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Heat Stress Affects the Brain, Too

New study findings demonstrate the extent to which heat can harm the human brain, impacting performance and safety.

Heat stress is a great concern for about half of the global population, and many workers in agriculture, construction, and transport are at risk from being affected by exposure to strong sunlight. Scientists—and anyone who has worked in the heat!—have long known that working for a long time in the sun can impact physical performance, but little research has been done on the effects of heat on the human brain, and previous studies were conducted on people in laboratories.

Researchers at the University of Copenhagen found clear negative effects on cognitively dominated functions and coordination of complex minor tasks. This implies that previous assumptions underestimated the impact of solar radiation on brain temperature and thus cognitive performance, particularly over long periods.

'The novelty of the study is that we provide evidence that direct exposure to sunlight - especially to the head - impairs motor and cognitive performance,' says professor Lars Nybo, the project coordinator from the Department of Nutrition, Exercise and Sports at the University of Copenhagen . He continues, 'Adding to this, the decline in motor and cognitive performance was observed at 38.5 degrees [Celsius], which is a 1-degree lower body temperature than previous studies have shown, which is a substantial difference.'

'Health and performance impairments provoked by thermal stress are societal challenges intensifying with global warming and that is a prolonged problem we must try to mitigate. But we must also adapt solution to prevent the current negative effects when e.g. workers are exposed and this study emphasize that it is of great importance that people working or undertaking daily activities outside should protect their head against sunlight. The ability to maintain concentration and avoid attenuation of motor-cognitive performance is certainly of relevance for work and traffic safety as well as for minimizing the risks of making mistakes during other daily tasks,' says associate professor Andreas Flouris from FAME Laboratory in Greece.

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Droughts Can Increase Electricity Bills

It seems obvious that droughts will have an impact on people's ability to water their lawn or result in farm losses, but what might be less obvious is the impact that it could have on your power bill.

A recent study conducted by North Carolina State University examined the 'downstream' effects of the 2012–2016 California drought, one of the worst in the state's history.

California relies on hydropower to supply about 13% of its energy needs, and during the drought, there were lower levels of precipitation, melted snow, and stream flow. As a result, hydropower met only 6% of the state's electricity needs during the worst year of the drought, even as increased temperatures led to a greater demand for power for cooling.

Researchers estimated that the loss of hydropower generation cost three main investor-owned utilities in California $1.9 billion. However, increased demand for cooling because of higher temperatures in the period probably had a larger economic cost than the lost hydropower, at $3.8 billion. Both are costs that can be passed on to consumers.

They also found that increased harmful emissions of greenhouse gases could be linked to hydropower losses during drought in the future, even as more sources of renewable energy are added to the grid.

'There is an expectation that droughts like this will happen again in the future, so there's a lot of attention on the way it impacted the state as a whole and their power system,' said Jordan Kern, corresponding author of the study and an assistant professor in NC State's Department of Forestry and Environmental Resources. 'We felt there was a need to understand what happens to the grid during drought, especially from a financial, economic, and environmental perspective, and we wanted to provide more clarity.'

The study was published online in the journal *Environmental Research Letters*.

Heat Causes Thousands, Not Hundreds, of Deaths Each Year, Study Says

A new study says more people may be dying of heat-related causes each year in the United States than previously thought. Previous estimates have

Hurricane Season Could Multiply COVID-19 Miseries

The COVID-19 pandemic could worsen stressors during hurricane season, an article in *Nature Climate Change* says.

The article, which brought together a variety of experts to weigh in on specific areas, focused on four main sectors—food, water, health, and infrastructure—where connected extremes can lead to unforeseen impacts. For example, in 2017, Hurricane Maria had an outsized impact on Puerto Rico's undermaintained infrastructure, limited budget, and aging population.

Now, with NOAA predicting an above-average hurricane season, experts are concerned that the combination of strong storms and COVID-19 challenges could create 'the perfect storm' of stressors.

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'The COVID-19 crisis will very likely increase the impacts associated with the climatic extreme events that will inevitably occur somewhere across the globe over the next weeks or months or already have occurred,' said coauthor Thomas Wahl, an assistant professor in University of Central Florida's Department of Civil, Environmental, and Construction Engineering and a member of University of Central Florida's National Center for Integrated Coastal Research.

He adds, 'For example, shelters cannot operate at full capacity, health care systems are already under pressure, and emergency funds are depleted.'

The researcher says that many of the most impactful natural hazards experienced over the past decade could be considered connected extremes, in which either different factors in the physical climate system combined in unfortunate ways or the impacts were made worse by interactions between physical and societal systems.

'It's important to recognize and treat connected extremes as such, and for scientists from different fields to engage directly with stakeholders and decision makers to develop new, robust and flexible policies to better combat their negative impacts,' Wahl says.

pegged the annual heat-related death toll at 600.

The study, by researchers at the Boston University School of Medicine, used data from the National Center for Health Statistics on deaths in the most populous counties from 1997 to 2006 and analyzed the association between days considered moderately or extremely hot in that county and the number of deaths from any cause.

They found that heat contributed to the deaths of 5,600 people each year on average in 297 counties comprising three-fifths of the U.S. population.

The researchers estimated that moderate heat killed 3,309 people per year in the counties included in the study, and extreme heat killed 2,299 people each year.

'How dangerous a hot day is may depend on where you live,' says study lead author Dr. Kate R. Weinberger, assistant professor of occupational and environmental health at the University of British Columbia School of Population and Public Health.

'A 90 °F day might be dangerous in Seattle, but not in Phoenix,' she says. 'One of the factors that gives rise to this phenomenon is differing degrees of adaptation to heat. For example, air conditioning is much more common in cities like Phoenix that experience hot weather frequently versus cities like Seattle with cooler climates,' Weinberger says, noting that demographic factors can also affect how vulnerable a population is to heat—heat especially endangers older adults, children, pregnant women, and outdoor workers.

Study senior author Dr. Gregory Wellenius, director of the Boston University School of Public Health Climate and Health program, said, 'Heat is very much a threat to the health of our communities and our families today. He added, 'Public health officials have a responsibility to implement heat action plans–as many communities across the world already have–in order to warn residents ahead of days of extreme heat and to help residents cope with the heat and minimize their health risks.'

The Air Really is Clearer Under COVID-19 Lockdowns, Studies Find

It's not just your imagination; the air really has been clearer since shelter-in-place orders went out across the globe in an effort to control the COVID-19 pandemic, two new studies in the journal *Geophysical Research Letters* have found.

Researchers used satellite measurements of air quality to estimate the changes in nitrogen dioxide pollution over the major epicenters of the outbreak: China, South Korea, Italy, Spain, France, Germany, Iran, and the United States.

They found that nitrogen dioxide pollution decreased by an average of 40% over Chinese cities and by 20–38% over Western Europe and the United States during the 2020 lockdown, as compared with the same time in 2019.

However, the drop in nitrogen dioxide pollution has caused an increase in surface ozone levels in China, according to one of the new studies.

In highly polluted areas, particularly in winter, surface ozone can be destroyed by nitrogen oxides, so ozone levels can increase when nitrogen dioxide pollution goes down. As a result, although air quality has largely improved in many regions, surface ozone can still be a problem, according to Guy Brasseur, an atmospheric scientist at the Max Planck Institute for Meteorology in Hamburg, Germany, and lead author of one of the new studies.

Jenny Stavrakou, an atmospheric scientist at the Royal Belgian Institute for Space Aeronomy in Brussels and co-author of one of the papers, said that researchers have not seen such a large drop in emissions since they began monitoring air quality from satellites in the 1990s.

'Maybe this unintended experiment could be used to understand better the emission regulations,' Stavrakou said. 'It is some positive news among a very tragic situation.


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