

# COULD EXPOSURE TO AIR POLLUTION INFLUENCE DEMENTIA RISK?

The state of the science

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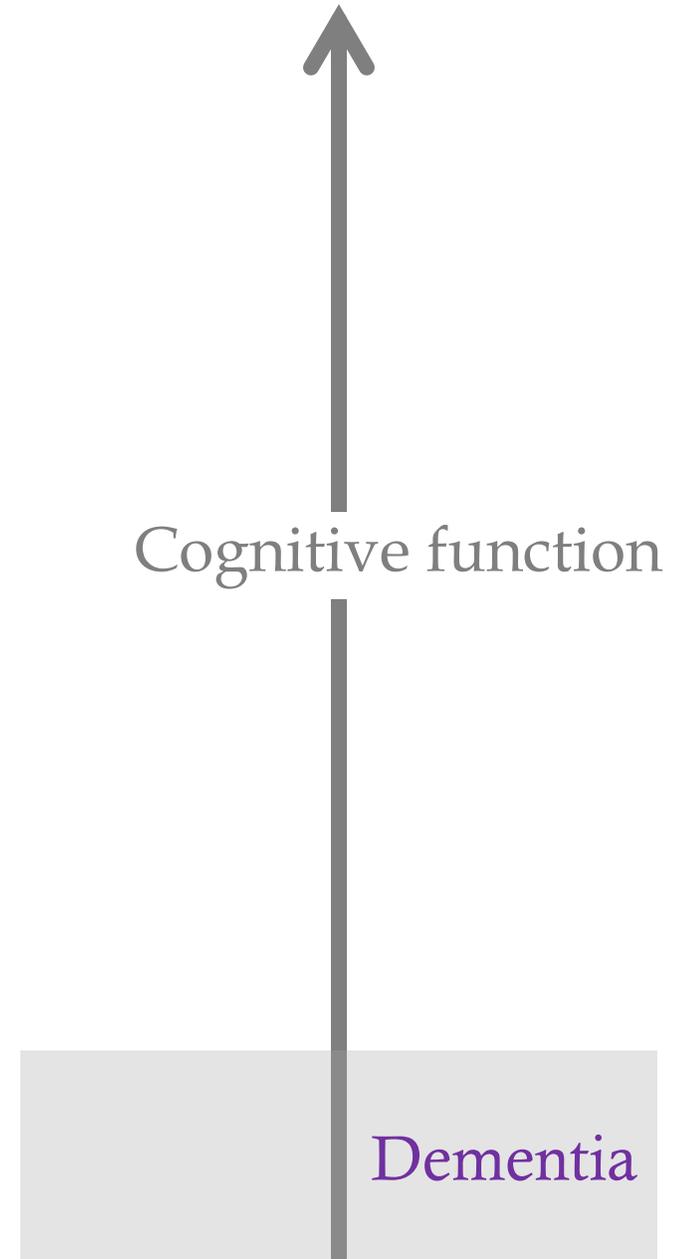
BOSTON  
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# What we mean by “dementia”

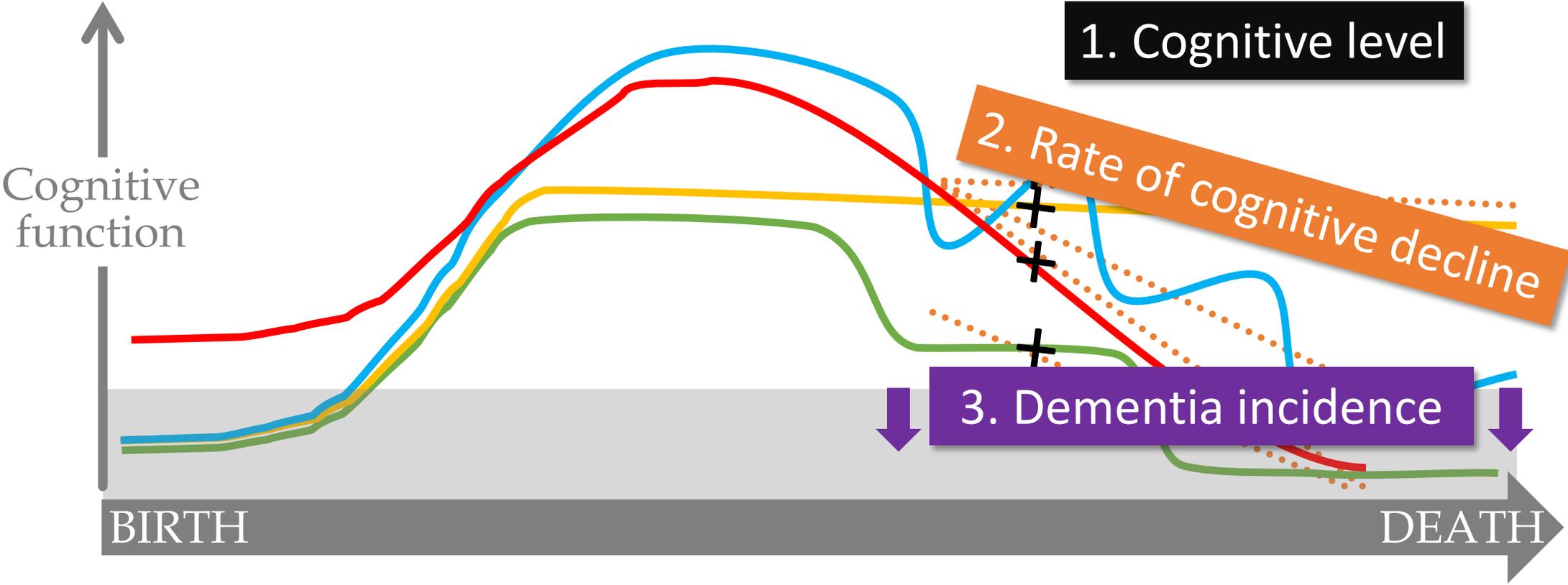
## Deficits

in **memory**, language, problem-solving  
and other **cognitive abilities**

that affect a person's **ability to  
perform everyday activities.**

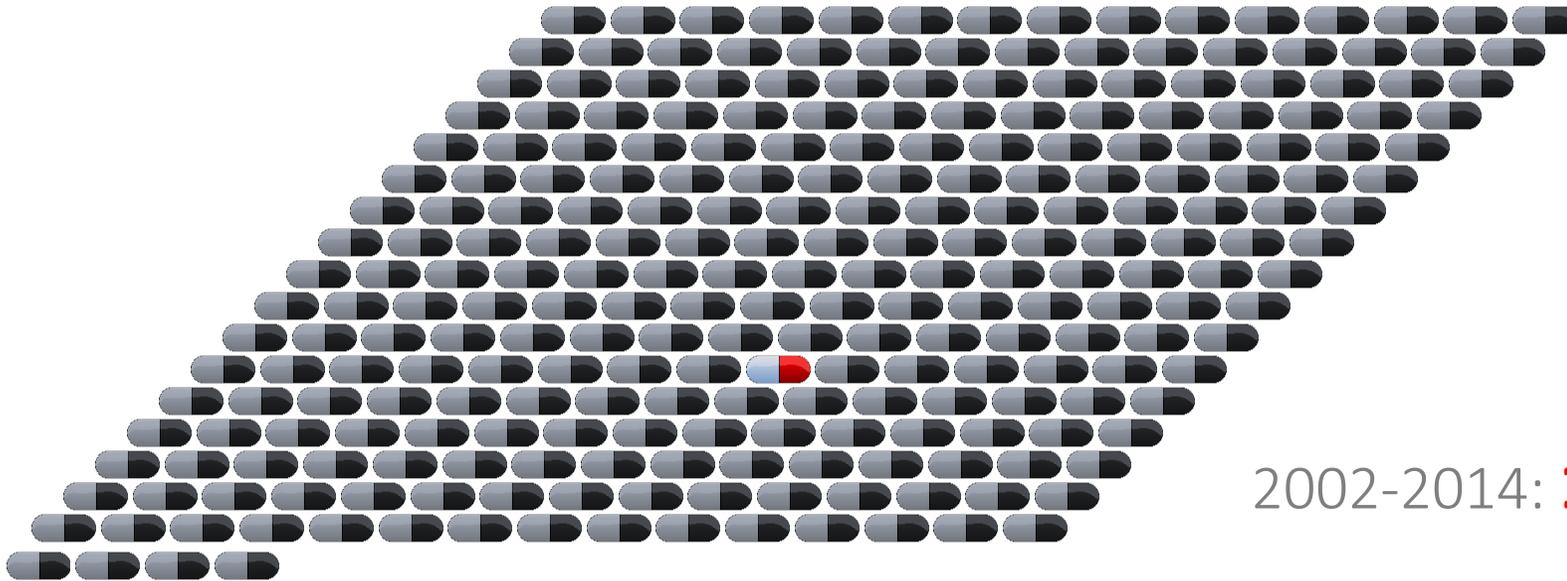


# Cognitive function, cognitive decline, and **dementia**



Adapted from M. Maria Glymour

# No drug has been shown to alter the clinical course of Alzheimer's dementia

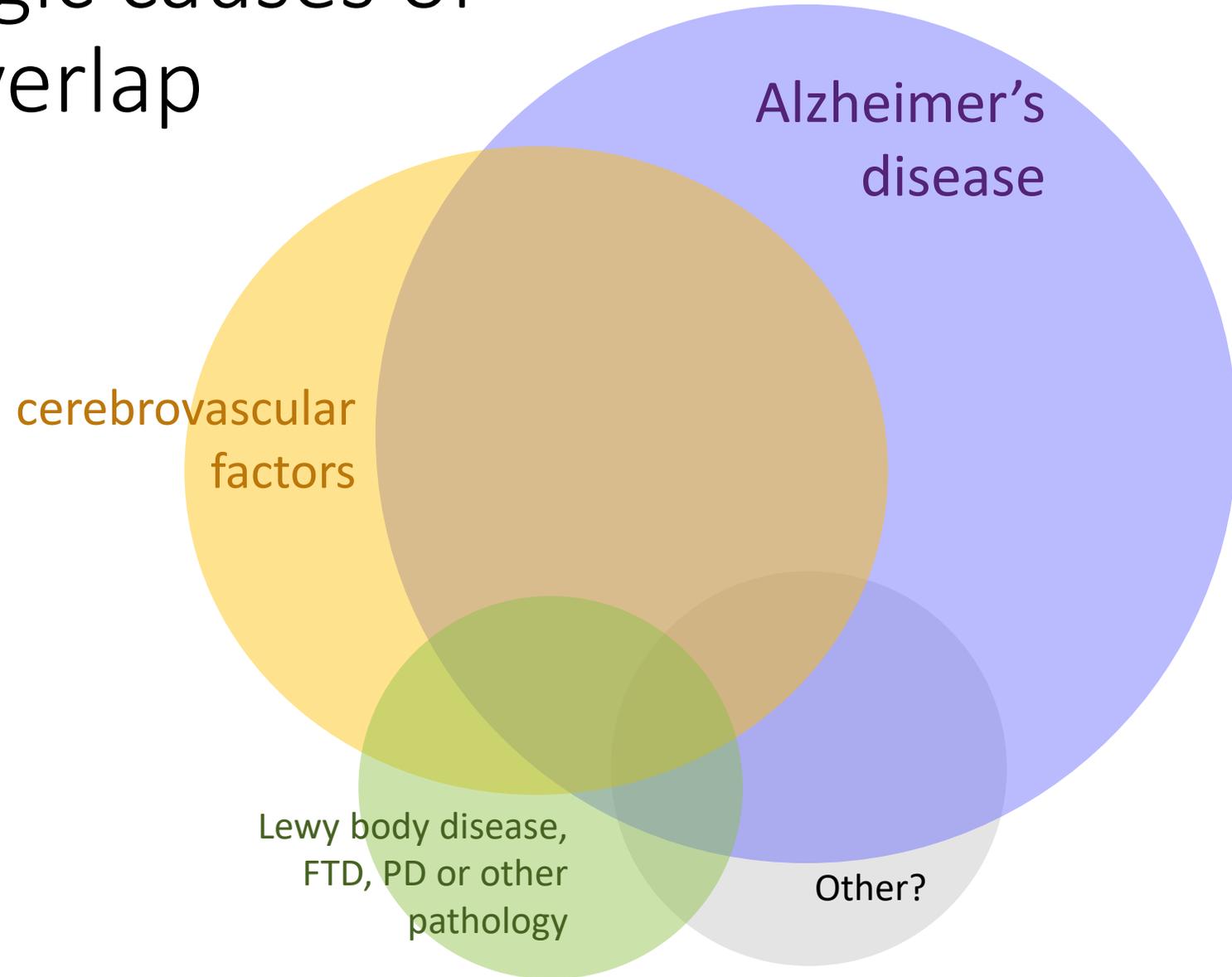


2002-2014: **1** new FDA-approved medication

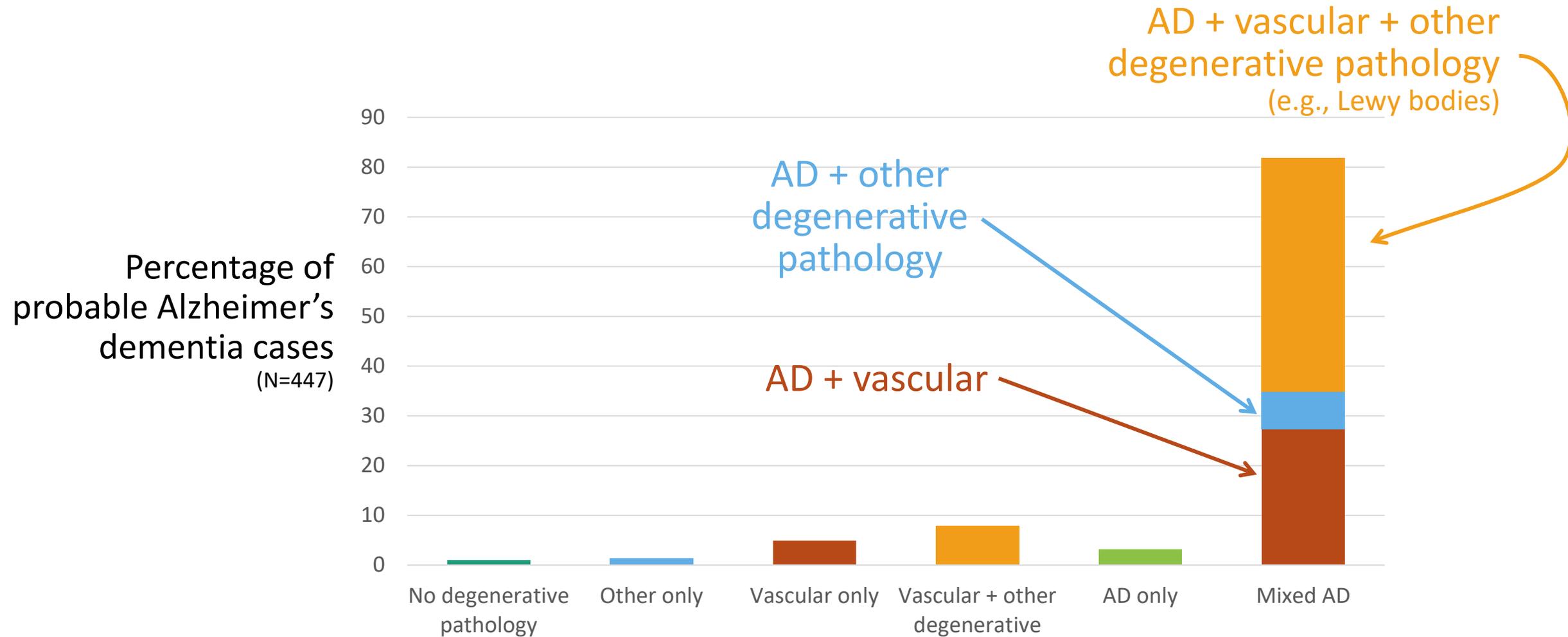
Cummings, et al. *Alzheimer's Res Therapy*. 2014

**Anti-amyloid agents: reduce amyloid, but do not markedly stall cognitive decline**

# The neuropathologic causes of dementia often overlap

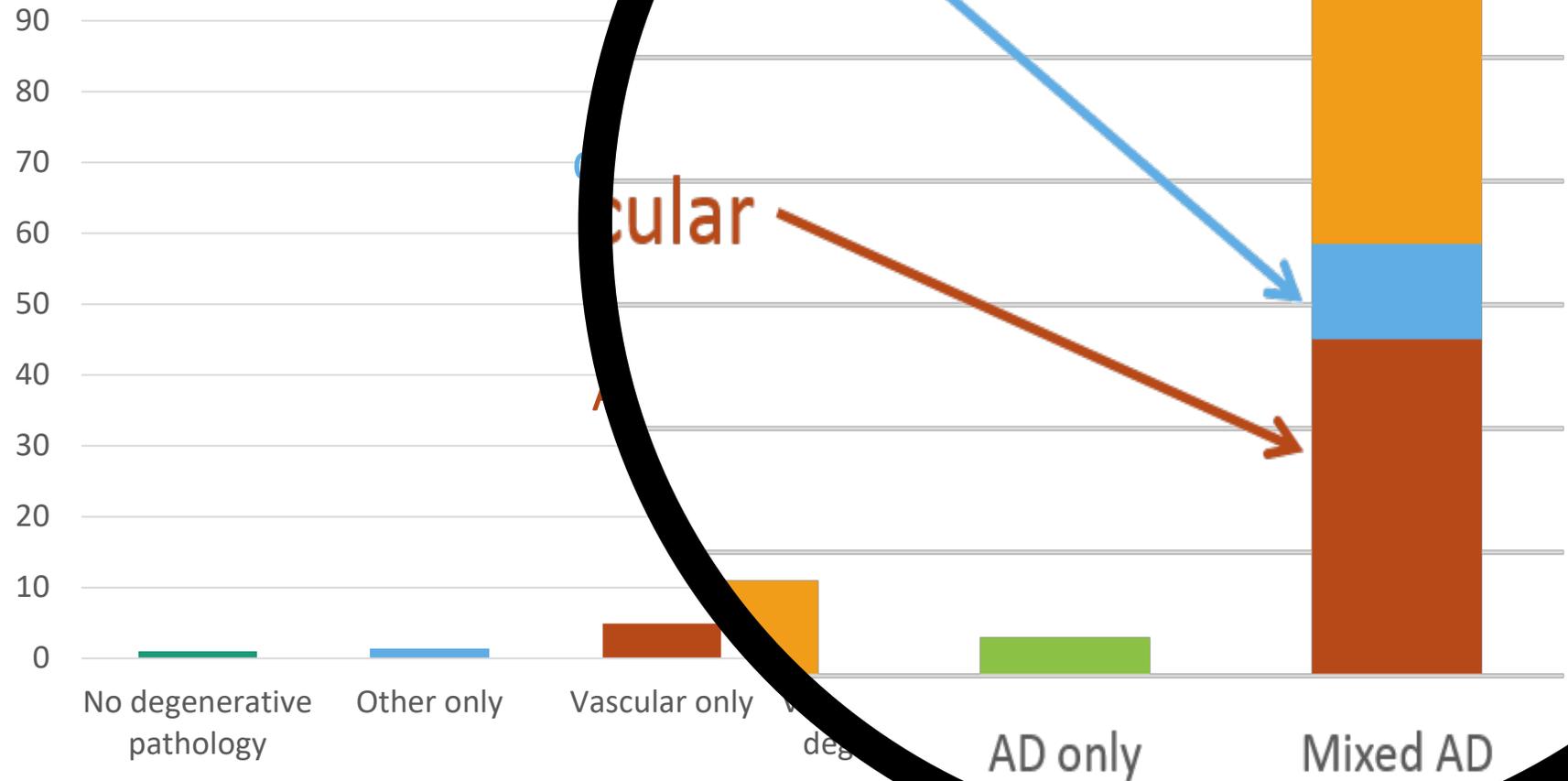


# Most Alzheimer's dementia occurs with other pathologies



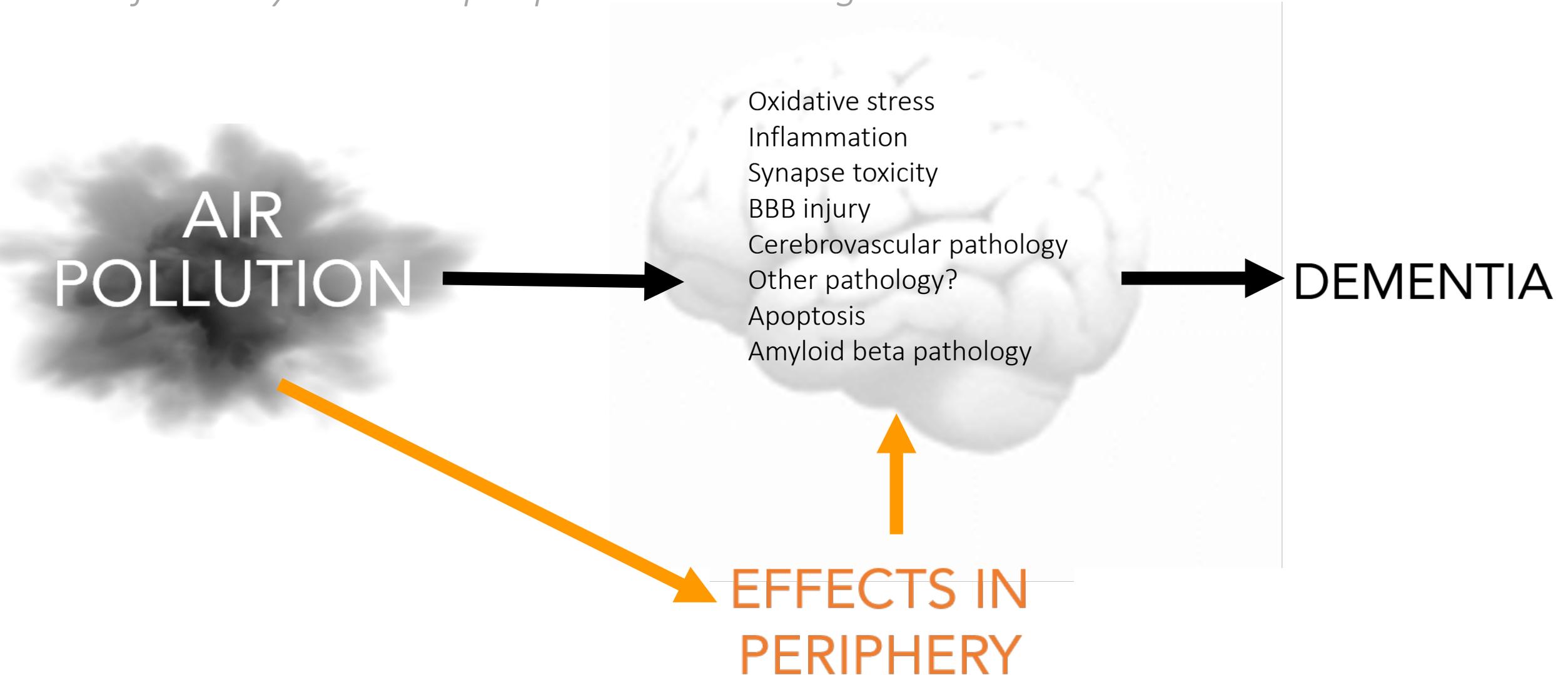
# Most Alzheimer's dementia occurs w

Percentage of probable Alzheimer's dementia cases (N=447)



# Potential **pleiotropy**

*not just amyloid beta plaques and tau tangles*



# State of the science

# UPDATE TO A SYSTEMATIC REVIEW

of published **epidemiologic** research  
on the relation of **air pollution** exposure  
with **dementia, its precursors and its correlates**

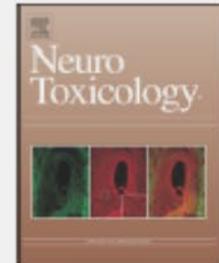


ELSEVIER

Contents lists available at [ScienceDirect](#)

NeuroToxicology

*NeuroToxicology* 56 (2016) 235–253



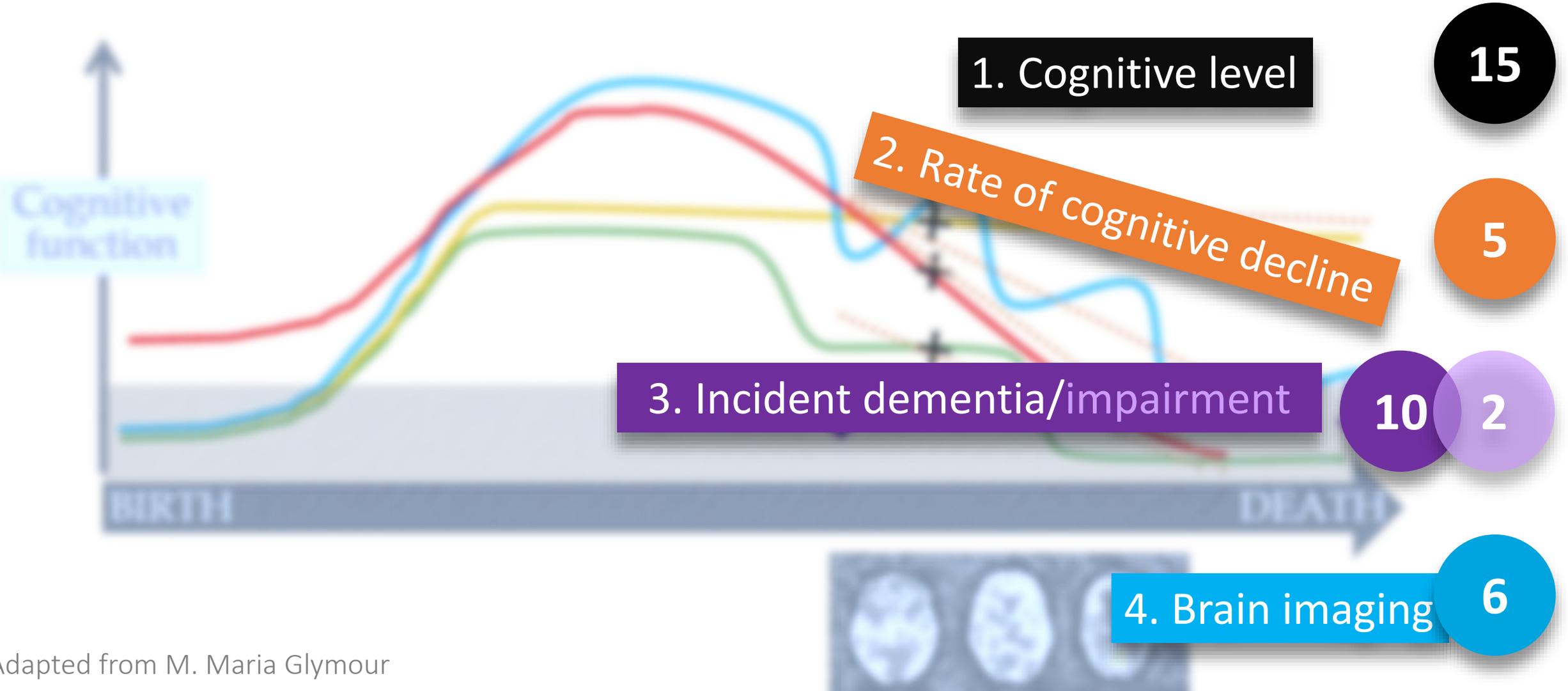
Full length article

Exposure to air pollution as a potential contributor to cognitive function, cognitive decline, brain imaging, and dementia: A systematic review of epidemiologic research



Melinda C. Power<sup>a,b</sup>, Sara D. Adar<sup>c</sup>, Jeff D. Yanosky<sup>d</sup>, Jennifer Weuve, MPH, ScD<sup>e,f,\*</sup>

# Studies identified

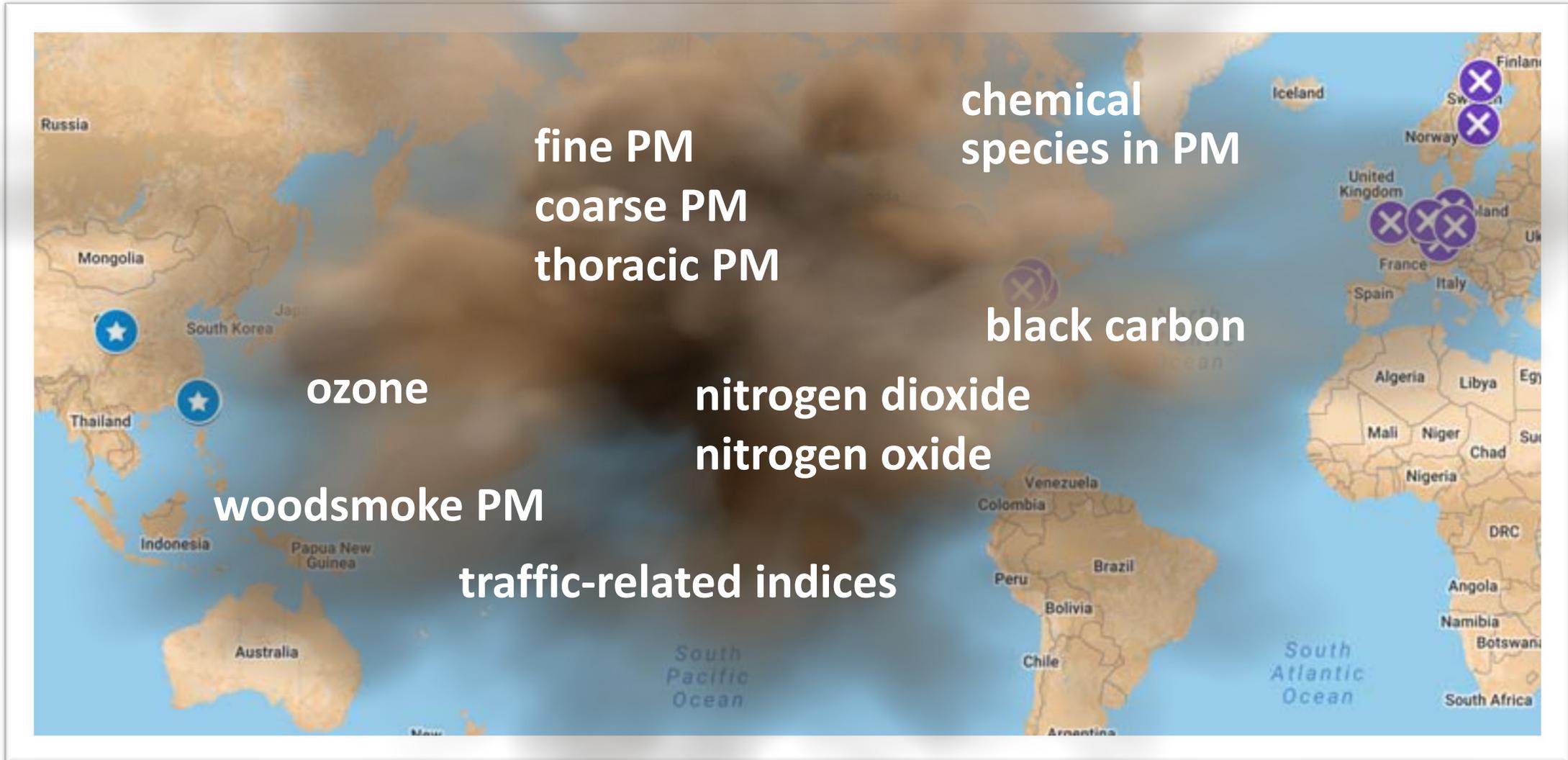


Adapted from M. Maria Glymour

# Study locations



# Pollutants investigated



# Summary of **findings**

Most studies reported an **adverse association** of at least one pollutant exposure with a dementia-related outcome.

**Most consistent** results involve:

PM<sub>2.5</sub>  
NO<sub>2</sub> NO<sub>x</sub>

Cognitive level  
Dementia  
Infarcts on MRI

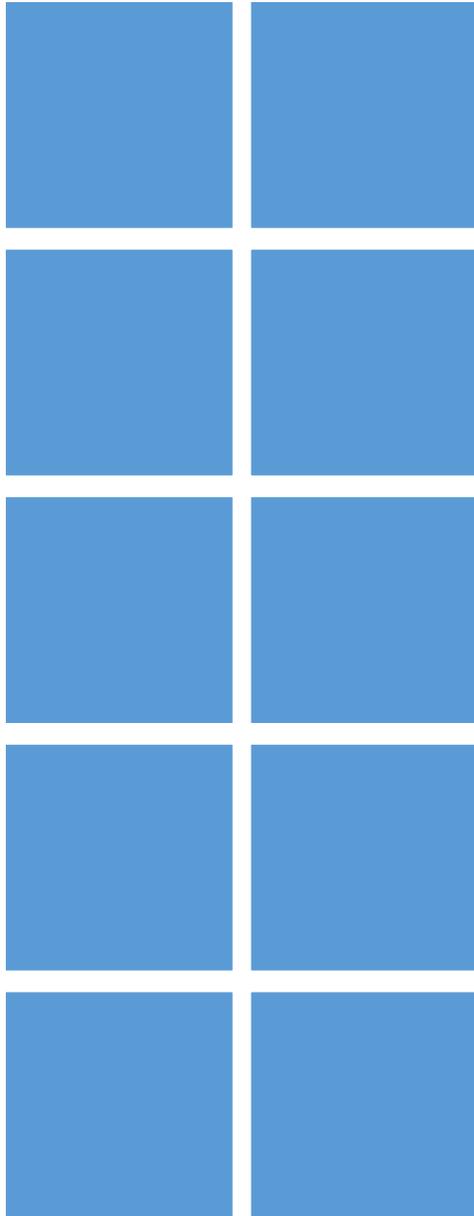
**Mixed/sparse** results involve:

PM<sub>10</sub> PM<sub>coarse</sub>  
Ozone, Sources

Cognitive decline  
Other MRI outcomes

Is this

good enough?



Of the **10 dementia studies**,

- **6** relied solely on **claims/medical records** to identify cases and non-cases.
- **2** relied **partially** on these data sources

# Audience quiz

What is the approximate positive predictive value of medical records and insurance claims for classifying people with dementia?

(a) 95%

(b) 83%

(c) 75%

(d) 64%

(e) 56%

Wait, what? Surely it's better in [\[insert non-US country\]](#).

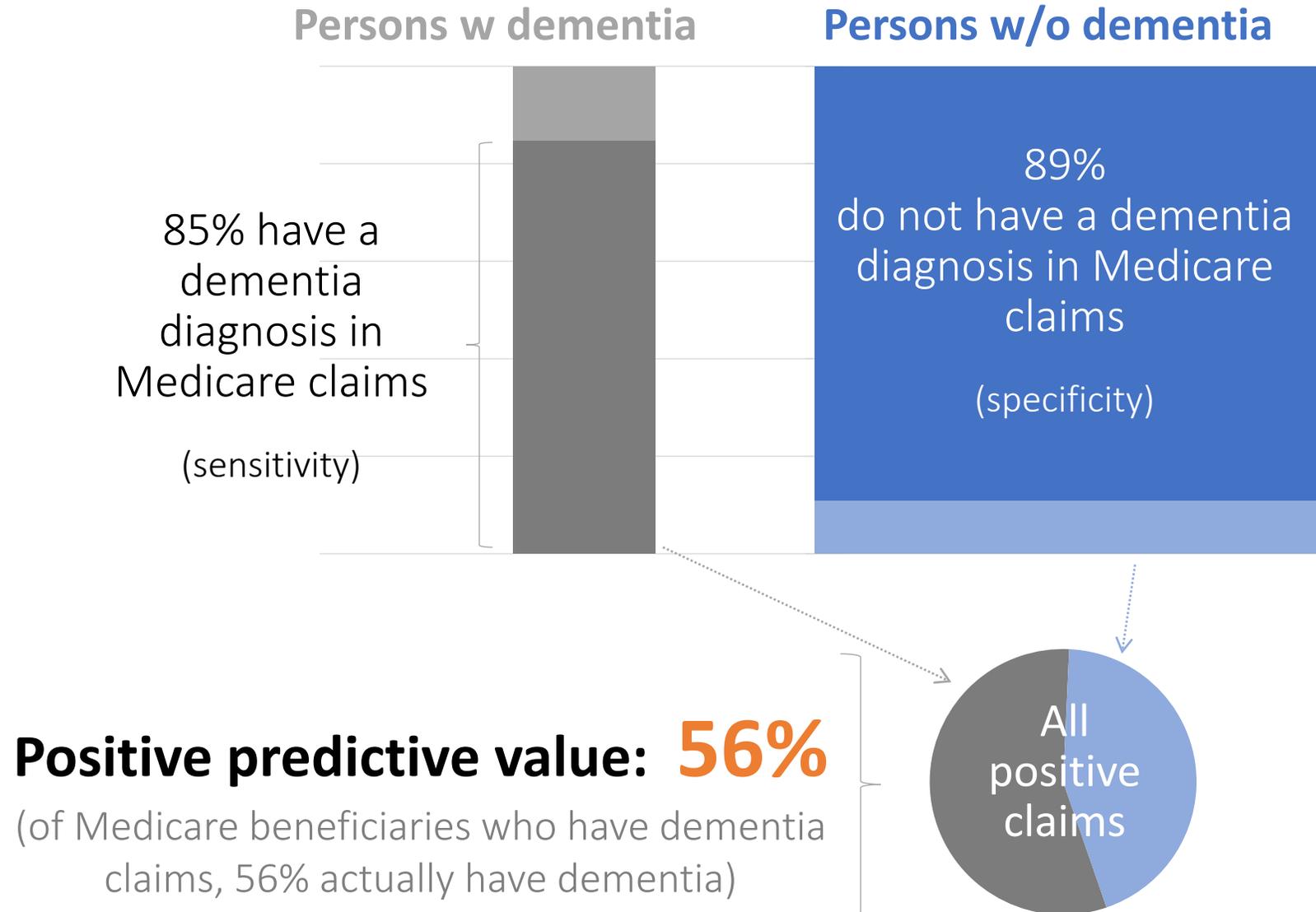
(a) It is not.

(b) Nope.

(c) Even worse for dementia “types.”

(d) All of these.

# Misclassification: Dementia diagnoses via “passive surveillance”

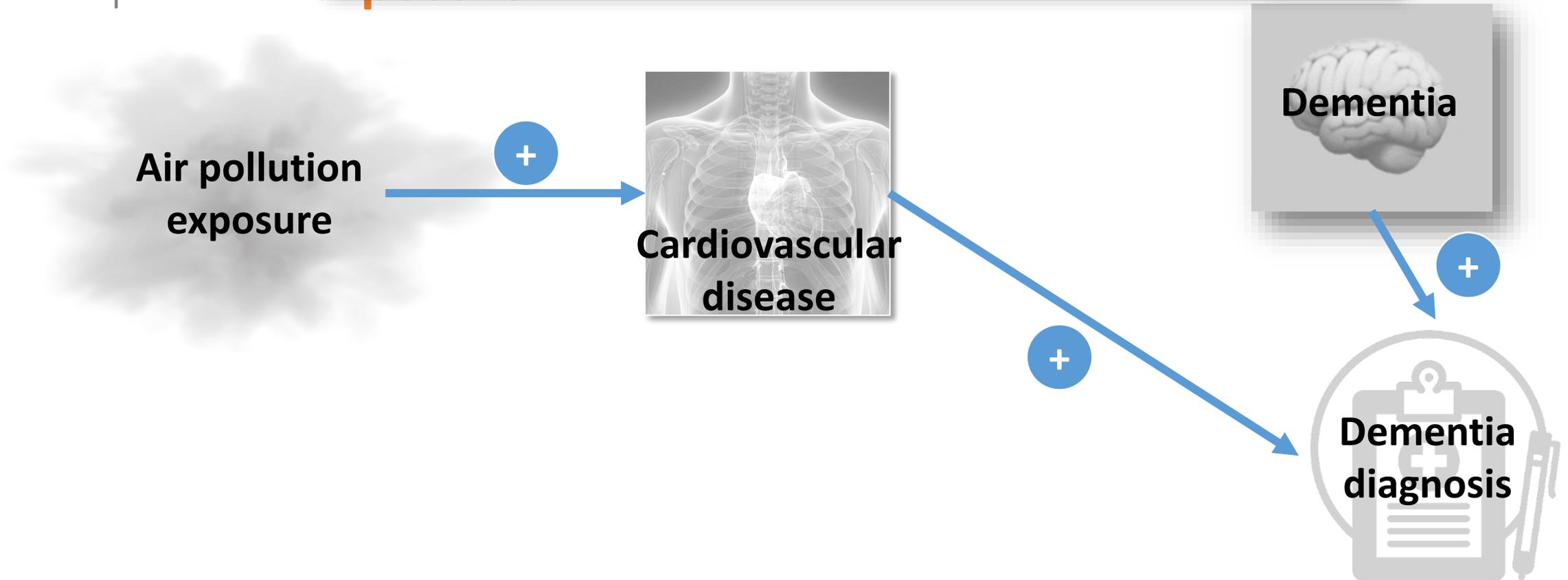


# UPSHOT?

Misclassification

**overestimation** of air pollution's

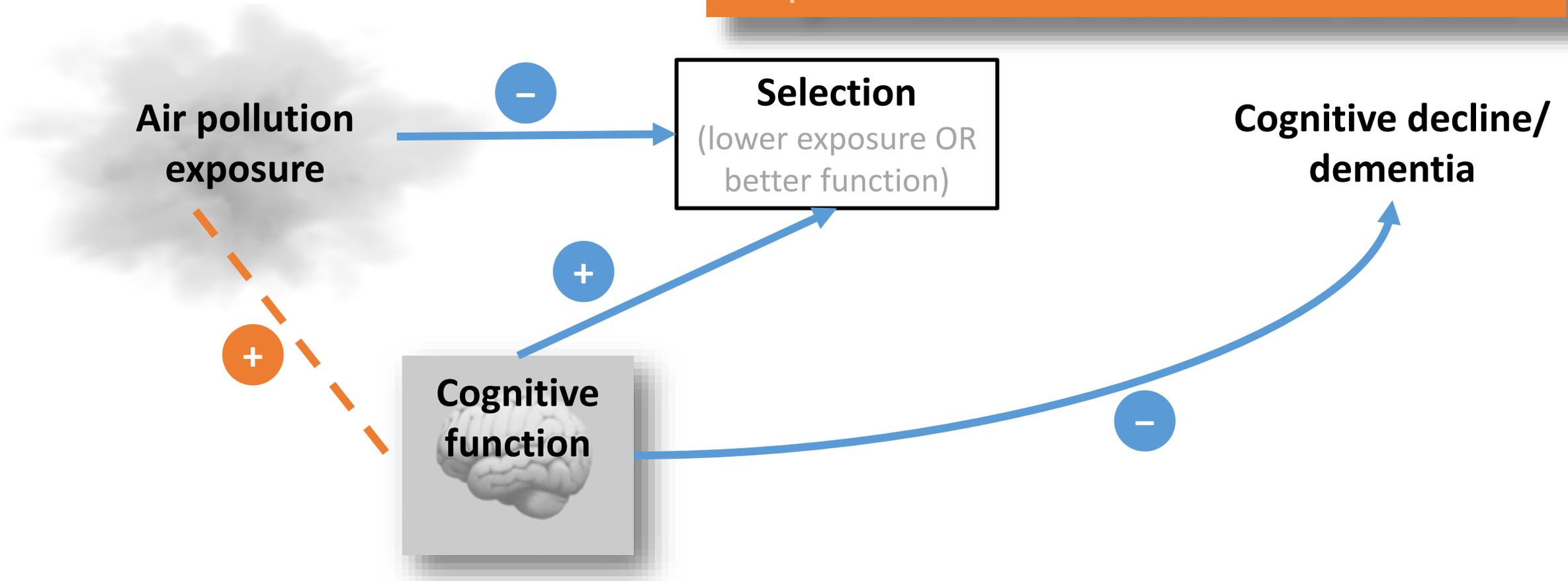
CONCERN: **Minimal** adverse effect on dementia **on**  
air pollution **exposure**.



**Selection bias:** e.g., health

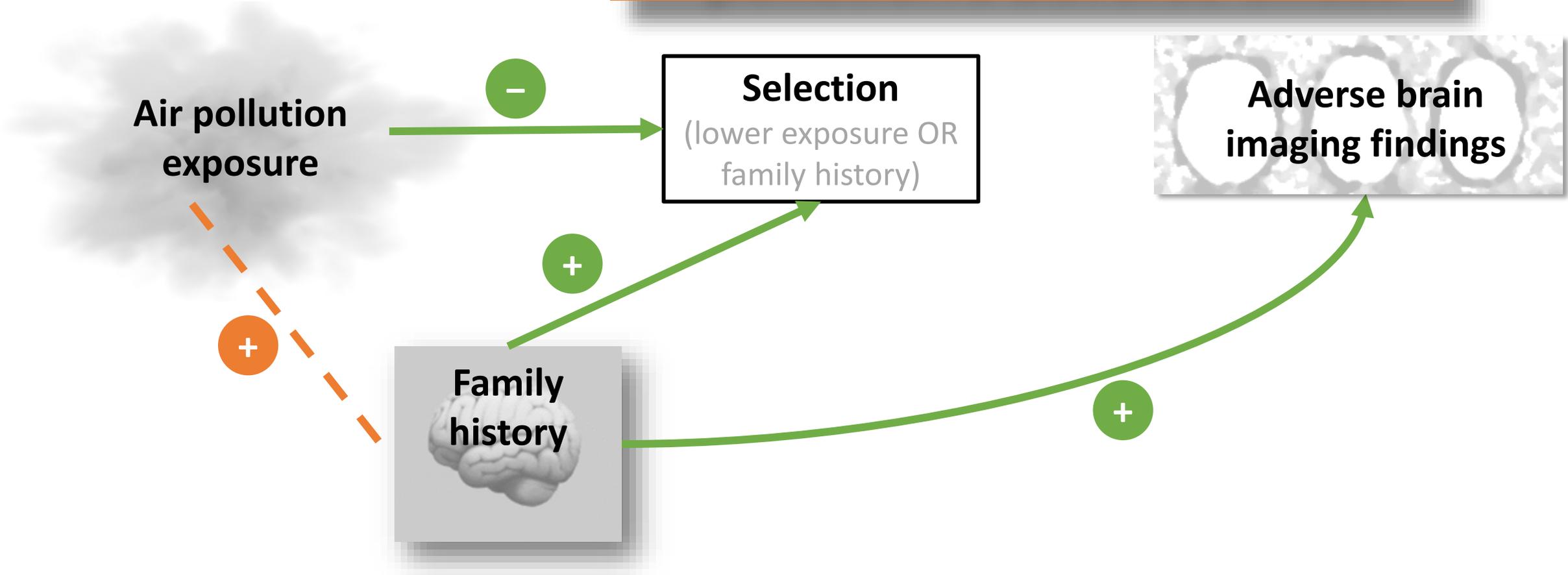
UPSHOT?

**underestimation** of air pollution's adverse effect

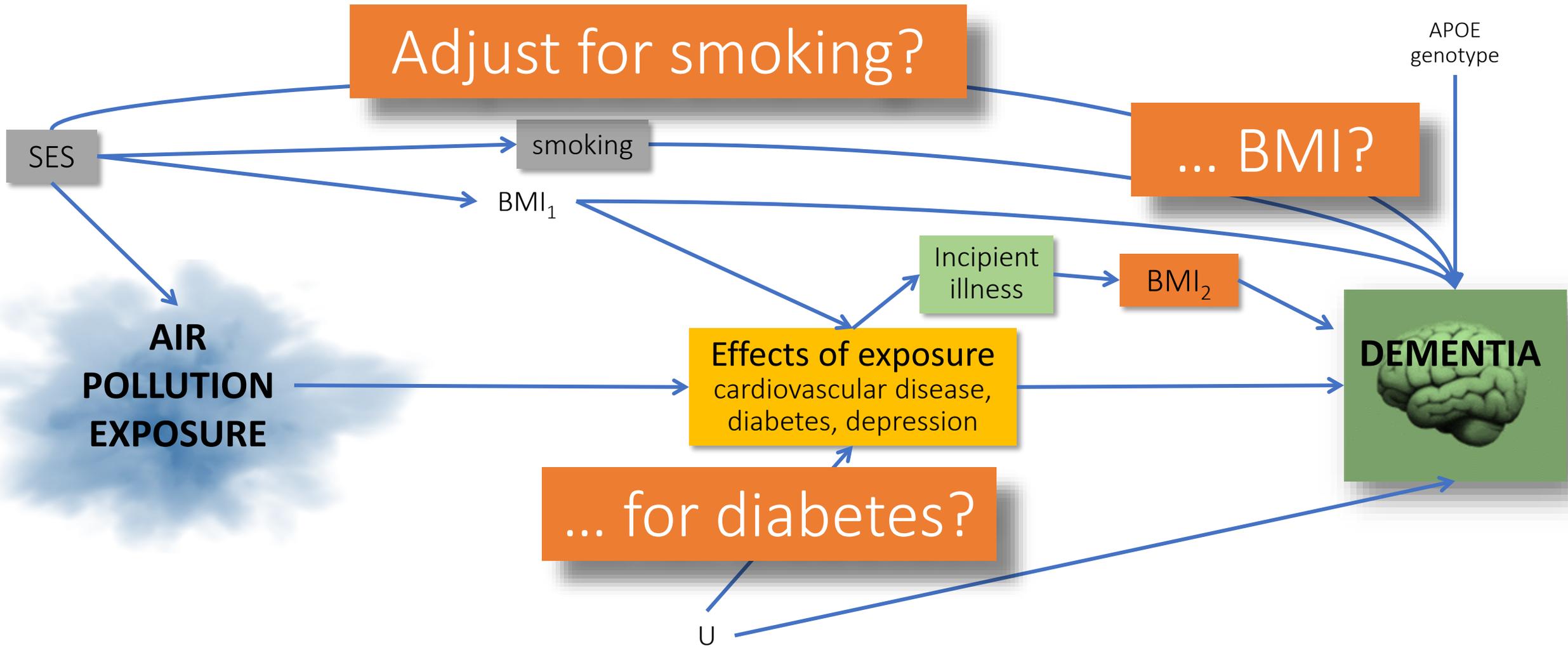


**Selection bias:** e.g., high-risk volunteers

UPSHOT?  
**overestimation** of air pollution's adverse effect



# Attention to mechanism: to **make informed decisions about adjustment**



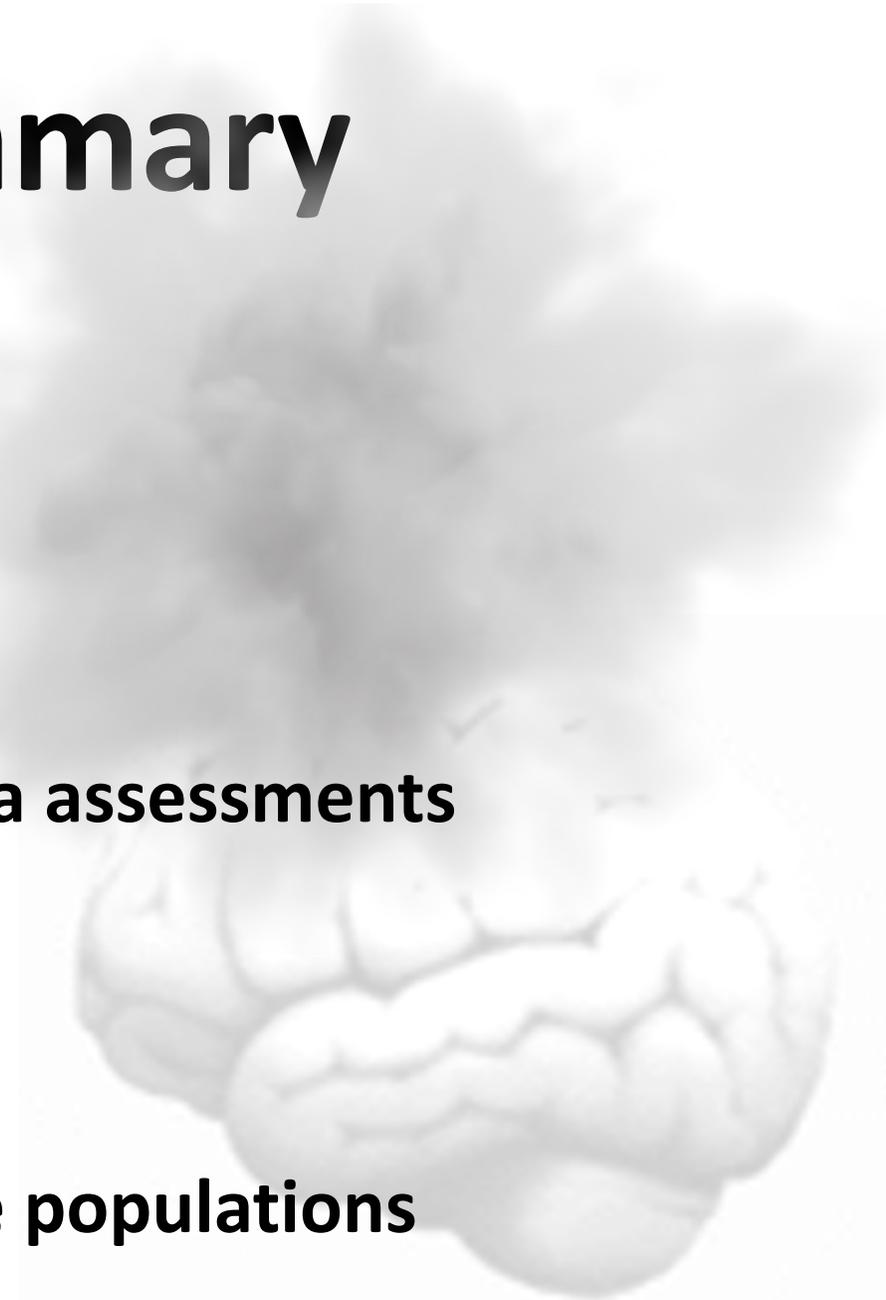
# State of the science: **summary**

*Suggestion of **adverse association***

Method deployed have improved, but ...

Needs:

- Studies using **uniform, standardized dementia assessments**
- Attention to **misclassification, selection bias**
- Realistic **time scales**
- Adequate **exposure contrasts**
- Involvement of **researcher disciplines, diverse populations**



# ACKNOWLEDGMENTS

- Sara **Adar**
  - Erin **Bennett**
  - Kan **Gianattasio**
  - Lynsie **Ranker**
  - Meredith **Pedde**
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  - NIH-NIEHS/R01ES05257
  - NIH-NIA/R01AG065359
  - NIH-NIA/R01AG067497
  - NIH-NIA/R13AG064971
- And the posse of other people who have bravely dared to cross disciplinary lines to ply their combined superpowers to investigate matters of air pollution and dementia risk.

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