



La salut com a motor de canvi: de la ciutat grisa a la verda

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ISGlobal
Institut de
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Barcelona

Una iniciativa de:



Guió

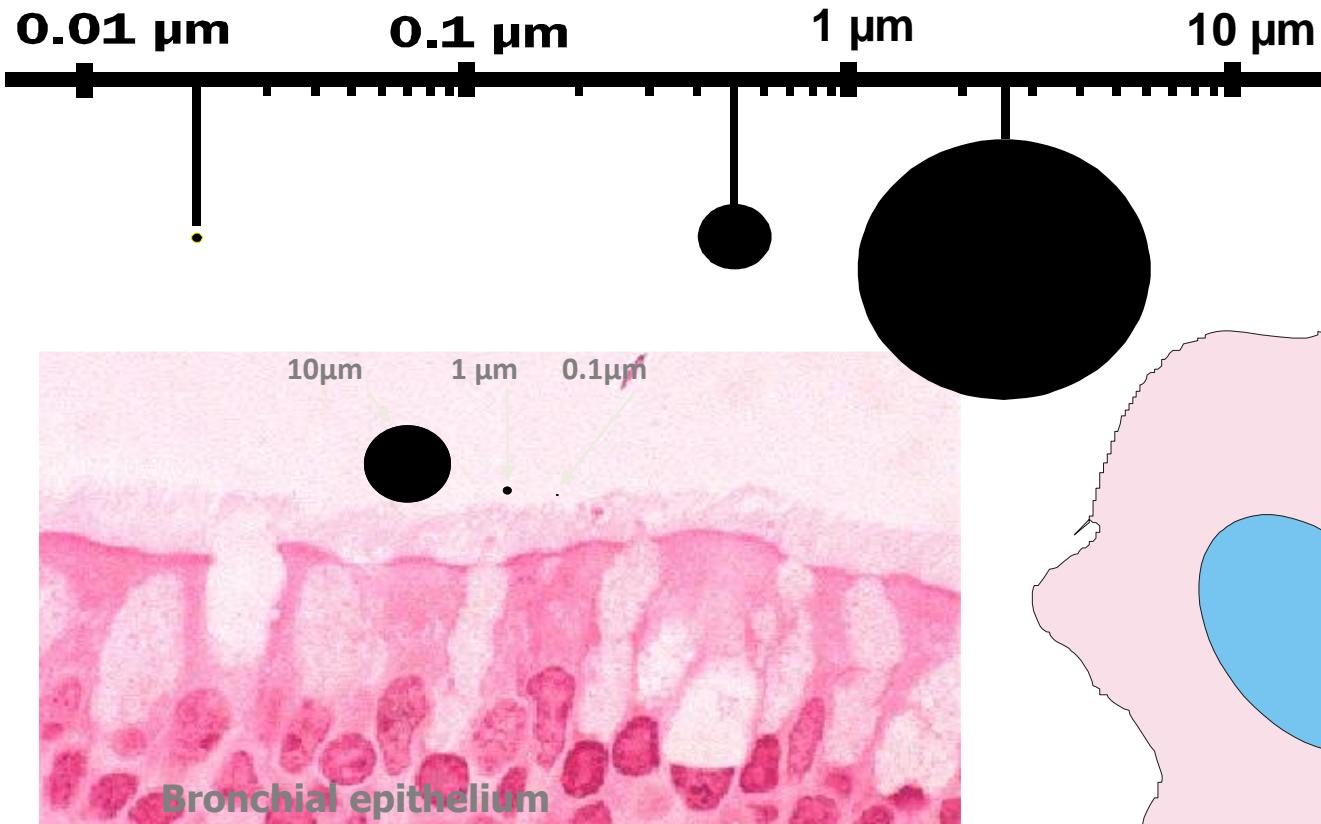
- Contaminació de l'aire i salut
- L'impacte negatiu del vehicle a motor en la ciutat
- Un nou model de ciutat

Ambient Aerosols

- Gases and primary particles
- Organic compounds
- Soot particles
- Metals
- Secondary particles
- Crustal material
- Biological material
-

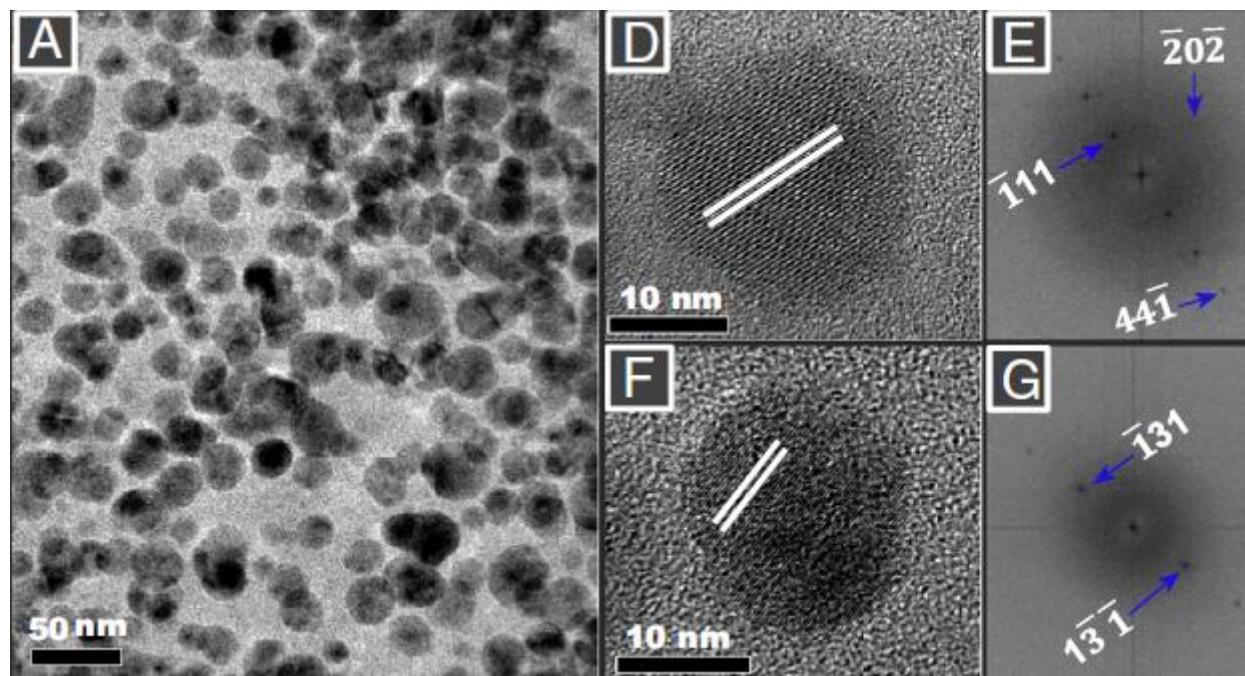
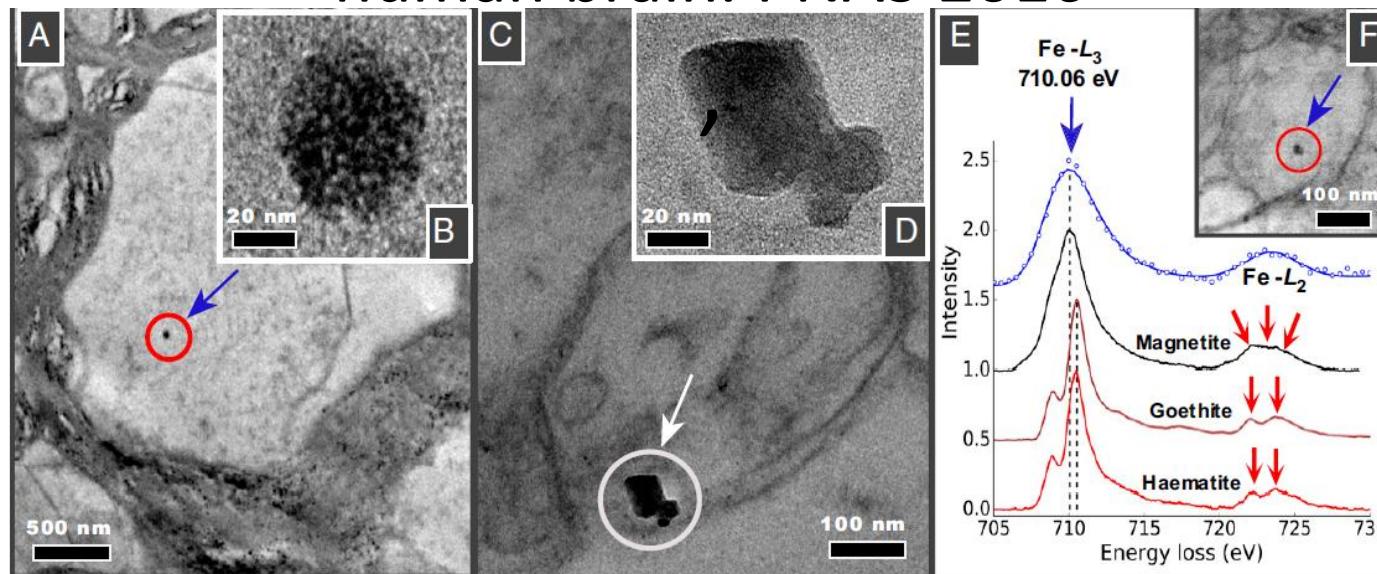


Size matters for the translocation



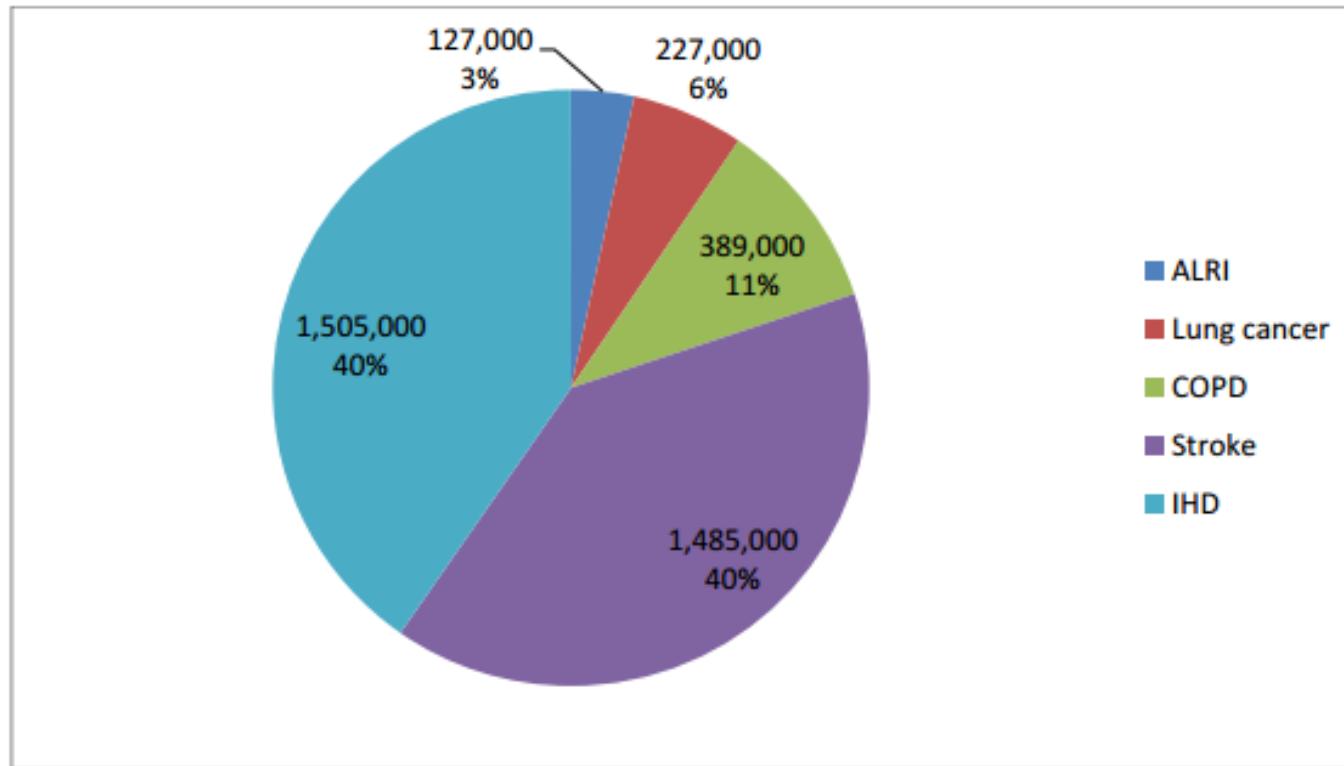
Courtesy: K. Donaldson & A. Peters

Maher BA. Magnetite pollution nanoparticles in the human brain. PNAS 2016



Particulate air pollution causes 3.5 million deaths

Figure 3. Deaths attributable to AAP in 2012, by disease



Percentage represents percent of total AAP burden (add up to 100%).

AAP: Ambient air pollution; ALRI: Acute lower respiratory disease; COPD: Chronic obstructive pulmonary disease; IHD: Ischaemic heart disease.

Air pollution affects multiple organs immediately and has long-term consequences

- Respiratory Disease Mortality
- Respiratory Disease Morbidity
- Lung Cancer
- Pneumonia

- Upper and lower respiratory symptoms
- Airway inflammation
- Decreased lung function
- Decreased lung growth

- Insulin Resistance
- Type 2 diabetes
- Type 1 diabetes
- Bone metabolism

- High blood pressure
- Endothelial dysfunction
- Increased blood coagulation
- Systemic inflammation
- Deep Venous Thrombosis

- Stroke

- Neurological development
- Mental Health
- Neurodegenerative diseases

- Cardiovascular Disease Mortality
- Cardiovascular Disease Morbidity

- Myocardial Infarction

- Arrhythmia

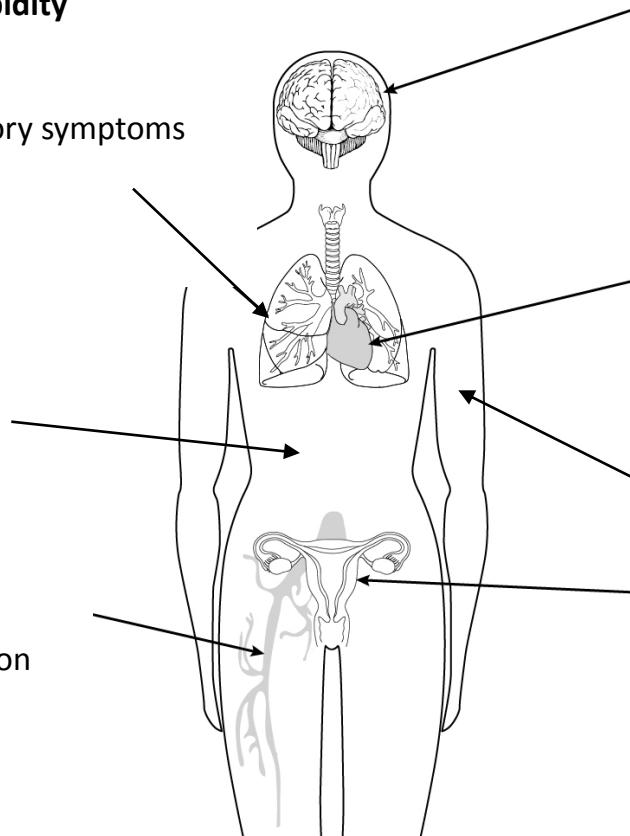
- Congestive Heart Failure

- Changes in Heart Rate Variability
- ST-Segment Depression

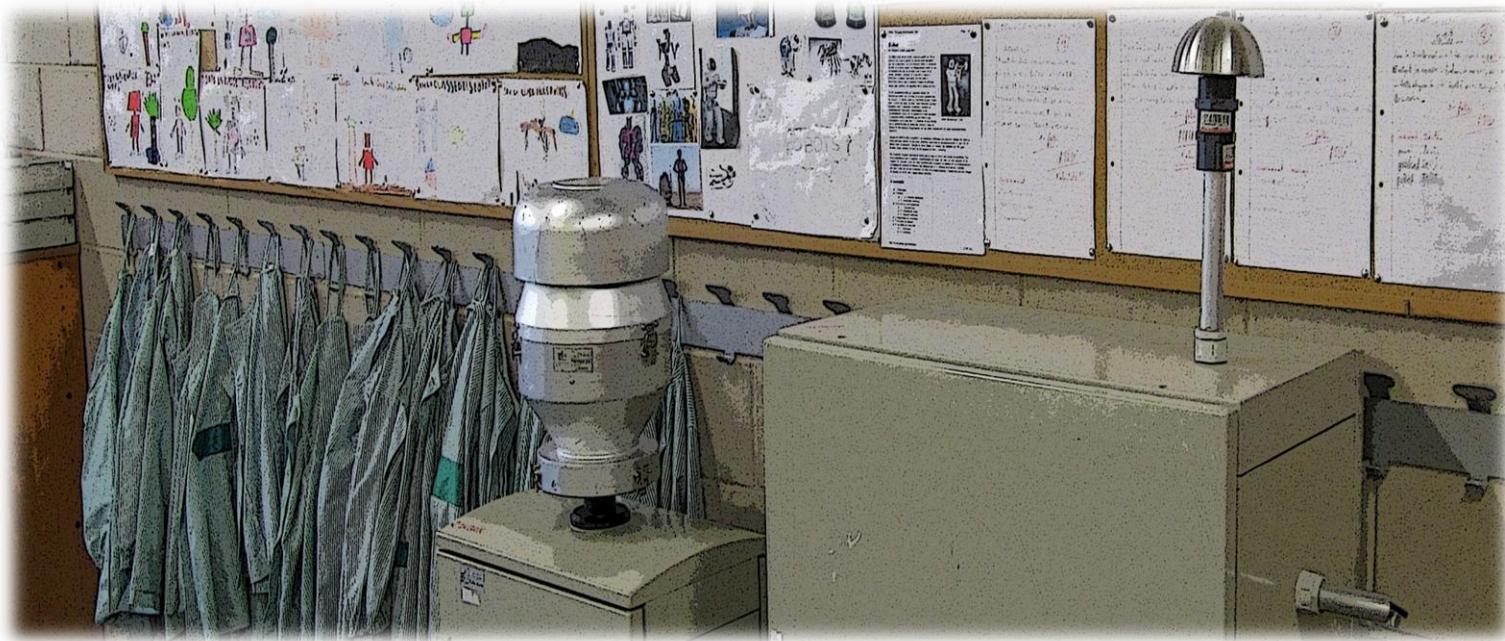
- Skin Aging

- Premature Birth

- Decreased Birth Weight
- Decreased foetal growth
- In uterine growth retardation
- Decreased sperm quality
- Preclampsia



The BREATHE project: BRain dEvelopment and Air pollution ultrafine particles in scHool childrEn



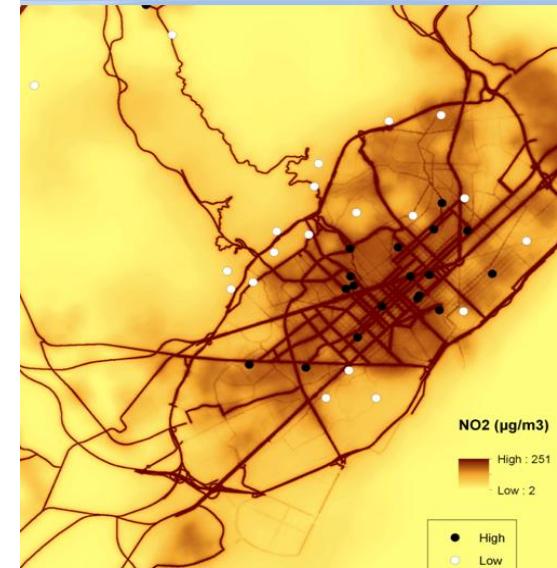
centre de recerca
en epidemiologia
ambiental



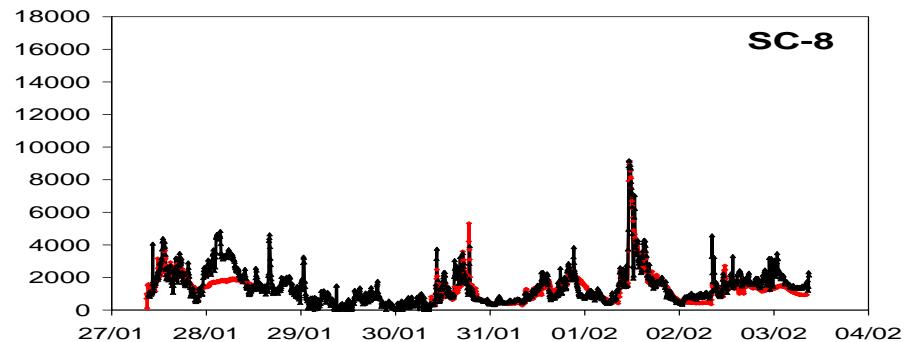
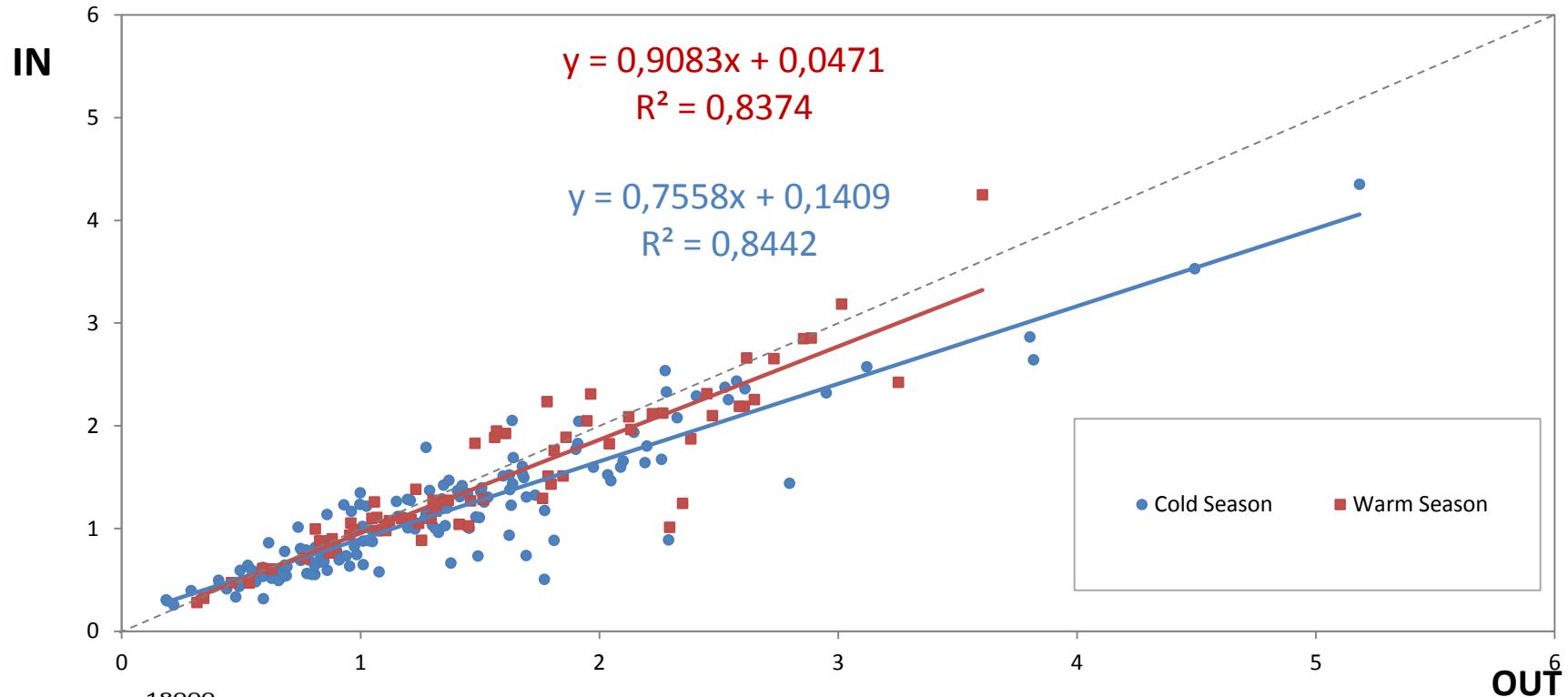
BREATHE
Brain Air
School
investigation

School study

- Schools stratified by traffic pollution
- Match each pair by similar social context
- Two sampling periods of one week by season
- Five monitoring stations at the same time: in/out & high/low, fixed site
- 39 schools, 1,092 PM filters during 2012

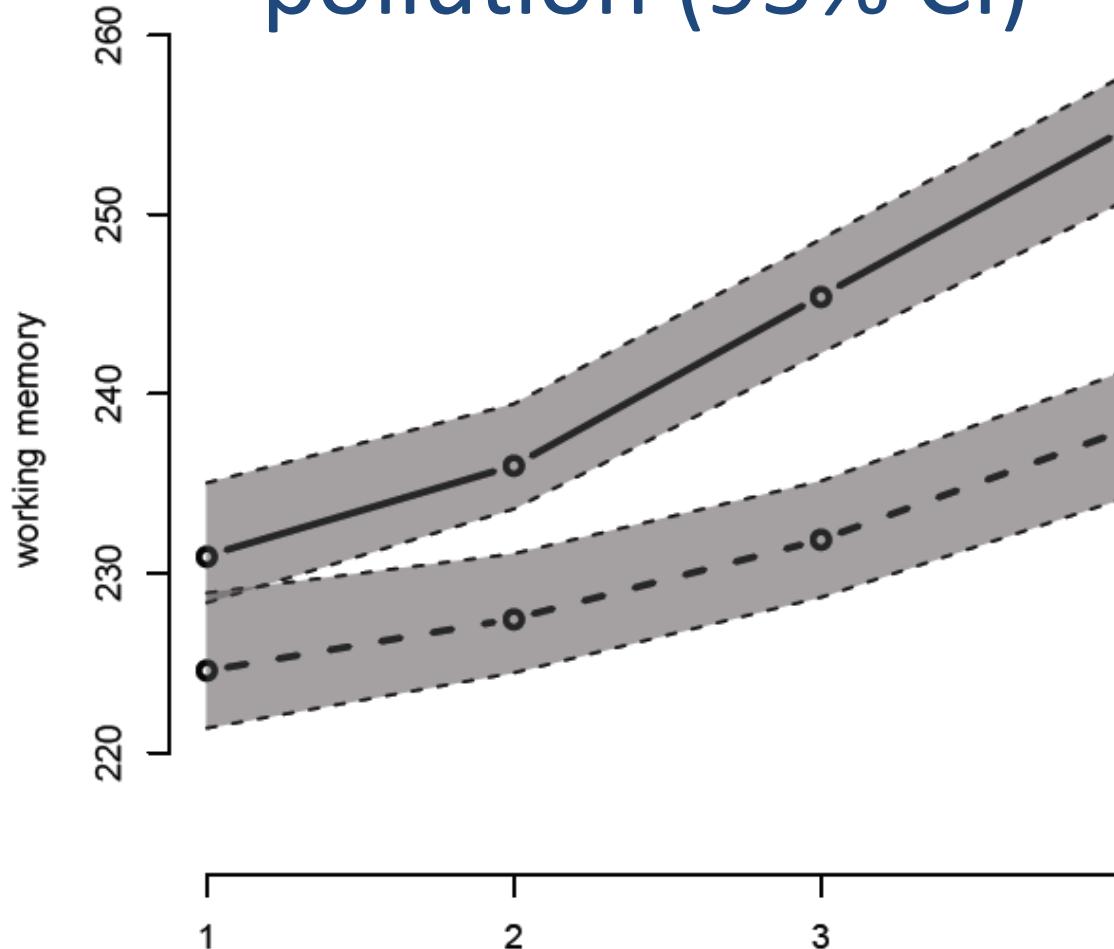


SCHOOL ELEMENTAL CARBON ($\mu\text{g}/\text{m}^3$) IN-OUT BY SEASON



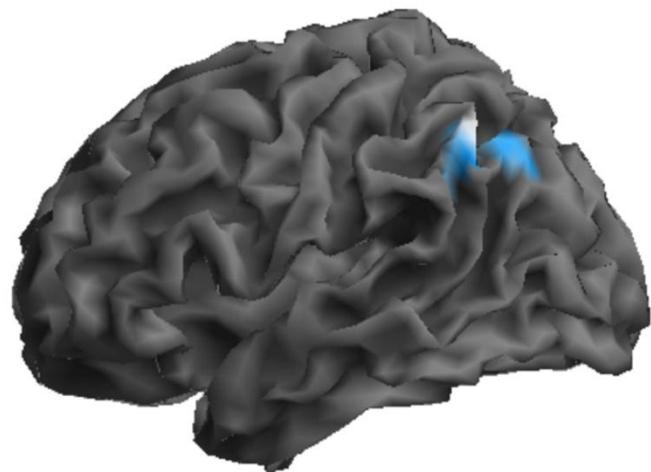
Rivas I, 2014

Working memory yearly development by low (—) and high (- -) traffic pollution (95% CI)

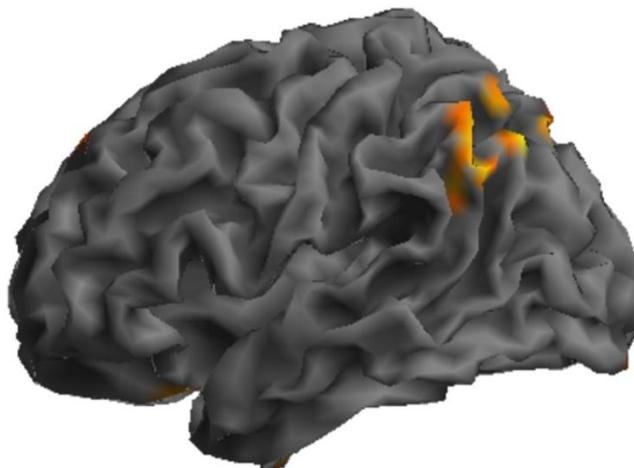


Sunyer et al. Plos
Medicine 2015

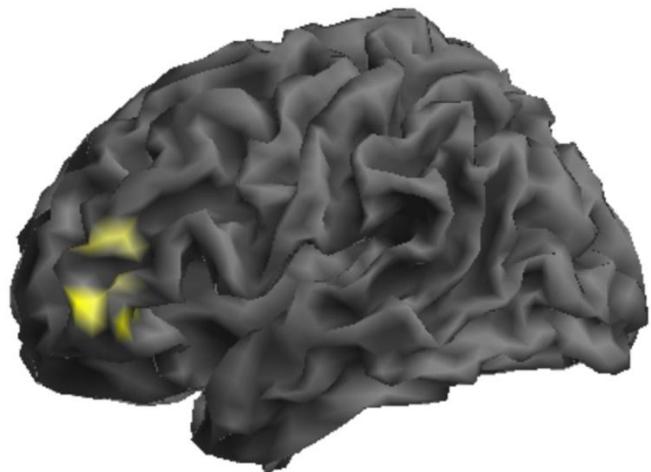
Adjusted for sex, maternal education, residential neighbourhood socio-economic status and school pair; school and subject as nested random effects.



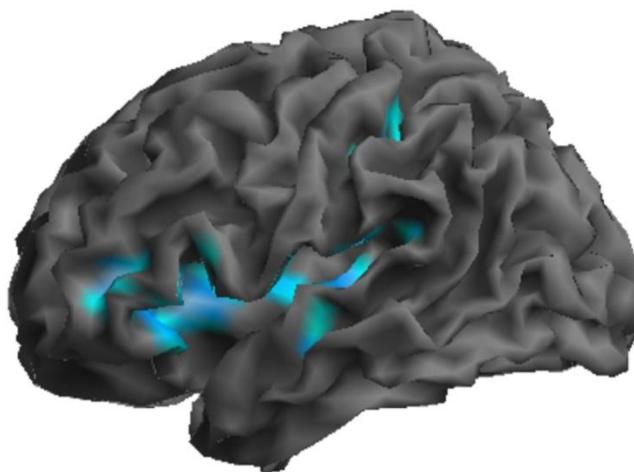
Pollutant-related decrease



Age-related increase



Pollutant-related increase



Age-related decrease

Diagnosis

- Tenim la diagnosi ben feta
- Una ciutat amb l'aire contaminat
- La contaminació s'origina sobretot pel tràfic
- La contaminació originada pel tràfic és un problema de salut de dimensions importants
- Ara toca trobar solucions.

Efectes secundaris del vehicle a motor URBÀ

- Contaminació aire
- Soroll
- Manca exercici físic
- Ocupació de l'espai (verd)

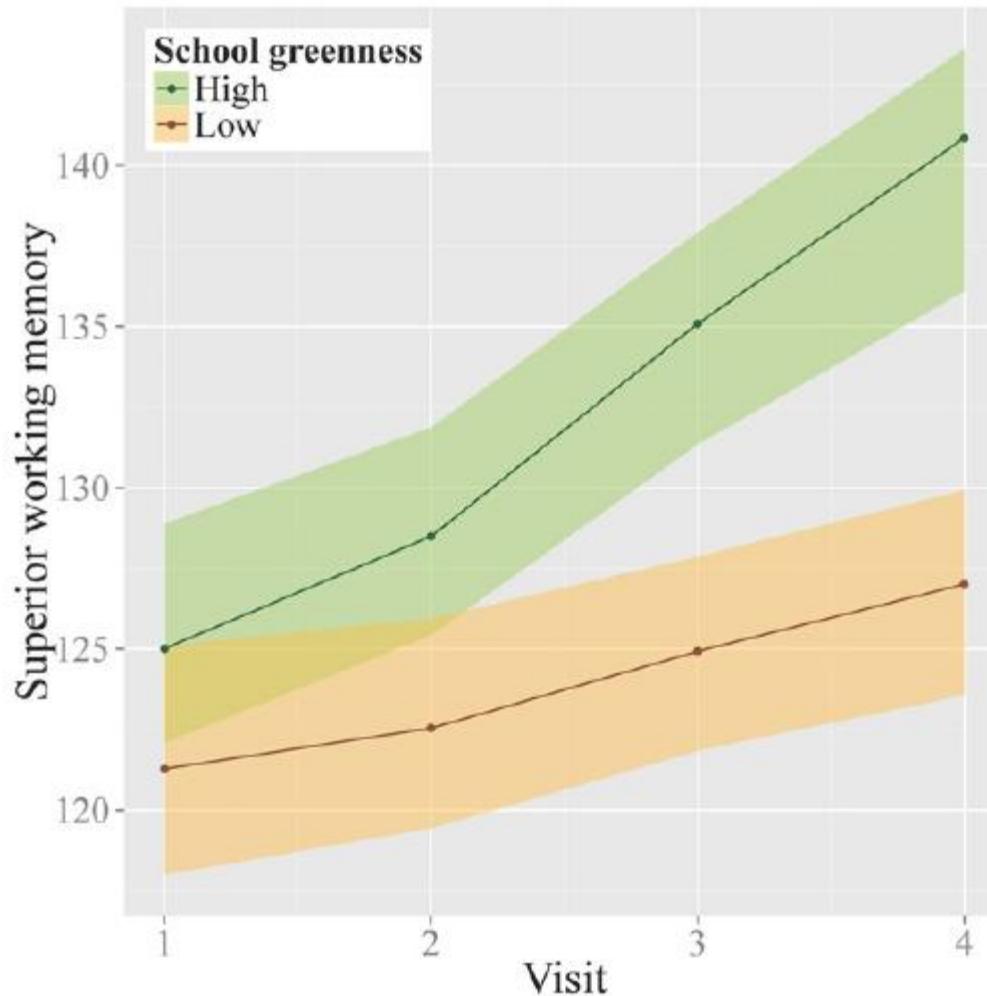
Green Exposure

– School greenness

- Within the school boundaries
- 50m buffer around the school around the school boundaries
- Normalized Difference Vegetation Index (NDVI) derived from a RapidEye image at 5m x 5m resolution



GREEN SPACE AND WORKING



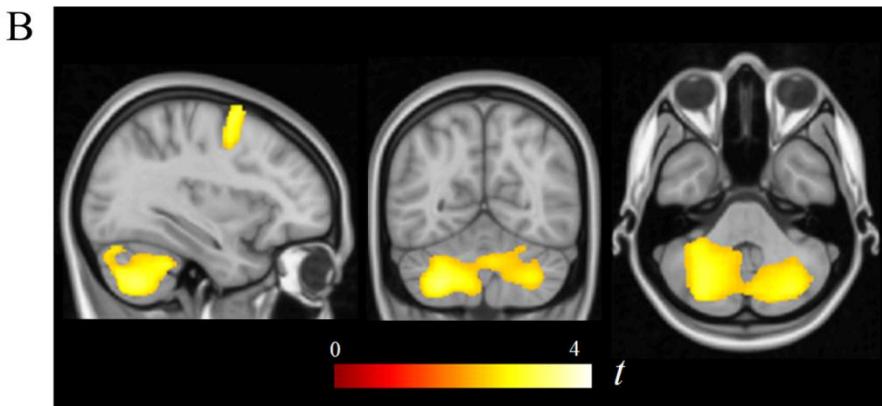
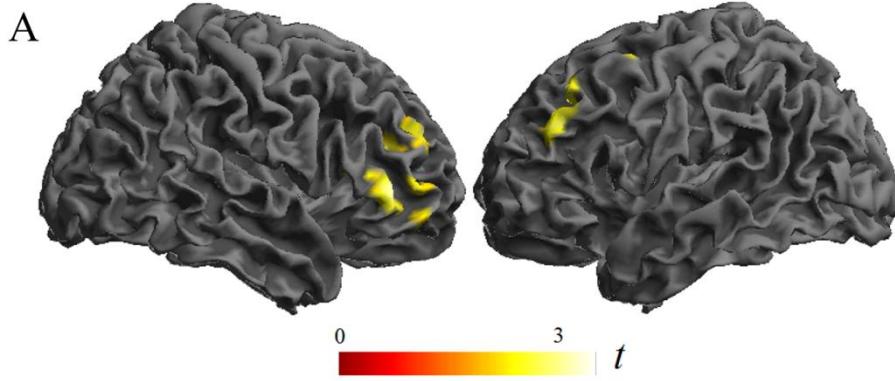
Dadvand et al 2015
PNAS

Fig. 1. Twelve-month progress (with 95% confidence bands) in superior working memory for participants with the first (low greenness) and third (high greenness) tertiles of greenness within the school boundaries.

N=2,593 children, 7-10 yrs

Early life green exposure

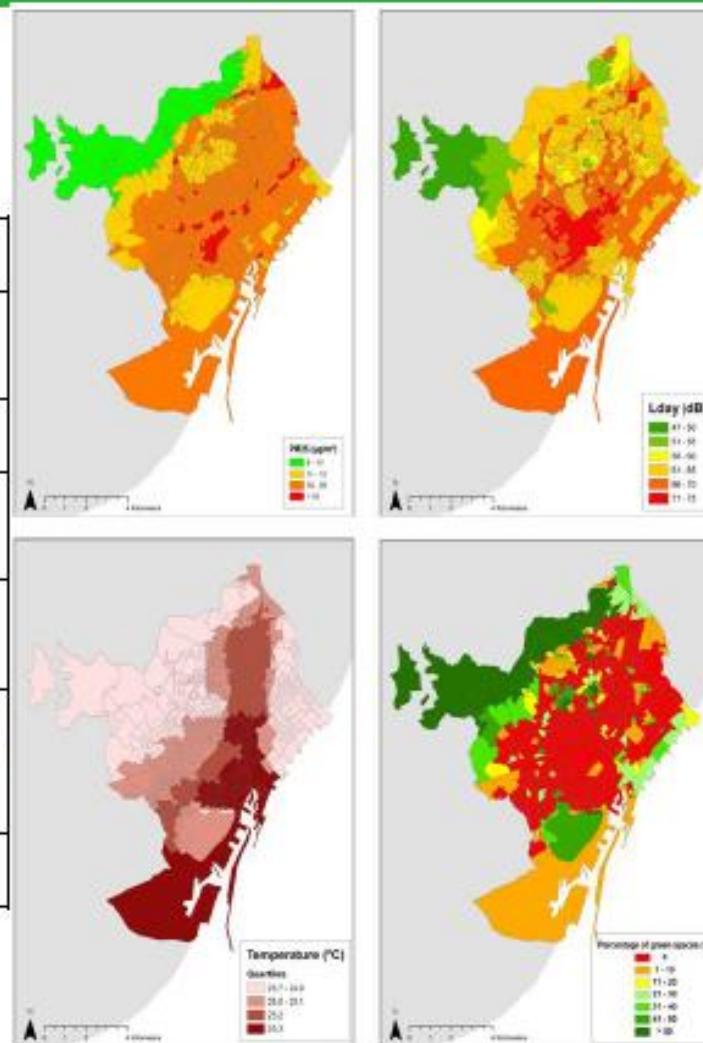
Increased **grey matter** volume in the left and right prefrontal cortex and left premotor cortex (A) and increased **white matter volume** in right prefrontal region, left premotor region, and both cerebellar hemispheres (B).



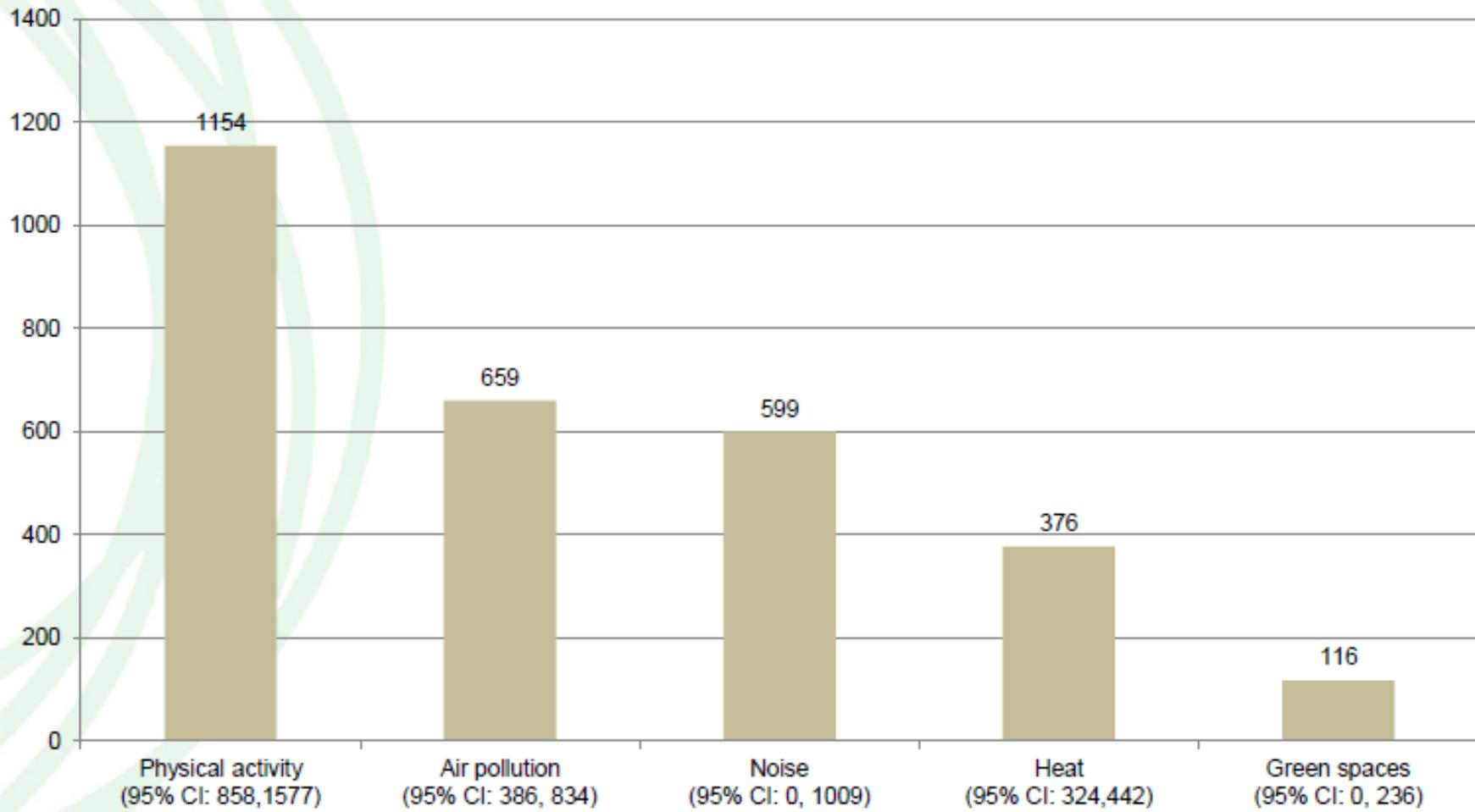
HIA OF CITIES: BARCELONA

What if we meet international guidelines?

Exposure	Recommendation ^a	Current exposure ^b
Physical activity		
Adults 18-64 years	600 MET minutes/week	77.7 MET minutes/week
Adults ≥ 65 years	450 MET minutes/week	36.7 MET minutes/week
Air pollution		
Annual mean PM _{2.5}	10 $\mu\text{g}/\text{m}^3$	16.6 $\mu\text{g}/\text{m}^3$
Noise		
Day time (7:00-23:00hr) outdoor activity noise ($L_{Aeq,15\text{hr}}$)	55 dB(A)	65.1dB(A)
Heat	Changes to urban plan may provide cooling of 4 °C	>21.8 °C on 101 days ('minimum mortality percentile')
Green spaces	Access to green space ≥ 0.5 ha within 300 m	31.1% of residents without access to green space ≥ 0.5 ha within 300 m
Total		



PREMATURE MORTALITY IN BARCELONA



Total number of premature deaths = 2904 (1568, 4098), 20% of total deaths

Life expectancy = 360 (219, 493) days, Total cost 9.3 (4.9, 13.2) billion euros

Muller et al. EHP 2016

Intervenció

- Vehicle urbà:
 - Bicicleta (elèctrica)
- Compartir el transport
 - Més i millor transport públic
 - ‘net’
- Transport mercaderies ‘net’
- Reduir vehicles privats
 - Corredors verds
 - Carrils bici
 - Super-illes
- **Nou model: Cars free cities**



Gràcies

jsunyer@creal.cat



Valors

- El canvi no només perquè tenim la diagnosis.
- La salut i el benestar han passat a formar part dels valors actuals.
- Al costat de la productivitat, comoditat, privacitat, llibertat que dona el cotxe.
- La llibertat té límits quan afecta la salut pública (tabac).
- Tensió entre:
 - temps-llibertat-privacitat-comoditat
 - contaminació-stress-salut-exercici-contacte social.
- Dilema individual de cada un dels habitants té un impacte col·lectiu (incorporar la salut i el benestar en els seus models i les seves equacions).