

# Cognitive development and neurologic disorders

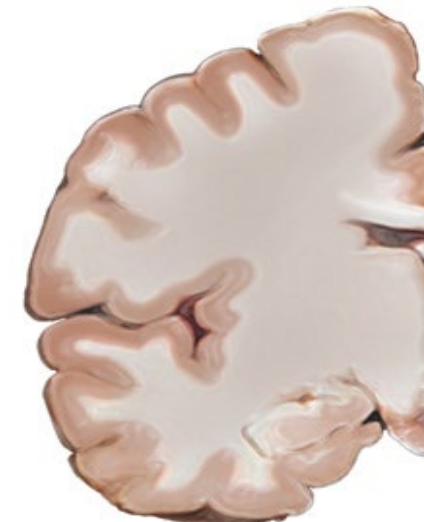
Barbara Hoffmann, Heinrich-Heine-University of Düsseldorf,  
ERS Advocacy Chair Elect

Clean Air in Europe for All  
Brussels, May 24, 2023

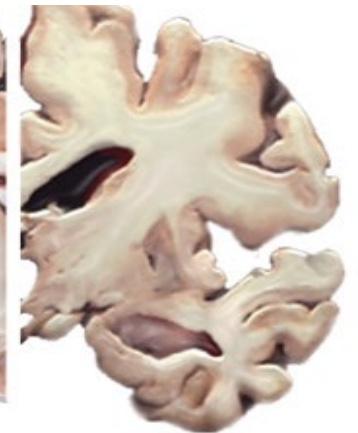


**CLEAN AIR IN EUROPE FOR ALL**

**Healthy  
brain**

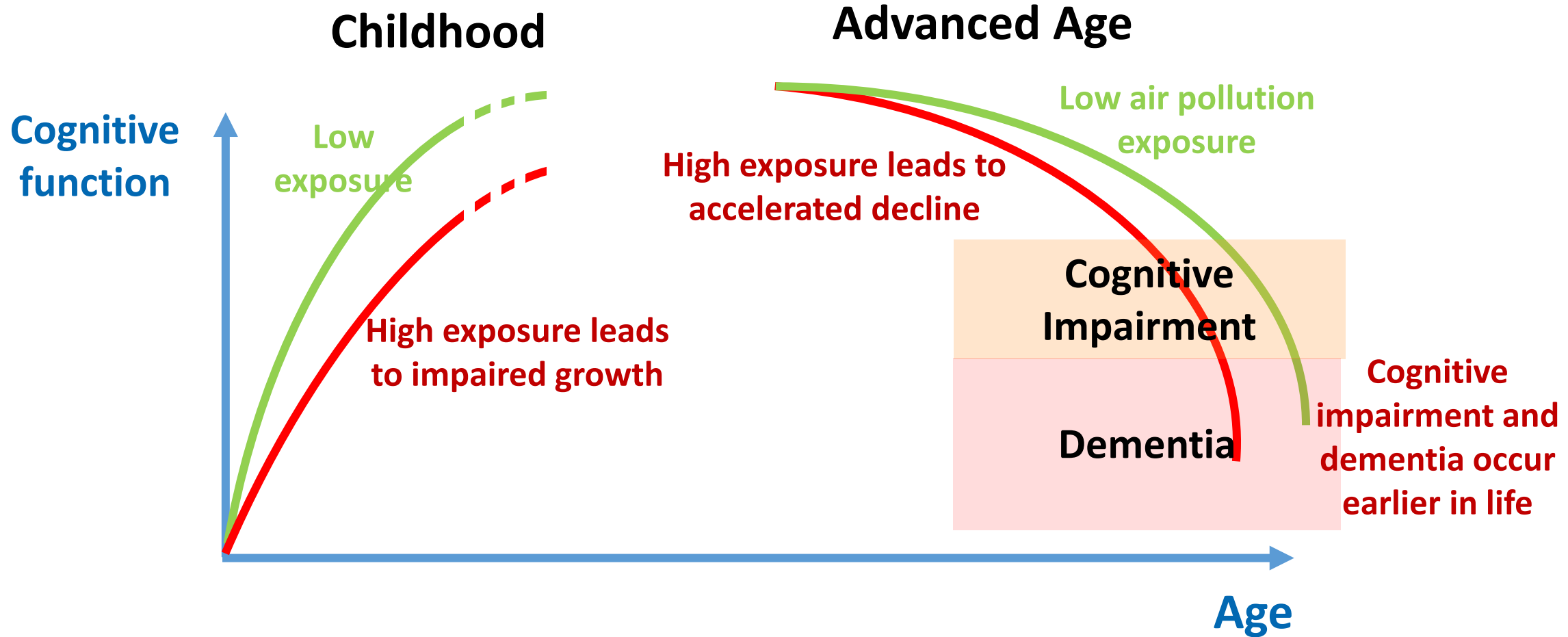


**Brain of  
Alzheimer  
patient**



# Air pollution and brain function

Hypotheses

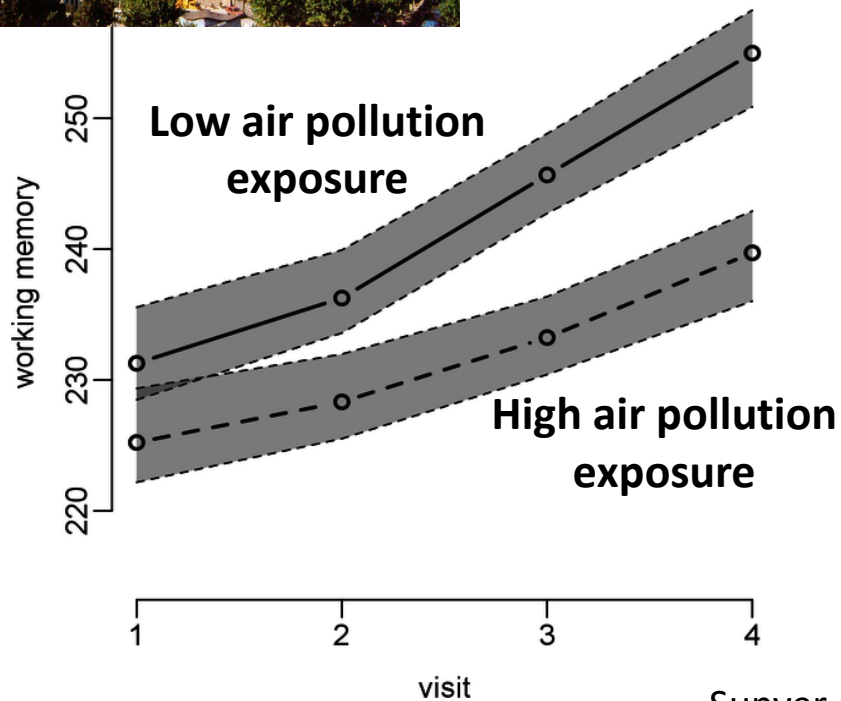


# Cognitive development and brain structure in children

## Barcelona and Rotterdam



Lower cognitive growth among highly exposed



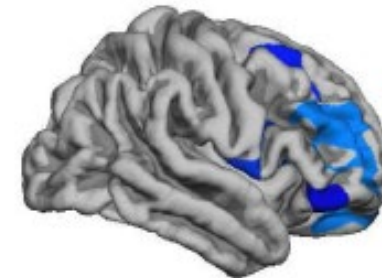
Sunyer et al. Plos Med 2015



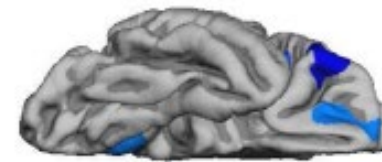
- Decrease in gray matter / cortical thickness
- Changes in white matter structure (wiring)

### A Fine particles exposure

Right hemisphere – lateral view

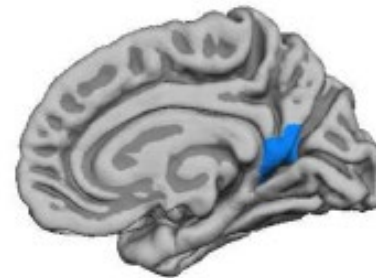


Right hemisphere – inferior view

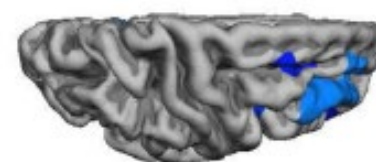


Left hemisphere – lateral view

Right hemisphere – medial view



Right hemisphere – superior view



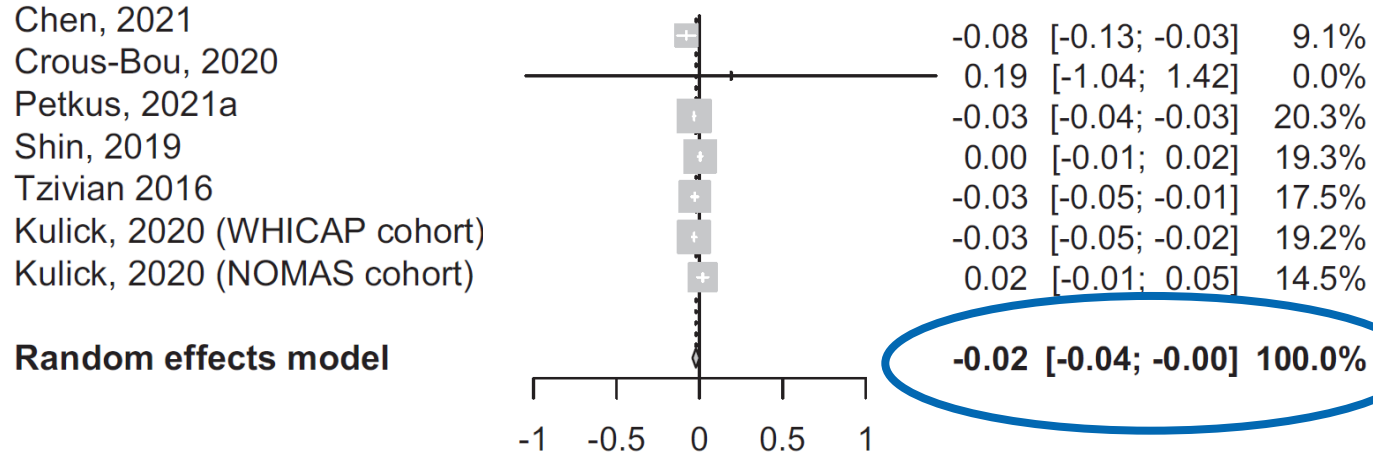
Left hemisphere – medial view

Guxens et al. BPS 2018

# Impact on the aging brain Meta-analyses

Thompson et al, 2023

## Study



**Air pollution is related to accelerated cognitive decline**

**Air pollution is related to incidence of dementia**

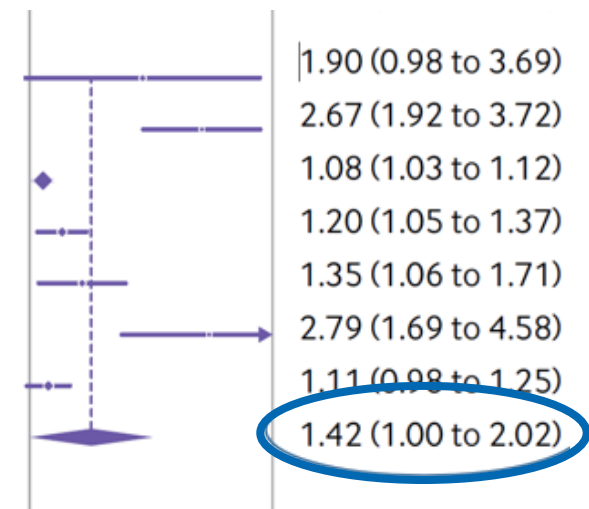
## Active

Astrom 2021	1806
Grande 2020	2927
Mortamais 2021	7066
Semmens 2022	2564
Shaffer 2021	4166
Sullivan 2021	1572
Wang 2022	2239

Test for heterogeneity:  $\tau^2=0.04$ ,  $I^2=87.69\%$ ;  $H^2=8.12$

Test for  $\theta_i=\theta_j$ :  $Q(6)=48.73$ ,  $P=0.00$

Wilker et al, BMJ, 2022



# Conclusions

- Air pollution impairs cognitive growth in babies and children
- Air pollution accelerates cognitive decline and development of dementia in the aging brain

