

How healthy places mitigate air pollution's impact on dementia and its progression

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Air pollution impacts dementia?

Current research suggests, YES!

- The contribution of air pollution exposure to a range of adverse health effects is well recognised, including respiratory, cardio-pulmonary, and whole-system impacts.
- Emerging research suggests exposure to high levels of air pollution at critical points in the life-course is detrimental to brain health, including contributing to the onset and acceleration of cognitive decline and dementia.


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Small increases in air pollution linked to rise in depression, finds study
Exclusive: Cutting pollution levels may help to reduce rates of mental health problems, say scientists



Air pollution particles in young brains linked to Alzheimer's damage
Exclusive: if discovery is confirmed it will have global implications as 90% of people breathe dirty air



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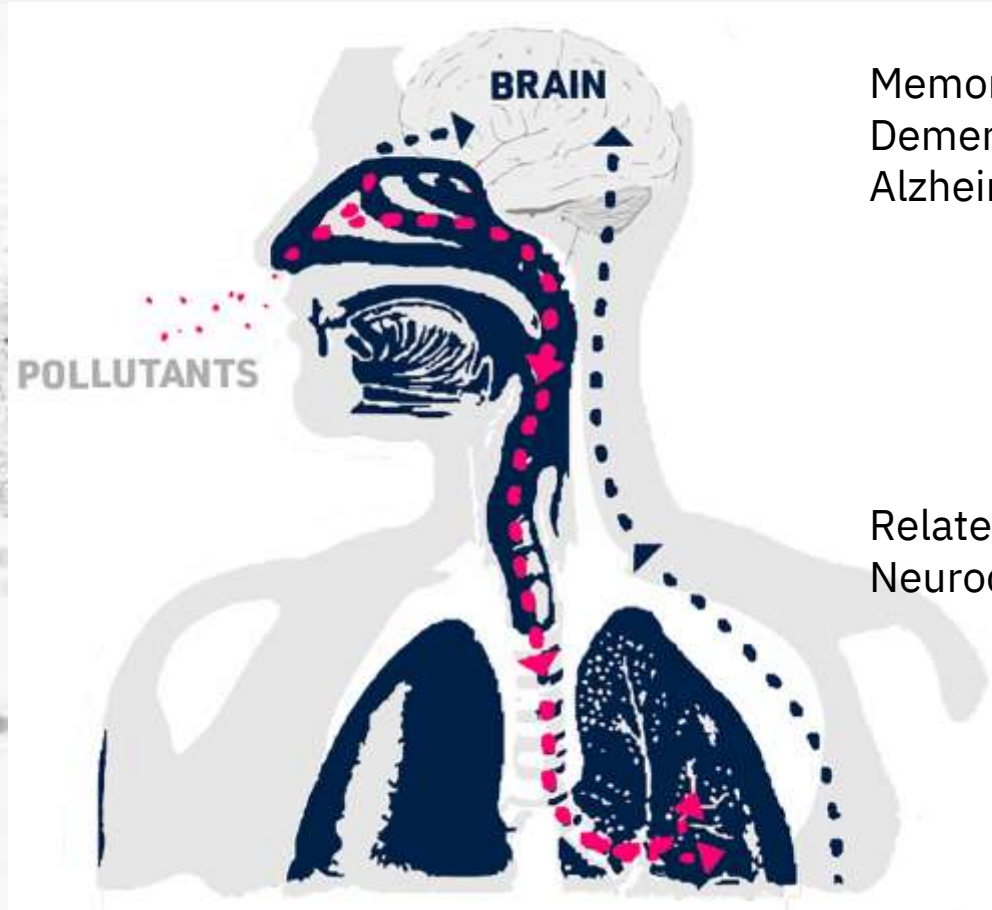
The New York Times

Air Pollution May Damage the Brain

Tiny air pollutants may cause changes in brain structure that resemble those of Alzheimer's disease.

For brain health, the air you breath matters

Birth • Infancy and Early Years • Childhood and Adolescence • Adulthood and Later Life



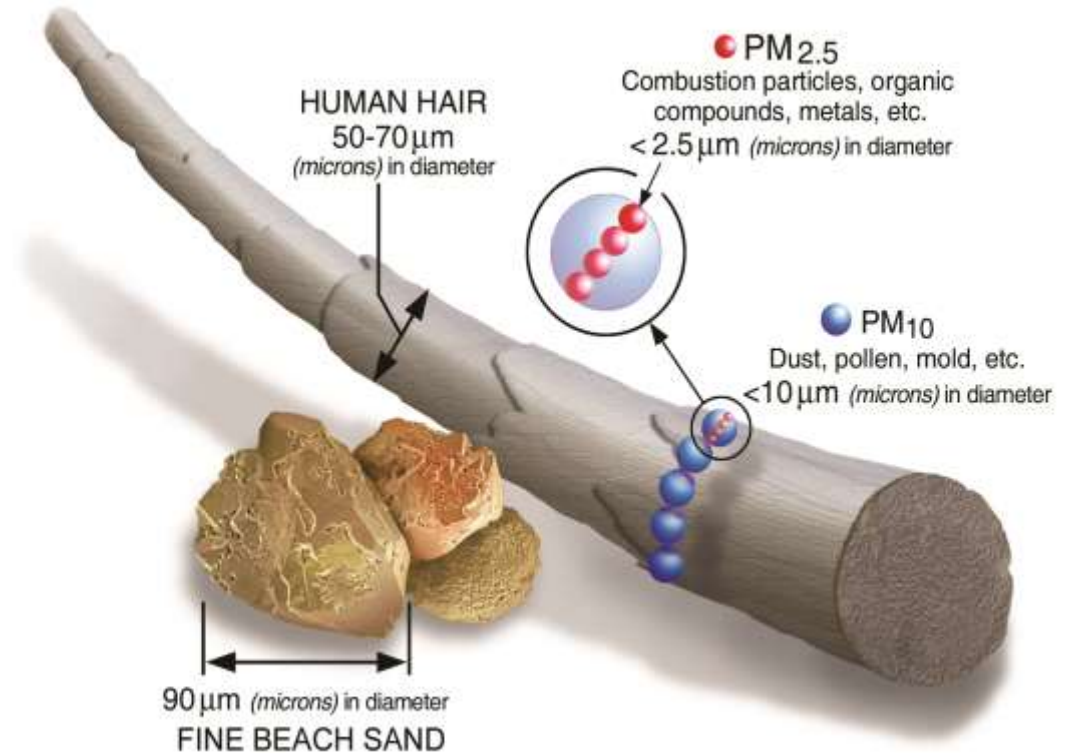
Memory Impairment
Dementia
Alzheimer's Disease

Depression
Learning Disabilities
ADHD

Related Cardiopulmonary
Neurodegenerative Disorders

PM2.5 Air pollution

- A key component of air pollution is fine particulate matter.
- This is particulate matter with an aerodynamic diameter of $\leq 2.5 \mu\text{m}$, $\text{PM}_{2.5}$
- In addition to a variety of natural and biogenic materials, $\text{PM}_{2.5}$ includes a wide range of emissions from fossil fuel and domestic wood combustion and non-combustion sources such as tyre and brake wear and cooking aerosols.





Air pollution and
dementia onset

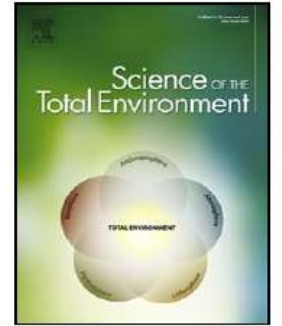


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Review

A critical review of the epidemiological evidence of effects of air pollution on dementia, cognitive function and cognitive decline in adult population

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- **FINDINGS**


- Cognitive decline and dementia incidence have consistently been associated with exposure to air pollution.
- The strength of association reported in some studies suggests a potentially important effect on public health.
- The available evidence also suggests that long-term exposure to air pollutants is associated with cognitive decline and with the risk of development of dementia.
- *Caution: temporal misalignment (of assumed causes and effects) could potentially affect the documentation of associations between exposure to air pollution and cognitive and neurological changes.*



Air pollution impact on
dementia progression

Air Pollution Is Associated with Cognitive Deterioration of Alzheimer's Disease

Feng Cheng Lin^{b, d, h, i} Chih Yin Chen^a Chung Wei Lin^a Ming Tsang Wu^{h, i, j, k}
Hsuan Yu Chen^c Poyin Huang^{d, e, f, g, h}



- **FINDINGS**

- Air pollution is revealed to be associated with increasing dementia incidence, but the relationship between air pollution and clinical AD cognitive deterioration is unclear.
- If air pollution is associated with the onset of dementia and Alzheimer's, then, by definition, it may also continue to have a negative impact post the onset or diagnosis of dementia syndrome.
- The impact may be associated with increasing cognitive deterioration, hastening the progression of dementia and Alzheimer's.
 - For example, a 2022 study found that air pollution also was a risk factor for the progression from Cognitive impairment but no dementia to dementia.

- *Caution:*

- *This research is very preliminary, and more studies are necessary.*
- *We are also still just learning the pathways to disease by which air pollution impacts dementia syndrome.*
- *We also do not know yet what configuration of air pollutants are responsible for the onset or progression of dementia.*

A photograph of a city street at sunset. The sun is low on the horizon, creating a warm, golden glow and long shadows. A person is walking across the street in the foreground, their silhouette partially illuminated by the low sun. The street is lined with multi-story buildings, and a few cars are visible in the distance. The overall atmosphere is serene and contemplative.

But that is not the whole story

Where people live matters

Our Innovative Primary Prevention Equation

**PLACE = Social Determinants
Health Inequalities**

<=> Ambient PM_{2.5} Exposure =>

**Cognitive/Brain
Health Outcomes**



Gerontology

Clinical Section: Research Article

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Air Pollution Is Associated with Cognitive Deterioration of Alzheimer's Disease

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Yuchi et al. *Environmental Health* (2020) 19:8
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Environmental Health

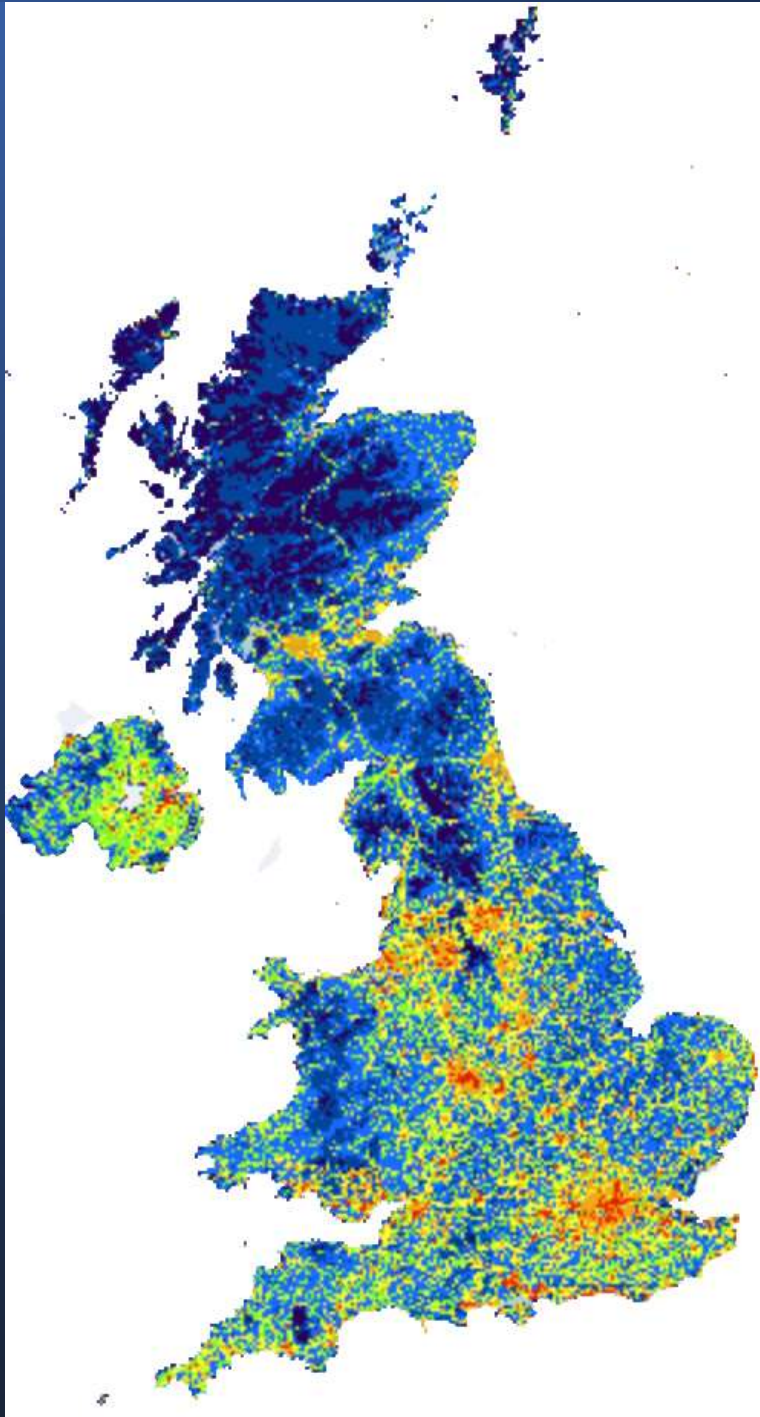
RESEARCH

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Road proximity, air pollution, noise, green space and neurologic disease incidence: a population-based cohort study

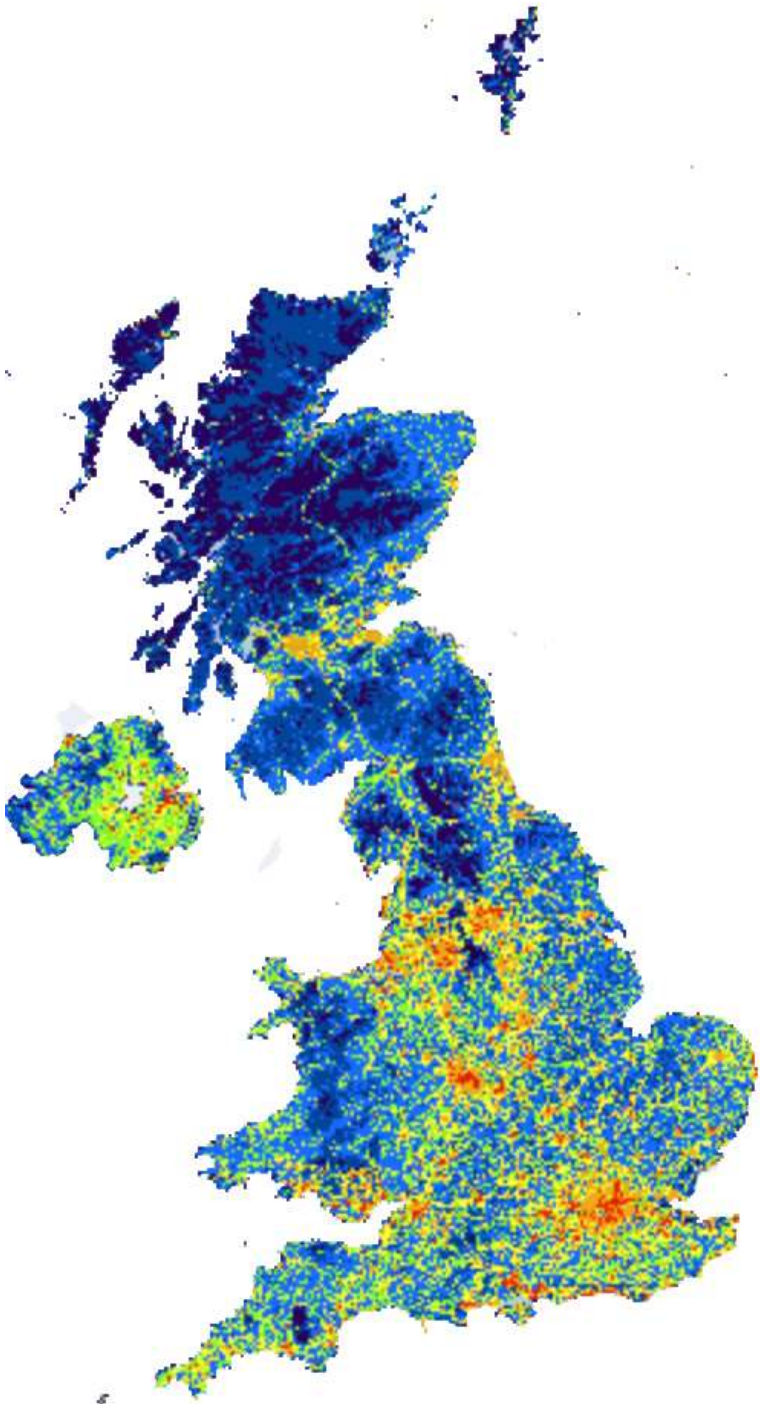
Weiran Yuchi, Hind Sbihi, Hugh Davies, Lillian Tamburic and Michael Brauer 





FINDINGS

- **Wider determinants** of health play a major role in air pollution's impact on brain health and dementia.
- They do so by shaping the **complex systems** in which people are born, live, work and age, particularly for vulnerable populations.
- Through variations in their complex intersection, wider determinants lead to **social and health inequalities** for vulnerable populations.
- 'Vulnerability' is not only the consequence of health behaviours and pre-existing health conditions such as having asthma or being elderly.
- It is also the outcome of the systems in which people live, as well as the inequalities certain populations experience in these systems.
- **THE PLACES WE LIVE MATTER!**



FINDINGS

- **Examples include:**

- a community's historical levels of deprivation
- disparities in income and educational background
- racism and sexism,
- access to healthcare
- available green space
- Dementia friendly environments
- working conditions
- quality of life
- Congested housing
- proximity of residential areas and amenities to road traffic and industrial air pollution sources.



The role of
place-based policy

Invited Perspective

A Section 508–conformant HTML version of this article
is available at <https://doi.org/10.1289/EHP9605>.

Invited Perspective: Air Pollution and Dementia: Challenges and Opportunities

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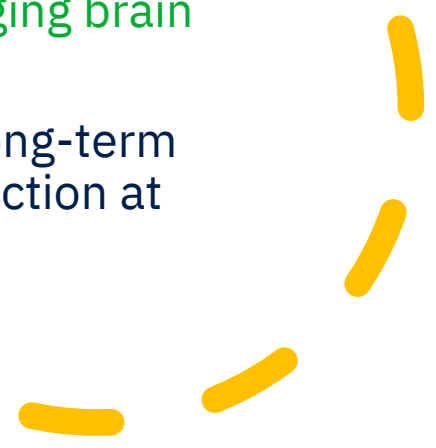
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- Although future multidisciplinary collaborations and resources are needed to address some remaining challenges in research on the role of air pollution in Alzheimer’s disease and related disorders, **there is no need to delay efforts to reduce environmental air pollution to protect the aging brain from the consequences of exposure.**
- Environmental air pollution reduction will require long-term policies, including standard-setting and collective action at international and local levels.





InSPIRE

Innovating UK clean air policies
to prevent cognitive disorders

<https://www.inspireairbrain.org/>