

WSO Policy Statement on Climate Change and Stroke

Developed by the WSO Global Policy Committee in March 2024

Key facts:

- Climate change is resulting in increasing frequency, scale, and intensity of heat waves, droughts, wildfires, dust storms, floods, tropical storms and hurricanes and per the World Health Organization is the '**single biggest health threat facing humanity.**'
- **Heat waves** and increases in ambient temperature have been directly linked to increased stroke incidence and mortality. Increasing heat also enhances the negative effects of **air pollution**, one of the greatest risk factors of stroke. Possible links also exist between inhalation of particulate matter inhalation from increasing wildfires and dust storms.
- **Indirect effects** of climate change on stroke include increase in infectious diseases and water salinification raising blood pressure, disruption of health infrastructure, and human displacement impacting service provision and clinical practice.
- Developing countries with weaker health infrastructures and in general already vulnerable populations including the elderly, ethnic minorities, and those with low income will be least prepared and most affected increasing already existent **health inequities** globally.
- **Greenhouse gas emission reduction** through more sustainable energy, transport, and food choices has the potential to achieve large health gains by reducing both climate change impacts and air pollution as well as achieving dietary health benefits.
- Developing **mitigation strategies** to reduce climate change impact and identifying **research priorities** represent additional priorities.

Climate Change and Health

The presence of climate change is now scientifically irrefutable and there is a large body of scientific evidence on the associated health impacts.[1,2] Health is impacted both directly and indirectly.[3] The direct effects relate to increases in ambient temperature and heat waves resulting in physical heat stress with older people and those without climatic home adaptations at greatest risk.[3] Heat related deaths alone have increased by 68% between 2000 and 2017.[4] Associated weather changes such

as rising sea levels and flooding, increases in extreme weather events such as droughts, wildfires, hurricanes and cyclones, dust, and sand storms can result both in direct harm to humans, e.g. inhalation of particulate matter and smoke, and indirect harm through disruption of food sources, infrastructure, and living space.[3] Impacts on water security due to droughts and contamination and changes in ecosystems has also been associated with a rise in water salinity and several infective microorganisms such as malaria and West Nile virus.[4-6] Finally, the stress associated with extreme weather events, the impact on human health and lives, and the threat of temporary or permanent displacement is also having increasing mental health impacts.[3]

Climate Change and Stroke

The most immediate climate change related effect on stroke is increasing temperature with conclusive evidence that heat waves and rises in average ambient temperature are associated with increased stroke incidence, severity, and mortality.[7,8] There is also some evidence to link air pollution from wildfires, dust and sand storms to increased stroke incidence and mortality although more evidence is needed to confirm especially the latter two.[7] A much clearer link exists between anthropogenic air pollution from fossil fuels and stroke risk, with this risk factor representing one of the most prominent stroke risk factors globally as per the Global Burden of Disease Group.[8] It can be argued that anthropogenic air pollution is primarily a cause of rather than an effect from climate change, however, increasing ambient temperature itself interacts with other pollutants to form ground ozone which in and of itself contributes to urban air pollution and represents a greenhouse gas contributing to a positive feedback loop.[9] Furthermore, there is a clear interconnectedness of all life on the planet and the symbiosis between air pollution's detrimental effect on both climate change and stroke risk draws it clearly into the realm of the climate change topic as an area of concern for the stroke community. [2] While to date there is no clear evidence directly linking flooding to stroke incidence there are clear indications that such disruptive severe weather events impact the health infrastructure required to adequately care for acute stroke patients and ensure stroke prevention strategies are maintained. Finally, salinification of groundwater due to flooding and sea level rises has been shown to increase systolic blood pressure and microorganism contamination and changes in insect habitats related to climate change have been associated with infections also associated with increased stroke risk.[6, 7] While undernutrition is not a commonly considered a stroke risk factor, crop losses of fruits and vegetables may lead to adverse stroke outcomes. Similar to air pollution, a synergy exists between a predominantly unprocessed plant-based diet to promote brain and vascular health and associated reduction in greenhouse gas emission and waste production associated with meat production and industrial food processing that could help mitigate climate change and the resultant adverse health effects.[11]

Vulnerable Populations

Temperature extremes disproportionately affect older people who cannot as effectively thermoregulate and may be less aware of symptoms of non-exertional hyperthermia. Wildfires and other extreme weather events have also been associated with greater impact on the elderly both due to lower biological resilience and greater impact of health infrastructure disruption.[5]

Those in low wealth-communities and several ethnic groups are also projected to be disproportionately impacted.[5, 12] Air pollution primarily affects communities with poorly regulated emission standards in the setting of urban crowding and much outdoor manual labour. Rising ambient temperature disproportionately affects the same population especially where heat shelter and climate control options are minimal or lacking. Low-income countries are at greatest risk for climate change related health impacts but even in high income countries certain sub-demographics are at higher risk. This situation significantly risks widening of the already existent health equity gap globally.[10, 12]

Need for Action

There is now sufficient evidence to expect that people with, or at risk for, stroke, as well as the stroke services they require, are and will be further impacted directly by climate change. Of special concern is the worsening of health equity gaps due to climate change.

WSO Proposed Climate Change Actions

- **Promote actions that both reduce carbon emissions and improve vascular brain health:**
 - advocate for government level rapid and equitable transition to a **clean energy economy** to reduce both the detrimental effects of air pollution and climate change on people living with or at risk of stroke;
 - promote unprocessed plant-based **food** choices that reduce stroke risk and reduce greenhouse emissions;
 - advocate for global **phaseout of factory** (industrialised animal) **farming**;
 - promote fossil fuel free **transport** that also encourages greater human physical exercise;
 - promote global **standardisation** of climate change metrics;

- **partner with** other likeminded **organisations** to improve impact.

- **Build a more resilient and environmentally sustainable stroke community:**
 - **assess impact** of climate change on the stroke community and workforce and develop proactive **mitigation strategies**;
 - incorporate climate change **core competencies in stroke education** including its impact on stroke and co-benefits; develop future climate change competent stroke leaders;
 - **review current organisational operations** of WSO, member organisations, stroke services, and hospitals to assess for potential improvements in mitigation impact on and mitigation of climate change.

- **Support ‘Climate Change and Stroke’ research, specifically:**
 - conduct **high-quality studies** assessing associations between climate change and stroke risk, mortality, and disability by stroke and aetiological sub-types;
 - develop and test **environmental surveillance tools or interventions** that may reduce stroke risk/severity, and/or improve outcomes for stroke survivors;
 - explore service and economic **impact of forecasted changes to the stroke community** related to climate change impacts.

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