Proceedings of the 4th International Conference on Statistics: Theory and Applications (ICSTA'22)
Prague, Czech Republic – July 28- 30, 2022
Paper No. 141
DOI: 10.11159/icsta22.141

Effect of Monthly Mean Temperature on Accidental Mortality in the Elderly: A Time-Series Analysis in Tokyo, Kyoto, Sapporo, Japan

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Extended Abstract

Based on monthly mortality from Non-Communicable Diseases (NCD) , we have studied on the relationship between temperature and disease deaths in Kyoto and Sapporo [1,2]. As a result, the Optimum Temperature (OT) indicated the lowest mortality showed the difference between the two cities, while the 84th percentile of daily mean temperature in each city showed the minimum mortality rate.

As the relationship between plague development and temperature has been clarified [3], it is important to study the relationship between temperature and disease in order to control diseases. However, there are few papers in Japan that study the relationship between temperature and accidental death such as falls for elderly.

Finding those OT values and epidemiological threshold quantities is urgent to minimize elderly mortality.

The purpose of this presentation is to clarify the relationship between the mortality rate of the elderly from injury and certain other consequences of external causes (ICD10, XIX) and the temperature in Japanese cities.

[Methods]

Vital Statistics of mortality by gender age-by month based on ICD10 are published by the Ministry of Health, Labour and Welfare of Japan. Three regions: Kyoto, Sapporo, and Tokyo were surveyed from 2010 to 2021. Monthly mean temperatures are announced by the Japan Meteorological Agency. The mortality rate was logarithmically converted to obtain the optimum curve with temperature. A time-series analysis [4] is based on the forecasting method of IBM SPSS ver. 26.

[Results and Discussions]

As with the relationship between total mortality and temperature, cubic regressions were most fitted for injury and certain other consequences of external causes in the elderly.

$\mathrm{Log}(m)=a_1x+a_2x^2+a_3x^3+C$ (m: monthly mortality, x: monthly means of daily mean, maximum, minimum temperature).

In autumn each 1℃ increase in monthly mean of daily mean temperature (MMT) was associated with a 3.4% increase in accidental mortality of elderly(AM), a 0.1% increase in total death of elderly(TD). In winter 1℃ decrease in MMT was associated with a 4.3% increase in AM, a 1.3% increase in TD. The heat related effects in summer were strong in AM, (Relative Risk AM vs TD elevated to be 1.15), though the cold-related effects were stronger in both deaths.

There was no significant difference in mortality from fall with temperature. No significant difference in OT value of 21-22℃, was observed for AM, TD in Tokyo. OT showed a lower temperature with the increase in age of the elderly in the case of AM.

Excessive heat death due to extreme weather has not been observed in Japan in terms of TD. TD usually increases further at low temperatures. Accidental mortality from injury and external causes have been shown to be the same.

This study results that elderly mortality from injury and external causes increases at higher rate in the high temperature range than total mortality.

In the high temperature environment in the future, there is concern that the increase in accidental mortality of elderly will be higher than the increase in NCD.

Thank Prof. Y. Honda for his appropriate advice.
There is no conflict of interest to declare.
This work was supported by JSPS KAKENHI Grant Number JP17K01829.

References

[1] M. Kanamori and Y. Honda, “A study on the relationship between monthly temperature and cause of death in Kyoto and Sapporo, Japan from 1995 to 2017,” ISEE Vertical e-Poster P0389, 2021.

[2] Y. Honda, “Heat-related mortality,” in Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s, pp17-26, 2014.

[3] N. Samia, “Dynamics of the plague-wildlife-human system in Central Asia are controlled by two epidemiological threshold,” PNAS vol. 108, pp14527―14532, 2011.

[4] A. Gasparrini, “Mortality risk attributable to high and low ambient temperature: a multicountry observational study,” Lancet, vol.386, pp369-75, 2015. [Online]. Available: http://dx.doi.org/10.1016/ S0140-6736(14)62114-0