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AUC RESEARCHERS CONTRIBUTE TO GLOBAL STUDY LINKING ENVIRONMENT TO BRAIN AGING

Cairo, May 3, 2026 - A team from The American University in Cairo (AUC), led by Mohamed Salama, professor at the Institute of Global Health and Human Ecology (IGHHE) and senior fellow at the Global Brain Health Institute (GBHI), and May Bakr, assistant professor in the Institute of Global Health and Human Ecology, contributed to a groundbreaking international study published in Nature Medicine revealing that the biological age of the brain can be accelerated or delayed by environmental risk and protective factors across 34 countries. The stronger effects arise from interactions among environmental, social and political conditions.

The study, which analyzed data from 18,701 individuals, explored how the “exposome,” the total combination of environmental, social, and political factors we experience throughout life, impacts the pace at which the human brain ages. The researchers found that these factors do not act in isolation. Instead, they work together in a "syndemic" way, meaning that when multiple negative factors, such as pollution and poverty, occur simultaneously, their combined impact on the brain is much more damaging than any single factor alone.

The study analyzed 73 country-level indicators, including air pollution, climate change, access to green spaces, water quality, income inequality, and political and democratic conditions. The team found that these combined factors explained the variation in brain aging 15 times better than looking at a single risk factor on its own. This represents a major shift in how scientists understand brain health: It is the cumulative effect of our environment that truly matters.

“This work showed the importance of providing several layers of assessments, including advanced radiological techniques, to achieve a better understanding of the brain aging process. The work emphasizes the exposome approach, which necessitates bringing together different datasets from biological, social, environmental and clinical perspectives,” Salama said.

The findings also showed that different types of environmental pressures affect the brain in different ways. Physical environment, such as pollution, extreme temperatures, and limited green spaces were linked to changes in the brain structure, especially affecting areas related to memory, emotions, and automatic body functions. Social conditions such as poverty, inequality, weak civic participation, and limited access to resources were more strongly linked to how the brain functions, affecting the networks responsible for decision-making, social understanding, and emotional control.

The research found that a high combined environmental burden had an even stronger link to accelerated brain aging than some clinical diagnoses, including Alzheimer’s disease and frontotemporal dementia. Among the main factors associated with faster brain aging were poverty, poor access to green spaces, high air pollution, extreme weather patterns, weak democratic institutions, and broader socioeconomic inequality.

The findings highlight that healthy brain aging depends not only on personal lifestyle choices and medical care, but also on broader environmental, social, and institutional factors. The study calls for coordinated action across public health, environmental, urban planning, and policy sectors to reduce pollution, improve access to green spaces and resources, and strengthen social support systems to promote healthier brain aging across populations.

Bakr, who led data coordination, quality control, and curation for the Egyptian cohort, ensuring its reliability and seamless integration into the global dataset, said, “This study represents a truly global effort, bringing together harmonized multimodal data from 34 countries to capture the complexity of brain aging. It uniquely integrates the physical and social exposome and shows that a higher combined exposome burden is associated with an increased risk of accelerated brain aging. The findings highlight the importance of coordinated action across public health, environmental and policy sectors to support healthy brain aging across populations.”