

Air Pollution-related Stroke in Guadalajara A Call to Action

Editorial

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INTRODUCTION

Stroke is one of the leading causes of death and long-term disability globally. Each year over 610,000 people experience a new stroke, being ischemic stroke the most common type.¹

Air pollution is the release of harmful substances into the ecological system. These substances compromise the ordinary conditions of human existence and development, especially when these substances in the atmosphere exceed a specific concentration. Faced with increasingly severe pollution problems, academics are more interested in research related to air pollution forecasting and prevention. The main pollutants to affect human health are SO₂, NO₂, CO₂, NO, CO, PM_{2.5}, and PM₁₀. In the last few years, there has been an exponential increase in population and air pollution. Despite the government's campaigns to reduce air pollution, industrial and traffic emissions have overwhelmed these efforts, especially in developing countries.

Currently, we know that air pollution affects life in society and even endangers humanity's survival because it is made up of a mixture of gasses and particles in harmful quantities which are released into the atmosphere due to natural or human activities dividing into natural sources: coming from natural phenomena that discharge air pollutants such as SO₂, CO₂, NO₂, CO, and sulfate; and anthropogenic sources, artificial sources that emit from industrial production that re-

lease hydrogen, oxygen, nitrogen, sulfur, metal compounds, and other particles. This release of pollutants results in a fundamental problem in many parts of the world, with two leading international concerns. First, there is an impact on human health, such as the aggravation of diseases. Second, increased environmental impacts, such as acid rain, climate change, and global warming.²

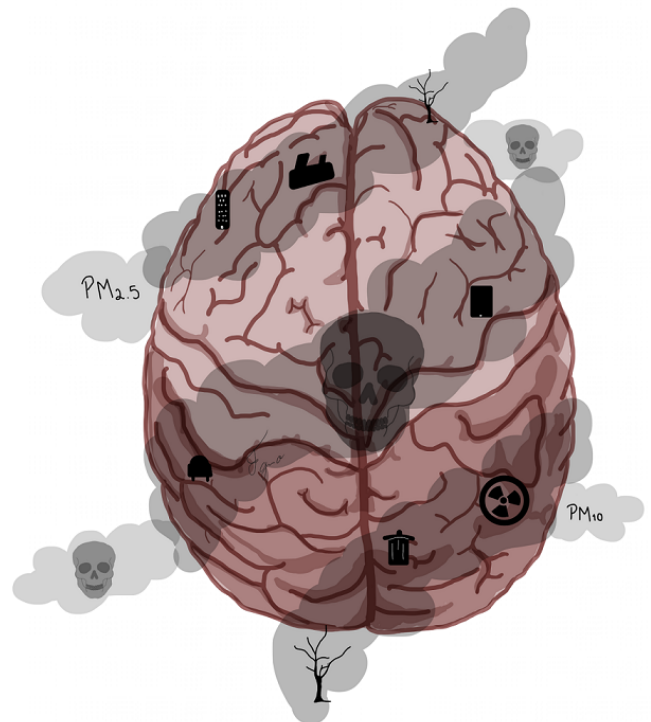


Figure 1: Brain and air pollution.



Figure 2: Primavera forest (Source: Wikipedia CC BY-SA 4.0).

Air pollution has been associated with detrimental effects on human health, including stroke (Figure 1). The mechanisms of air pollution-related stroke have not been fully elucidated. However, evidence suggests that air pollutants increase oxidative stress and hypothalamic-pituitary-adrenal axis activation, leading to endothelial and blood-brain barrier dysfunction. Fine particles like $<2.5 \mu\text{m}$ ($\text{PM}_{2.5}$), one of the main pollutants of traffic emissions, can reach the brain and cause local inflammatory responses. Therefore, chronic exposure to these substances substantially increases the risk of stroke.³

EVIDENCE OF ASSOCIATION IN MEXICO

Mexico City, once considered the most polluted city in the world, has faced decremental conditions in air quality. These effects are associated with various diseases, with increased interest in the heart and lungs, particularly in susceptible populations with underlying conditions. A study carried out in this metropolitan area, published in 2018 by Gutierrez-Avila et al., performed daily measures of $\text{PM}_{2.5}$ in the city-wide, assessed with estimates from a new hybrid spatiotemporal model using satellite aerosol optical depth collection ($\text{AOD-PM}_{2.5}$), between 2004 and 2013. In this study, the authors reported a mean incidence of cardiovascular and cerebrovascular death of 39 ± 8.2 , being hemorrhagic stroke the most common cause of cerebrovascular death. The daily av-

erages of $\text{AOD-PM}_{2.5}$ and $\text{GAM-PM}_{2.5}$ were $24.4 \mu\text{m}^3 \pm 8.2$ and $25.9 \mu\text{g}/\text{m}^3 \pm 10.3$, respectively, reflecting better estimations with the AOD model. Increases of $10 \mu\text{g}/\text{m}^3$ in $\text{PM}_{2.5}$ showed trends of association with cerebrovascular mortality (3.43%; 95% CI: 0.10-6.28).⁴ Similar results were obtained from a systematic review conducted in 2014 by Wang et al., where $\text{PM}_{2.5}$ was associated with a 1.4% increase in the risk of cerebrovascular death (95% CI: 1.009-1.019).⁵

Awareness of air quality and its consequences is the first step in the fight against climate change and air pollution-related diseases. In a study conducted by Borbet TC et al., which defined ranges of air quality by the Índice Metropolitano de la Calidad del Aire (IMECA), being the range of 101 to 150 unhealthy for sensitive populations, such as young children and older adults with underlying heart or lung disease, and the range of 151 to 200 a state of emergency, in which the entire population was at risk of adverse health effects. This study showed IMECA knowledge, an easy tool to measure air quality, in only 61.4% and 43.9% of the population in Mexico City and Mexico state, respectively. The population with a respiratory illness, compared to those without, was 14% more likely to know this index. Health physicians mainly provided awareness of this air quality index. These results highlight the critical role of health providers in raising awareness among the general population between air pollution and disease.⁶

As well as Mexico City, Guadalajara is one of the most populated urban areas in Mexico. Recent increases in traffic and industrial emissions, combined with the annual burn of the Primavera forest (Figure 2), have decreased the air quality in this metropolitan area, increasing the risk of cardiovascular and cerebrovascular diseases.⁷ Therefore, an extensive analysis of the association between cerebrovascular diseases and air quality should be carried out.

DECLARATION OF CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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