

# Can sudden weather change cause strokes?

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Credit: George Hodan/public domain

A collaborative study led by a neurologist at Rush University Medical Center and an environmental scientist at the University of Illinois at Chicago suggests that weather patterns that cause dramatic changes in barometric pressure may increase the incidence of a type of stroke known as spontaneous intracerebral hemorrhage, that is, the rupture of a

blood vessel in the brain.

The researchers reported their findings in the journal article "The Influence of Weather on the Incidence of Primary Spontaneous Intracerebral Hemorrhage" which recently was published in the online edition of the *Journal of Stroke and Cerebrovascular Diseases*.

"Prior studies have found that colder temperatures lead to an increased risk for intracerebral [hemorrhage](#)," said Dr. Rajeev Garg, an assistant professor in the Department of Neurological Sciences at Rush and principal investigator of the study. "Temperature influences barometric [pressure](#) and vice versa."

"What we do not know is which of these two is causing the increased risk of hemorrhage. Our findings suggest that when it gets colder outside, the corresponding barometric pressure is likely the cause for the increased risk for intracerebral hemorrhage, not just [temperature change](#) alone."

The team of researchers analyzed the impact of one of these two [weather](#) variables when the other is held constant. They found that the change in barometric pressure and average barometric pressure are independent, but the change in [temperature](#) is influenced by the average barometric pressure.

"This is the first study to look at the collective influence of temperature, barometric pressure and dew point temperature on the incidence of spontaneous intracerebral hemorrhage," Garg said.

Study compared 455 stroke incidents with weather data

The study prospectively screened 603 patients who suffered a spontaneous intracerebral hemorrhage (sICH) between January 2013 and

December 2016. The mean age was 61 years, 56 percent of patients were men, 59.1 percent were black and 86.6 percent of patients were diagnosed with high blood pressure.

Hourly temperature, sea level barometric pressure and dew point for the three-year period were obtained from the National Oceanic Atmospheric Administration's weather stations at Midway and O'Hare International Airports.

Of the 603 patients, 455 (75.5 percent) patients identified had an established date and time when they each last felt normal. Then, temperature, barometric pressure, and dew point temperature were analyzed for a six-hour period prior to each stroke incident for the patients. The date and time of the last known normal, which is the time right before hemorrhage, were prospectively ascertained from each patient during a personal interview.

## **Three weather variables could be linked to higher hemorrhage risk**

Researchers used a type of analysis called the Monte-Carlo simulation to determine whether the [weather patterns](#) prior to hemorrhage were different from the weather at a randomly selected moment in time. They found that the following three variables could be linked to higher risk for sICH:

1. Change in temperature
2. Change in barometric pressure
3. Average [barometric pressure](#)

Researchers also wanted to see if specific characteristics such as age, gender, or race were more likely associated with weather patterns that

increased the risk for spontaneous intracerebral hemorrhage.

"The results of the study indicate that the influence of weather on the incidence of spontaneous intracerebral hemorrhages is not a chance event," Garg said. "We did not find any association between patient characteristics and high-risk weather patterns. This suggests that high-risk weather patterns seem to impact [patients](#) equally."

"We must monitor the effects of climate change on weather variability," Garg added. "If weather variability increases, this may place us at an increased risk for spontaneous intracerebral hemorrhage."

## **Study suggests need for increased weather monitoring and warnings**

According to Max Berkelhammer, Ph.D., the [environmental scientist](#) at UIC who is co-investigator of the study, "if climate change leads to an increase in the variability of pressure, then we might see an increase risk (of sICH).

"The results of our study highlight the continued need for climate and atmospheric scientists to develop denser networks of observations to provide information on climate and weather at the scales of cities or even neighborhoods," Berkelhammer continued.

"There are strong linkages between weather and human health, and we should work to harness the potential to operationalize weather data and weather models to reduce risks to vulnerable populations."

"In the same way we have air quality warnings and encourage people to stay inside under certain conditions, one could also imagine that if forewarning of large pressure changes associated with passing weather

fronts was known, we could communicate this to those at risk."

**More information:** Rajeev Kumar Garg et al. The Influence of Weather on the Incidence of Primary Spontaneous Intracerebral Hemorrhage, *Journal of Stroke and Cerebrovascular Diseases* (2018). DOI: [10.1016/j.jstrokecerebrovasdis.2018.10.011](https://doi.org/10.1016/j.jstrokecerebrovasdis.2018.10.011)

Provided by Rush University Medical Center

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