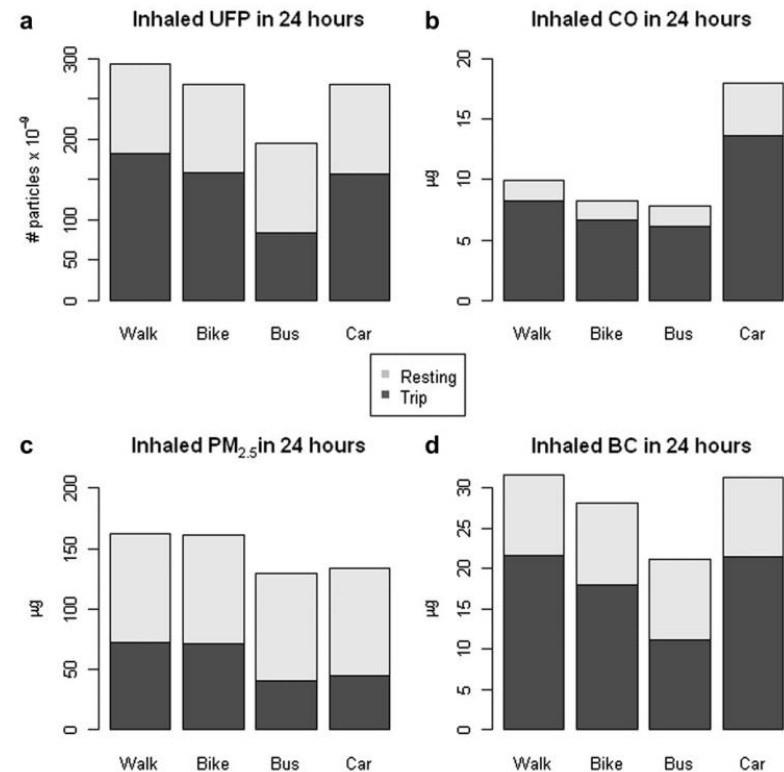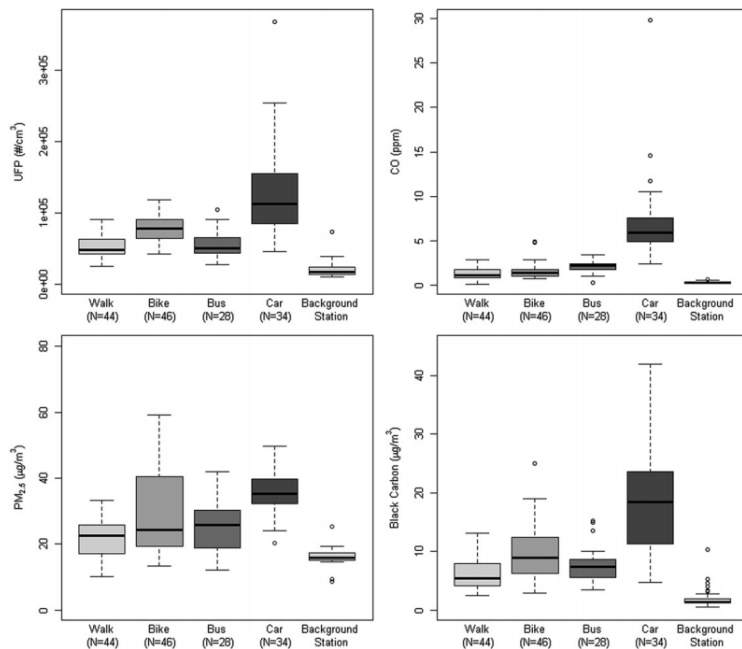
For pedestrians/cyclists

Higher levels of physical activity
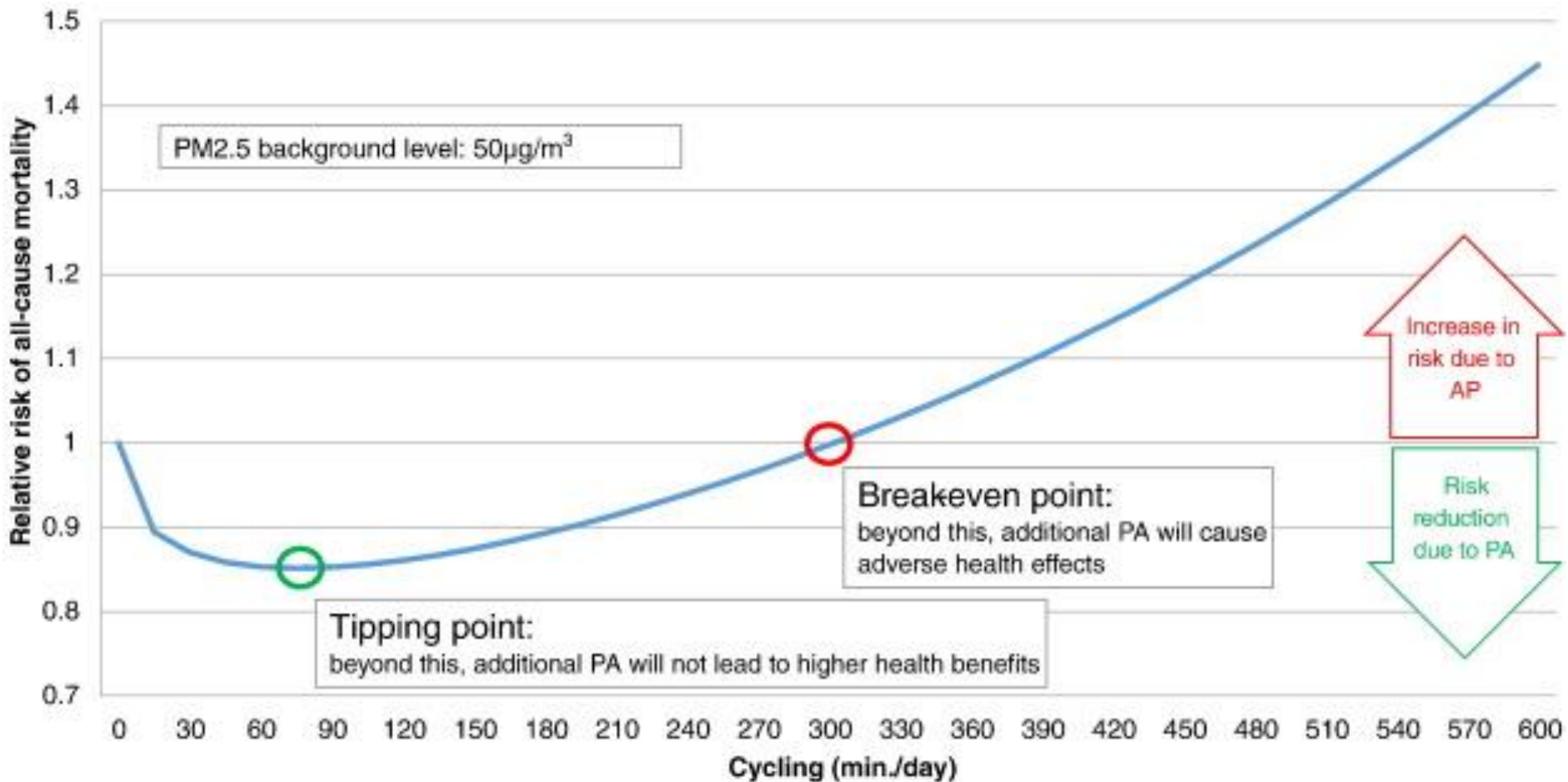
Less protected (in collision with other road users)

Exposure to air pollution?

Pollution and active travel

de Nazelle, Fruin, Westerdahl, Martinez Ripoll, Kubesch, Nieuwenhuijsen. A travel mode comparison of commuters' exposures to air pollutants in Barcelona Atmospheric Environment 59 (2012) 151e159
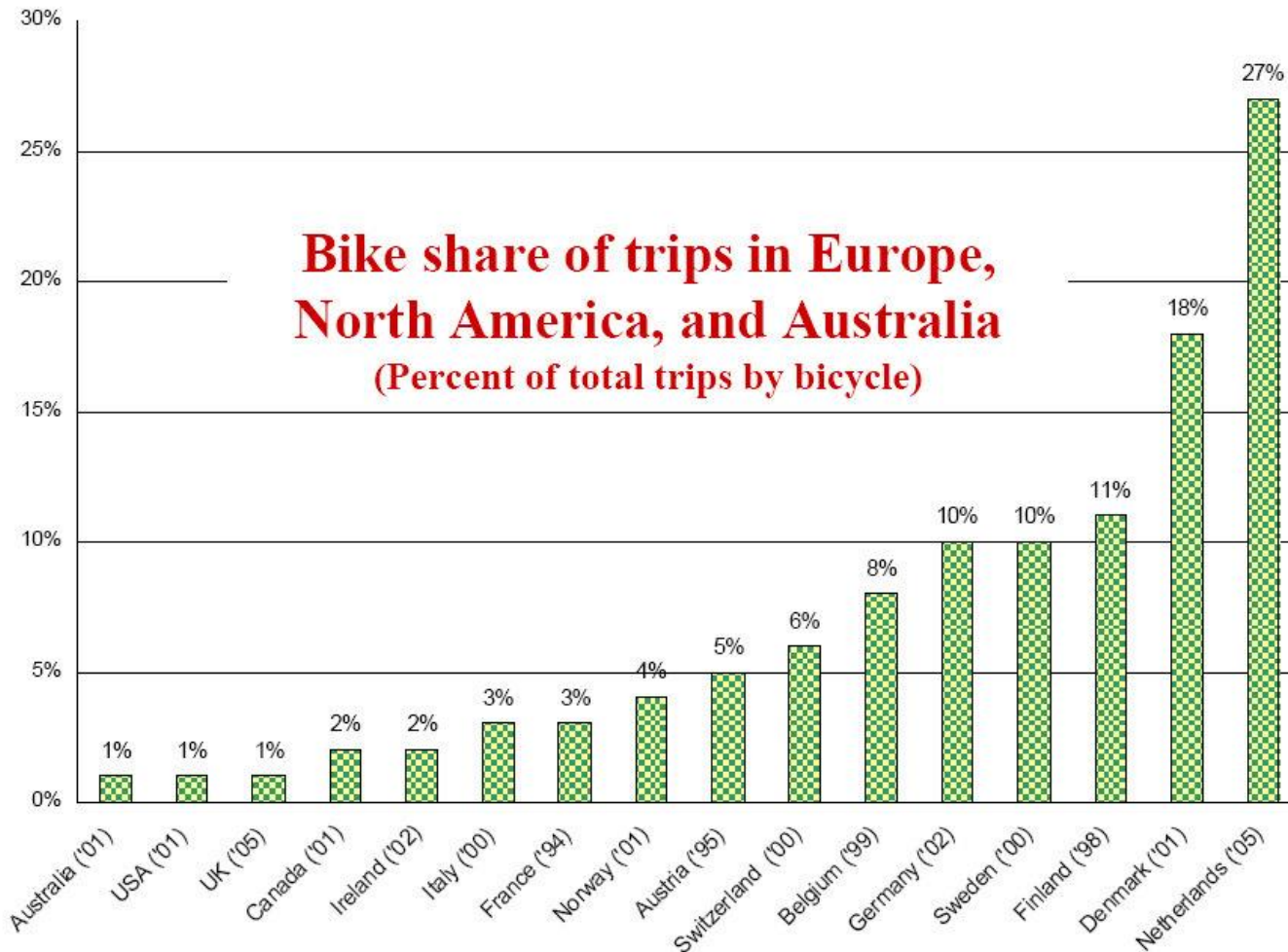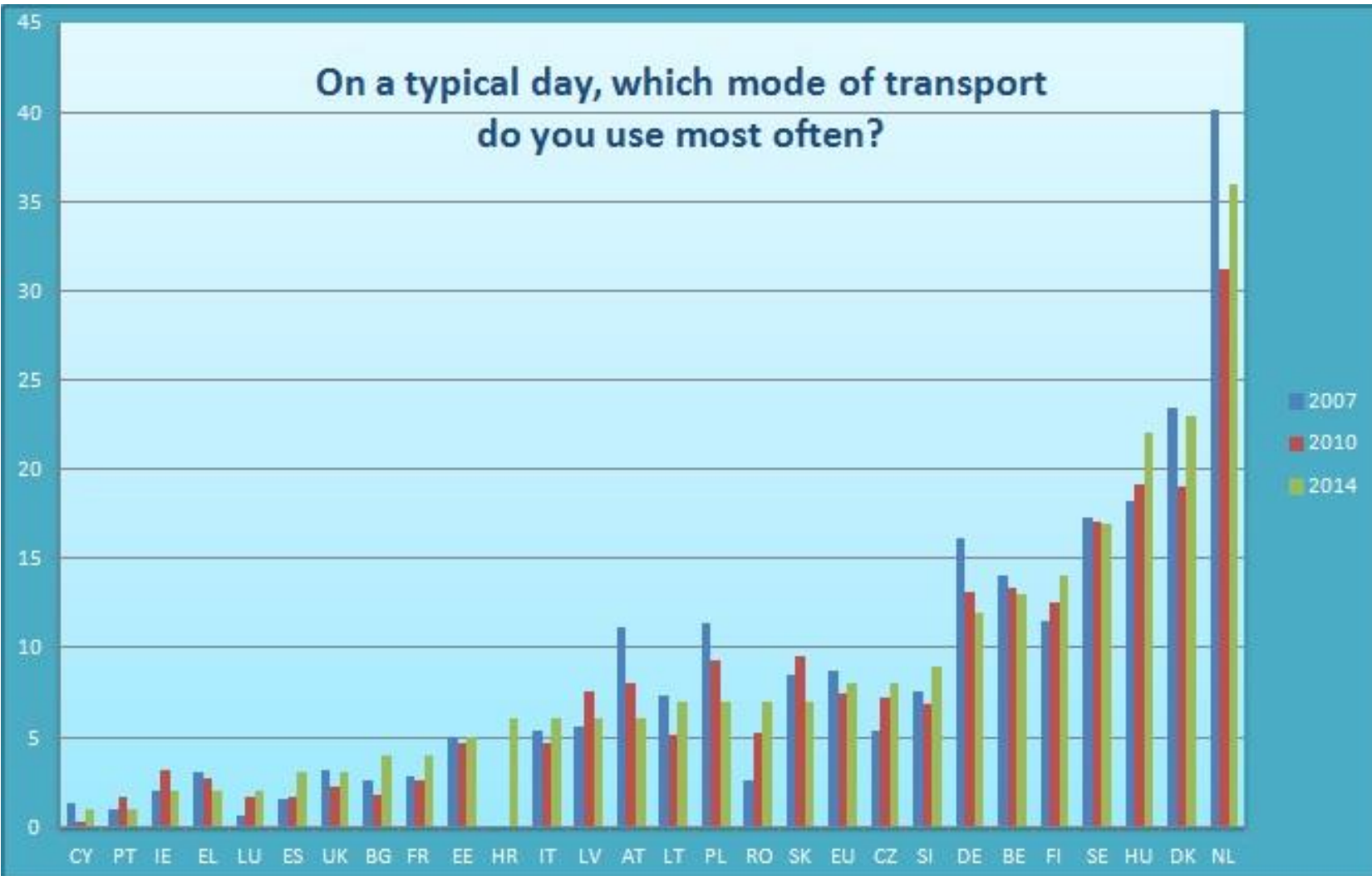
Tainio et al (2015)

Cycling and walking – stats and trends

Bike share of trips in Europe, North America, and Australia
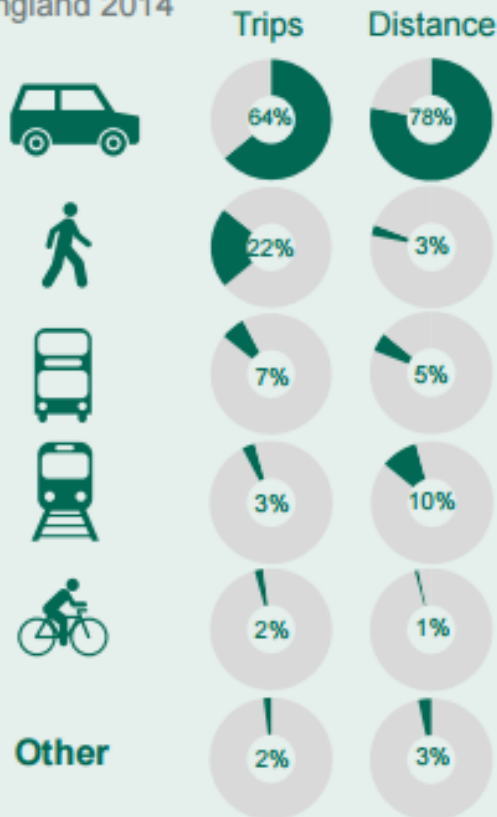(Percent of total trips by bicycle)

Pucher & Buehler (2008) Making Cycling Irresistible: Lessons from The Netherlands, Denmark and Germany
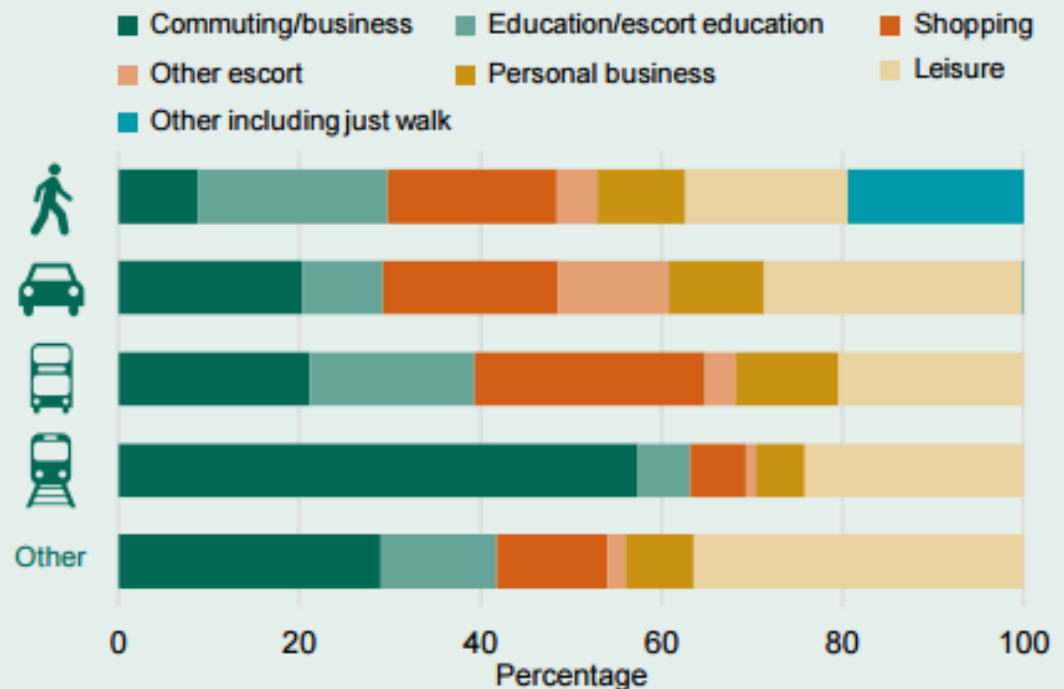
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On a typical day, which mode of transport do you use most often?

European Cycling Federation: https://ecf.com/resources/cycling-facts-and-figures

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Mode share TSGB0104-0105

How we travelled, mode share of trips: England 2014

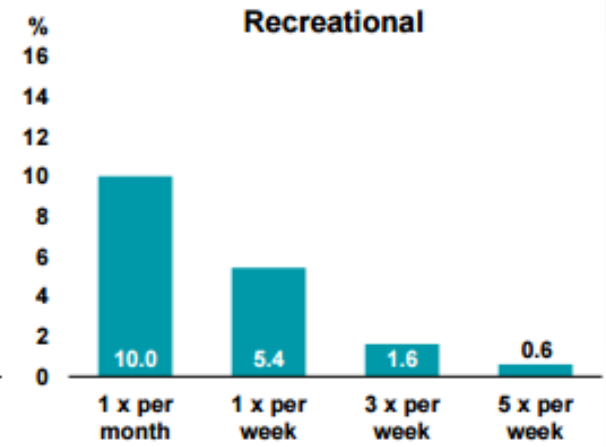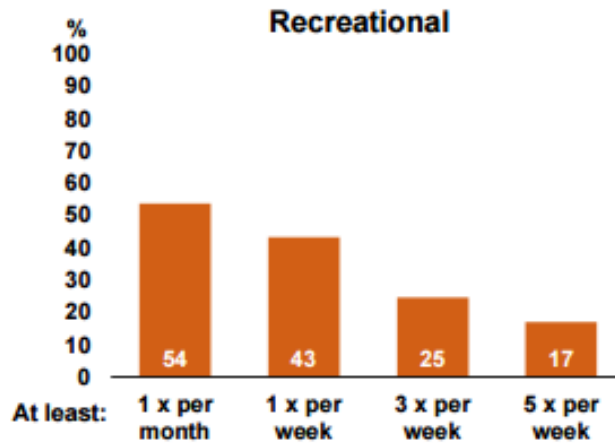|	Trips	Distance
Car	64%	78%
Walk	22%	3%
Bus	7%	5%
Rail	3%	10%
Cycle	2%	1%
Other	2%	3%

Mode and purpose share TSGB0104

Trips by main mode and purpose: England 2014

- Commuting/business
- Education/escort education
- Shopping
- Other escort
- Personal business
- Leisure
- Other including just walk

Percentage (0 – 100)
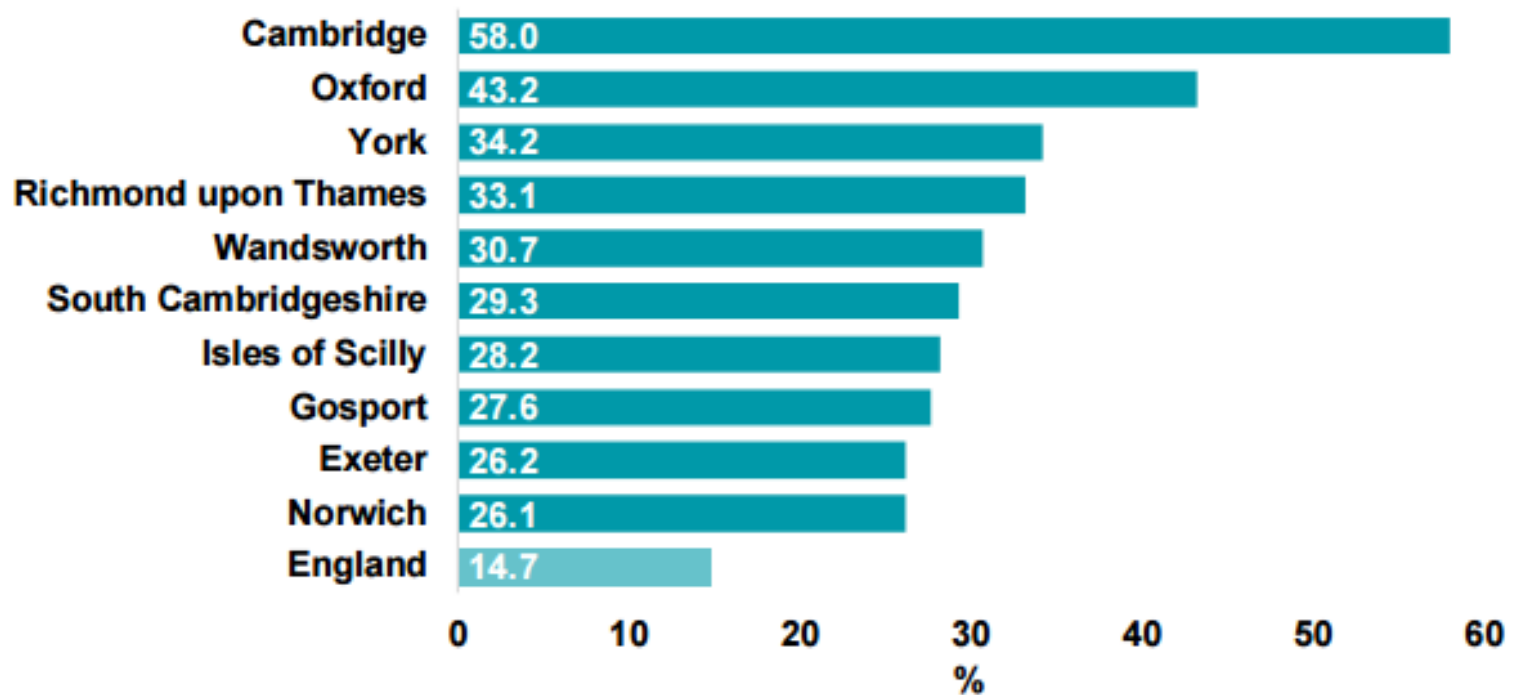
Most modes are used for a mixture of purposes, however over half (57%) of all trips by rail are for commuting/business purposes.

Any purpose — Walking

At least:	1 x per month	1 x per week	3 x per week	5 x per week
%	86	81	62	51

Any purpose — Cycling

At least:	1 x per month	1 x per week	3 x per week	5 x per week
%	14.7	9.5	4.4	2.6

Recreational — Walking

At least:	1 x per month	1 x per week	3 x per week	5 x per week
%	54	43	25	17

Recreational — Cycling

At least:	1 x per month	1 x per week	3 x per week	5 x per week
%	10.0	5.4	1.6	0.6

Utility — Walking

At least:	1 x per month	1 x per week	3 x per week	5 x per week
%	60	53	36	25

Utility — Cycling

At least:	1 x per month	1 x per week	3 x per week	5 x per week
%	6.5	4.5	2.6	1.5

DFT:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/536822/local-area-walking-and-cycling-in-england-2015.pdf

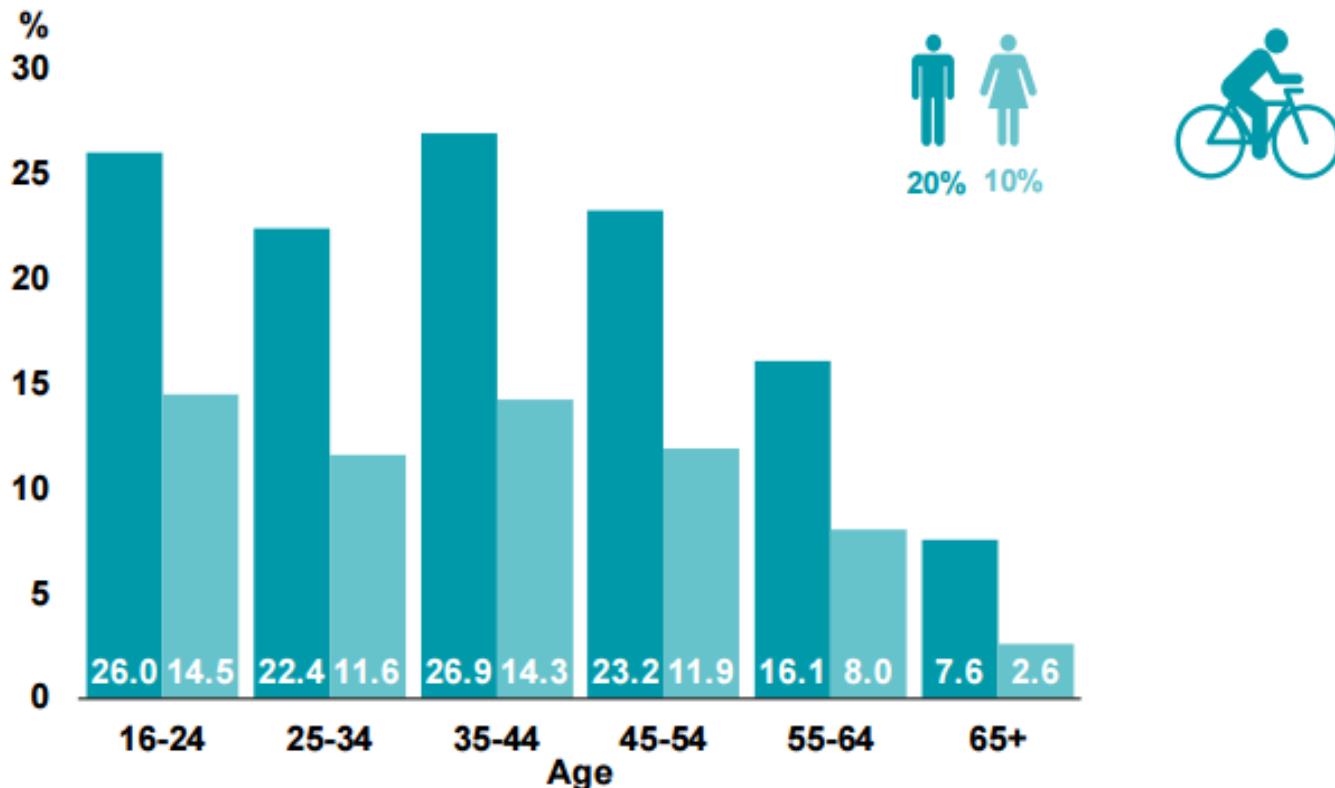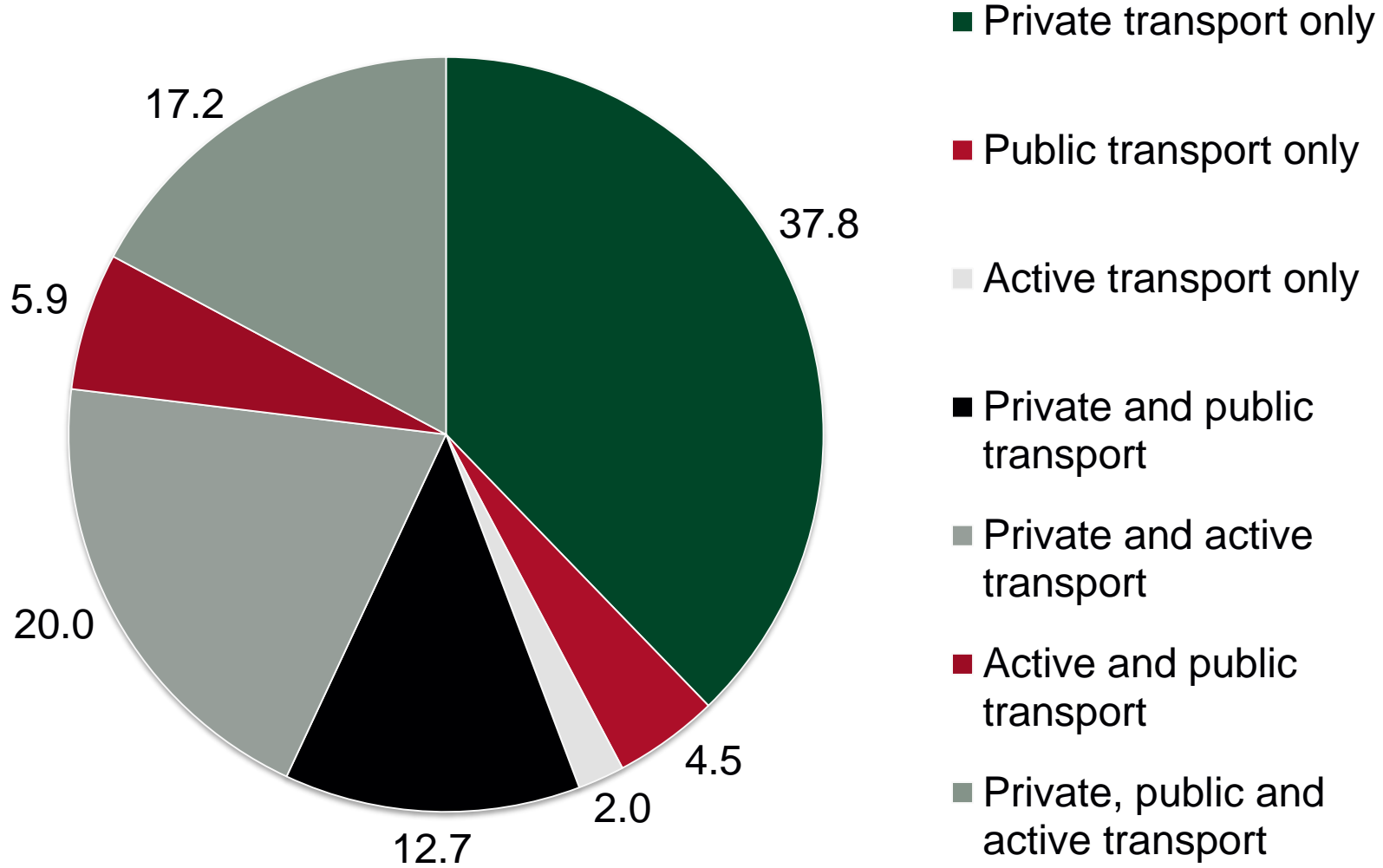## Percentage of adults cycling at least once a month: top 10 local authorities, England, 2014-2015

Local authority	%
Cambridge	58.0
Oxford	43.2
York	34.2
Richmond upon Thames	33.1
Wandsworth	30.7
South Cambridgeshire	29.3
Isles of Scilly	28.2
Gosport	27.6
Exeter	26.2
Norwich	26.1
England	14.7

DFT:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/5368
22/local-area-walking-and-cycling-in-england-2015.pdf

Perentage of adults cycling at least once a month for any purpose, by age and gender. England 2014-2015.

Data – modal variability groups

Pie chart legend:
- Private transport only
- Public transport only
- Active transport only
- Private and public transport
- Private and active transport
- Active and public transport
- Private, public and active transport

Pie chart values: 37.8, 4.5, 2.0, 12.7, 20.0, 5.9, 17.2

N=14,607

How can we encourage active travel?

Preferences?

Infrastructure: If you build it, they will come…

Higher levels of bicycle infrastructure positively correlated with higher rates of bicycle commuting (Dill & Carr, 2003)

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However correlations do not mean causations

And if we see cyclists, what does it mean?

Table 2

Summary of temporal associations between built environmental attributes and any physical activity outcome by type of quasi-experimental design

	Change in physical activity behavior		
	Increase	No change	Decrease
Neighborhood built characteristics			
Street/pedestrian connectivity			●
Land use mix	◐ ◐	◐	
Recreation land use proximity	● ◐	◐ ◐	●
Non-recreational land use proximity	◐	◐ ◐	◐
Transit proximity/access	◎	● ◎	
Population/residential density	●	● ●	●
Employment/job density			●
Aesthetics/variety/diversity			●
Trails/pathways/cycle ways/sidewalk	◯ ◯	● ◎ ◎	
Parks/public open space	●	● ◎	◎ ◎
Pedestrian/cyclist amenities	◯		
Traffic-related		●	
Sprawl		●	

● Association found using a same sample pre-post design (residential relocation)

◎ Association found using a same sample pre-post design (environmental modification)

◯ Association found using a different sample pre-post design (environmental modification)

◐ Association found using a same sample pre-post quasi-longitudinal design

McCormack & Shiell. In search of causality: a systematic review of the relationship between the built environment and physical activity among adults
Int J Behav Nutr Phys Act, 8 (2011), p. 125

Table 1 Summary of associations between built environmental attributes and physical activity among all studies (cross-sectional and quasi-experiments)

	N total (studies)	Recreation walking	Transportation walking	General walking	General cycling	Combined walk/cycle	Moderate to vigorous PA*
Neighborhood characteristics							
Street/pedestrian connectivity	5	o[48]	+[48]	o[57]/+[58]		+[47]	-[33]
Land use mix	6	o[45]	+[45]	+[44,45]	+[45]	+[51,60]	o[59]/+[54]
Recreation land use proximity	7	o[45]	o[45]	o[44]	+[45]	o[60]/-[51]	o[59]/+[34,54]/-[34]
Non-recreational land use proximity	10	o[45,48]	+[45]/-[45,46,48]	o[44]/-[58]	o[45]	o[47,51,60]	o[54,59]
Transit proximity/access	5			o[39]/+[58]		+[47]	o[39,42]/+[37]
Population/residential density	6	+[35]/-[35]	+[35]	+[57]		o[47]	o[33,34,59]
Employment/job density	5			o[57]/+[58]		o[47]	o[59]/-[33]
Aesthetics/variety/diversity	2	o[48]	o[48]				-[34]
Trails/pathways/cycle ways/sidewalk	5			o[31]/+[43]/-[40,41]	o[31,41,47]/+[28,43]/-[40]		o[40]/+[43]/-[41]
Parks/public open space install or improvements	2			+[31]	o[31]		o[38]
Pedestrian/cyclist amenities (street furniture, lighting, shading)	3	o[48]	o[48]	+[30]			o[59]
Traffic-related	2	o[48]	+[48]	o[31]	o[31]		
Aggregated neighborhood characteristics							
Walkability/pedestrian index	4	o[29,55]/+[50]	+[29,50,55]	+[57]		o[52]	+[55]
Neighborhood type (traditional, New urbanist)	5	+[53]	+[53]	+[32,56]		+[49,51]	
Sprawl	1			o[36]			o[36]

+: studies reporting statistically significant positive association between the environmental characteristic and physical activity.

-: studies reporting statistically significant negative association between the environmental characteristic and physical activity.

o: studies reporting no statistically significant association between the environmental characteristic and physical activity.

Cross-sectional results that adjust for residential selection included only. Quasi-experimental studies: [28,30,31,33-43].

* Also included pedometer and accelerometer-determined physical activity and use of specific locations (i.e., parks or trails).

Example of new infrastructure

The impact of new transport infrastructure

Aim

To determine the effect of a transport infrastructure intervention on changes in mode share.

Not all built environments seem equally supportive for walking and cycling, and there is no causal evidence on which conditions are sufficiently supportive to effectuate behavioural change.

Cross-sectional studies show that characteristics of the built environment are associated with differences in travel behaviour (e.g. Saelens & Handy, 2008; Ewing & Cervero, 2010).
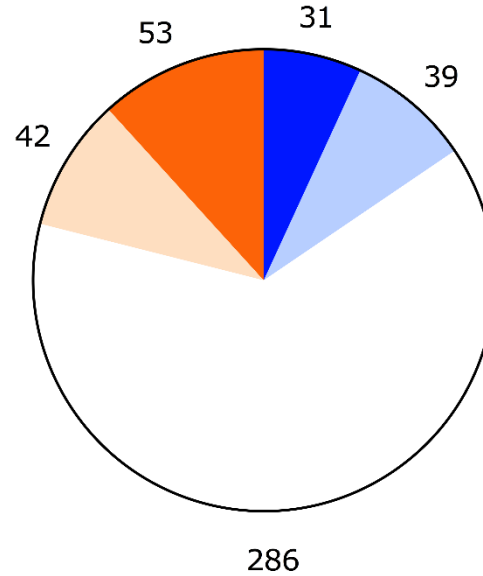
However, most studies are cross-sectional, and consequently do not allow causal inference.
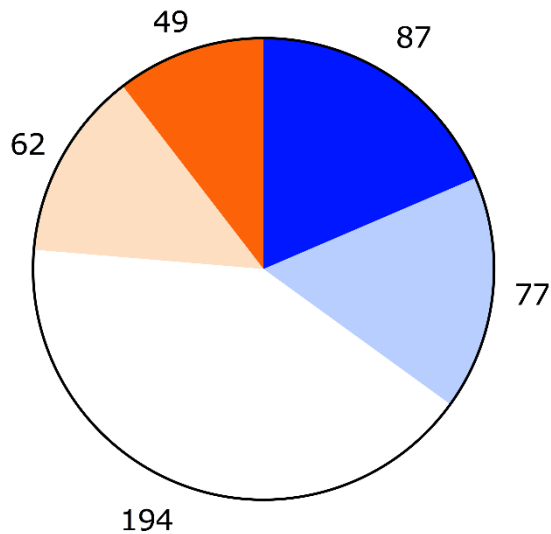
About your travel to and from work in the last seven days

In this section, we are interested in **how you travelled to and from work on each of the last seven days**.

50   **For each of the last seven days, please tell us what time you started and finished work and tick all the modes of transport you used on the journey to and from work.** If you did not travel to work on a particular day (either because it was a day off or because you worked at home), please tick the box 'Did not travel to work'. If your journey to and from work was the same on more than one day, you can tick the box 'Same as previous' instead of repeating the information again. *We have given you an example for one day in the first row of the table.*

Which modes of transport did you use on this journey? *Tick all that apply*

Day of the week	Time started work	Time finished work	Did not travel to work		Same as previous	Guided bus	Other bus or coach	Train or underground	Car, taxi or van	Motorcycle or moped	Bicycle	Walking	Other
Thu	7.30 am/~~pm~~	3.30 ~~am~~/pm		To work		☑	☐	☐	☐	☐	☐	☑	☐
				From work		☑	☐	☐	☐	☐	☐	☑	☐
	am/pm	am/pm		To work		☐	☐	☐	☐	☐	☐	☐	☐
				From work		☐	☐	☐	☐	☐	☐	☐	☐
	am/pm	am/pm		To work	☐	☐	☐	☐	☐	☐	☐	☐	☐
				From work	☐	☐	☐	☐	☐	☐	☐	☐	☐
	am/pm	am/pm		To work	☐	☐	☐	☐	☐	☐	☐	☐	☐
				From work	☐	☐	☐	☐	☐	☐	☐	☐	☐
	am/pm	am/pm		To work	☐	☐	☐	☐	☐	☐	☐	☐	☐
				From work	☐	☐	☐	☐	☐	☐	☐	☐	☐
	am/pm	am/pm		To work	☐	☐	☐	☐	☐	☐	☐	☐	☐
				From work	☐	☐	☐	☐	☐	☐	☐	☐	☐
	am/pm	am/pm		To work	☐	☐	☐	☐	☐	☐	☐	☐	☐
				From work	☐	☐	☐	☐	☐	☐	☐	☐	☐
	am/pm	am/pm		To work	☐	☐	☐	☐	☐	☐	☐	☐	☐
				From work	☐	☐	☐	☐	☐	☐	☐	☐	☐

Change in Active Travel Share
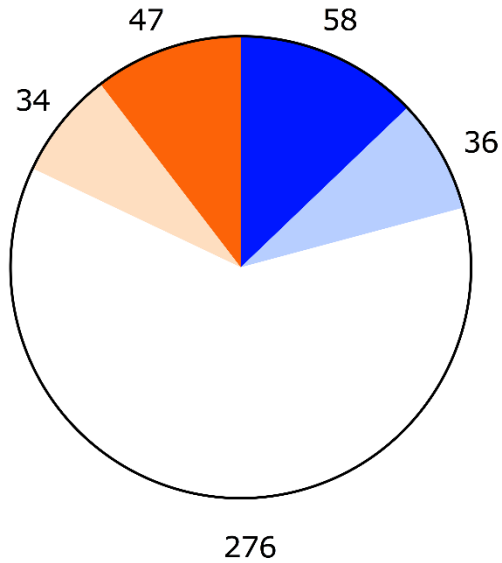
Change in Car Share

Change in Number of Trips

Change in Public Transport Share

Map labels and annotations:

Chatteris

Ely

Mildenhall

4km

9km

Newmarket

St Neots

Sandy

Biggleswade

Royston

Saffron Walden

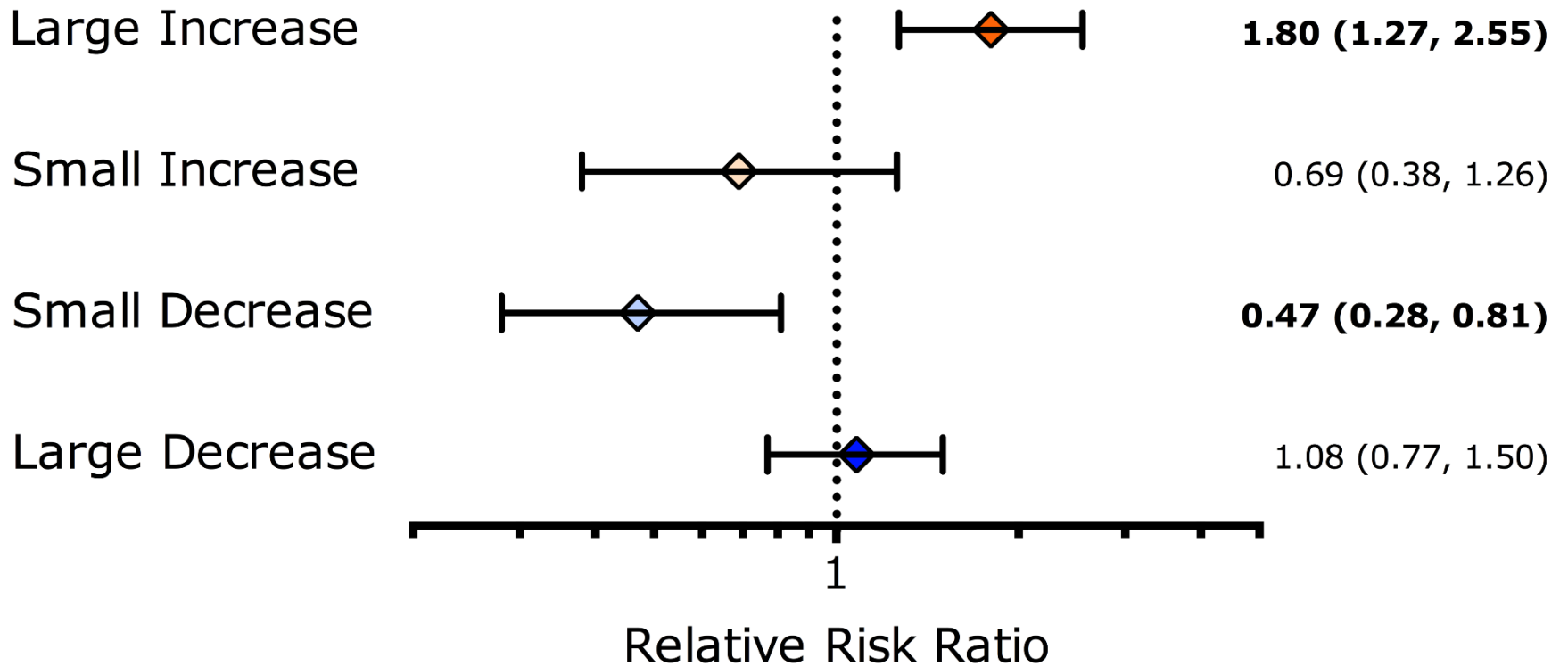Haverhill

N
W — E
S

0 1 2 4 6 8 10 12
Kilometers
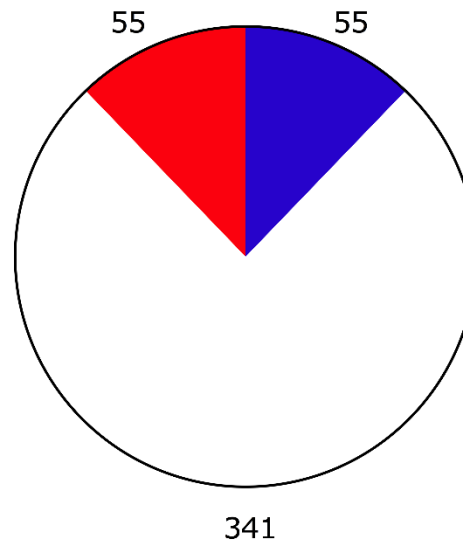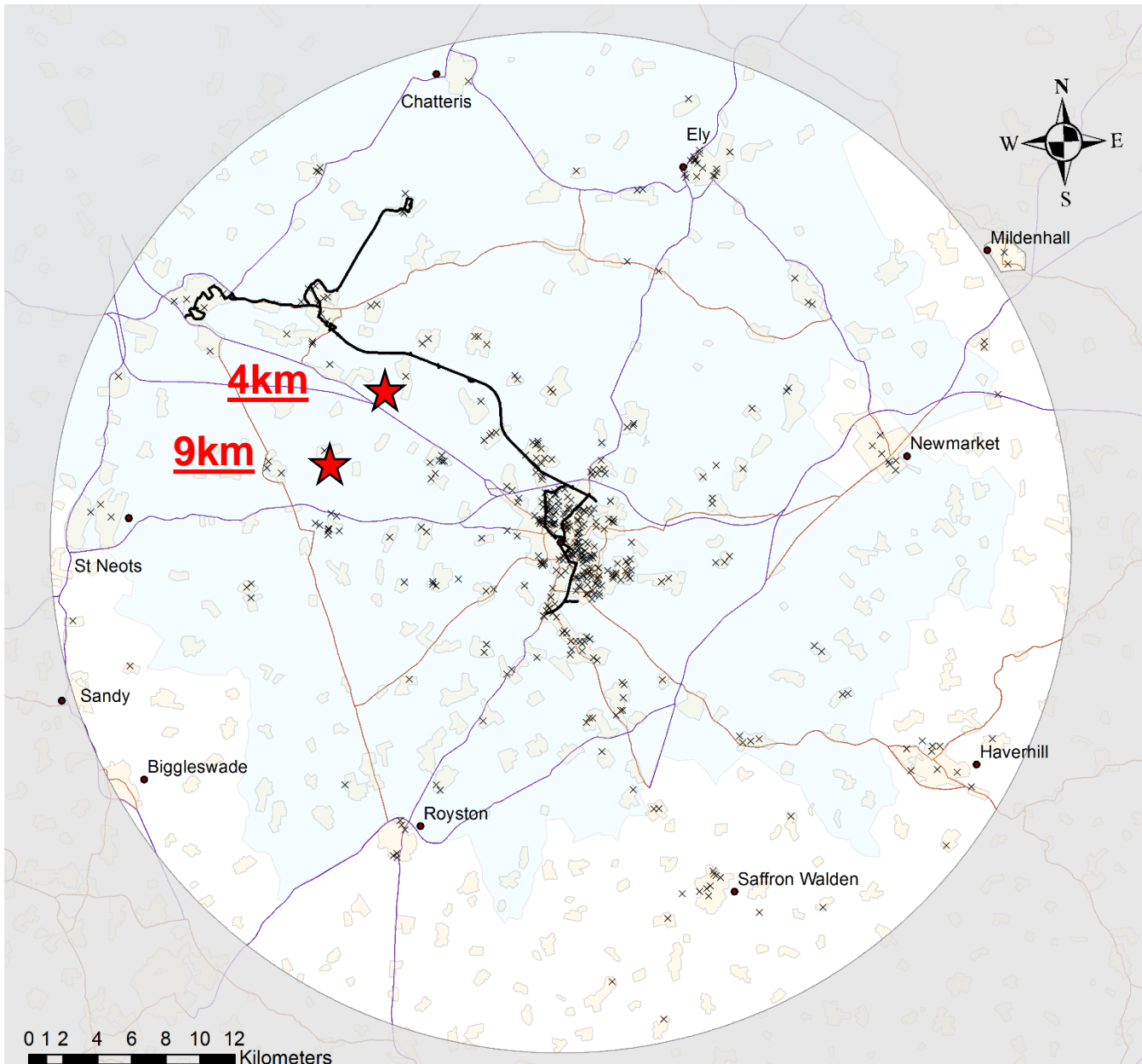
Legend

× All Participants

— Busway Route

— Motorways & Primary Roads
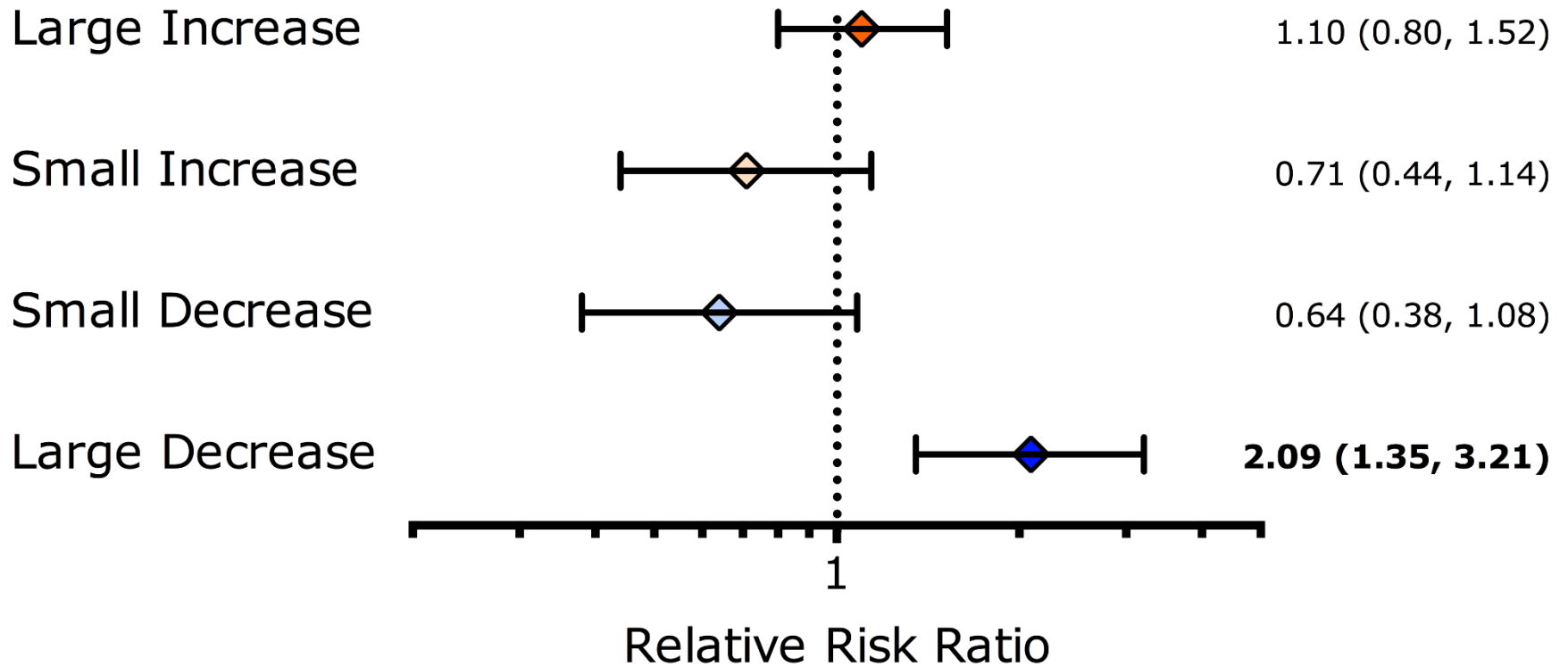
— Secondary Roads

Settlements

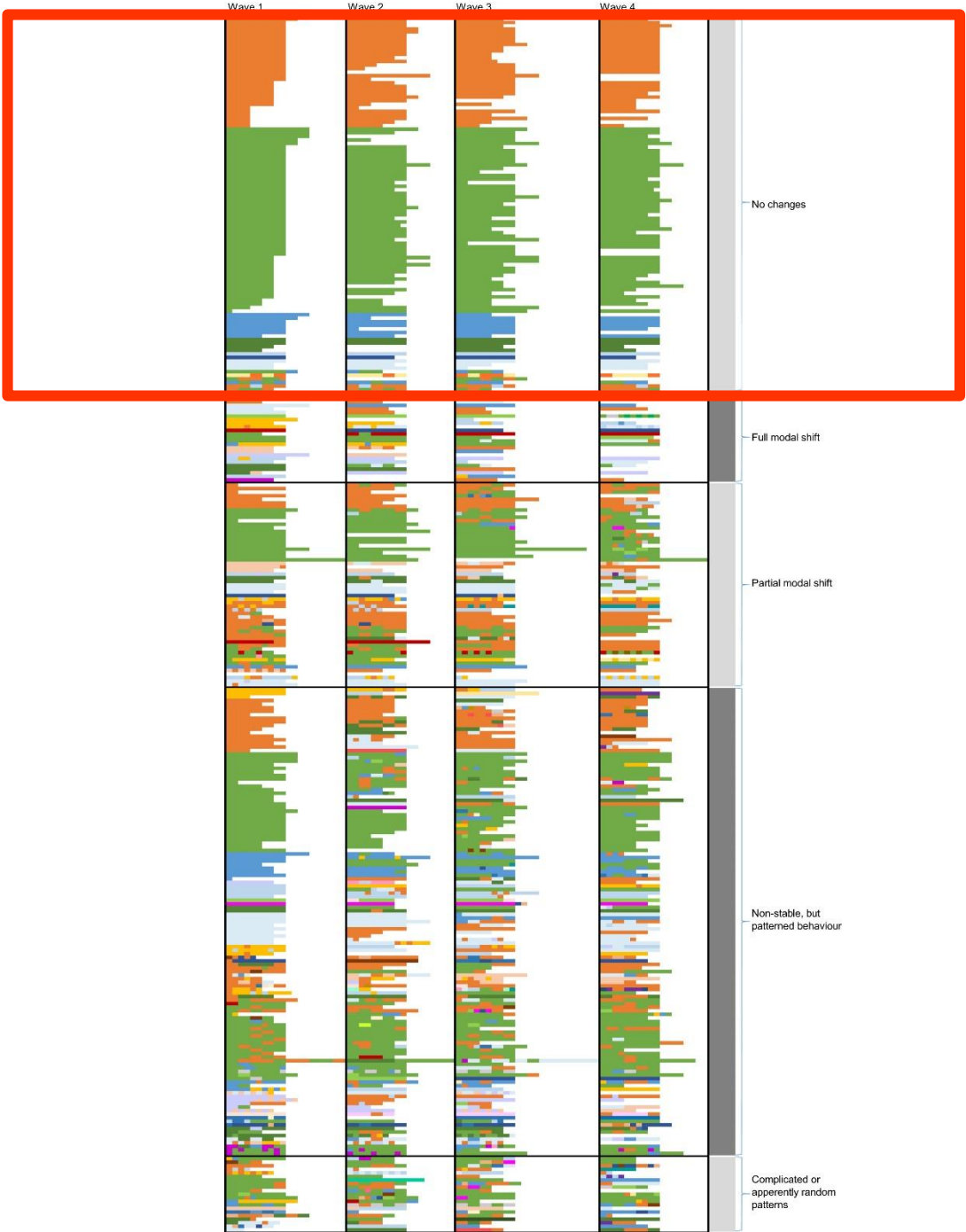© Crown Copyright 2015. An Ordnance Survey/EDINA supplied service

The exact location of the home addresses of the respondents have been altered to secure their anonymity

Associations between exposure to busway and changes in active travel mode share

Large Increase		**1.80 (1.27, 2.55)**
Small Increase		0.69 (0.38, 1.26)
Small Decrease		**0.47 (0.28, 0.81)**
Large Decrease		1.08 (0.77, 1.50)

1

Relative Risk Ratio

Associations between exposure to busway and changes in car mode share

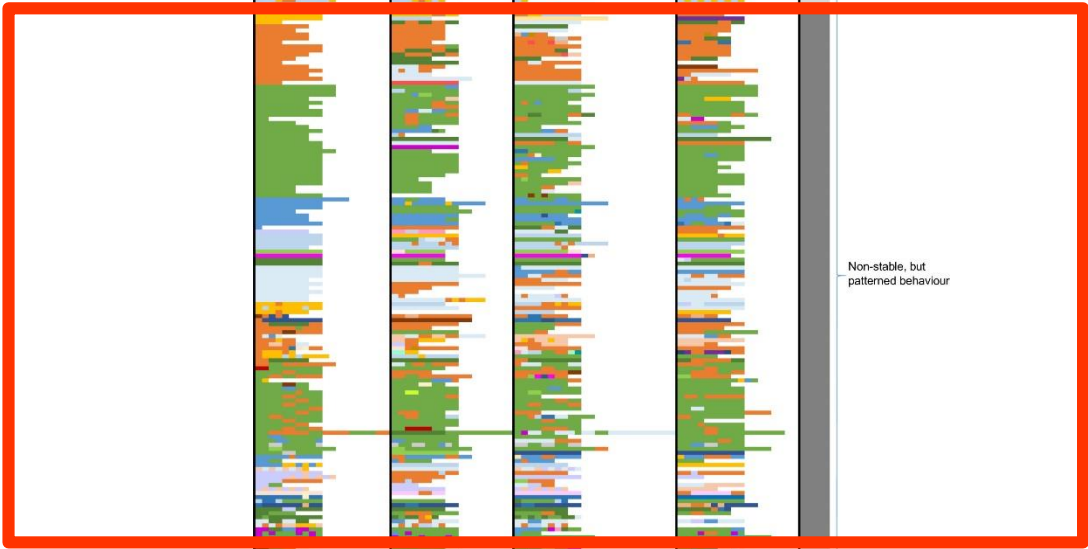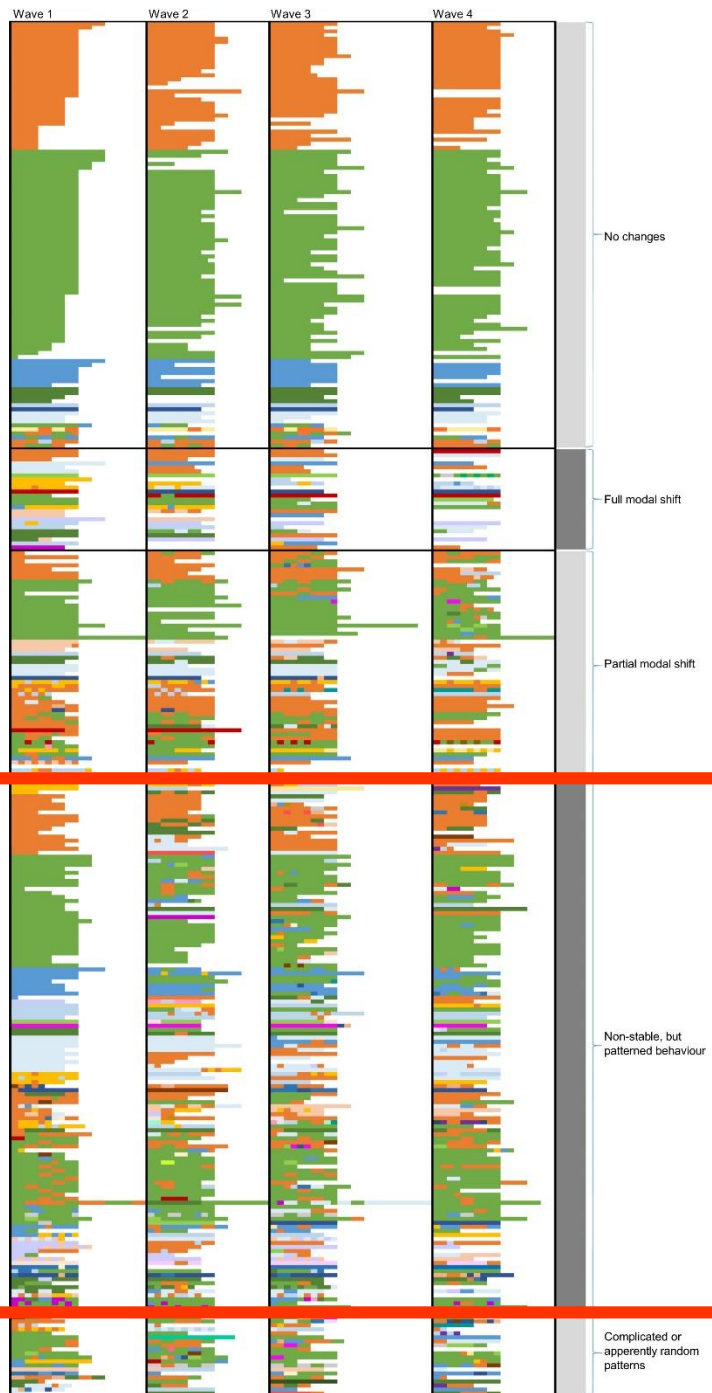|	Relative Risk Ratio
Large Increase	1.10 (0.80, 1.52)
Small Increase	0.71 (0.44, 1.14)
Small Decrease	0.64 (0.38, 1.08)
Large Decrease	**2.09 (1.35, 3.21)**

Wave 1   Wave 2   Wave 3   Wave 4

No changes

Full modal shift

Partial modal shift

Non-stable, but
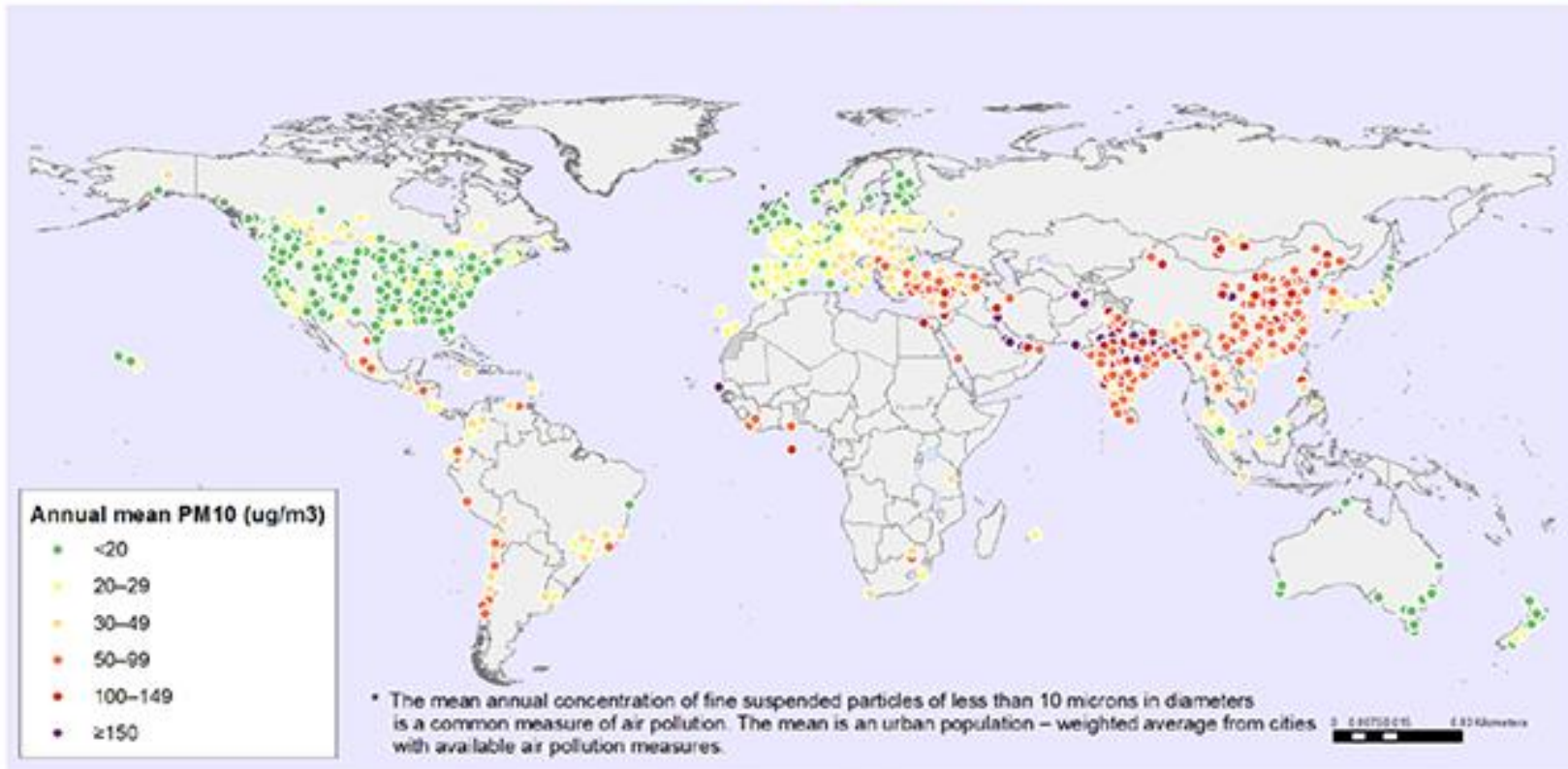patterned behaviour

Complicated or
apperently random
patterns

Wave 1 · Wave 2 · Wave 3 · Wave 4

No changes

Full modal shift

Partial modal shift

Non-stable, but
patterned behaviour

Complicated or
apperently random
patterns

Wave 1　　Wave 2　　Wave 3　　Wave 4

No changes

Full modal shift

Partial modal shift

Non-stable, but
patterned behaviour

Complicated or
apperently random
patterns

A Social-Ecological Model for Physical Activity - Adapted from Heise, L., Ellsberg, M., & Gottemoeller, M. (1999)

Challenges

Exposure to particulate matter with an aerodynamic diameter of 10 μm or less (PM10) in 1600 urban areas*, 2008–2013

Little evidence still from the global south

The challenges may actually be different:

Car as status symbol

Social safety

Five years after the rape and murder of Jyoti Singh, nothing has changed in India

The death of the New Delhi student sparked a wave of protest but her parents say the situation for women is now worse

Sat, Dec 16, 2017, 10:00

Rosita Boland

Joyti Singh, who was fatally assaulted by six men on a bus in Delhi. Photographs: Arkaprava Ghosh / Barcroft India via Getty Images and Natisha Mallick

Five years ago today, Jyoti Singh got on a bus in New Delhi after going to watch The Life of Pi with a male friend. What happend next to her on that bus shocked not just India but the world – six men took it in turns to rape her and used an iron bar. When she died on December 29th of the dreadful internal injuries she had sustained in the attck, India and the world was transfixed by the story.

Despite the demonstrations that took place all over India, campaigning for a

Higher chance of accidents

Table 3. Modelled road traffic injury fatality rates (per 100 000 population),[a] by WHO region and income group

WHO REGION	HIGH-INCOME	MIDDLE-INCOME	LOW-INCOME	TOTAL
AFRICAN REGION[b]	—	32.2	32.3	32.2
REGION OF THE AMERICAS[c]	13.4	17.3	—	15.8
SOUTH-EAST ASIA REGION[b]	—	16.7	16.5	16.6
EASTERN MEDITERRANEAN REGION	28.5	35.8	27.5	32.2
EUROPEAN REGION	7.9	19.3	12.2	13.4
WESTERN PACIFIC REGION	7.2	16.9	15.6	15.6
GLOBAL	10.3	19.5	21.5	18.8

[a] 30-day definition.
[b] No high-income countries.
[c] No low-income countries.

Questions?

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