

# Association of Suicide Attempts with Temperature by Different Humidity

Seunghyeon Kim<sup>1</sup> and Eunsik Park<sup>1</sup>

<sup>1</sup>*Chonnam National University,  
Gwangju, 61186, Korea*

## Abstract

The effect of temperature on suicide is clear. Many countries around the world have investigated the effect of temperature on suicide or suicide attempts and found that short-term exposure to high temperatures can be a trigger in common. However, the results by season differed across countries. The study in Israel showed that the effect of temperature and suicide attempts was significant only in summer, and the study in Korea was only significant in winter. We hypothesized that these seasonal differences are due to humidity. Therefore, this study investigated the modification of temperature effects on suicide attempts by humidity. We applied a time-stratified case-crossover design to control for seasonality and individual differences. We combined conditional Poisson regression with distributed lag non-linear models (DLNM) to explore a lag pattern and to obtain risk ratios (RR) and their 95% confidence intervals(CI) for the effects of the 80th percentile of temperature relative to the 10th percentile temperature. Then, interaction terms between relative humidity quartiles and temperature were generated to evaluate the modification of temperature effects on suicide attempts by relative humidity. Between 2014 and 2018, the count of suicide attempts is 39,803. The relative risk at the 80th percentile minimum temperature for suicide attempts was 1.09 (95% CI: 1.03, 1.15) compared with the risk at the 10th percentile minimum temperature at lag 1. In the case of maximum temperature, the relative risk was 1.12 (95% CI: 1.03, 1.22) at lag 0. The interaction effects between relative humidity and temperature effect were only found in the lowest humidity quantiles. This may explain why the effect of seasonal temperature varies from country to country. It also emphasizes that the association between temperature and suicide attempts is clear at low humidity. However, the study needs to be conducted in more countries to confirm the effect of temperature on humidity.

## Keywords

Suicide attempts; Temperature; Relative humidity; Case cross-over design; Distributed lag non-linear model

## References:

- Kalkstein, A. J., Belorid, M., Dixon, P. G., Kim, K. R., and Bremer, K. A. (2019). Seasonal variations in temperature–suicide associations across South Korea. *Weather, Climate, and Society*. 11(4), 731-739.
- Kubo, R., Ueda, K., Seposo, X., Honda, A., and Takano, H. (2021). Association between ambient temperature and intentional injuries: a case-crossover analysis using ambulance transport records in Japan. *Science of the total environment*. 774, 145511.
- Gasparrini, A., Armstrong, B., and Kenward, M. G. (2010). Distributed lag nonlinear models. *Statistics in medicine*. 29(21), 2224-2234.
- Yarza, S., Vodonos, A., Hassan, L., Shalev, H., Novack, V., and Novack, L. (2020). Suicide behavior and meteorological characteristics in hot and arid climate. *Environmental research*. 184, 109314.