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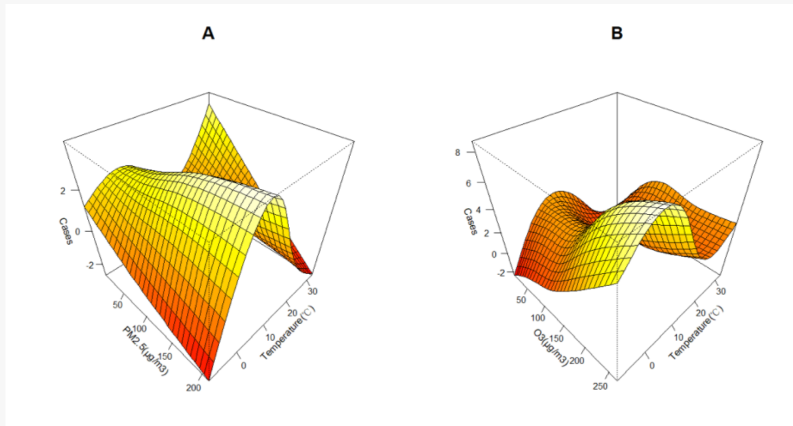
Interactive Effects of Weather and Air Pollutants factors on Influenza in Huaian, China

FAYETTEVILLE, GA, UNITED STATES, September 10, 2025 / EINPresswire.com/ -- This study found interesting, complex and important interactive effects among meteorological factors and ambient air pollutants on influenza incidences in Huaian, China.



Three-dimensional map of the interaction effect of temperature, PM2.5(Fine Particulate Matter) and O3(Ozone) with temperature on influenza in Huaian, China during 2019–2022.

Influenza, or the flu, is an infection that affects the respiratory system. The World Health Organization (WHO) notes that flu is common around the world, affecting about 5%–10% of adults and 20%–30% of children each year. Seasonal outbreaks can be serious, leading to 3–5 million cases of severe illness and an estimated 290,000 to 650,000 deaths worldwide each year.

Generally, influenza is highly contagious and exhibits strong seasonality, with outbreaks typically peaking during the autumn and winter months. This has prompted researchers to investigate the potential impacts of meteorological factors and air pollution on the transmission of influenza.

A study published in Infectious Disease Modelling used Huaian, China, as a case study to examine the interactive effects of meteorological factors (including temperature, humidity, wind speed, and air pressure) and air pollutants (including AQI, PM2.5, PM10, SO2, NO2, O3, and CO) on influenza cases from 2019 to 2022. “Our findings revealed that these relationships are far from being simple linear associations,” shares the study’s corresponding author Daihai He. “Huaian, located in the transitional zone between the southern warm temperate and northern subtropical regions, has a population of 45.62 million. During the study period, 9,205 influenza cases were reported.”

The researchers performed descriptive statistics for all collected continuous variables and established a distributed lag nonlinear model (DLNM) to quantify the impact of each factor. “The main findings showed that increasing PM2.5 levels were associated with a decreased risk of influenza at low concentrations (<32 μg/m³, AF = -16.24%), but with an increased risk at high concentrations (>32 μg/m³, AF = 15.90%),” adds He.

Within a certain temperature range, the risk of influenza increased as temperature decreased (AF = 30.91%). Subsequent interaction analysis showed that high temperatures could mitigate the promoting effect of PM2.5. Additionally, low humidity (<40%) during cooler months increases the survival and airborne transmission of viral droplets, while rainfall events may lead to indoor crowding and amplify contact-based transmission.

“Quantifying these lagged relationships can help local public health authorities use humidity and rainfall trends as early warning signals to predict influenza outbreaks in advance, enabling proactive measures such as targeted vaccination campaigns or hospital resource allocation. In addition, outdoor exposure time should be minimized during periods of low temperature and high PM2.5,” says He.

References
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