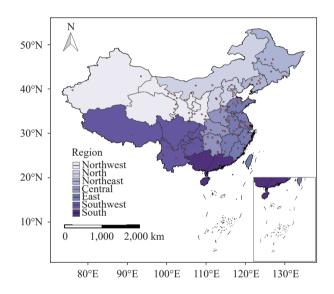
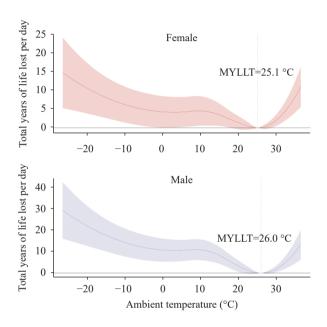
# **Supplemental Material**

#### **Statistical Model**

We used the best linear unbiased prediction (BLUP) to pool the regional- and national- overall cumulative associations. This method allows cities with small numbers of deaths to borrow information from larger populations sharing similar characteristics, which could provide more accurate estimates (1). To account for the effect modifications of climatological, demographic and socioeconomic factors, we included latitude and longitude, urbanization rates, population, gross domestic product (GDP), average temperature, and temperature range of each city into the BLUP estimations. Cochran Q test and I<sup>2</sup> statistic was reported to represent the residual heterogeneity (Supplementary Table S2).



SUPPLEMENTARY FIGURE S1. The spatial distribution of 93 study cities from 30 provincial-level administrative divisions in China used to explore the associations between ambient temperature and years of life lost due to stroke.



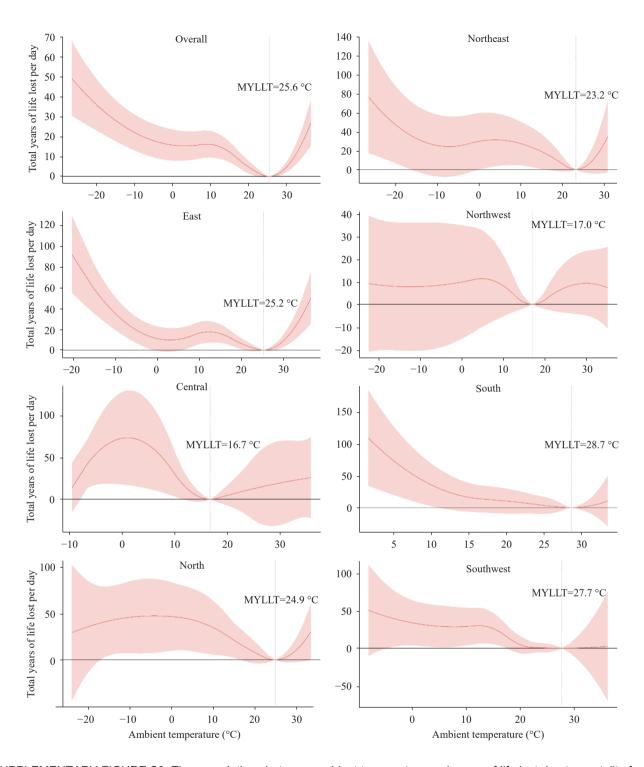
SUPPLEMENTARY FIGURE S2. The associations between ambient temperature and years of life lost due to mortality from stroke by sex in China, 2013–2016.

Abbreviation: MYLLT=The minimum years of life lost temperature.

SUPPLEMENTARY TABLE S1. The fractions of years of life lost and life expectancy loss caused by hot, cold and overall temperature across the seven regions.

Region	Attributable fraction (%, 95% CI)			Attributable life expectancy loss (years, 95% CI)		
	Hot	Cold	Non-optimum	Hot	Cold	Non-optimum
North	0.10 (-0.14, 0.35)	16.85 (2.36, 31.35) *	16.96 (2.21, 31.70) *	0.01 (-0.02, 0.05)	2.19 (0.31, 4.07)	2.20 (0.29, 4.11)
Northeast	0.16 (-0.16, 0.47)	8.59 (-0.70, 17.87)	8.75 (-0.85, 18.34)	0.02 (-0.02, 0.07)	1.26 (-0.10, 2.61)	1.28 (-0.12, 2.68)
Northwest	1.72 (-1.07, 4.50)	5.79 (-8.56, 20.14)	7.51 (-9.63, 24.64)	0.24 (-0.15, 0.62)	0.80 (-1.18, 2.77)	1.03 (-1.32, 3.38)
East	0.55 (0.15, 0.94)	4.88 (0.35, 9.40) *	5.42 (0.50, 10.35) *	0.06 (0.02, 0.11)	0.56 (0.04, 1.08)	0.62 (0.06, 1.19)
Central	2.40 (-8.21, 13.02)	8.30 (-2.51, 19.12)	10.71 (-10.72, 32.14)	0.31 (-1.07, 1.69)	1.08 (-0.33, 2.48)	1.39 (-1.39, 4.17)
South	0.07 (-0.37, 0.50)	8.68 (-4.60, 21.97)	8.75 (-4.97, 22.47)	0.01 (-0.05, 0.06)	1.08 (-0.57, 2.73)	1.09 (-0.62, 2.79)
Southwest	$9.36 \times 10^{-5} \ (-2.89 \times^{10-3}, \ 3.08 \times 10^{-3})$	12.91 (1.10, 24.71) *	12.91 (1.10, 24.71) *	1.19×10 <sup>-5</sup> (-3.69×10 <sup>-4</sup> , 3.92×10 <sup>-4</sup> )	1.64 (0.14, 3.15)	1.64 (0.14, 3.15)
Nationwide	0.07 (-0.02, 0.16)	10.84 (5.69, 15.99)	10.91 (5.67, 16.15) *	1.47×10 <sup>-2</sup> (3.60×10 <sup>-3</sup> , 2.58×10 <sup>-2</sup> )	1.38 (0.72, 2.04)	1.39 (0.72, 2.06)

<sup>\*</sup> The estimated value is statistically significant.



SUPPLEMENTARY FIGURE S3. The associations between ambient temperature and years of life lost due to mortality from stroke by regions in China, 2013–2016.

Abbreviations: MYLLT=The minimum years of life lost temperature.

## **Estimating the Attributable Number and Fraction of YLLs**

Based on the overall cumulative temperature-YLL curve, we divided daily mean temperature into components related to low and high temperatures separated by MYLLT. The coefficients corresponding to each unfavorable temperature were then extracted for the following analyses. The calculation formula for a specific region was shown as below:

SUPPLEMENTARY TABLE S2. I<sup>2</sup> statistic and Cochran Q test from different multivariate random-effects meta-regression models.

Model	Predictor	Test for predictor	Q test	l² (%)
Intercept-only	-	<0.00	904.79	46.90
Single predictor				
	Average temperature	<0.01	889.71	46.60
	Temperature range	<0.01	891.63	46.70
	GDP	<0.01	858.59	44.70
	Urbanization rate	<0.01	888.13	46.50
	Latitude	<0.01	892.71	46.80
	Longitude	<0.01	874.32	45.70
Full model	-	<0.01	767.27	42.00

Abbreviation: GDP=gross domestic product.

$$AY = \sum_{(i=1)}^{j} (Temp_i - MYT) \times coef_i$$
  
 
$$AF = AY/TotalYLLs$$

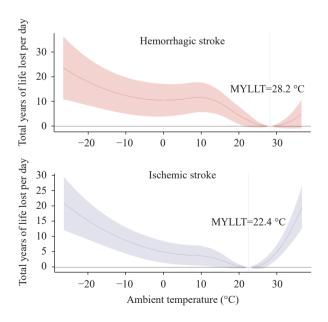
where j represents the sequence of non-optimum temperature days; Temp, refers to the value of unfavorable temperatures on day i; MYLLT represents the temperature corresponding to minimum YLL risk; coef, represents exposure-response coefficient at specific temperature; AY and AF represents the YLLs and fraction attributable to non-optimum temperatures, respectively; Total YLLs represents the sum of the daily YLLs during the study period.

## **Calculating the Attributable Loss of Life Expectancy**

To assess how many years of life expectancy lost to each of the deceased person due to unfavorable temperatures, we further calculated the attributable life expectancy loss in a specific region, by adopting the following formula:

Attributable life loss = AY / Total deaths

where AY represents the attributable YLLs, total deaths represent the sum of daily death count during the study period.

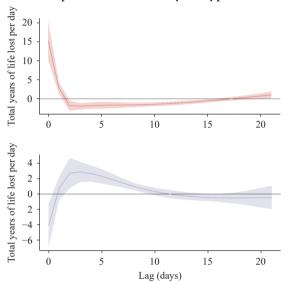


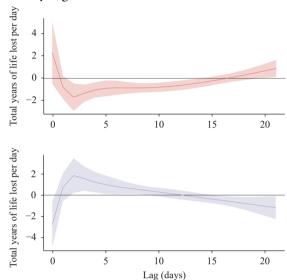
SUPPLEMENTARY FIGURE S4. The associations between ambient temperature and years of life lost due to mortality from hemorrhagic stroke and ischemic stroke in China, 2013–2016.

Abbreviation: MYLLT=The minimum years of life lost temperature.

## Lag Effects of Temperature on YLLs from Stroke

Supplementary Figure S5 depict the pooled delayed associations within 21 days between cold and heat weather and YLL due to stroke. We defined the 2.5th and 97.5th percentile of the daily average temperature to represent cold and hot days. We observed that cold weather was associated with longer-lasting effects on YLL than heat weather and the YLL risk could last for 10 days with a highest effect on lag 3 day. For hot temperatures, there was the strongest YLL risk on the current day and the effects decreased rapidly to zero until lag 2 day, which followed by an obvious mortality displacement. In addition, we observed the similar patterns for lag-response curves of the heat and cold temperature, stratified by subtypes of stroke (Supplementary Figures S6, S7).



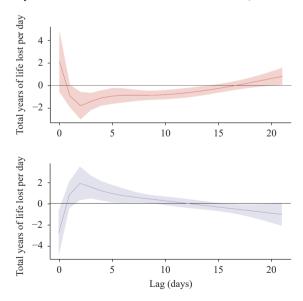


SUPPLEMENTARY FIGURE S5. Lag-response curves of effects of extreme heat and extreme cold temperature on years of life lost due to stroke on the days of death (lag=0) and up to 21 days prior to death.

The red and blue sections represent extreme heat and extreme cold temperature, respectively.

SUPPLEMENTARY FIGURE S6. Lag-response curves of effects of extreme heat and extreme cold temperature on years of life lost due to hemorrhagic stroke on the days of death (lag=0) and up to 21 days prior to death.

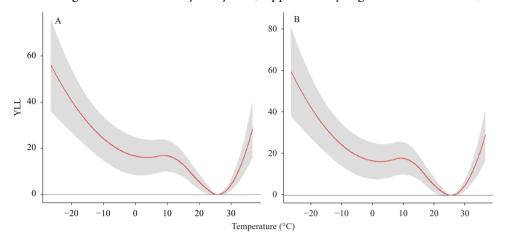
The red and blue sections represent extreme heat and extreme cold temperature, respectively.



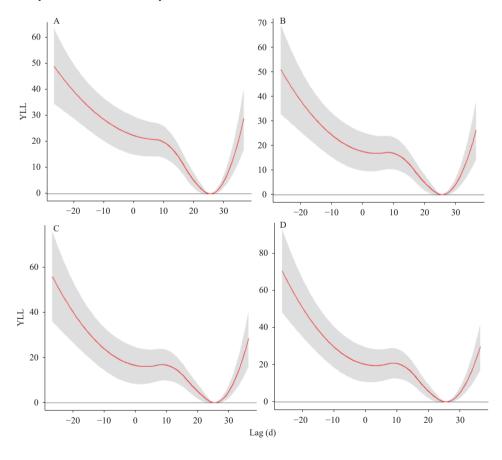
SUPPLEMENTARY FIGURE S7. Lag-response curves of effects of extreme heat and extreme cold temperature on years of life lost due to ischemic stroke on the days of death (lag=0) and up to 21 days prior to death. The red and blue sections represent extreme heat and extreme cold temperature, respectively.

### **Sensitivity Analyses**

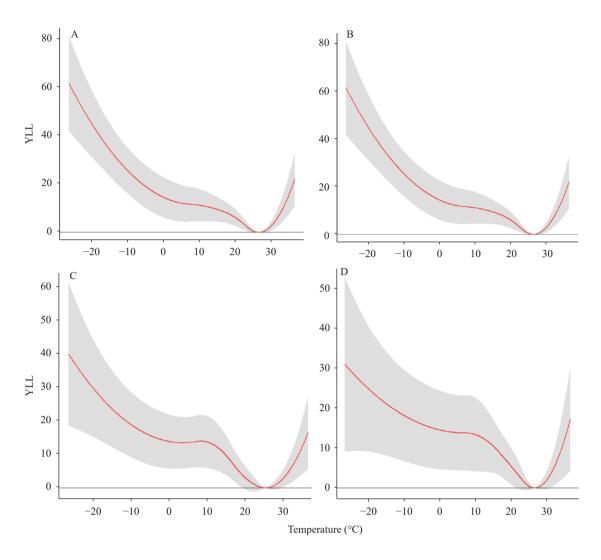
To evaluate the robustness of the main model, we conducted the following sensitivity analyses by: (1) controlling for the confounding effects of other air pollutants by adding the concentrations of O<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>; (2) alternating maximum lags at 15 d, 18 d, 21 d, and 24 d; (3) alternating the df of time term from 6 to 9. And we obtained the robust findings from the sensitivity analyses. (Supplementary Figures S8, S9 and S10).



SUPPLEMENTARY FIGURE S8. The national-pooled cumulative temperature-years of life lost (estimates and 95% confidence intervals), with and without the adjustment of  $O_3$ ,  $SO_2$ , and  $NO_2$ . A, B represents not added and added the above pollutants, respectively. Abbreviations: YLL=years of life lost.



SUPPLEMENTARY FIGURE S9. The national-pooled cumulative temperature-years of life lost (estimates and 95% confidence intervals), by changing maximum lags. A, B, C, and D represents 15 d, 18 d, 21 d, and 24 d, respectively. Abbreviation: YLL=years of life lost.



SUPPLEMENTARY FIGURE S10. The national-pooled cumulative temperature-years of life lost (estimates and 95% confidence intervals), by changing degree of freedom (df) of time term. A, B, C, and D represents the df set to 6, 7, 8, and 9, respectively. Abbreviations: YLL=years of life lost.

#### **REFERENCES**

1. Gasparrini A, Guo Y, Hashizume M, Lavigne E, Zanobetti A, Schwartz J, et al. Mortality risk attributable to high and low ambient temperature: a multicountry observational study. Lancet 2015;386:369 – 375. http://dx.doi.org/10.1016/s0140-6736(14)62114-0.