Physical activity and the environment: in search of scientific evidence for public health solutions

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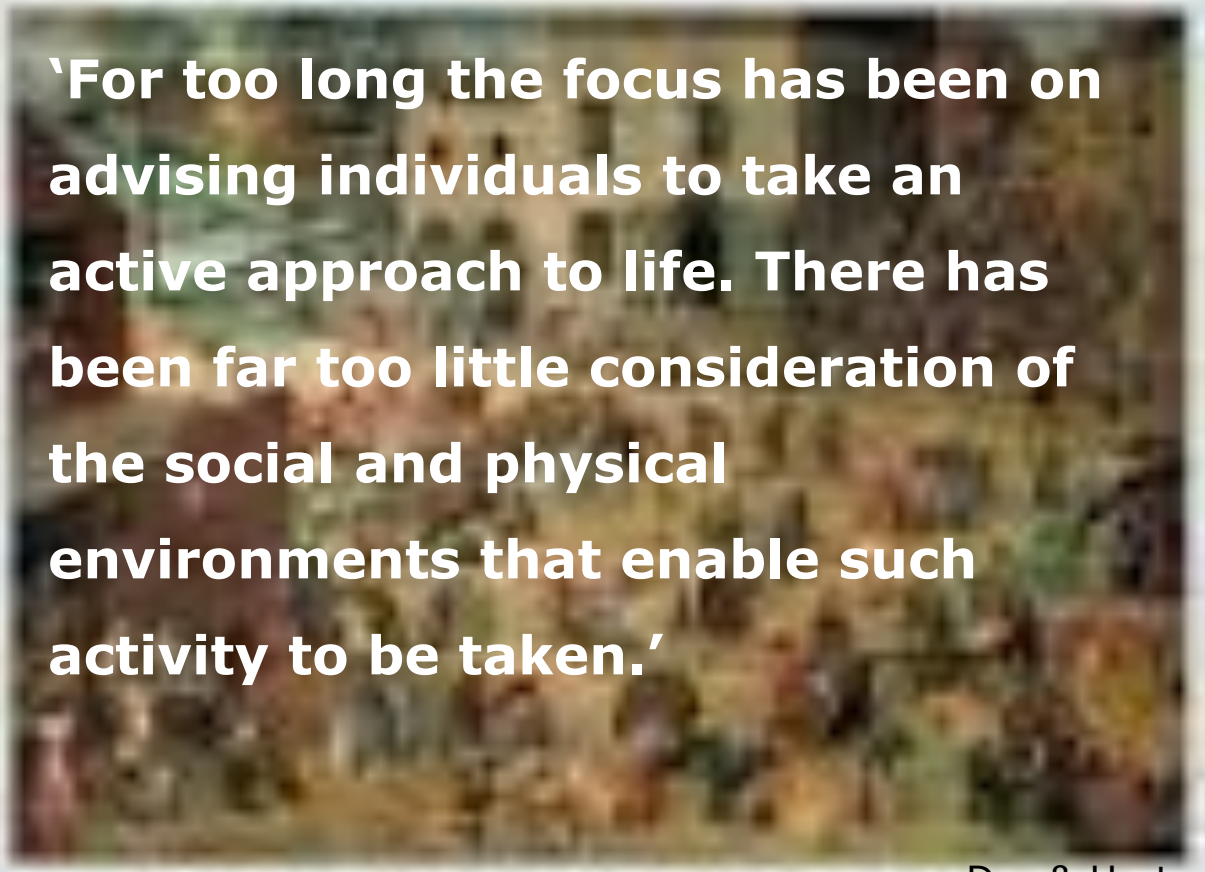
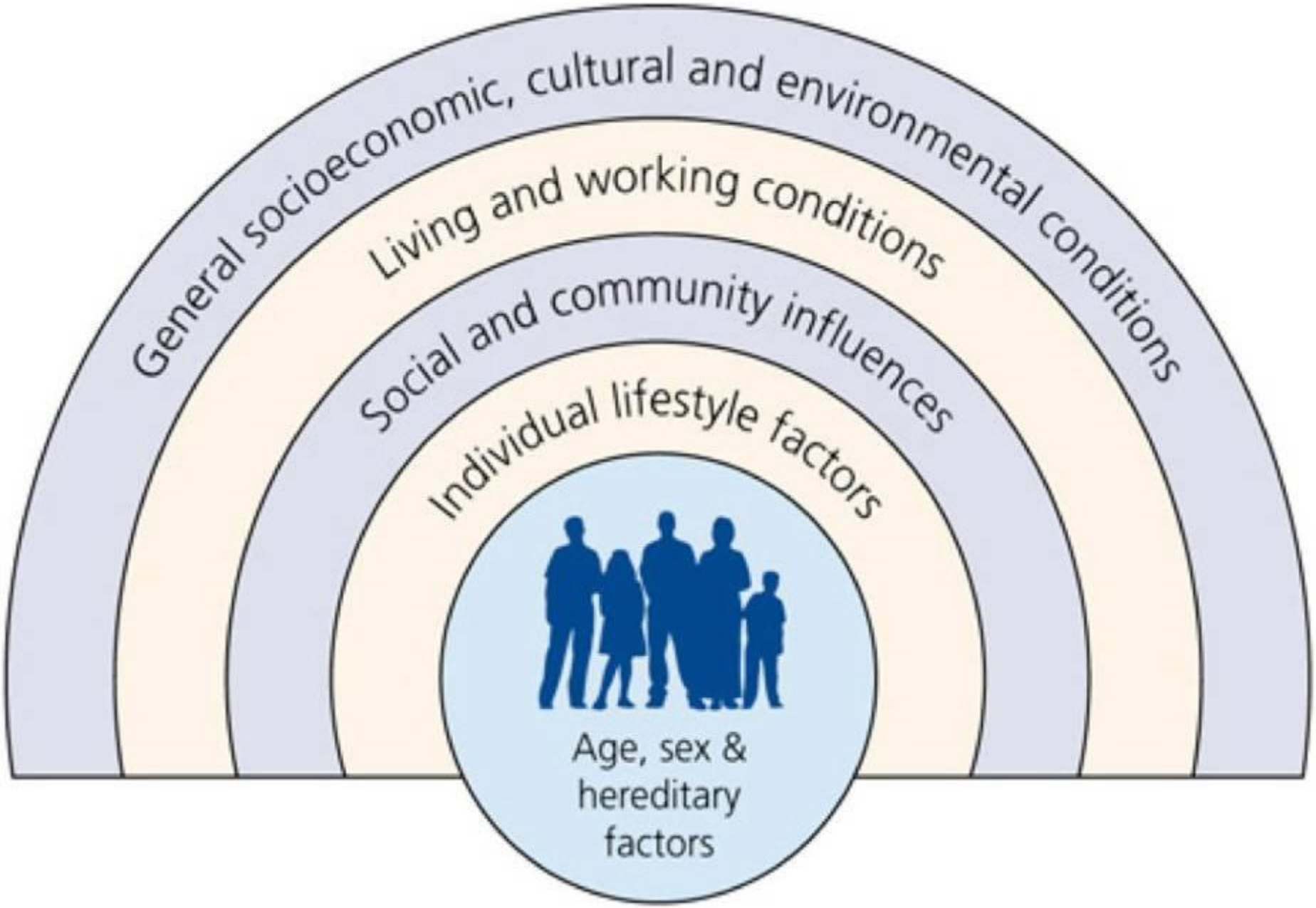
1. The ‘environment’

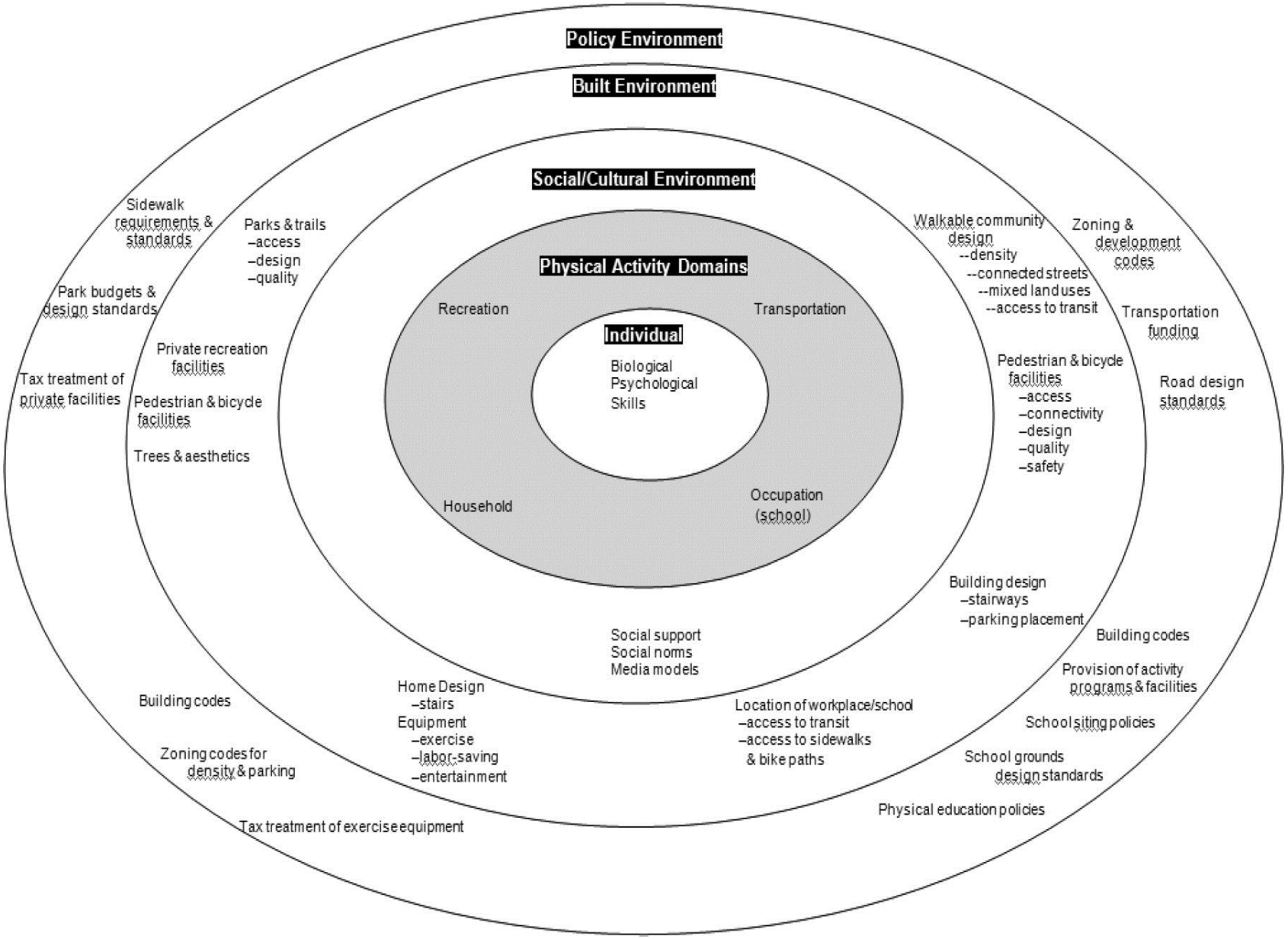
THE LANCET



Das & Horton, *Lancet* 2012



Dahlgren & Whitehead 1991



Sallis et al., *Circulation* 2012

Environments

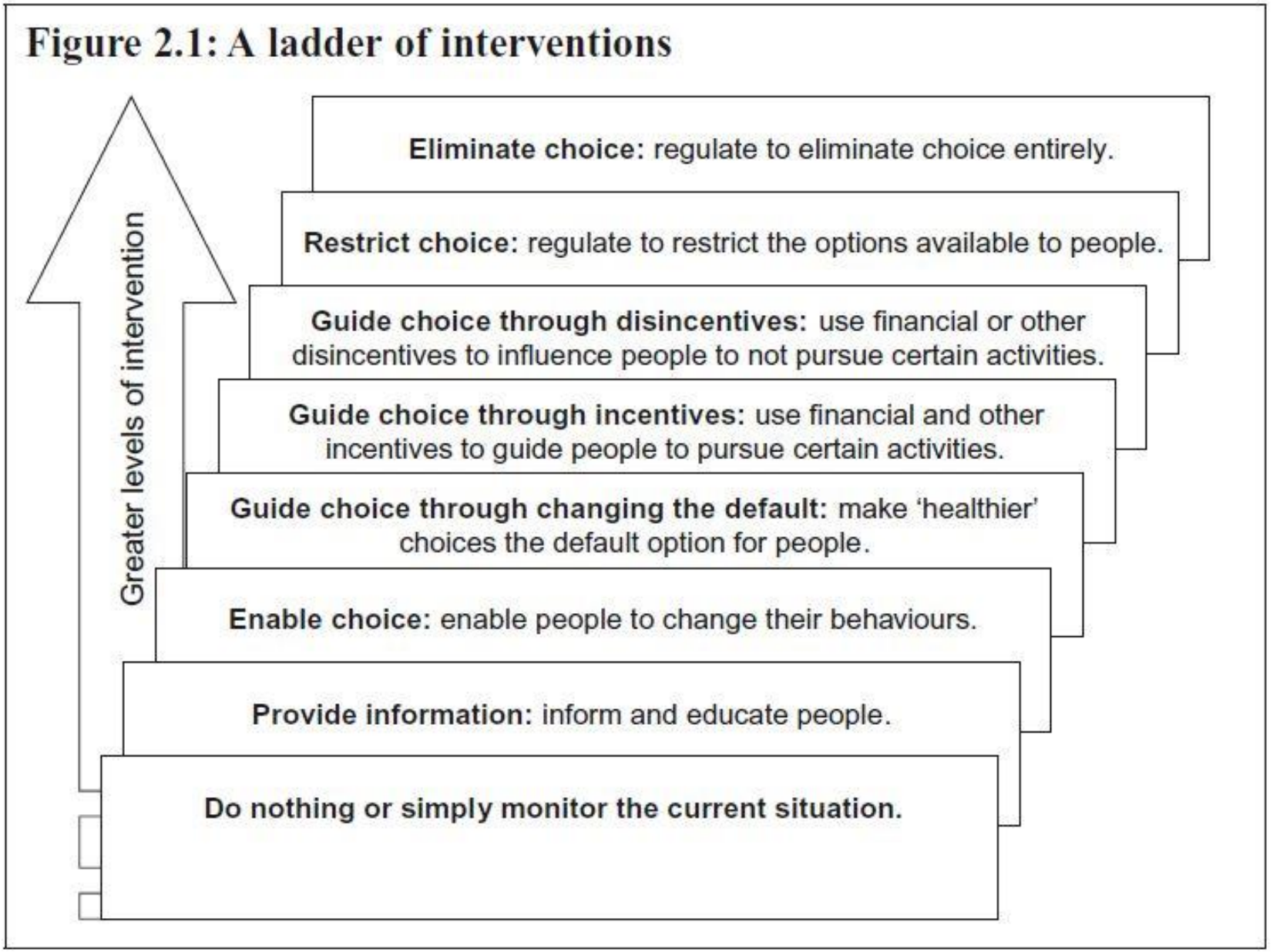
	Physical	Economic	Political	Socio-cultural
Micro (settings)				
Macro (sectors)				

The ANGELO framework. Swinburn et al., *Prev Med* 1999

Multilevel interventions

'The thesis […] is that multilevel interventions based on ecological models and targeting individuals, social environments, physical environments, and policies must be implemented to achieve population change in physical activity.'

Sallis et al., *Annu Rev Public Health* 2006



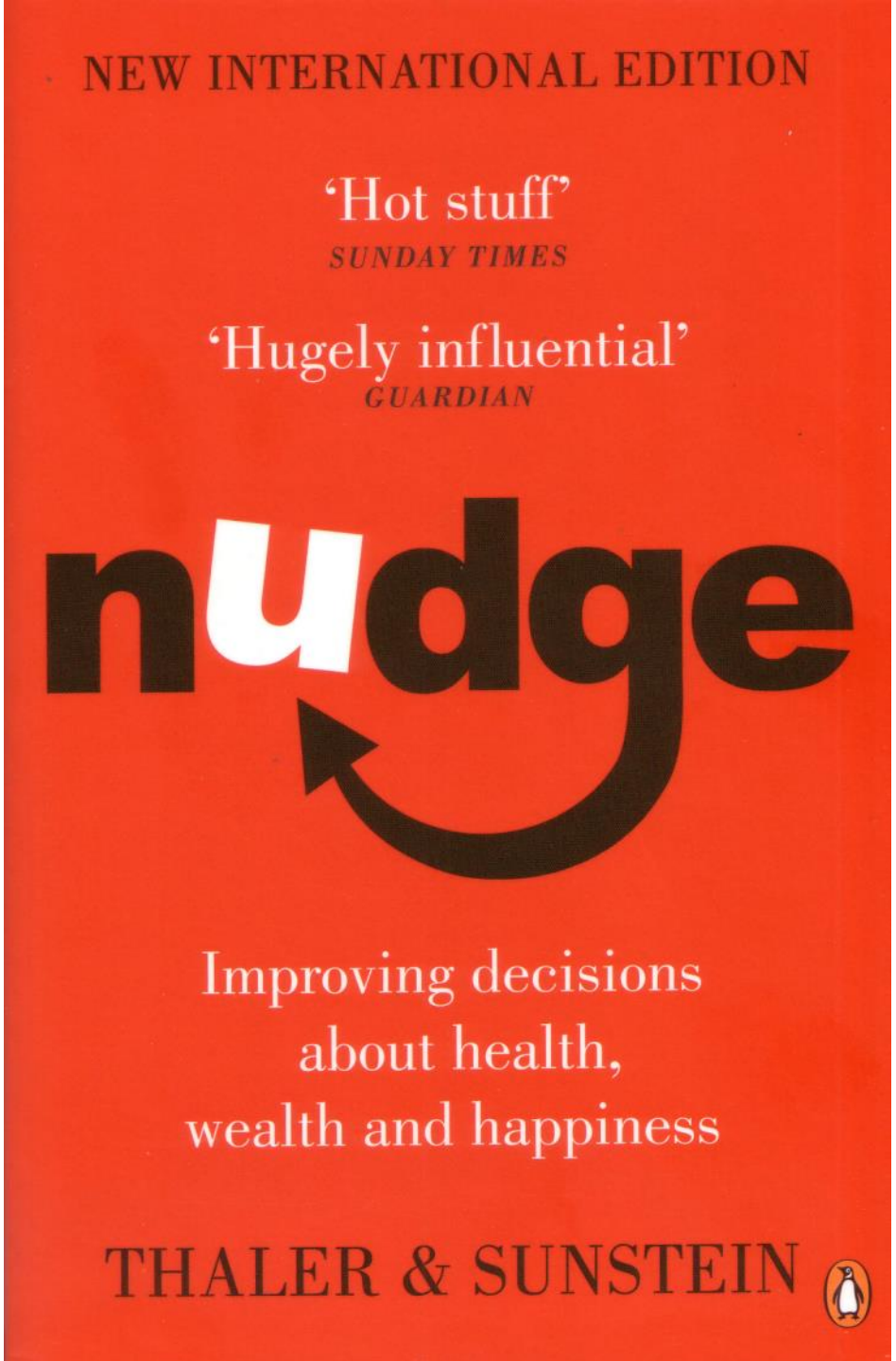
Department of Health, 2010 (after Nuffield Council on Bioethics, 2007)


DELIVERY
2.3d

Weighing up the alternatives

'Participants were motivated by convenience, speed, cost and reliability when selecting modes of travel for commuting. Physical activity was not a primary motivation…'

Jones & Ogilvie, *Int J Behav Nutr Phys Act* 2012



Thaler & Sunstein, 2008

Debate

Environmental influences on energy balance-related behaviors: A dual-process view

Stef PJ Kremers*[1], Gert-Jan de Bruijn[1], Tommy LS Visscher[2,3], Willem van Mechelen[4], Nanne K de Vries[1] and Johannes Brug[5]

Kremers et al., *Int J Behav Nutr Phys Act* 2006


Take the stairs
Stair climbing burns more calories per minute than jogging
7 minutes of stair climbing per day protects your heart
Stair climbing burns more calories per minute than tennis
Take the stairs

2. The evidence

Distinctions

'One distinction is between population-level and individual-level interventions. While superficially appealing, **there are many interventions that this distinction cannot readily classify** and it has not been possible to arrive at a satisfactory definition.'

Michie et al., *Implement Sci* 2011

Evidence of effectiveness?

'… there is a noticeable inconsistency of the findings of the available studies and this is confounded by serious methodological issues within the included studies. **The body of evidence in this review does not support the hypothesis** that multi-component community wide interventions effectively increase population levels of physical activity.'

Baker et al., *Cochrane Database Syst Rev* 2011

National Institute for
Health and Clinical Excellence

Promoting and creating built or natural environments that encourage and support physical activity

NICE, 2008

NICE guidance

- Strategies, policies and plans Prioritise activity
- Transport
- Public open spaces Accessible · Well maintained
- Buildings Routes on campus · Staircases
- Schools Playground markings

NICE, 2008

NICE guidance: transport

1. Ensure pedestrians and cyclists are given the highest priority. Use one or more of the following methods:

- Reallocate road space
- Restrict motor vehicle access
- Road user charging
- Traffic calming
- Safe routes to schools

2. Plan and provide a comprehensive network of routes

NICE, 2008

Evidence of effectiveness?

'There is **little published evidence to support** the use of the environment as a public health intervention to promote health-enhancing physical activity […] Current national policy has embraced the environment as an option for promoting health-enhancing physical activity, especially active travel, in spite of the lack of effectiveness data.'

Foster & Hillsdon, *J Sports Sci* 2004

Evidence of effectiveness?

'According to the Community Guide rules of evidence, **sufficient evidence shows** that community-scale urban design and land use regulations, policies, and practices can be effective in increasing walking and bicycling.'

Heath et al., *J Phys Act Health* 2006

Evidence of effectiveness?

'The weakness of this body of evidence is that the outcome measures of physical activity were often incomplete; **the studies were all cross-sectional**, raising the specter of selection bias, and limited the outcomes to behavioral differences rather than behavioral change.'

Heath et al., *J Phys Act Health* 2006

See also e.g. Pucher et al., *Prev Med* 2010 cf. Yang et al., *BMJ* 2010; Heath et al., *Lancet* 2012

Evidence of effectiveness?

'**Strong evidence** was found for the effectiveness of school based interventions including family or community involvement and multicomponent interventions.'

'The results suggest that **combining educational and environmental components** […] give better and more relevant effects.'

Van Sluijs et al., *BMJ* 2007; De Bourdeaudhuij et al., *Obes Rev* 2011

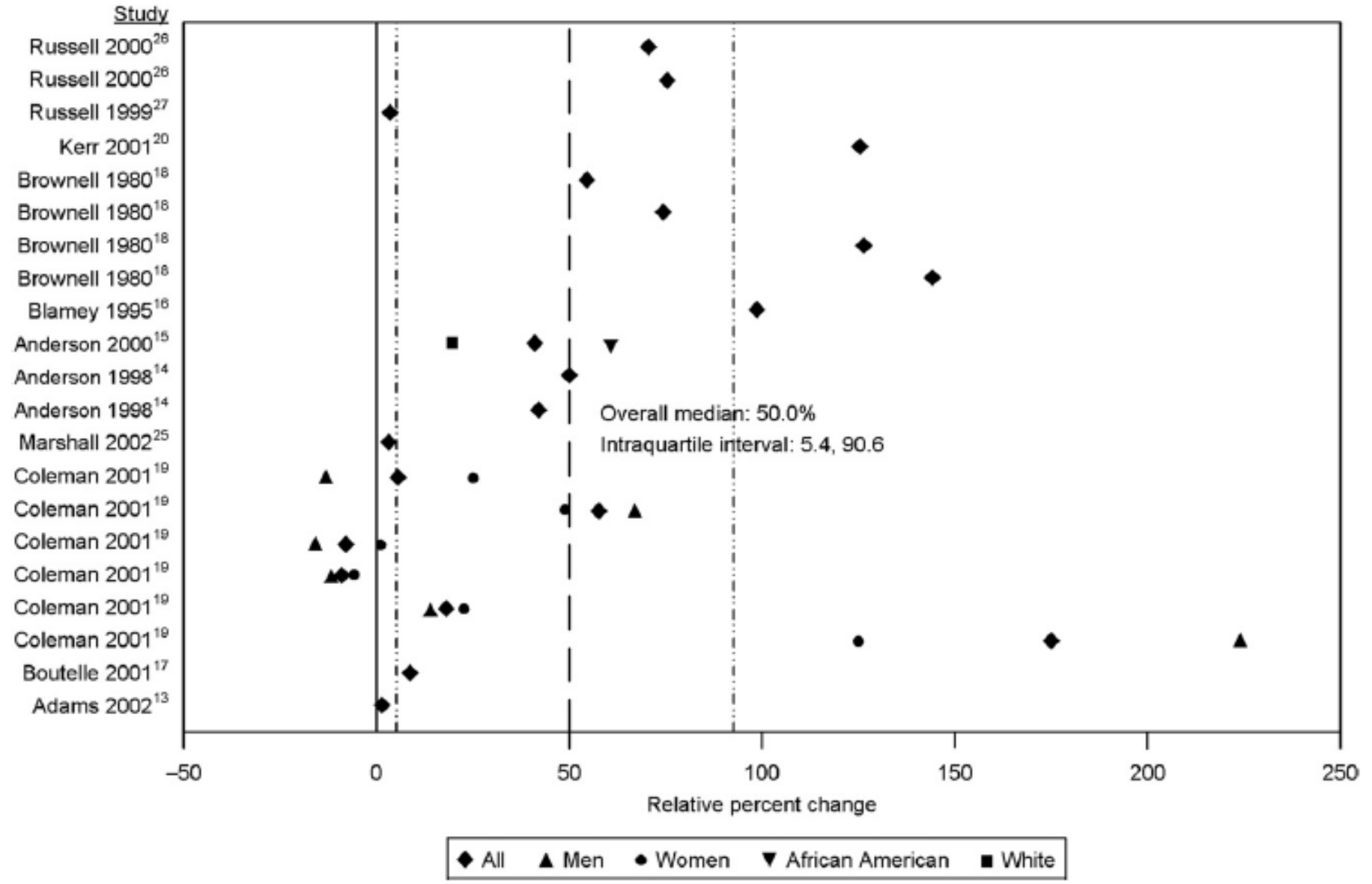


Figure 2. Relative change in percentage of people using stairs when point-of-decision prompts are displayed (n=35 measurements from 21 study arms in 11 qualifying studies). Some studies have multiple study arms so are repeated.

Median *absolute* increase in stair use = 2.4% of users. Soler et al., *Am J Prev Med* 2010

‘Inverse evidence law’

Ogilvie et al., *J Epidemiol Community Health* 2005

What sort of evidence do we need? Discuss

3. The challenges

3a. Opportunities

Research recommendations

'More emphasis on rigorous prospective investigations or quasi-experimental evaluations of natural experiments would advance this field, which has relied mainly on cross-sectional studies.'

Sallis et al., *Am J Prev Med* 2009

Using natural experiments to evaluate population health interventions:

guidance for producers and users of evidence

Craig et al., MRC 2011; Craig et al., *J Epidemiol Community Health* 2012

Absence of evidence

‘The most damning criticisms of Government policies we have heard in this inquiry have not been of the policies themselves, but rather of the Government's approach to designing and introducing new policies which make meaningful evaluation impossible.’

Health Select Committee, 2009

iConnect

Impact of **CO**nstructing **N**on-motorised **N**etworks and **E**valuating **C**hanges in Travel

Ogilvie et al., *Am J Public Health* 2011
Sahlqvist et al., *BMC Med Res Methodol* 2011
Powell et al., *Built Environ* 2011
Ogilvie et al., *BMJ Open* 2012
Sahlqvist et al., *Prev Med* 2012
Goodman et al., *Environ Health* 2012
Sahlqvist et al., *Int J Behav Nutr Phys Act* 2013
Brand et al., *Appl Energy* 2013
Bird et al., *Health Psychol* 2013

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Health impacts of the Cambridgeshire Guided Busway: the *Commuting and Health in Cambridge* study

Ogilvie et al, *BMC Public Health* 2010
Panter et al., *Int J Behav Nutr Phys Act* 2011
Goodman et al., *Soc Sci Med* 2012
Guell et al., *Soc Sci Med* 2012
Jones & Ogilvie, *Int J Behav Nutr Phys Act* 2012
Panter et al., *PLoS ONE* 2012
Yang et al., *Prev Med* 2012

Yang et al., *BMC Public Health* 2012
Carse et al., *J Transport Geogr* 2013
Guell & Ogilvie, *Qual Res* 2013
Panter et al., *Prev Med* 2013
Humphreys et al., *Prev Med* 2013
Guell et al., *BMC Public Health* in press
Dalton et al., *PLoS ONE* in press

Ogilvie et al., *Am J Prev Med* 2006
Ogilvie et al., *Int J Behav Nutr Phys Act* 2008a
Ogilvie et al., *Int J Behav Nutr Phys Act* 2008b
Ogilvie et al., *Int J Behav Nutr Phys Act* 2010

Health impacts of a new urban motorway: the M74 study

3a. Opportunities

3b. Internal validity

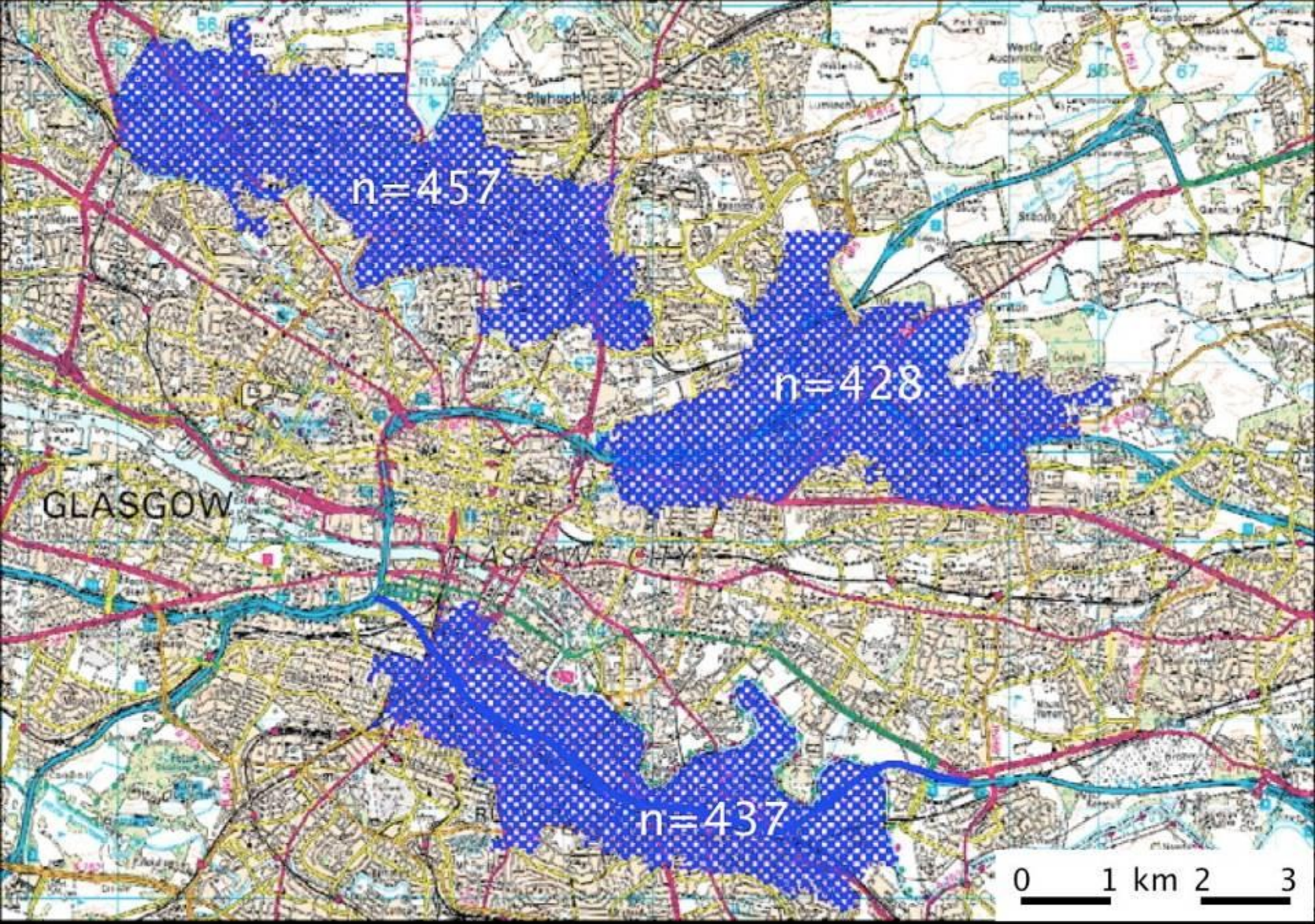
NICE guidance: research recommendations

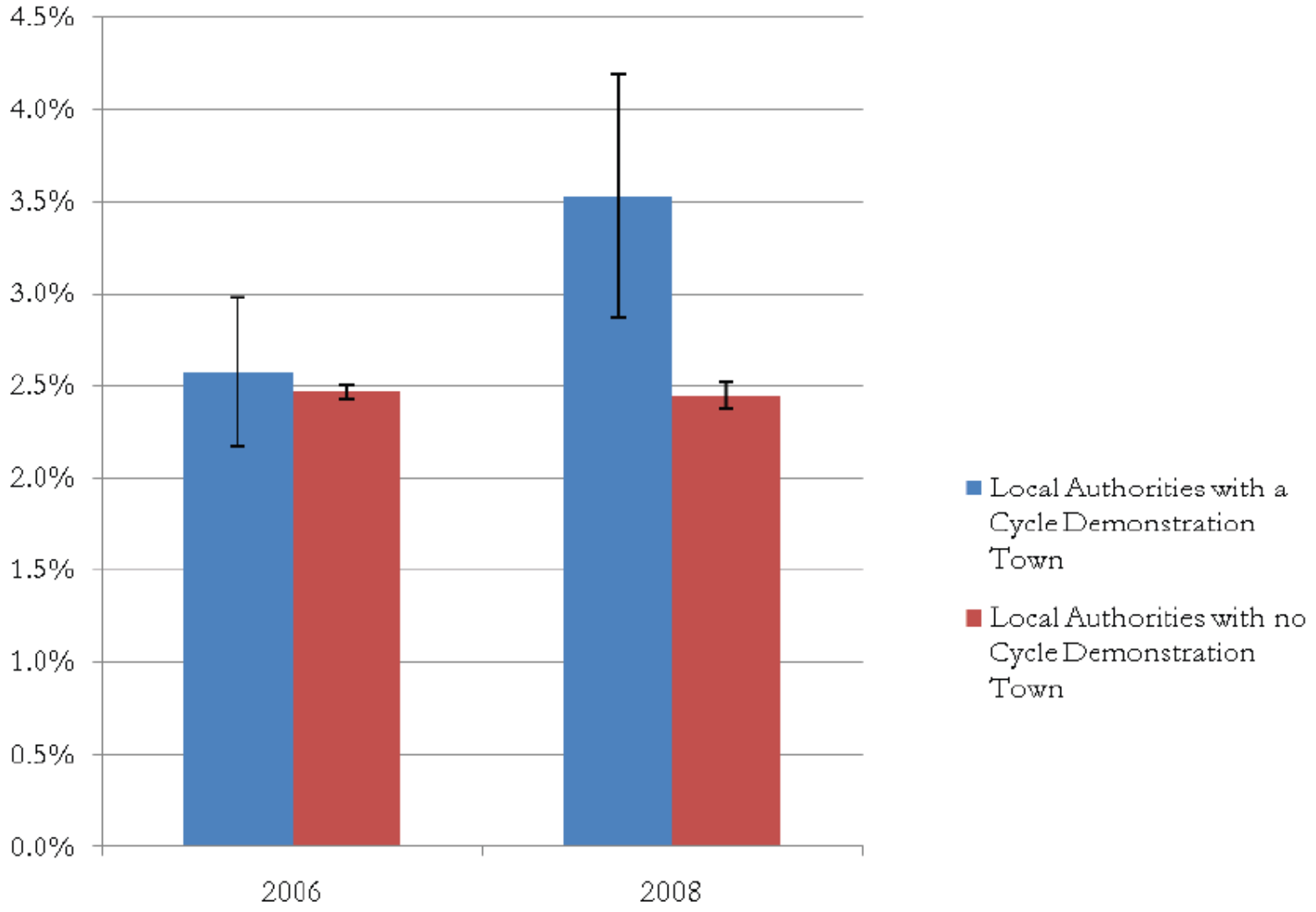
Ensure public health outcomes can be identified and attributed.

Include:

- Controls
- Appropriate and valid outcome measures
- Appropriate follow-up periods […]

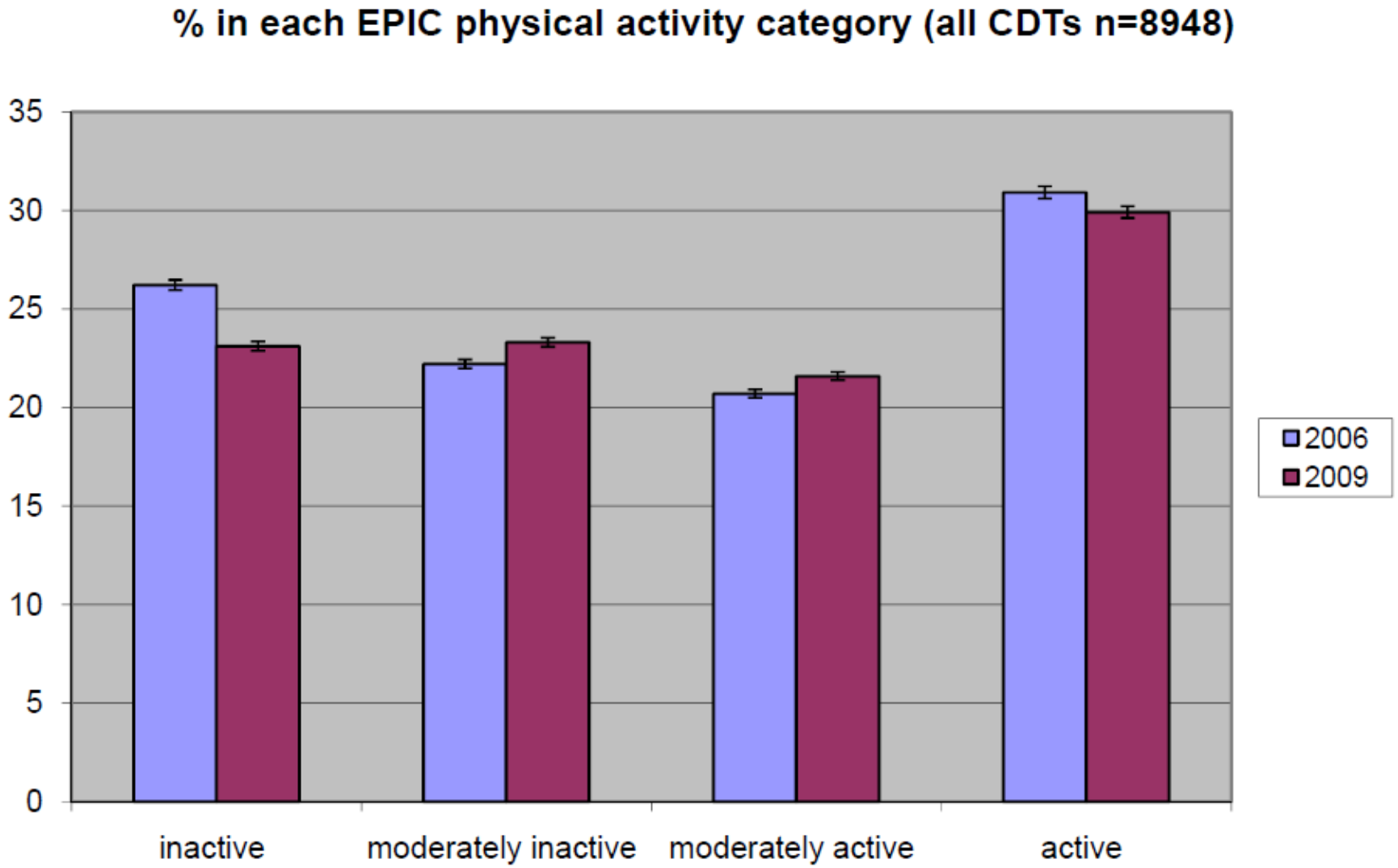
NICE, 2008


n=457
n=428
n=437
GLASGOW
GLASGOW CITY
0 1 km 2 3



Source: Active People Survey. 2006 total n= approximately 1,000 per local authority; 2008 total n=approximately 500 per local authority

Sloman et al., DfT and Cycling England 2009; reviewed in Yang et al., *BMJ* 2010



Cavill et al., Cycling England 2009; reviewed in Yang et al., *BMJ* 2010

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Goodman et al., *Environ Health* 2012
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Brand et al., *Appl Energy* 2013
Bird et al., *Health Psychol* 2013

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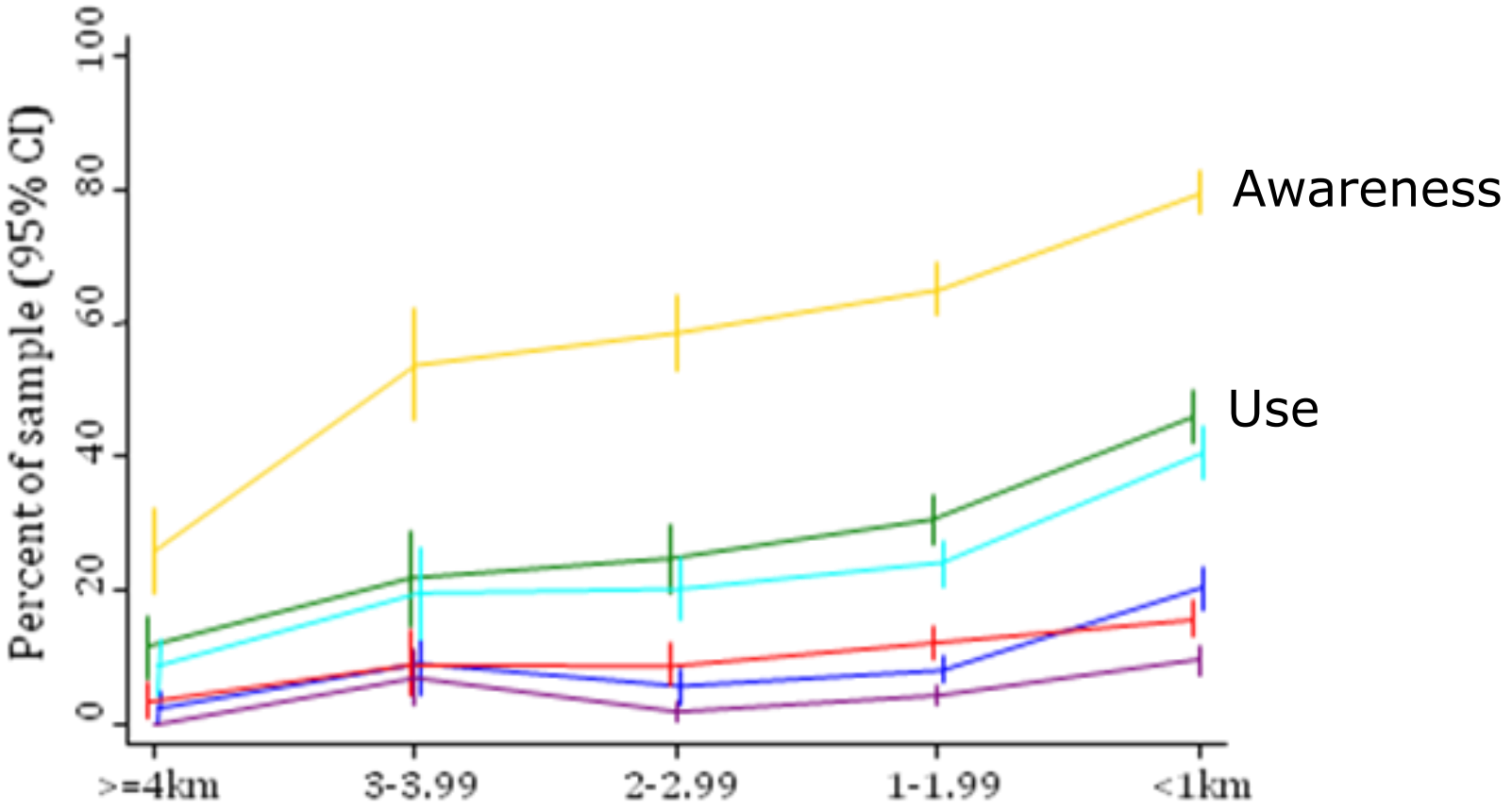
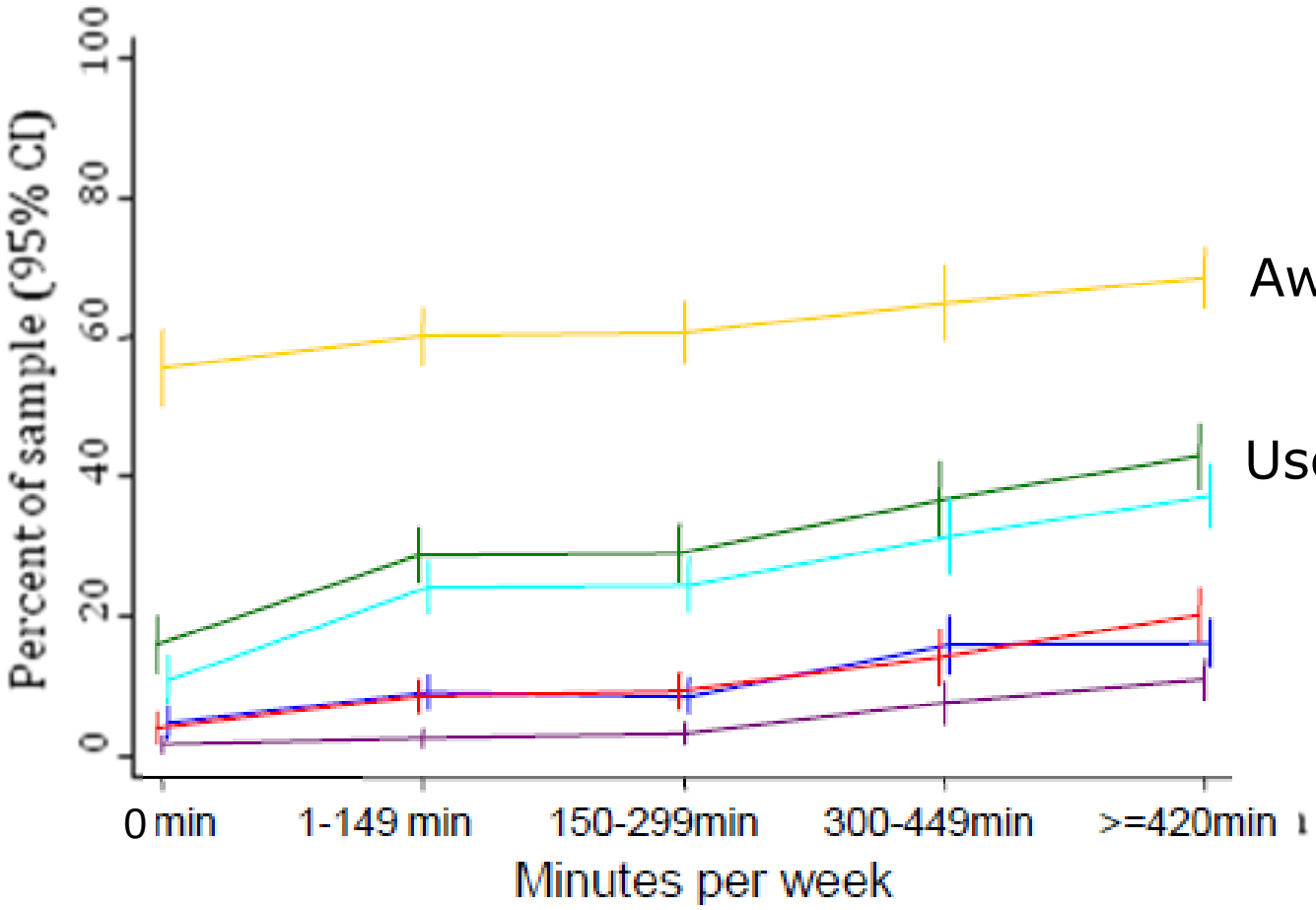
Distance predicts awareness and use…



Goodman et al., under review

… and so does baseline activity…



Goodman et al., under review

… and effects may take time to emerge

Outcome	Effect size after one year	Effect size after two years
Increase in time spent walking and cycling	3.4	17.1**
Increase in time spent in overall physical activity	1.7	14.4*

Adjusted linear regression coefficients representing estimated increase in weekly minutes of activity per additional kilometre of proximity

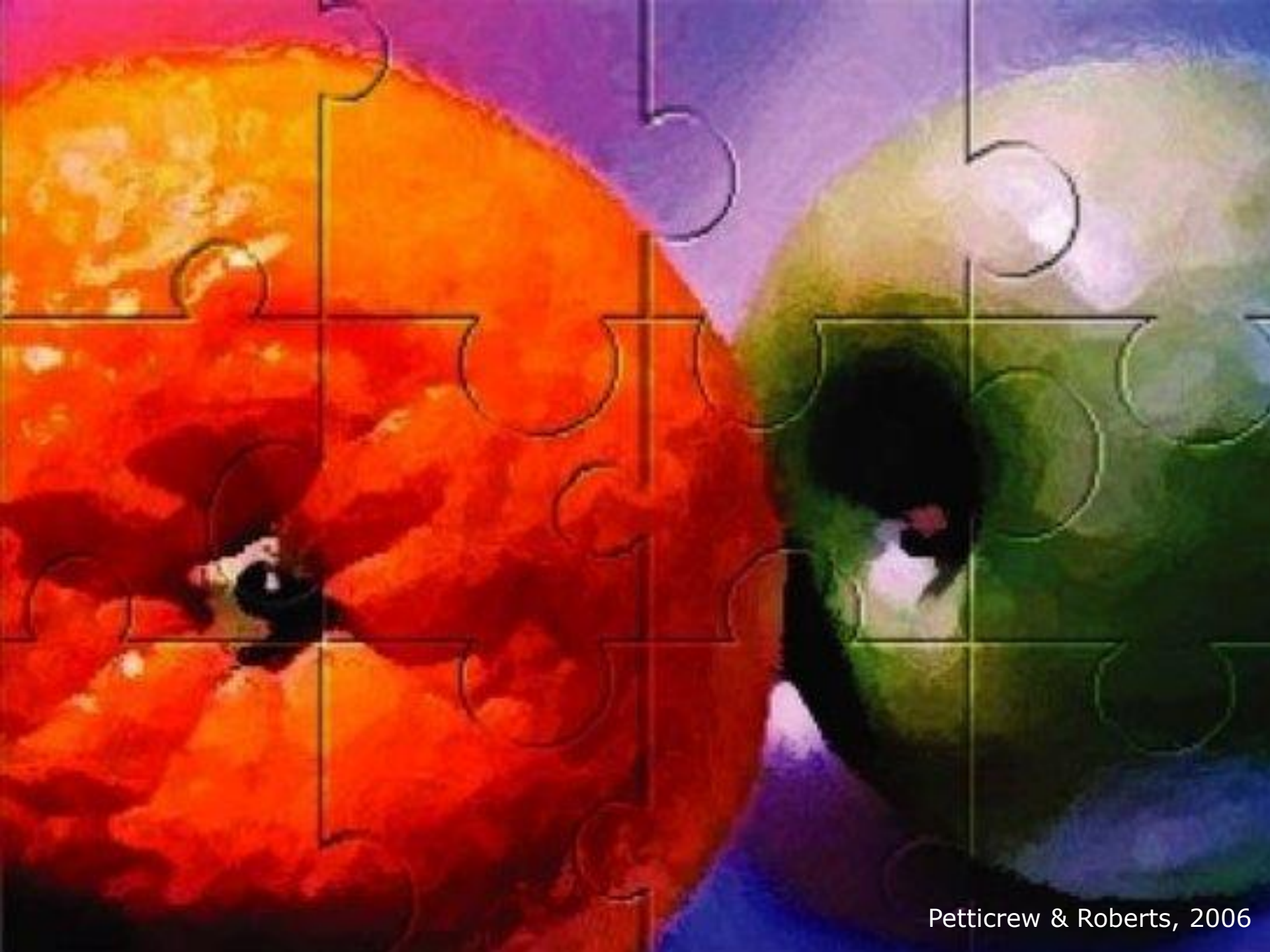
*p<0.05 **p<0.01

Goodman et al., under review

3a. Opportunities

3b. Internal validity

3c. Generalisability



Petticrew & Roberts, 2006

Intervention theory

'Interventions are commonly designed without evidence of having gone through this kind of process, with no formal analysis of either the target behaviour or the theoretically predicted mechanisms of action. They are based on **implicit commonsense models** of behaviour […]'

Michie et al., *Implement Sci* 2011

Why so little convincing evidence?

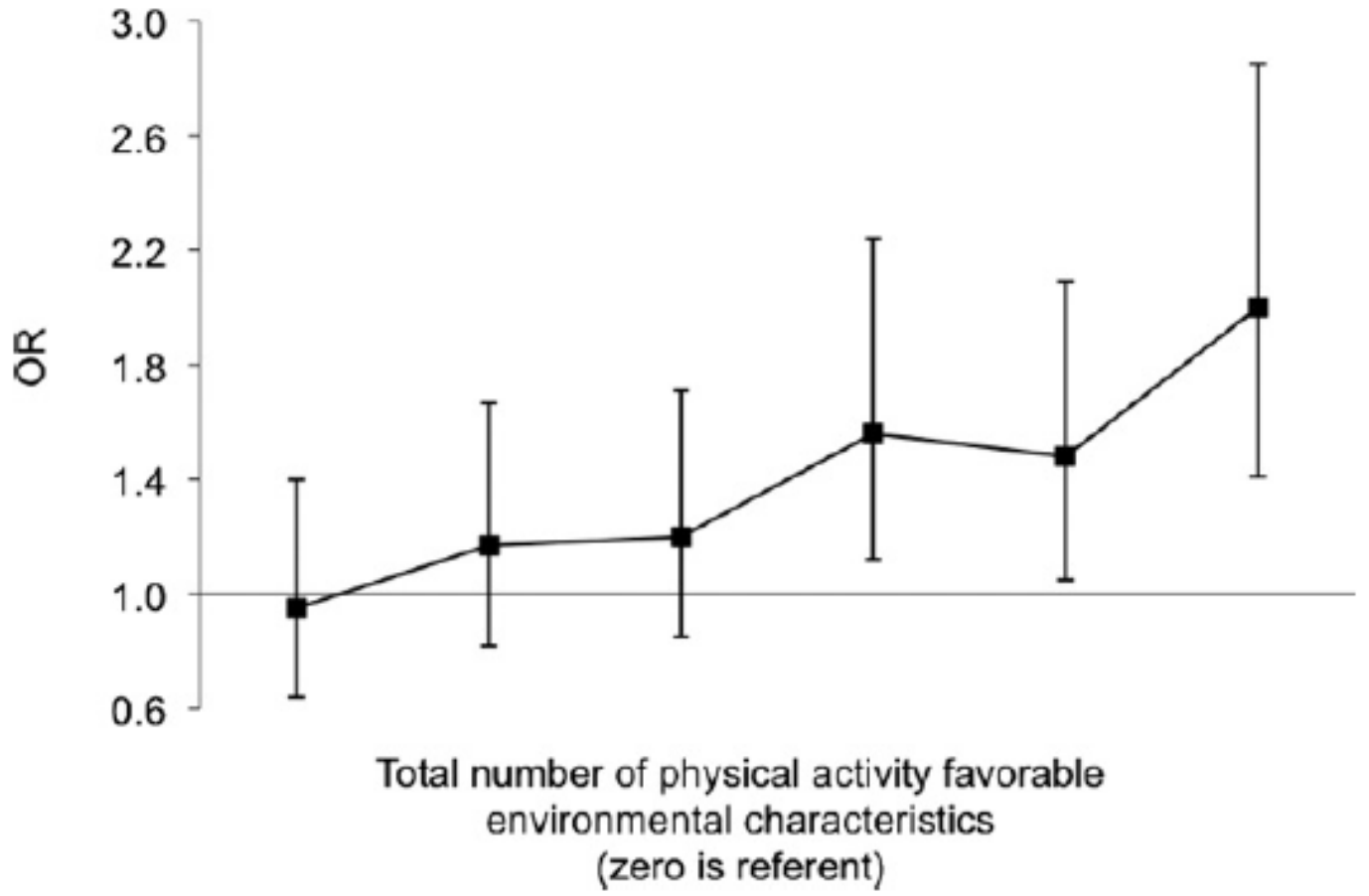
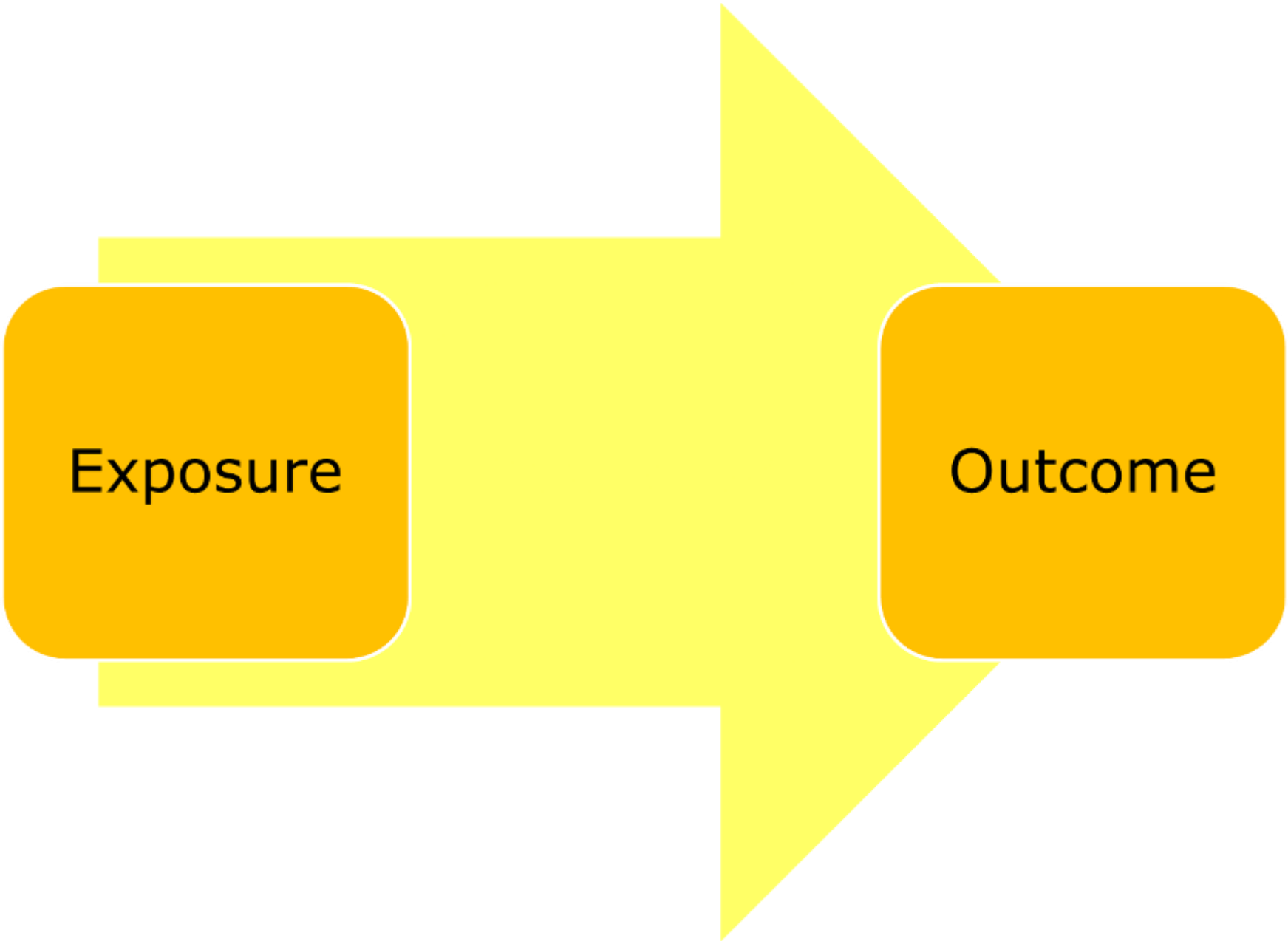


Figure 2. Association between number of physical activity–favorable built-environment attributes and meeting physical activity guidelines among city residents only, adjusted for gender, age, and country (pooled sample N=11,541)

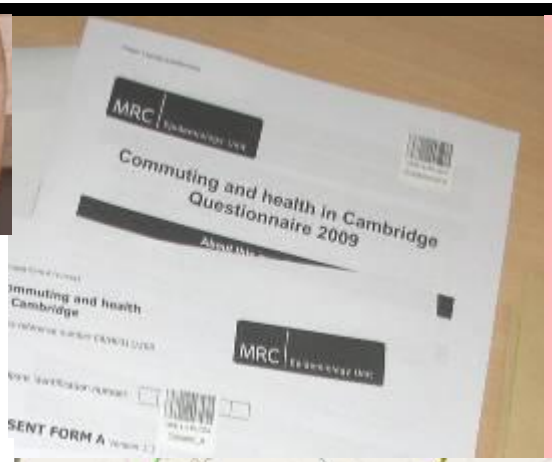
Sallis et al., *Am J Prev Med* 2009

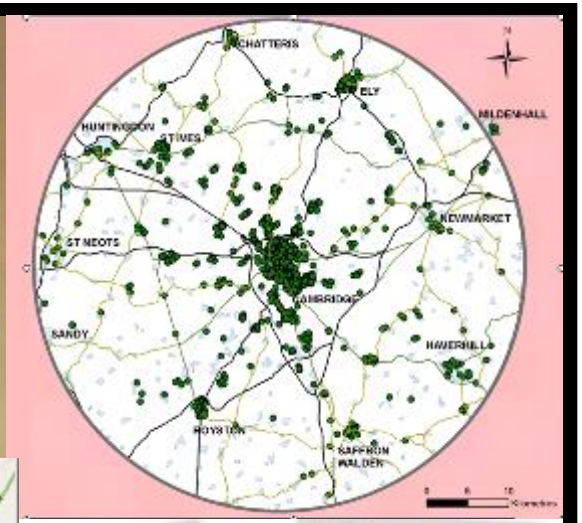
- ‘Dose’
    - Implementation
    - Vision
- Measurement
- Necessary but not sufficient
- Evidence synthesis

4. The implications


Exposure
Outcome

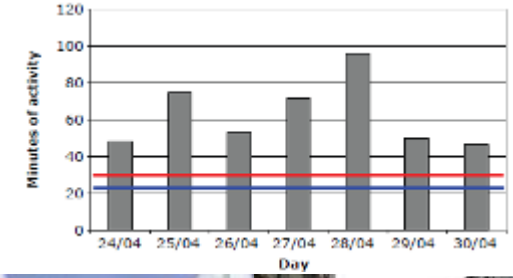

IPEN
International Physical Activity and the Environment Network

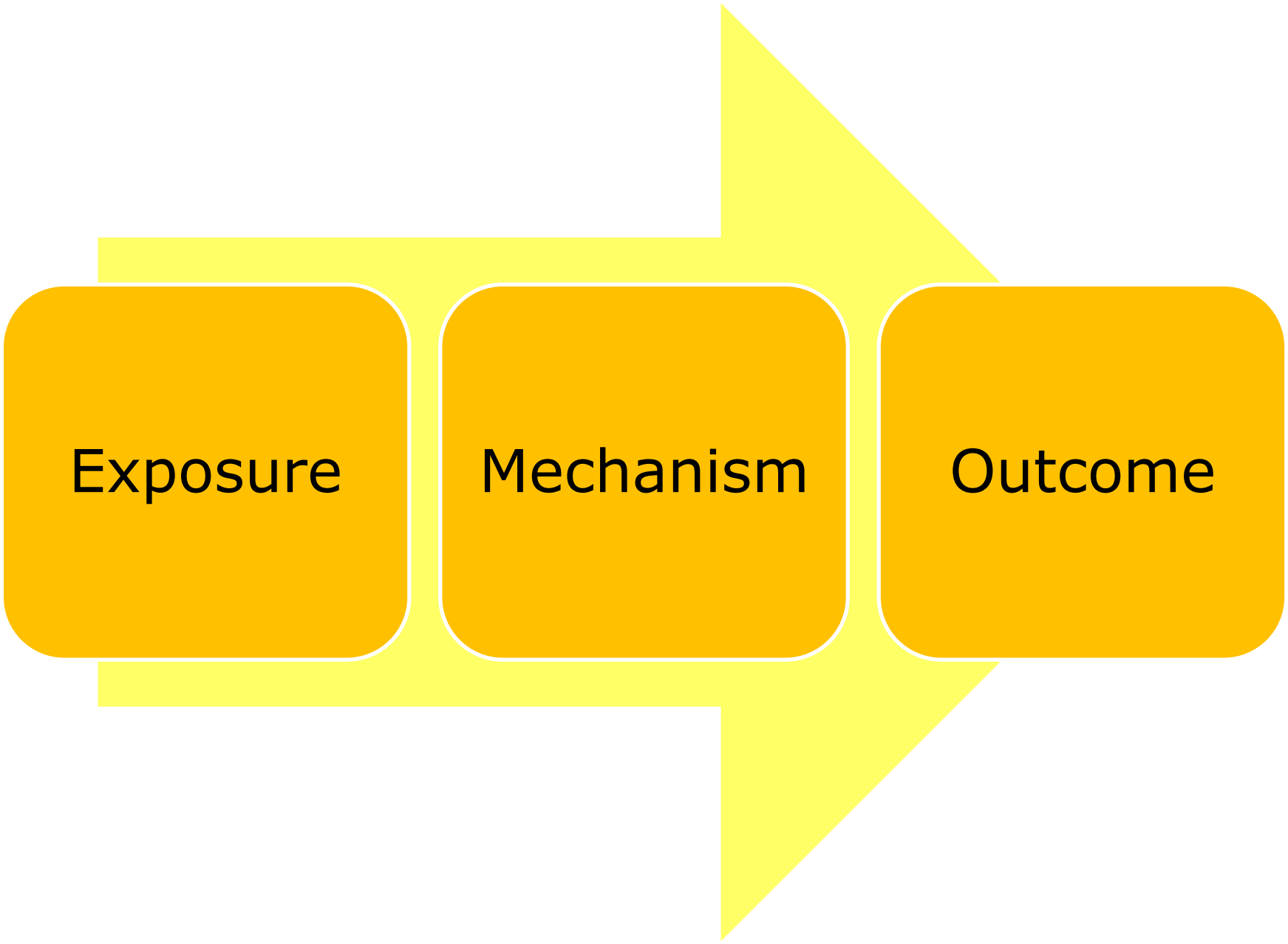


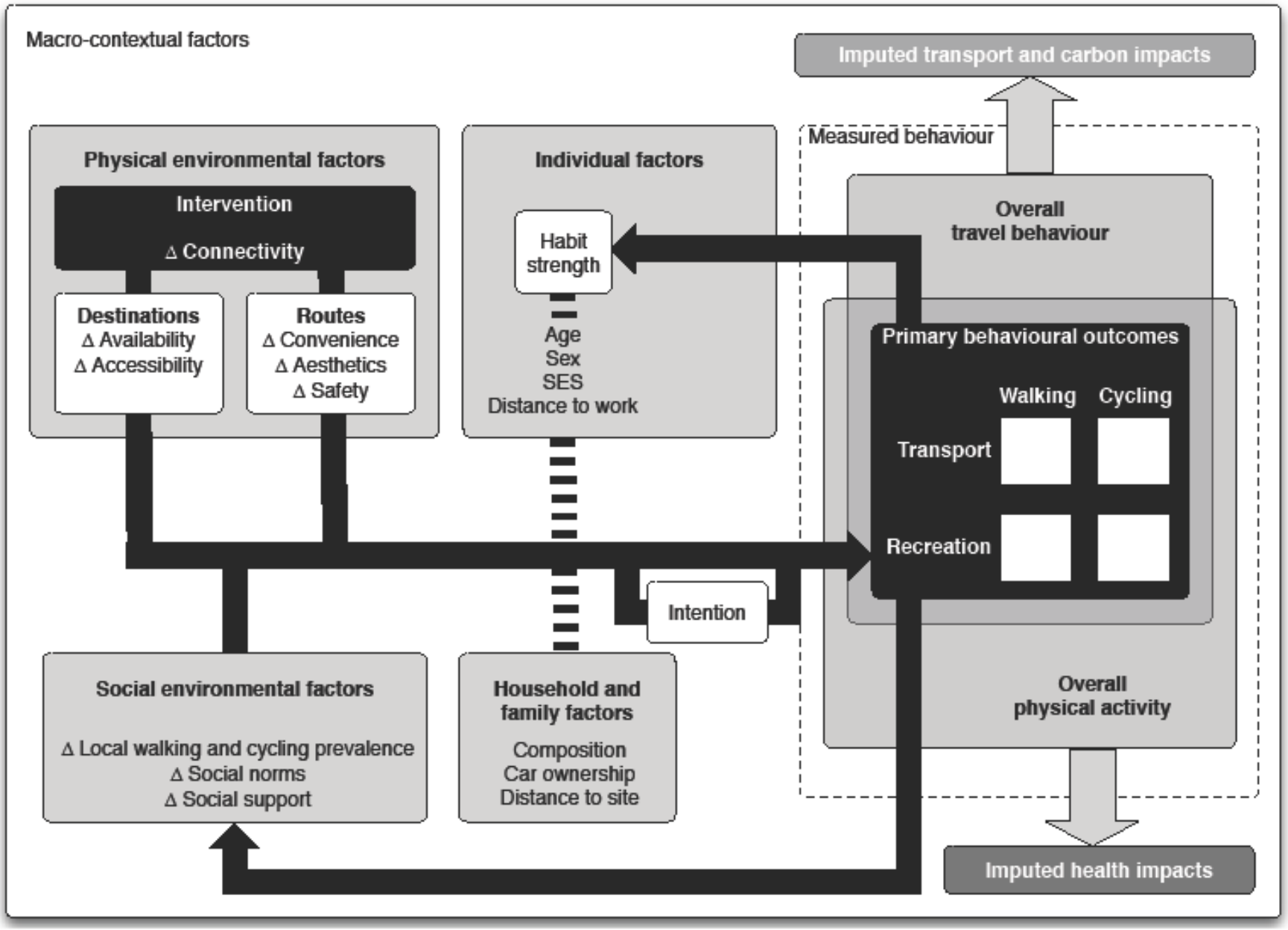


"I hurt myself quite badly and now my wife won't let me cycle in town, she says it's too dangerous"

[Cycling] is probably the most dangerous thing I do but well I read the statistics and it's more dangerous not to cycle from the health point of view!

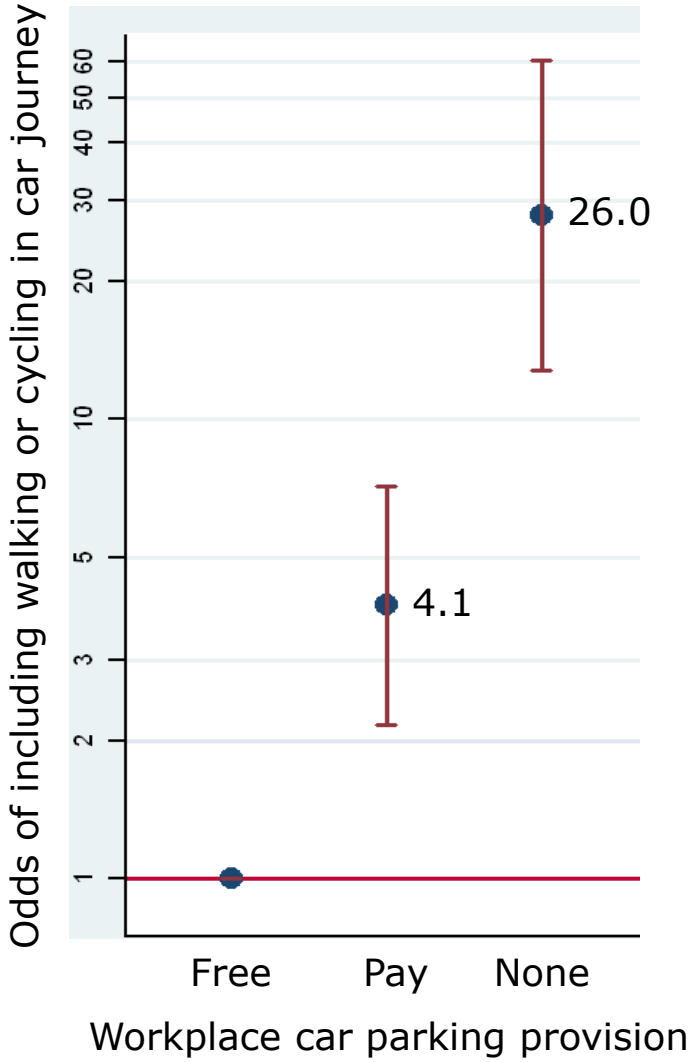



Exposure
Mechanism
Outcome



Ogilvie et al., *Am J Public Health* 2011

Active commuting and workplace parking



Panter et al., *Prev Med* 2013


Customer parking
Goods vehicles
park ride
P
Y215 HBR

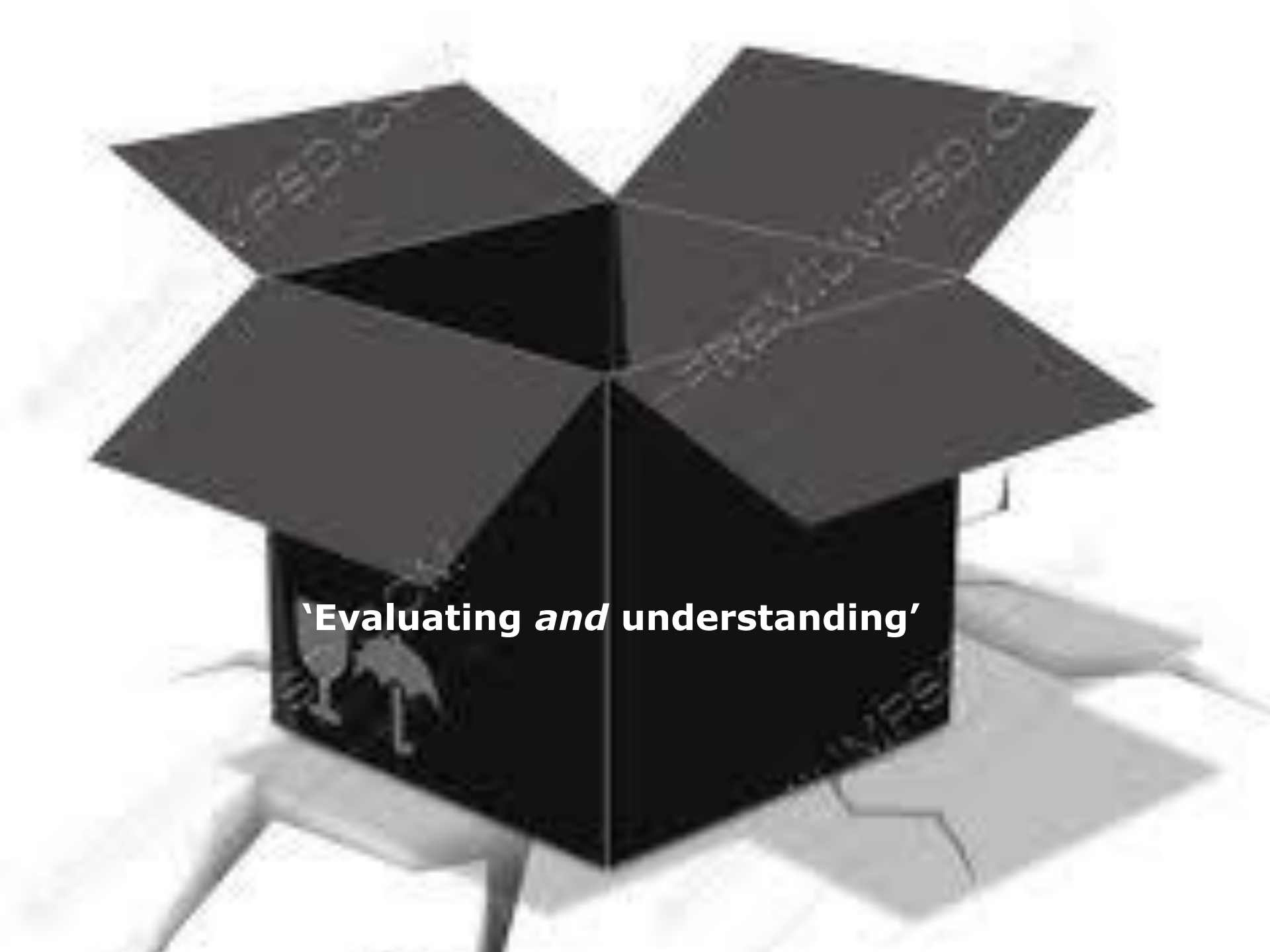
It’s not (just) about physical activity

‘Physical activity was not a primary motivation, but **incidental increases in physical activity were described and valued** in association with active commuting, the use of public transport and the use of park-and-ride facilities.’

Jones & Ogilvie, *Int J Behav Nutr Phys Act* 2012

What sort of research do we need?

- Applied to the most appropriate opportunities
- Control over and/or clearer understanding of exposure
- Appropriate selection of outcomes
- Specificity in exposure-outcome relationships
- Investigation and understanding of mechanisms
- Flexibility in study design and analysis
- Application of a broader public health perspective


‘Evaluating *and* understanding’

Acknowledgments and further details

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For further information and references relating to our studies in this area please visit **www.cedar.iph.cam.ac.uk**.