Cold Temperature and Cardiovascular Mortality – Reply –

We thank Dr Athyros and colleagues for their interest in our study and comments comparing their study with ours.

There are a few differences between the studies. Although Karagiannis et al reported a seasonal variation in stroke occurrence using hospital-based data,¹ we focused on mortality from cardiovascular disease (CVD) using cohort-based data.² However, it is certain that CVD occurrence and mortality are closely related because case fatality for CVD is relatively high.³ Therefore, we would like to discuss the effect of cold weather without being particular about whether it leads to the onset of or death from CVD.

There are several reports on seasonal variation in the occurrence of or death from CVD.^{4–6} As Athyros et al mentioned, the increase in CVD because of cold weather might be related to increased sympathetic tone, arterial hypertension, and high plasma fibrinogen levels. These risk factors have been reported to show seasonal variation.^{7–9} The main mechanism of the seasonal variation of these risk factors might be the effect of temperature. In other words, the effect of season could include the effect of temperature. Moreover, because a time-stratified case cross-over design is expected to control for seasonality as described in our paper, we believe that the results of our study indicated an independent effect of cold temperature on CVD.

It may be interesting to analyze the relationship between temperature and CVD for each season. Our study did not show a significant relationship between cold temperature and CVD mortality when we analyzed each season separately, probably because of the limitation of sample size. A more detailed and larger cohort of data would be required to reveal a relationship between temperature and CVD for each season. If we acquire such information about seasonal variation in the relationship between temperature and CVD, it would be more useful for educating susceptible people.

Additionally, Karagiannis et al classified stroke into ischemic stroke, intracerebral hemorrhage, subarachnoid hemorrhage, and transient ischemic attack.¹ We could not obtain significant results when we divided stroke into subgroups. This result may again be related to the small sample size. Because the mechanisms of ischemic stroke and hemorrhagic stroke are different, we need to analyze ischemic stroke and hemorrhagic stroke separately with a larger cohort of data.

Disclosures

None.

References

1. Karagiannis A, Tziomalos K, Mikhailidis DP, Semertzidis P, Kountana E, Kakafika AI, et al. Seasonal variation in the occurrence of stroke in northern greece: A 10 year study in 8204 patients. *Neurol Res* 2010; **32**: 326–331.
2. Atsumi A, Ueda K, Irie F, Sairenchi T, Iimura K, Watanabe H, et al. Relationship between cold temperature and cardiovascular mortality, with assessment of effect modification by individual characteristics. *Circ J* 2013; **77**: 1854–1861.
3. Tunstall-Pedoe H, Kuulasmaa K, Amouyel P, Arveiler D, Rajakangas AM, Pajak A. Myocardial infarction and coronary deaths in the World Health Organization MONICA project: Registration procedures, event rates, and case-fatality rates in 38 populations from 21 countries in four continents. *Circulation* 1994; **90**: 583–612.
4. Tanaka H, Shinjo M, Tsukuma H, Kawazuma Y, Shimoji S, Kinoshita N, et al. Seasonal variation in mortality from ischemic heart disease and cerebrovascular disease in Okinawa and Osaka: The possible role of air temperature. *J Epidemiol* 2000; **10**: 392–398.
5. Nakanishi N, Nishizawa S, Kitamura Y, Nakamura T, Matsumuro A, Sawada T, et al. Circadian, weekly, and seasonal mortality variations in out-of-hospital cardiac arrest in Japan: Analysis from AMI-Kyoto Multicenter Risk Study database. *Am J Emerg Med* 2011; **29**: 1037–1043.
6. Jakovljević D, Salomaa V, Sivenius J, Tamminen M, Sarti C, Salmi K, et al. Seasonal variation in the occurrence of stroke in a Finnish adult population. The FINMONICA stroke register [Finnish Monitoring Trends and Determinants in Cardiovascular Disease]. *Stroke* 1996; **27**: 1774–1779.
7. Lewington S, Li L, Sherliker P, Guo Y, Millwood I, Bian Z, et al. Seasonal variation in blood pressure and its relationship with outdoor temperature in 10 diverse regions of China: The China Kadoorie Biobank. *J Hypertens* 2012; **30**: 1383–1391.
8. Woodhouse PR, Khaw KT, Plummer M. Seasonal variation of blood pressure and its relationship to ambient temperature in an elderly population. *J Hypertens* 1993; **11**: 1267–1274.
9. Woodhouse PR, Khaw KT, Plummer M, Foley A, Meade TW. Seasonal variations of plasma fibrinogen and factor VII activity in the elderly: Winter infections and death from cardiovascular disease. *Lancet* 1994; **343**: 435–439.

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