Making It Personal

How Air Pollution Exposure Research Is Creating Targeted Health Evidence and Engaging Tools For Risk Reduction

Dr Ben Barratt, IAPSC, 12 June 2018

Portable air pollution monitoring is here

Personal monitoring – the aspiration

Who's fighting air pollution? Pigeons. Wearing tiny backpacks with pollution sensors.

Tweet your area of London to @PigeonAir and they'll tell you how toxic it is!

origins

MENU

LASER EGG

BUY NOW £133

Meet the world's most popular smart air quality monitor.

The Laser Egg tells you instantly and accurately what is in the air you're breathing, so that you know whether or not you efforts to keep your environment clean and healthy are working.

12
GOOD

AQI

origins

airvisual   Home   World pollution map   Air

Search   Barnstaple, bar

Meet the Node

The world's smartest air quality monitor helping you track, foresee, and take action against invisible threats in the air.

LEARN MORE

Barnstaple A39

More details..

AIR QUALITY
12   GOOD

Tuesday   Wednesday   Thursday

17°C
RAIN
HUMIDITY: 93%
WIND: 3.08 KM/H W

13   17   17
13   17   17

Last updated: 2 hours ago

Personal monitoring – the (current) reality

Science   Fashion

Does this represent the air that you're breathing?

Air quality modelling
More spatial detail, but...

We are mobile and active...

Personal air pollution exposure

- A detailed attempt to quantify what an individual breathes:

What?   Where?   Why?   How much? $\Rightarrow$ Impact

(A) Time spent in activity spaces

(B) NO$_2$ concentration in activity spaces

(C) Percent contribution to time weighted average concentration

(D) Percent contribution to total inhaled dose

De-Nazelle, Environmental Pollution 2013
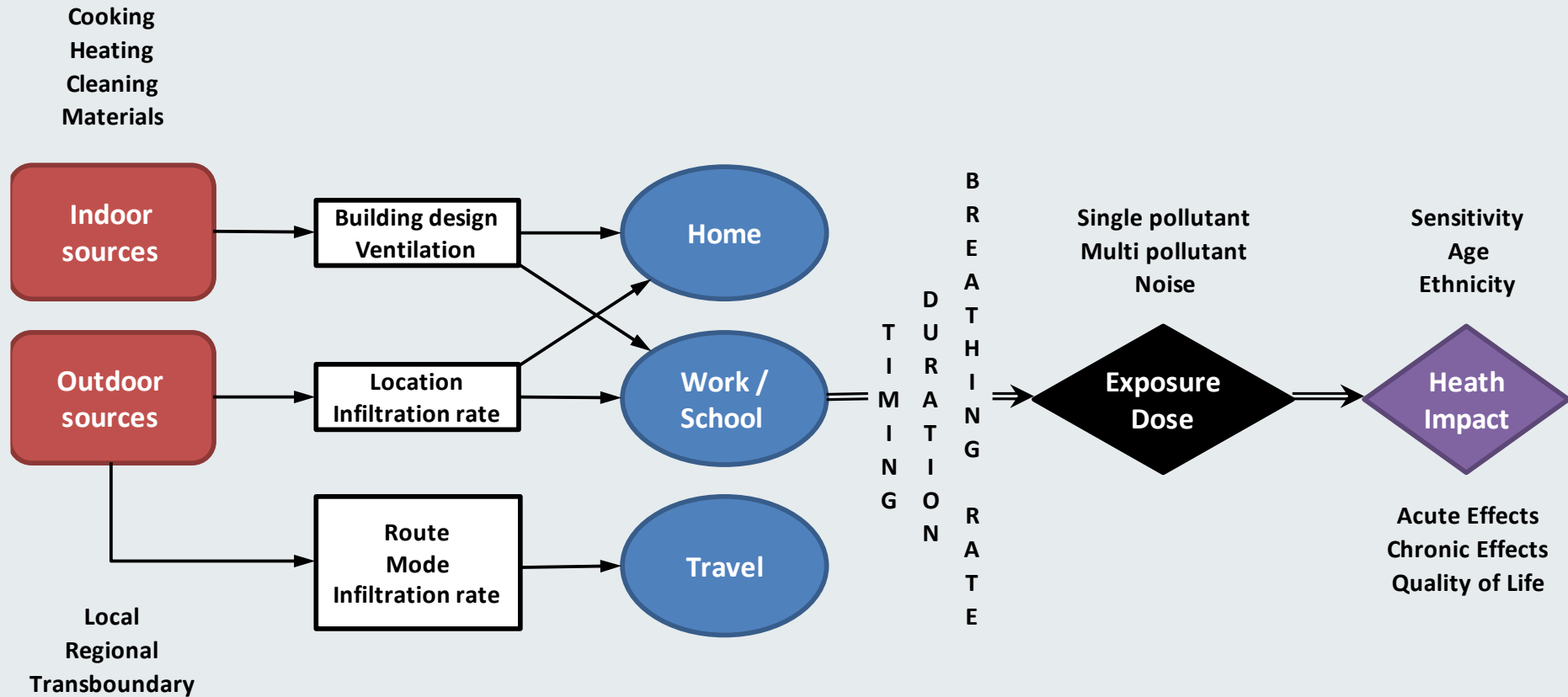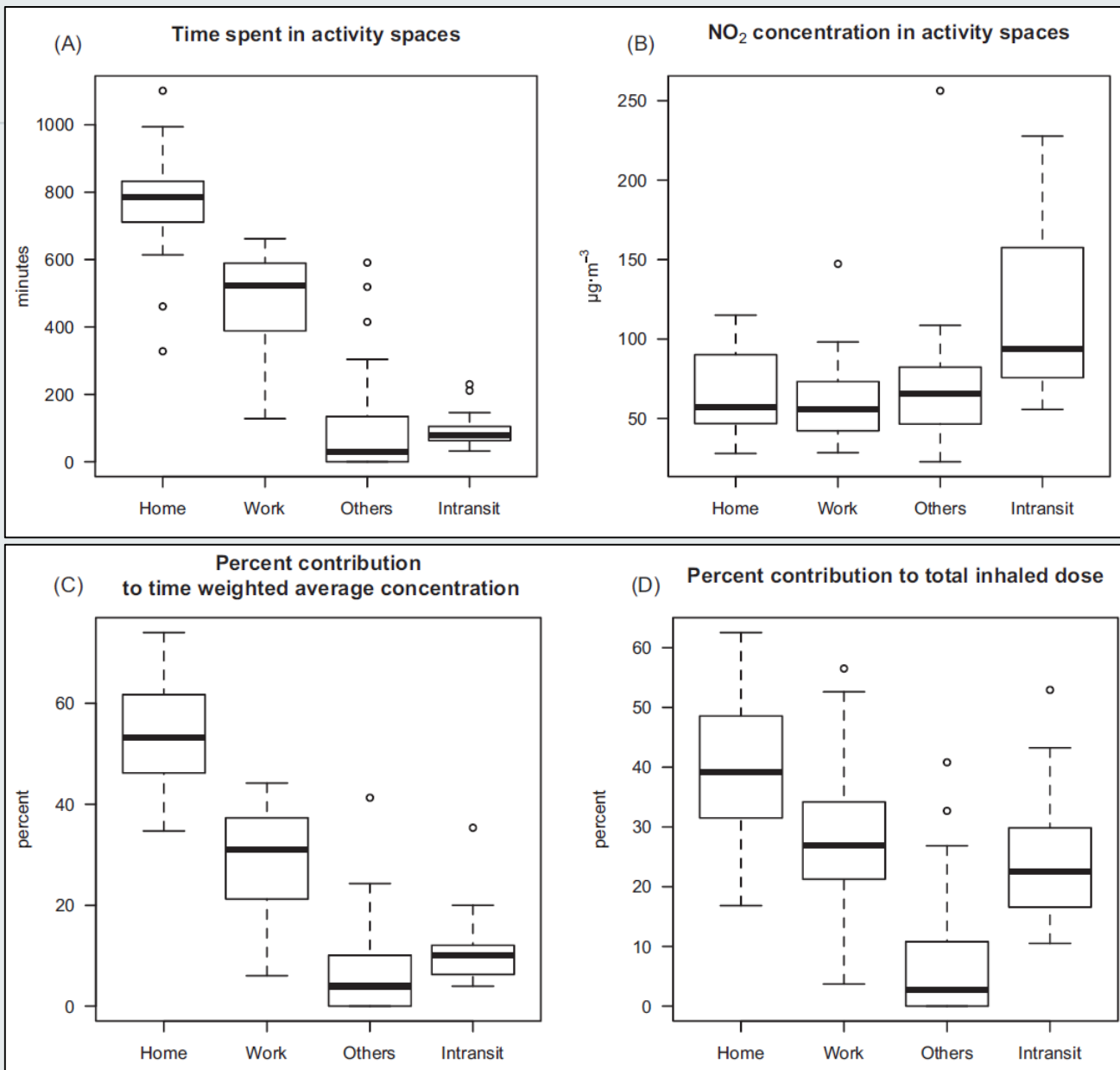
Why is air pollution exposure important?

- Improved exposure estimates should provide:
  - Stronger toxicological evidence
  - Stronger epidemiological evidence (reduced uncertainty)
  - More targeted evidence for emissions control
  - More targeted evidence for health protection (sensitive individuals)
- Exposure reduction presents a method of protecting human health beyond air quality improvement.
- Social justice and engagement - Air pollution exposure is poorly understood as a public health risk
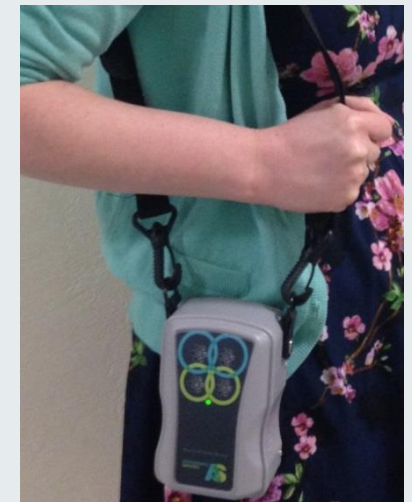
Stronger toxicological evidence
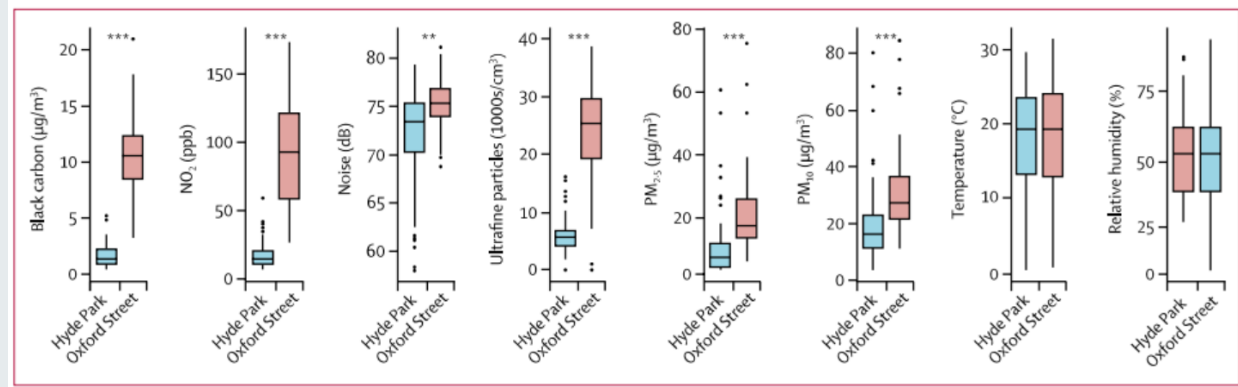
"Our findings show for the first time the detrimental effect of air pollution on walking at a normal pace. We document the beneficial cardiorespiratory benefits of walking in healthy volunteers aged 60 years and older, an effect that is lost when walking in a polluted environment."

Sinharay et al, The Lancet, 2017

# Stronger associations: personalised 'medicine'

Moore et al, BMJ Open, 2016
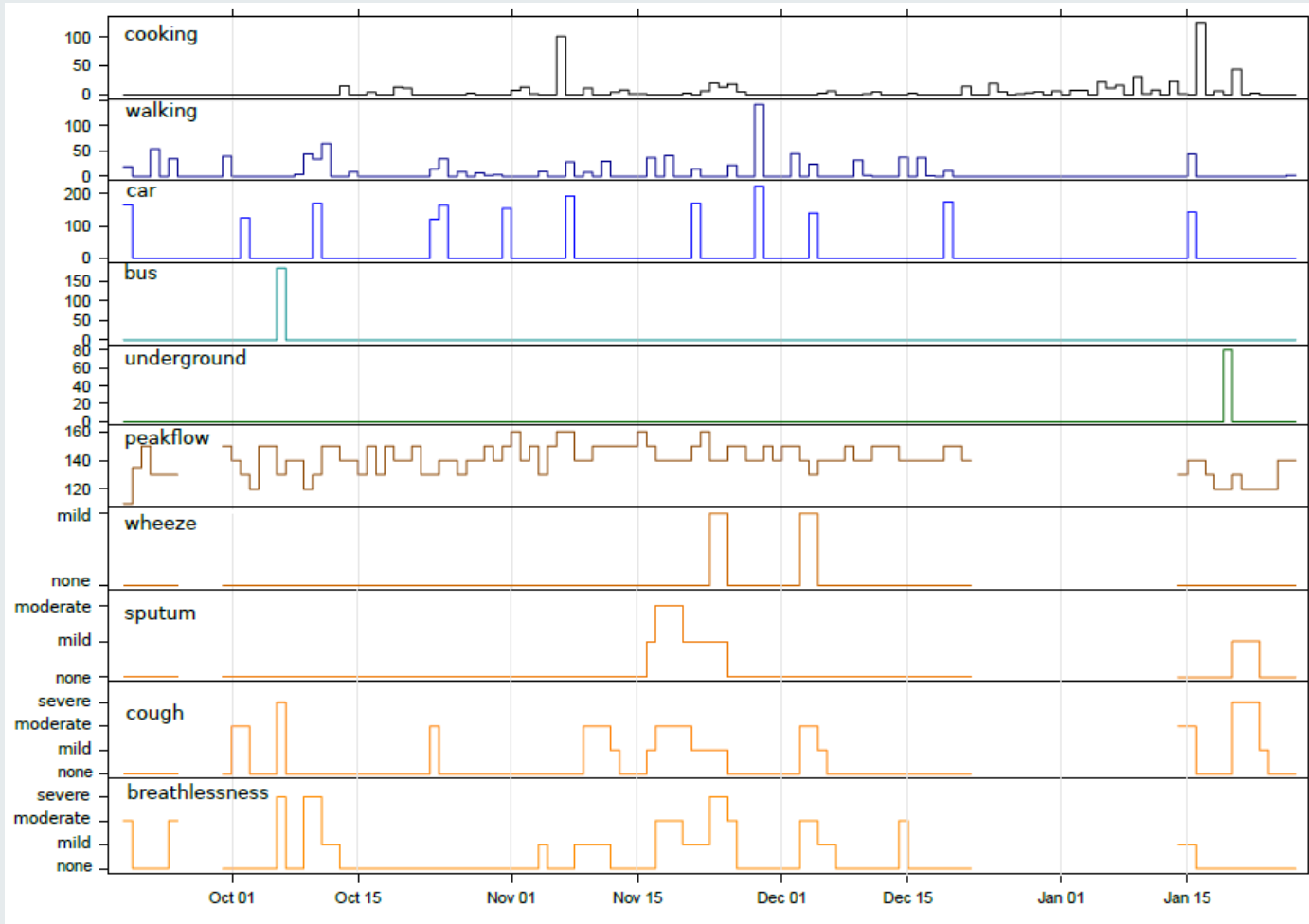
Stronger epidemiological evidence

Cause of Death	Fine particulates (PM$_{2.5}$)		Nitrogen Dioxide (NO$_2$)	
	2D	D3D	2D	D3D
All natural causes	**1.03 (1.01, 1.06)***	**1.07 (1.04, 1.09)***	1.00 (0.97, 1.03)	**1.06 (1.03, 1.08)***
Cardiovascular	**1.06 (1.02, 1.10)***	**1.10 (1.05, 1.14)***	1.00 (0.95, 1.05)	**1.09 (1.04, 1.14)***
IHD	1.03 (0.97, 1.10)	**1.09 (1.03, 1.17)***	1.09 (1.00, 1.18)	**1.15 (1.06, 1.24)***
Cerebrovascular	1.06 (0.99, 1.13)	**1.08 (1.01, 1.16)***	1.00 (0.91, 1.09)	1.06 (0.98, 1.15)
Respiratory	1.02 (0.97, 1.06)	**1.06 (1.01, 1.11)***	0.99 (0.93, 1.06)	1.06 (1.00, 1.12)

Barratt et al, Res Rep Health Eff Inst, 2018

Targeted epidemiological evidence – dynamic modelling
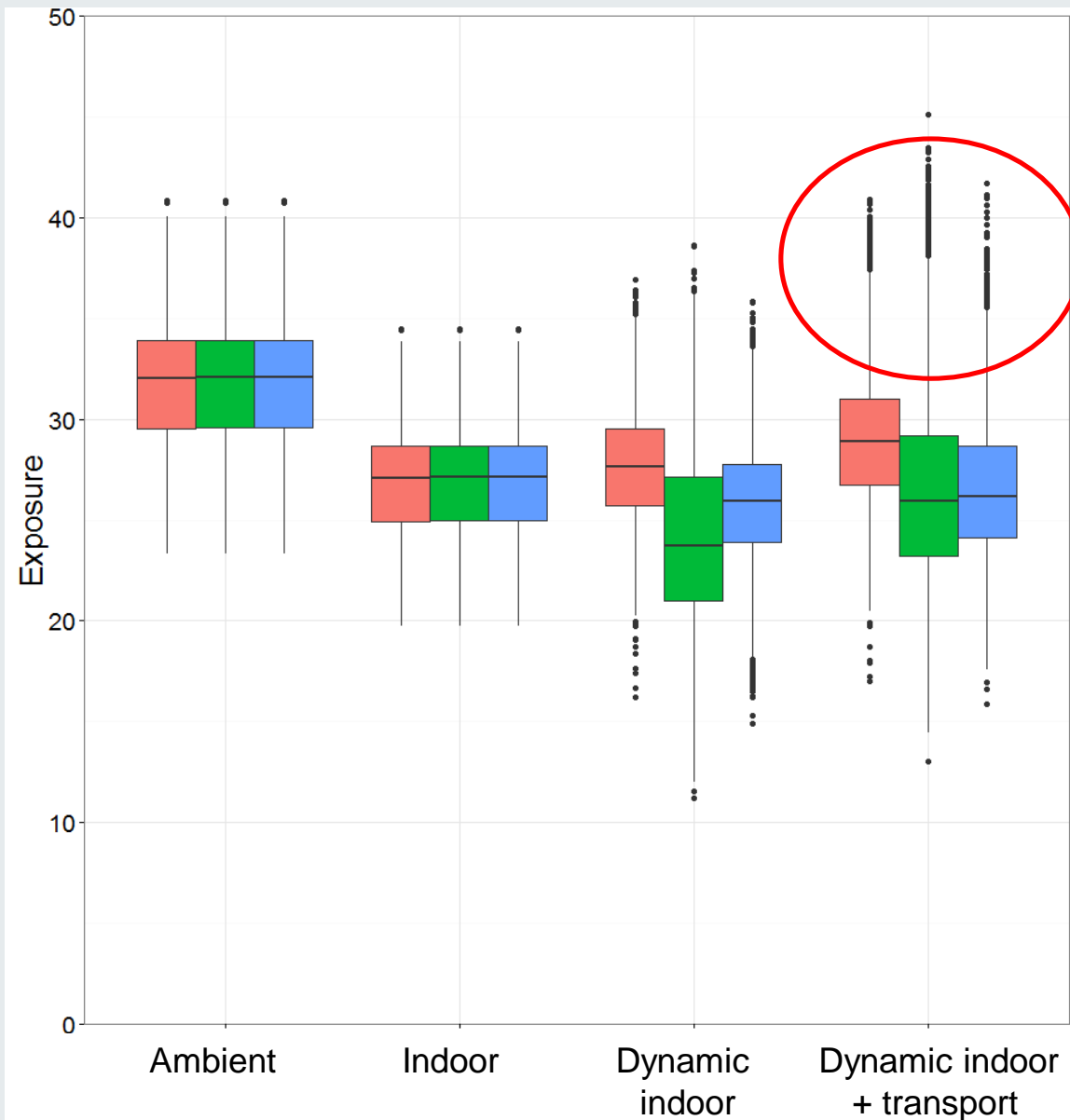
1 – <18 years
2 – 18-64 years
3 – 65=> years

Exposure estimates for populations aged <18 vs >65:

$PM_{2.5}$: +13%
NO_2 : +14%
BC: +39%

Tang et al, Environment International, 2018
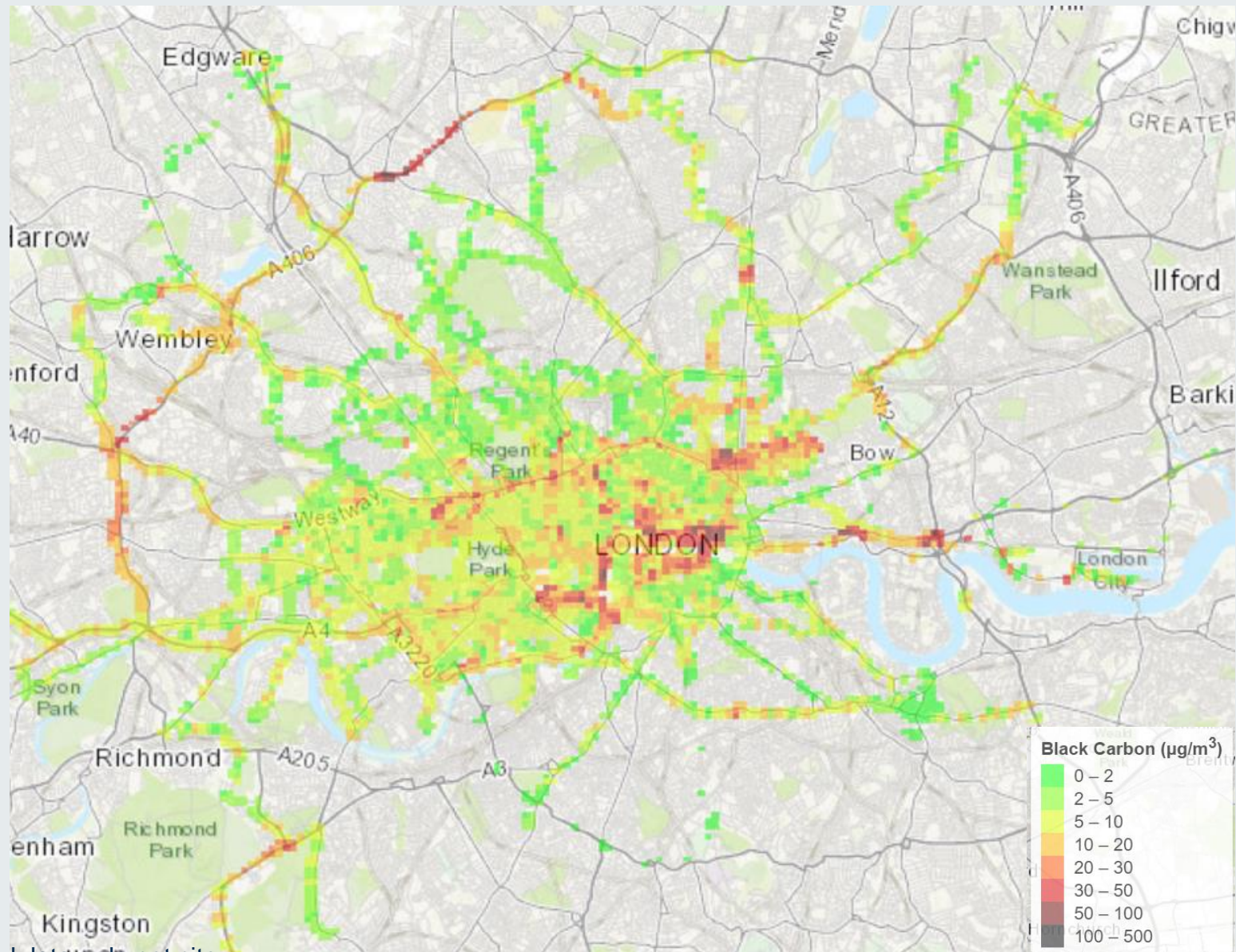
Health risk reduction – professional urban drivers
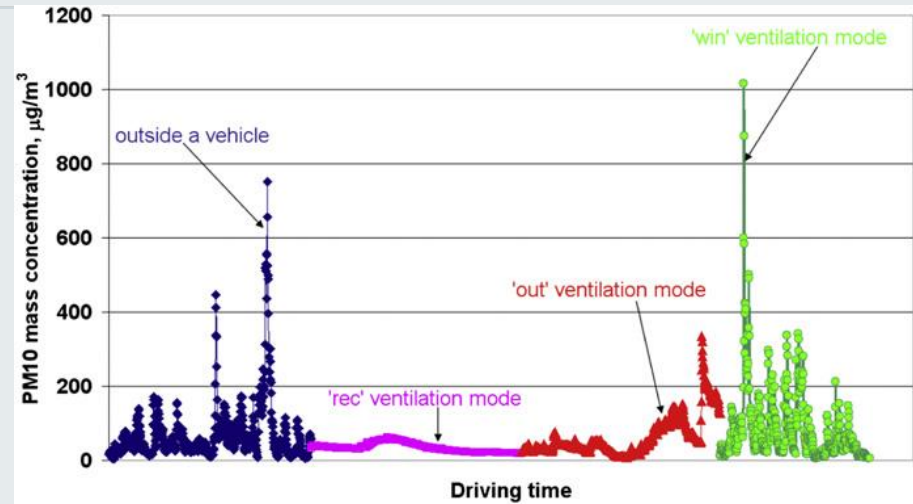
Health risk reduction – professional urban drivers

Health risk reduction – The Tube

PM2.5 concentrations recorded at each station of the Central Line.

Prioritising exposure reduction – The Tube

Top 30 London Underground stations ranked by passenger numbers (red), $PM_{2.5}$ concentrations (green) and population-weighted exposure (blue).

Who needs scientists?

Risk reduction through behavioural change

Social science meets 'hard' science

Participatory Research approach in practice

- Motivations for participation
- Expected and observed outcomes
- From knowledge to empowerment
- Disseminating the findings
- *Participatory approach (advantages and disadvantages)*

Risk communication

- What is really the risk?
- Visible vs invisible risk
- How people understand and cope with the risk identified depending of the setting bus/tube/streets/ home?
- The role of the media in communicating the risk and the public response?

Policy context

- Do people think that the current governments' approach is appropriate?
- Public demand for policy interventions
- Sympathy with new policies
- Is climate change and air pollution the same thing?
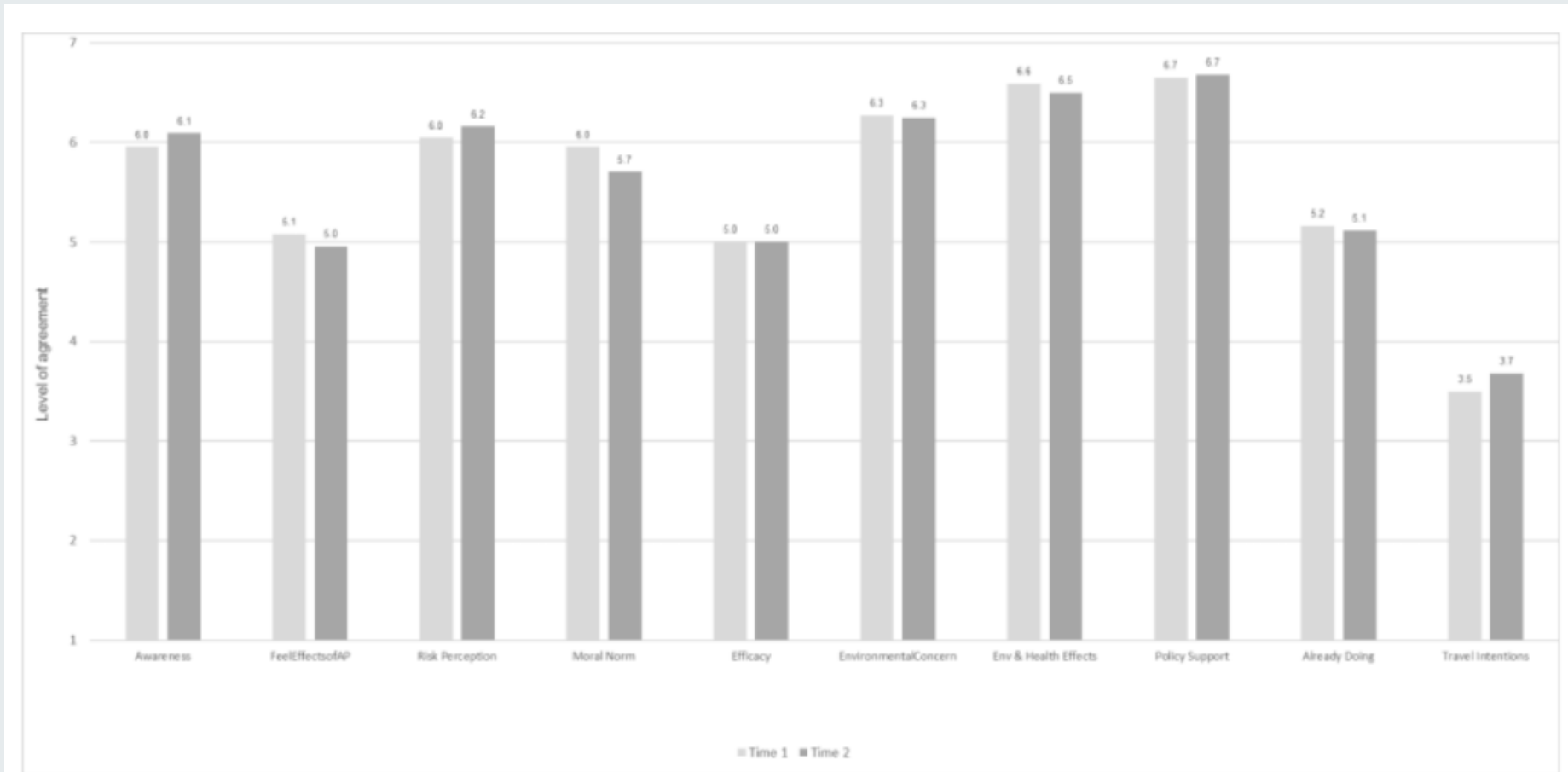
Engaging the engaged and the unengaged

Figure 1. Perceptions and attitudes towards air pollution
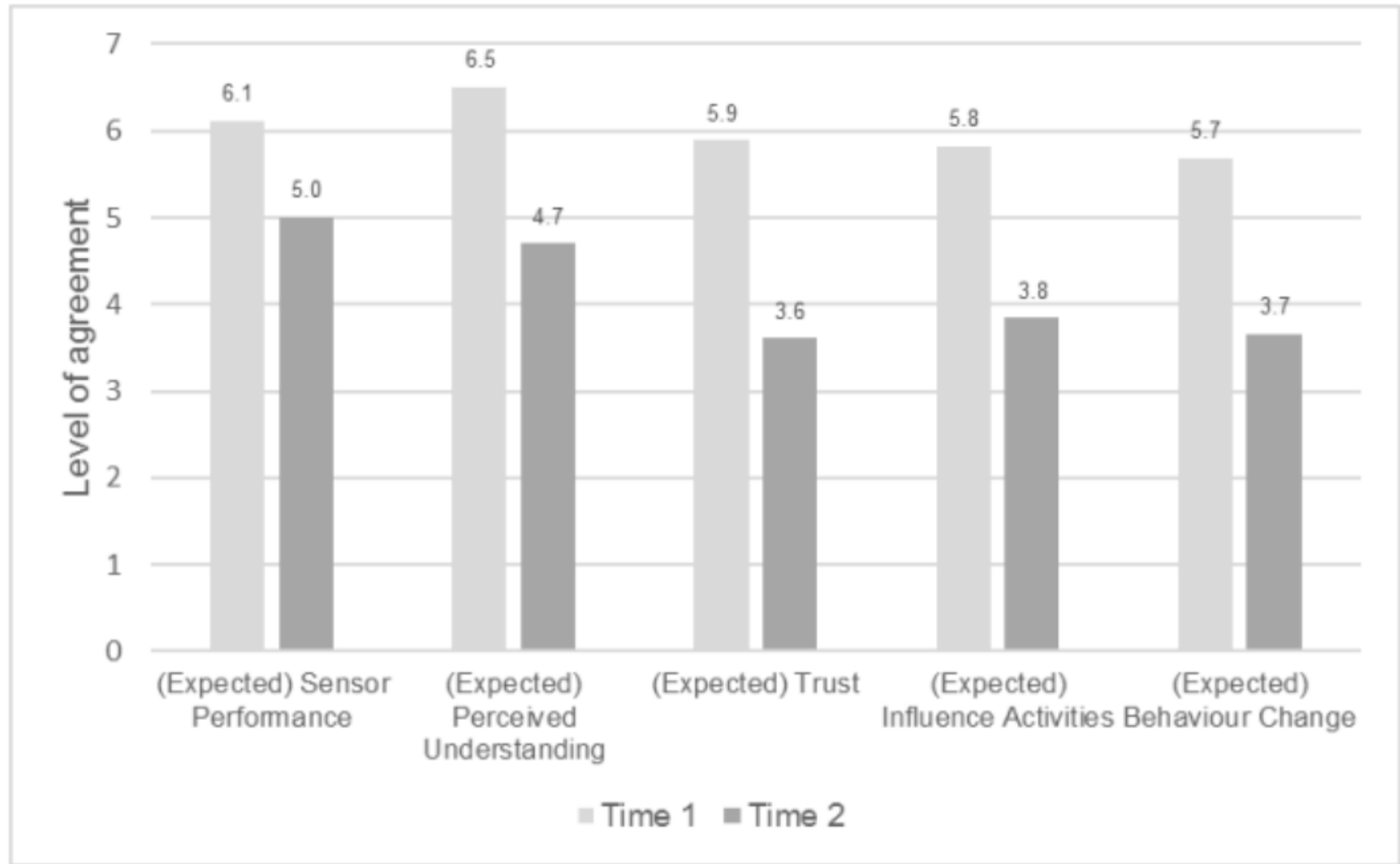
Finally – look before you leap...

Figure 2. Expected Perceptions and Perceptions towards the sensor and app

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