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Analysis of important meteorological indicators of heatstroke mortality in Japan

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Background and Aim: Heatstroke has become a serious issue in Japan. To reduce the risk of heatstroke, the Japanese government has implemented initiatives such as the "Heatstroke Alert", which is issued when the wet bulb globe temperature (WBGT) exceeds 33 °C. Although such initiatives employ the WBGT as a standard, other important meteorological indicators may also be related to heatstroke. In this study, we analyzed important meteorological indicators of heatstroke mortality using machine learning.

Methods: We used ICD-10: X30 for heatstroke mortality data. The analysis was performed for two age groups, i.e., the <65- and ≥65-year age groups, across all 47 Japanese prefectures. The assessed meteorological indicators were the daily maximum/minimum/mean temperature, daily precipitation, solar radiation, daily average wind speed, daily average relative humidity, and daily maximum/average WBGT. We also assessed the lag and accumulated heat effects. Furthermore, the parameters RelTemp and RelWBGT, which consider the cumulative temperature/WBGT values from May 1 to the day of incidence, were adopted to express heat acclimatization. To analyze the importance of meteorological indicators, we applied the conditional permutation method, which can deal with collinearity among meteorological indicators, using a random forest approach.

Results: For each prefecture, we ranked the importance of the meteorological indicators for each age group and tabulated the number of times these meteorological indicators appeared in each ranking. RelTemp ranked first in 13 and 18 prefectures for the <65- and ≥65-year age groups, respectively. The meteorological indicators ranking first in the other prefectures varied.

Conclusions: RelTemp is the most important meteorological factor for heatstroke mortality in many prefectures; hence, RelTemp could be adopted as an auxiliary indicator for the "Heatstroke Alert".