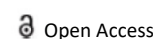




SHORT COMMUNICATION



Age and Regional Differences in the Incidence of Heat-Related Ambulance Transport in Japan

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ABSTRACT

Heat waves are increasing in intensity, frequency and length due to climate change. In recent years, Tokyo has often had more than 10 days with a daily maximum temperature exceeding 35°C. In 2020, Japan had 1,528 fatalities due to extreme heat exposure. Concurrently, populations are aging in many societies worldwide. In 2020, Japan's percentage of the population aged 65 or older reached 28.6%. Much of the literature indicates that older people are physiologically and behaviorally less resistant to heat stress, resulting in age-related differences in the incidence of heat stroke. In addition to age, the difference in summer environmental conditions of a residential area may cause heterogeneity in the ability for local populations to adapt to extreme high temperatures.

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KEYWORDS

Heterogeneity; Environmental conditions; Physiological subject experiment; Acclimatization

Description

Our study examined the association between extreme temperatures and Heat-related Ambulance Transport (HAT) in terms of age and region [1]. The number of daily HAT, Daily Maximum Temperature (DMT), and Daily Maximum Wet Bulb Globe Temperature (DMW) were collected for all 47 prefectures in Japan from July 21st to August 31st in the years 2017 to 2020. Age categories were juveniles (7 to 17 years old), adults (18 to 64 years old) and elderly (65 years old or older). The total number of incidents examined was 178,357. The number of people transported by ambulance due to heat-related incidence per unit population per day was calculated for each degree of DMT or DMW for three age categories of 47 prefectures. The number of HAT increased almost exponentially with respect to DMT or DMW. By using the exponential relationships of regression curves, DMT (denoted as T_1) or DMW (denoted as W_1) when HAT is expected to occur for one in 100,000 people was calculated for three age categories and 47 prefectures. For 47 prefectures, T_1 and W_1 were plotted against DMT or DMW averaged during the period of the selected HAT data. The regression line relating T_1 to aver-

age DMT of 47 prefectures was calculated for three age groups by least square weighted by the population of each prefecture. For regional difference, the highest average DMT was 34.4°C in Kyoto and the lowest was 26.1°C in Hokkaido. The highest, mean and lowest T_1 in 47 prefectures were 35.4°C, 33.0°C and 30.5°C for juveniles, 37.0°C, 34.9°C and 31.4°C for adults, and 33.3°C, 31.7°C and 29.4°C for elderly, respectively. A comparison at the same average DMT of 32.0°C, T_1 was 33.5°C, 35.2°C and 31.9°C for juveniles, adults and elderly, respectively. Similarly, the highest average DMW was 31.3°C in Nagasaki and the lowest was 24.0°C in Hokkaido. The highest, mean and lowest W_1 in 47 prefectures were 32.5°C, 30.4°C and 28.0°C for juveniles, 33.5°C, 31.8°C and 28.7°C for adults, and 30.8°C, 29.4°C and 26.9°C for elderly. A comparison at the same average DMW of 30.0°C, W_1 was 31.1°C, 32.4°C and 29.8°C for juveniles, adults and elderly, respectively.

Acclimatization occurs depending on the intensity or duration of environmental heat stress. In Japan, a physiological subject experiment observed that the human body becomes heat acclimatized by the natural summer heat environment [2]. Since Japan has a long north-south axis and average dai-

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ly maximum temperatures in summer differed by more than 8°C, the heat acclimatization level is also expected to differ from prefecture to prefecture. In this study, T_1 , W_1 were used as indicators of the local population's susceptibility to heat stroke. Our analysis showed that T_1 and W_1 were lower in northern prefectures, indicating that residents in the north are less acclimatized to heat stress than those in the south. In the U.S., regional heat safety activity guidelines were made for each of three regions divided by warm season maximum WBGT [3]. In Ontario, Canada, three heat warnings were tailored to the differences in meteorological conditions and heat vulnerability identified across Extreme South-western, Southern, and Northern Ontario [4].

Conclusion

Regarding age differences, T_1 was 3.3°C higher in adults than in the elderly, indicating that heat stroke occurs at lower temperatures in the elderly. The benefit of our research is that the data analysis by age group corrects for discrepancies due to the different age structure of each prefecture, because both age and residence influence the occurrence of heat-related illness. The results of this study suggested that regional differences in summer temperatures and age should be taken into account for heat-related illness prevention planning.

Acknowledgement

None

Competing Interests

None

References

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