

# The Interrelated Impacts of Climate Change and Neurodegenerative Diseases: A Literature Review

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**Abstract:** As global society confronts the extensive ramifications of climate change, an often-overlooked yet significant issue has surfaced: the relationship between environmental influences and the increasing prevalence of neurodegenerative diseases. Conditions such as Alzheimer's and Parkinson's have traditionally been linked to the aging process; however, emerging studies indicate that climate change and exposure to environmental toxins could intensify the severity of these debilitating disorders. This literature review looks at the various connections between environmental changes and brain health, focusing on how rising temperatures, extreme weather, and pollution may worsen diseases like Alzheimer's and Parkinson's. By reviewing existing studies, the review aims to clarify the biological, psychological, and social impacts of these connections, showing how climate-related stressors can lead to neuroinflammation and cognitive decline. Additionally, it will discuss the differences in vulnerability, highlighting that marginalized groups might have greater risks from both environmental harm and neurodegenerative diseases. This review aims to add to the academic conversation and promote strategies that address both climate change and public health challenges. The significance of physiotherapy in managing back pain during pregnancy is increasingly recognized as both vital and beneficial. Through techniques such as manual therapy, tailored exercise regimens, and education on body mechanics, physiotherapy effectively alleviates discomfort and enables expectant mothers to maintain an active and autonomous lifestyle. Integrating physiotherapy into prenatal care represents a crucial strategy for enhancing maternal health and addressing the difficulties associated with pregnancy-related pain.

**Keywords:** climate change, neurodegenerative diseases.

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## 1. INTRODUCTION

The overlap of climate change and neurodegenerative diseases shows a complicated situation where the environment greatly affects human health. Climate change, which includes higher temperatures, strong weather events, and worse air quality, worsens current health issues and introduces new dangers, especially for at-risk groups (Alf Cérez et al., 2018). Neurodegenerative diseases like Alzheimer's and Parkinson's connect closely to environmental toxins, many of which increase due to climate-related factors such as pollution and heatwaves. Studies show that pollutants like particulate matter can worsen neurodegenerative diseases, highlighting a strong need for more research on this relationship (Abuabara et al., 2024). Also, as cities grow and climate effects get worse, the need for sustainable living and a good quality of life becomes very important, especially for older adults who might be more exposed to these changing threats. Grasping these linked effects is vital for creating public health strategies that effectively deal with both climate change and brain health.

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The link between environmental factors and health matters more and more, especially with climate change. Environmental factors, like air quality and extreme temperatures, play an important role in determining health outcomes for different groups of people. Research shows that global warming makes current health problems worse by raising air pollution levels, which are associated with respiratory issues and other serious health concerns (Alf C erez et al., 2018). Furthermore, the relationship between high temperatures and poor air quality can create even greater health risks, especially for at-risk populations (Breitner-Busch et al., 2023). This situation creates a cycle of health issues that mainly impacts low-income communities and those with existing health problems, thus worsening systemic inequalities. In the end, grasping these connections is critical for developing effective public health strategies and climate-resilient healthcare systems, which are necessary to reduce the harmful effects of environmental changes on human health.

The study of climate change and neurodegenerative diseases is very important because environmental factors greatly affect public health. Research shows that climate change makes air pollution worse, which raises the risk of various health issues, including neurodegenerative diseases like Alzheimer's and Parkinson's. Poor air quality, marked by high levels of pollutants, is connected to worsening cognitive function and a higher occurrence of mental health disorders, especially in vulnerable groups like older adults (Breitner-Busch et al., 2023). Moreover, increasing temperatures and heat waves create serious health problems, putting more pressure on healthcare systems that are already dealing with an aging population. Understanding these multiple impacts helps to create better public health plans and highlights the need to tackle climate change as a health issue (Breitner-Busch et al., 2023). By studying these links, researchers can provide clearer guidance for policy choices that aim to reduce both climate-related health threats and the impact of neurodegenerative diseases.

When looking at the goals and range of the literature review about climate change and neurodegenerative diseases, it is important to put together various research that shows how environmental factors and neurological health interact. This review wants to highlight how different environmental stressors, which are made worse by climate change, can affect how common and how fast neurodegenerative diseases develop. By using existing frameworks, like the one in (Barnes et al., 2018), which focuses on the socioeconomic aspects of environmental exposure, the review will carefully examine proof linking climate-related effects to health outcomes. Additionally, similar to what is discussed in (Davies et al., 2015), it will look into the many social impacts of these diseases, especially on vulnerable groups. In summary, this literature review aims to close gaps in current knowledge and suggest areas for more research, which will help shape public health strategies and guide policy decisions related to climate and health issues.

## **2. THE BIOLOGICAL MECHANISMS LINKING CLIMATE CHANGE AND NEURODEGENERATIVE DISEASES**

The complicated link between climate change and neurodegenerative diseases can be somewhat explained by biological processes that highlight both environmental stresses and bodily reactions. Climate change causes changes in the exposome, like increased air pollution and psychosocial stress, which worsen existing health issues, including neurodegenerative diseases. Key processes, such as oxidative stress and neuroinflammation, play important roles in this connection, tying climate-related environmental shifts to the development of diseases like Alzheimer's and Parkinson's (Khreis et al., 2017). Moreover, the epigenetic processes that help species adjust to changing environments point to a possible way to understand how long-term exposure to climate-related stressors may impact human health by changing gene expression connected to neuroprotection and neuron health (Operations et al., 2019). This complicated relationship needs more research, especially looking at the combined effects of environmental pollutants on neurodegenerative conditions, as current studies may not fully recognize how much air pollution affects neurological health.

### *Impact of air pollution on neurological health*

The link between air pollution and brain health is becoming more important in discussions about climate change and its effects on diseases that affect the brain. New research shows that pollutants, like fine particulate matter, might worsen issues such as dementia and depression, especially in at-risk groups like older adults (Bell et al., 2024). Additionally, the overall impacts of climate change, characterized by higher temperatures and poorer air quality, make the situation surrounding brain disorders more complex by affecting how often these disorders occur and how severe they are (Bramon et al., 2024). This dual problem is highlighted by studies connecting climate change and air pollution to worsening mental health issues,

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revealing a complicated network of factors that intensify the public health crisis. To grasp these relationships fully, it is essential to take a broad approach that considers environmental factors affecting neuronal health, which stresses the critical need for creating policies and focused interventions (Breitner-Busch et al., 2023).

***Role of temperature fluctuations in neurodegeneration***

Changes in temperature due to climate change have become a major issue regarding neurodegenerative diseases. As temperatures increase and become more unpredictable, people may face greater risks related to neurological disorders, such as Alzheimer's and Parkinson's disease. Studies show that extreme heat can worsen the symptoms of these diseases and might even speed up their progression. The link between bad air quality and extreme temperatures makes this issue more complex, since climate change is associated with higher levels of air pollution—something that hasn't been thoroughly explored in connection with neurodegeneration (Breitner-Busch et al., 2023). Additionally, the biological processes at play, especially how daily temperature changes affect brain health, need more research. Therefore, dealing with temperature fluctuations in the context of climate change is crucial for creating effective prevention and treatment plans for neurodegenerative diseases.

***Influence of environmental toxins exacerbated by climate change***

The connection between environmental toxins and climate change has significant effects on public health, especially regarding neurodegenerative diseases. As climate change changes ecosystems, harmful algal blooms (HABs) happen more often and with greater intensity, causing more exposure to toxins produced by cyanobacteria. The neurotoxic impacts of these toxins, such as non-proteinogenic amino acids like BMAA, have been shown to cause damage to neurons and lead to neurodegenerative disorders. Moreover, the growth of food production systems that use contaminated water can result in these toxins entering the food chain, increasing the risk of chronic diseases like liver and kidney disorders. The possibility that climate change can worsen these environmental dangers highlights the need for thorough monitoring and intervention plans to reduce the public health issues expected from rising toxin exposure (Breitner-Busch et al., 2023; Bramon et al., 2024).

***Neuroinflammation as a common pathway***

Neuroinflammation has become an important link between climate change and neurodegenerative diseases, like Alzheimer's and Parkinson's. More exposure to air pollutants, especially woodsmoke, has been noted as a trigger for inflammatory processes in the central nervous system, possibly speeding up the development of neurodegenerative diseases (Askarova et al., 2023). This inflammatory reaction includes the excessive production of amyloid-beta peptides, which play a key role in the pathophysiology of Alzheimer's disease, resulting in oxidative stress and harm to neurons. Additionally, the influence of dietary elements, such as polyphenols in wine, has been studied, indicating they might reduce neuroinflammation and have protective effects on the brain (Abeyasiriwardena et al., 2018). Recent research also points out that changes in metabolic pathways linked to inflammation, like the kynurenine pathway, could act as markers for neuroinflammatory conditions. Therefore, recognizing neuroinflammation as a shared pathway gives vital understanding of the connected effects of climate change and neurodegenerative diseases.

### **3. EPIDEMIOLOGICAL EVIDENCE OF CLIMATE CHANGE EFFECTS ON NEURODEGENERATIVE DISEASES**

As climate change gets worse, studies show a concerning connection with neurodegenerative diseases. For example, the link between heat exposure caused by climate change and neurodegenerative disorders like Parkinson's disease is becoming clearer. However, the connections with Alzheimer's Disease and Amyotrophic Lateral Sclerosis are still not well defined, indicating a complicated nature in how these diseases develop. Research indicates that high temperatures can worsen mental health problems in older adults, which can affect the start and development of neurocognitive decline (Bandodkar et al., 2022). Furthermore, air pollution, which comes from climate change, adds extra risks, and these may not be well reported in current studies, pointing out that the extent and impact of air pollution could be underestimated. Therefore, it is essential to keep strong epidemiological monitoring to clarify these connections as climate trends change (Casale et al., 2019).

**International Journal of Novel Research in Healthcare and Nursing**Vol. 12, Issue 1, pp: (36-43), Month: January - April 2025, Available at: [www.noveltyjournals.com](http://www.noveltyjournals.com)*Trends in neurodegenerative disease prevalence in changing climates*

Climate change is changing environmental conditions, and this is affecting neurodegenerative diseases, creating a big public health problem. New research shows that extreme weather, like changes in temperature and air pollution, increases neurological diseases, especially in vulnerable groups like older adults. For example, a systematic review shows a link between outdoor temperature and more hospital visits for mental disorders, with a risk ratio suggesting more cases during heat waves and hotter weather. Also, how climate affects neurodegenerative diseases could be connected to indirect issues like food security and migration, which significantly impact mental health (Jay et al., 2018). Therefore, it is important to understand these connected trends for future healthcare planning and to create ways to lessen the negative effects of climate change on brain health (Johnson et al., 2024).

*Geographic disparities in disease incidence related to climate factors*

The differences in disease rates based on location are more and more recognized when viewed through climate elements, which greatly affect health results among different groups. In places such as Appalachia, where coal mining is common, there is a clear link between air quality and higher death rates, showing how local environmental actions can worsen health dangers (Pugh et al., 2017). Also, Indigenous communities show a major lack in understanding about brain health and mental function, with not enough focus on the cultural and social aspects that influence their situations, adding to gaps in neurodegenerative disease rates (Claringbold et al., 2024). Likewise, the worsening of atopic dermatitis in people due to climate threats highlights the pressing need to study how these environmental changes influence risks in various areas. Research like the German National Cohort shows the importance of using different fields to grasp these links, ultimately creating ways to better prevent and treat diseases.

*Case studies linking extreme weather events to neurological health outcomes*

The increasing data showing links between extreme weather and brain health highlights the urgent need for more study in our changing climate. For example, big changes in temperature and heat waves have been linked to more mental health issues in older adults, as a systematic review showed a 1.269 risk ratio for hospital stays related to heat wave exposure. These negative outcomes can be linked to the wider effects of climate change on the exposome, which includes environmental stresses that harm brain function (Bell et al., 2024). Moreover, as climate change worsens air pollution, kids and teenagers are increasingly at risk for mental health problems, showing a demographic weakness that calls for immediate action. The main issue is the lack of long-term data, making it hard to make clear connections between specific extreme weather events and brain health issues (Bramon et al., 2024).

*Longitudinal studies assessing climate impact on cognitive decline*

Studying how climate change affects cognitive decline needs long-term studies to uncover the complicated relationship between environmental factors and brain diseases. Evidence shows that things like high temperatures, air pollution, and disasters from climate change really affect cognitive abilities in older people, as mentioned in some recent reviews about mental health issues tied to climate problems. Furthermore, it has been found that health conditions like coronary artery disease, which is linked to high coronary artery calcium scores, increase the chances of developing mild cognitive impairment and dementia over time (de Bock et al., 2020). Also, research suggests that following a Mediterranean diet can help slow down cognitive decline and reflects lifestyle choices that are impacted by environmental factors. By combining these aspects, long-term studies create a way to understand how climate change worsens cognitive decline, stressing the need for specific actions (Montrose et al., 2020).

#### **4. SOCIOECONOMIC FACTORS AND VULNERABILITY TO NEURODEGENERATIVE DISEASES IN THE CONTEXT OF CLIMATE CHANGE**

The connection between socioeconomic factors and the risk of neurodegenerative diseases is significantly affected by climate change, which worsens health inequalities among different groups. Communities already dealing with financial struggles experience greater challenges due to various health risks linked to environmental shifts, like more air pollution and severe weather. These elements worsen existing weaknesses, especially in older adults who are more likely to face

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neurodegenerative diseases. The World Health Organization points out that the negative health impacts of climate change disproportionately hit low-income groups, increasing existing inequalities and gender disparities (Johnson et al., 2024). Additionally, studies show that environmental risks have not been properly analysed regarding their combined effects on health, creating a gap that limits understanding of complete vulnerabilities related to climate change (Lange et al., 2019). Thus, recognizing these connected dynamics is crucial for shaping effective public health policies and reducing future risks.

*Disparities in healthcare access and outcomes*

Differences in access to healthcare and results greatly worsen the problems brought about by climate change, especially concerning neurodegenerative diseases. At-risk groups, who often live in places with few health services and more environmental dangers, face a higher chance of poor health results. This unfair access to healthcare is tied to a lack of transportation options, where limited public transport makes it harder to get to medical care, which ultimately affects health results (Fox et al., 2021). Also, stressors from climate change, like extreme heat and more air pollution, have been connected to negative impacts on brain growth and thinking skills, notably in disadvantaged groups (Bezgrebelna et al., 2023). Indigenous communities illustrate this issue, with cultural factors affecting brain health and cognitive abilities, highlighting the need for care that respects cultural differences. Tackling healthcare gaps through policy actions can act as an important connection between climate measures and better health outcomes for vulnerable groups.

*Impact of climate-induced migration on mental health*

The link between climate change-related migration and mental health highlights an important but often ignored aspect of the effects of climate change. Being forced to move due to climate events disrupts not just the physical setting but also the social connections, leading to increased stress and anxiety for those affected. People who have to migrate may carry significant psychological burdens, made worse by losing their community, identity, and sense of stability. Studies show that climate change impacts various health areas, with worsening pre-existing neurodegenerative diseases due to environmental stressors. In addition, new evidence points to harmful mental health effects associated with the combined impact of environmental issues, like air pollution and extreme weather, on at-risk groups (Bramon et al., 2024). It is becoming more apparent that there is a need to use comprehensive public health strategies that link these complex issues, stressing the importance of having accessible mental health services in this situation (Weitzman et al., 2022).

*Socioeconomic status as a determinant of exposure to environmental risks*

Socioeconomic status (SES) is very important in showing how much people are exposed to environmental risks, which can greatly affect health, especially in terms of neurodevelopmental disorders. People with lower SES usually live in places with more pollution and less access to health care and education, which keeps them in cycles of risk. Air pollution, which is made worse by climate change, is connected to many health problems, including neurodegenerative diseases, and shows how environmental injustice and health differences overlap. Also, the rules and enforcement of environmental policies often do not protect disadvantaged groups, resulting in more cases of developmental disabilities and lower cognitive abilities (Rahim A et al., 2022). Studies show a clear link between SES and contact with environmental dangers, highlighting the need for specific actions to tackle these differences and lessen the dangers faced by the most at-risk groups.

*Community resilience and adaptation strategies*

Good community resilience and adaptation strategies are very important for lessening the various effects of climate change, especially for vulnerable groups like older adults and those with neurodegenerative diseases. Recent studies show that high temperatures and extreme weather can worsen mental health problems and increase cognitive decline in older people (Alf Cerez et al., 2018). Additionally, climate change is changing freshwater ecosystems, leading to higher risks of health issues from waterborne germs connected to neurological and mental illnesses (Barnes et al., 2018). These environmental changes highlight the pressing need for communities to create strong monitoring and quick response plans designed for new health threats. Also, a comprehensive approach that takes into account both individual and population genetics could make adaptation strategies more effective, ultimately building resilience in communities struggling with the dangers of climate change. These linked actions will be essential for protecting the health of at-risk populations.

**International Journal of Novel Research in Healthcare and Nursing**Vol. 12, Issue 1, pp: (36-43), Month: January - April 2025, Available at: [www.noveltyjournals.com](http://www.noveltyjournals.com)**5. CONCLUSION**

To sum up, the complicated link between climate change and neurodegenerative diseases presents a major public health issue that needs quick action. The combined effects of higher temperatures, air pollution, and severe weather create conditions that worsen neurological problems, especially for at-risk groups. While earlier studies have shown connections between climate conditions and various neurodegenerative diseases, like Parkinson's disease, the exact effects on Alzheimer's Disease and other types of dementia are still not well understood. Additionally, the likely underestimation of the harmful impacts of air pollution on health suggests a need for thorough research to reevaluate current data used in policy-making (Jay et al., 2018). It is clear that taking proactive steps to address climate change is necessary since it could help reduce related health risks, leading to better brain health and overall well-being (Bezgrebelna et al., 2023). This link highlights the necessity for collaborative approaches to effectively address these urgent challenges.

*Summary of key findings from the literature review*

The literature review shows a worrying link between climate change and neurodegenerative diseases, stressing the need for more research in this area. Important findings show that higher temperatures are strongly associated with more hospital visits for mental health issues in older adults, with a risk ratio of 1.269 during heat waves when compared to times without heat waves (Bell et al., 2024). Additionally, socioeconomic status is a key factor in how exposed and vulnerable people are to health impacts from climate change, highlighting the need to address inequalities in risk (Barnes et al., 2018). The transportation sector also has a complex role in health outcomes, connecting air pollution and other stressors to negative effects on the brain. These findings together highlight an urgent need for public health policies that take into account environmental changes and their effects on neurological health, aiming for a fairer approach to health in light of the challenges from climate change.

*Implications for public health policy and research*

The effects of climate change on diseases that cause brain degeneration show a need for better public health policies and research efforts. Research indicates that climate change and air pollution worsen mental health and have negative impacts on brain development, especially in at-risk groups like children and the elderly (Fox et al., 2021). This shows the need for policies aimed at reducing these environmental dangers and protecting mental and cognitive health (Vierck et al., 2020). Furthermore, studies might greatly underestimate the real death and illness rates linked to air pollution, implying that current health data could mislead public health actions. Thus, focusing on preventive measures and intervention programs that tackle the mental health effects of climate change is crucial, with a strong emphasis on early intervention and data-based methods to guide policy. Tackling these intertwined issues could improve health strategies and outcomes for those impacted.

*Recommendations for future studies*

Future studies looking at climate change and neurodegenerative diseases should focus on a multi-disciplinary approach, combining epidemiological, environmental, and neurological views. Researchers need to investigate how changing temperatures impact thinking and the advancement of neurodegenerative disorders, especially in at-risk groups like older adults, as noted by (Bell et al., 2024). It is also important to explore the combined effects of air pollution worsened by climate change, since bad air quality greatly increases health dangers related to neurodegenerative diseases (Breitner-Busch et al., 2023). Long-term studies that follow people over time will give useful insights into these connected factors. Moreover, creating stricter air quality rules, as pointed out in (Breitner-Busch et al., 2023), will be essential not just for immediate health advantages but also for reducing long-term impacts on brain development, stressing the need for proactive public health strategies linked to climate initiatives.

*Final thoughts on the importance of addressing climate change and neurodegenerative diseases together*

In summary, the link between climate change and neurodegenerative diseases needs a complete and broad approach to public health and environmental rules. The rising impacts of climate change, like more air pollution and severe weather, have been found to worsen brain health, highlighting a clear need for joint efforts in both research and action. By understanding the two-way connection—where bad environmental conditions can lead to the start and worsening of neurodegenerative diseases—policymakers can create plans that reduce climate dangers and support brain health.

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Campaigns to raise public knowledge and educational programs are vital for building a better understanding of this connection, encouraging community backing for green practices that value both the environment and human health. In the end, tackling these two urgent global issues together may create new solutions that boost resilience and enhance life quality amid environmental unpredictability.

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