

Climate Change and the Nervous System

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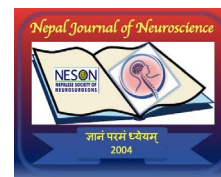
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Climate change has received significant media attention. The recent COP 28 summit in November and December 2023 in Dubai has once again brought together the leaders of all countries and has made everyone aware of its effect on global health. Despite this attention, scholarly works on the subject, particularly from developing economies are relatively scarce.

Climate change mainly consists of three major events, 1) global warming, 2) changes in precipitation patterns, and 3) increases in extreme weather events. These, in turn, lead to rising temperatures, abbreviated seasons, and ocean acidification. According to the Paris Declaration, environmental changes is a perpetual threat to our health.¹ WHO in 2018 declared climate change as a global medical challenge for the 21st century.² The nervous system is no exception in this regard.³ A scoping review by Louis et al in 2023 noted 364 articles published on climate change and brain diseases emphasizing the fact that the nervous system is at the forefront when it comes to the effects of climate change.⁴

Physiological Basis for Disease

There are direct/indirect effects of temperature on the performance of sensory and other cognitive systems. The nervous system (including sensory component) is key to the adaptation to stress. To a certain extent, an individual adjusts to the changing environment beyond which, the person begins to show the effects.

Changing temperature has been shown to alter gene expression, neuronal structure, brain organization, and learning ability in animal models.⁵

Common Neurological Illnesses

Although no direct causal relationship has yet been demonstrated in humans, the nervous system is believed to be affected in many ways.^{3,4,6,7}

1. The distribution and concentrations of air contaminants is subject to weather conditions. We have noticed increasing air pollution in big cities which is in part contributed by the climate change. The frequency and expansion of wildfires have become more frequent. There has been an unusual growth of harmful neurotoxin (microcystin, saxitoxin, and brevetoxin) producing algal blooms. Memory disturbances, seizure disorders, Parkinsonian- and dementia-like symptoms are linked to these neurotoxins.

2. The change in climate has been shown to affect the occurrence in wider geographical location, virulence, incubation period, survival, distribution, and transmission of pathogens and vectors that potentially involve the brain. Examples include Dengue, Zika, Chikungunya, West Nile, Yellow Fever, Bacterial meningitis, Syphilis, Cerebral schistosomiasis, Toxoplasmosis, and Neurocysticercosis. Dengue fever first detected in Nepal in 2004 is now commonly seen in all parts of Nepal with more than 55000 cases per year.⁸

3. Increased stroke incidence and severity, migraine (frequency and severity), increased hospitalization of patients with dementia, and exacerbation of multiple sclerosis have been linked to temperature extremes and variability. Exposure to airborne pollutants especially PM2.5 and nitrates has been found to have a direct correlation with the occurrence of these diseases.

4. Uncertain seasonal food availability, food contamination, and malnutrition are often the consequences of extreme climate events. These events can influence neurodevelopment in children with neurocognitive underperformances later in life.

5. Mental illnesses ensue from personal loss, environmental pollution, decreased food availability to name a few. Climate change increases the risk of anxiety and depression, stress, or post-traumatic stress disorder. Also, people living in extreme climatic conditions are more likely to suffer from substance use and have increased suicide rates.

6. Competition for food and shelter in extreme weather environments often leads to violence and injury that can result in traumatic brain and spinal injury with devastating consequences.

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Paradoxical Effects of Climate Change

While it is crucial to care about the impact of climate change and advocate for a healthier planet, excessive worry can inadvertently contribute to psychological distress. Striking the right balance is key for both our planet and mental well-being.

Areas/Ideas That Need To Be Addressed Currently

There has been an increased awareness among neuroscientists regarding climate change.⁹ First and foremost is the need to spread awareness to the public regarding the negative effects of climate change. Secondly, people should learn to adapt to change by avoiding places prone to extreme weather conditions or adjusting to the 'new' environment. Thirdly, we, as neuroscientists, should develop social support/advocacy groups to help people affected by it to recover fast.

Recommendations

The recommendations can be at various levels:

1. For individuals: Everyone is recommended to be aware of the changes and adapt to them; at the same time advocating against the factors that are known to promote climate change.
2. For communities: Communities should collaborate to resist deforestation and the increased use of fossil fuels.
3. For health workers: They need to keep themselves up-to-date with diseases associated with climatic conditions and conduct research regarding treatment.
4. For organizations of health and technology: They should work in tandem with health workers and the government to effect a change in policy to mitigate the effect of climate change.

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