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*Review Article*

Journal of Complementary Research and Alternative Medicine

# Dementia and the Environment: Why it is Important to Study the Link

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**Submitted:** 19 March 2025 **Accepted:** 24 March 2025 **Published:** 31 March 2025

***Citation:*** *Reuben, C., (2025) Dementia and the Environment: Why it is Important to Study the Link. J of Complement Res Altern Med, 2(1), 01-03.*

***Abstract***

*Dementia and the environment: why it is important to study the link Given that air pollution is already accepted as undesirable for its negative impact on health, and responsible for deaths from respiratory and cardiovascular, why is it important to study the link to dementia? Dementia is a general term for loss of memory, language, problem-solving and other thinking abilities that are severe enough to interfere with daily life. Dementia is increasing exponentially globally. It is estimated by WHO that currently there are more than 55 million people living with dementia. Although no cure is yet available the focus is to modify the risk factors of dementia. One of the risk factors for dementia is exposure to air pollutants. Current literature addresses the link between exposure to air pollutants and cognitive impairment, especially dementia. The presentation aims to give a brief walk through into the literature highlighting the unpleasant effects the environment has on dementia with its possible mechanisms which are pointing toward toxins that damage the cells of the blood-brain barrier, neuroinflammatory processes and oxidative stress triggered by iron-induced free radicals. Air pollution could be capable of worsening the build-up of amyloid in the brains of people living with Alzheimer's. Smoking is also considered as a risk factor for dementia. Possible explanations could be the vascular risk with an increase in plasma homocysteine caused by smoking; atherosclerotic changes; oxidative stress due to smoking; and the increase the risk for carriers of Apolipoprotein E (APOE) ?4 allele. Cycling whilst breathing filtered air; and increasing green spaces may reduce the cognitive decline and decrease the disease burden.*

**Keywords:** Dementia, Environmental Factors, Pollution.

## Introduction

Given that air pollution is already accepted as undesirable for its negative impact on health, responsible for deaths from respiratory and cardiovascular so why is it important to study the link to dementia? Dementia is a general term for loss of memory, language, problem-solving and other thinking abilities that are severe enough to interfere with daily life. Dementia is increasing exponentially globally. It is estimated that currently there are more than 55 million people living with dementia WHO (2024). Although no cure is yet available the focus is to modify the risk factors of dementia. One of the risks factors of dementia is exposure to air pollutants. Current literature is addressing the link between exposure to air pollutants and cognitive impairment especially dementia, highlighting the unpleasant effects the environment has on dementia with its possible mechanisms. Possible mechanisms are pointing towards toxins that damage the cells of the blood-brain barrier, neuroinflammatory processes and oxidative stress triggered by iron induced free radicals. Air pollution could be capable of worsening the build-up of amyloid in the brains of people living with Alzheimer's.

## Air Pollution and Fossil Fuels

More than $650bn (£494bn) a year in public subsidies goes to fossil fuel companies, intensive agriculture and other harmful industries in the developing world. Developed countries are also actively subsidising such harmful activities the subsidies entrench high greenhouse gas emissions and are fuelling the destruction of the natural world [1].

## Environmental Factors

Environmental pollution is a global problem and the subject of increasing worldwide public health concern [2-3]. They can be caused by air pollution, pesticide and heavy metal exposure.

Air pollution is a crucial risk for cognitive impairment and dementia. The exact causation is still unknown, but a plausible cause is pointing towards inflammation and oxidation of the brain, activation of the HPA axis which causes neuroendocrine stress response [4]. Air pollution contains several different gases, chemical compounds, metals and tiny particles known as particulate matter (PM). These PM may decrease cognitive performance via neuroinflammation as a result of systemic inflammation or oxidative stress following lung irritation [5].

Furthermore, UFP (ultra-fine particles) could contribute to Alzheimer's disease development by translocation to the cortex regions where Alzheimer's disease is initiated [6]. Also, the smallest particles, found in air pollutants are often coated with neurotoxic chemicals, that can enter the brain through the olfactory bulb or cross the blood-brain barrier.

**Pesticide Exposure**

Some pesticides may increase amyloid-β levels in the cortex and hippocampus, as well as increase memory loss and reduced motor activity [7].

**Possible Solutions**

Natural areas and parks have been associated with lower levels of harmful air pollutants, including particular matter ≤10μm in size (PM10) and nitrogen dioxide (NO2) [8]. Cycling whilst breathing filtered air and increase green spaces may also reduce the cognitive decline and decrease the disease burden

**Smoking**

The World Health Organisation estimates that 14% of cases of dementia worldwide could be caused by smoking. Tobacco smoke contains a myriad of toxic substances favouring oxidative stress and inflammation, which potentially exacerbate AD pathology by inducing an increase in the number, burden and maturation of amyloid plaques in the hippocampus and cortex [9].

One such toxic element found in tobacco is cadmium which is highly toxic and accelerates cognitive impairment. A growing body of evidence suggests that cadmium may contribute to the aggregation of Aβ plaques in AD patients [10-11].

Smoking is also considered as a risk factor for dementia. Possible explanations could be the vascular risk. an increase in the plasma homocysteine caused by smoking, atherosclerotic changes, oxidative stress due to smoking and the increase the risk for carriers of Apolipoprotein E (APOE) ε4 allele. Apolipoprotein E (APOE) ε4 allele, is a genetic risk factor for dementia, and smoking tobacco can increase the risk for carriers of this gene [12].

Homocysteine is an amino acid that helps create proteins. Cigarette smoking increases homocysteine. It is a candidate for this role because of its direct neurotoxicity and its association with cerebrovascular disease which is currently believed to play a significant role in AD aetiology . Also smoking exerts effects on amyloid precursor protein processing, reduces Aβ microglia clearance, enhances microglial proinflammatory response and induces neurodegenerative-related synaptic changes [13-15].

## Conclusion

This conference paper gave a snapshot on the unpleasant effects the environment has on dementia with its possible mechanisms. Possible mechanisms are pointing towards toxins that damage the cells of the blood-brain barrier, neuroinflammatory processes and oxidative stress triggered by iron induced free radicals. Air pollution could be capable of worsening the build-up of amyloid in the brains of people living with Alzheimer's.

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