Supplementary Materials to

Mortality risk and burden associated with ambient temperature: time-series study in 272 main Chinese cities

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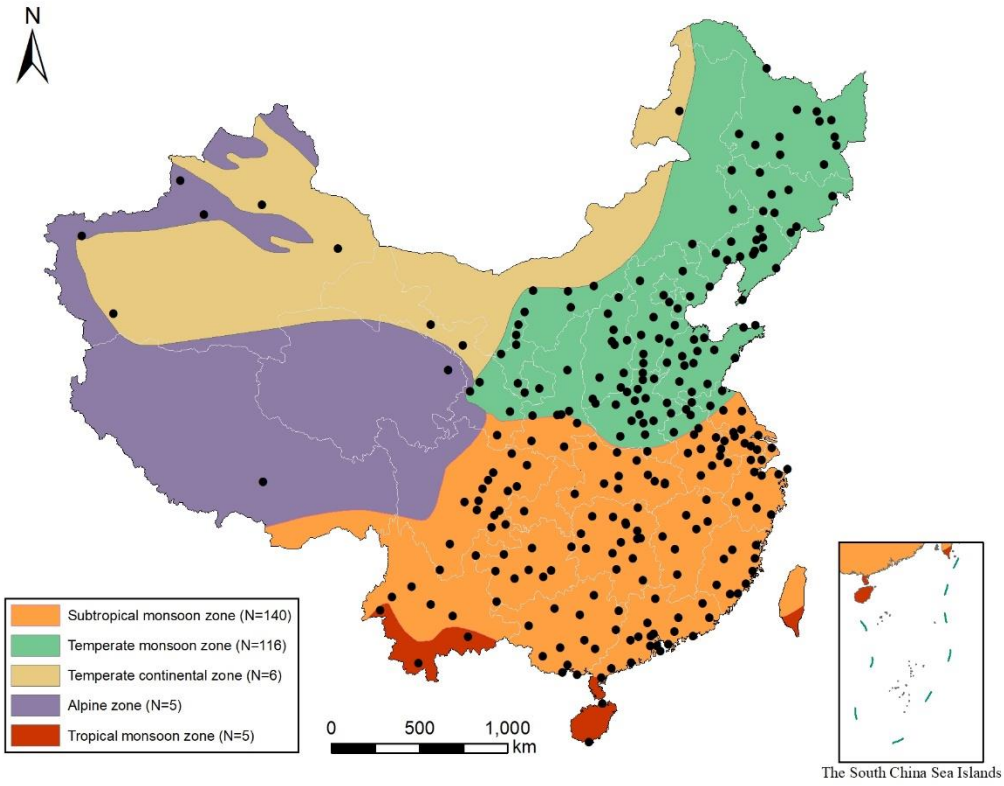

Figure SM1. The map and climatic divisions of 272 main cities in China

Table SM1. The descriptive statistics of minimum-mortality percentiles and minimum-mortality temperatures in 272 Chinese cities, 2013 to 2015

Variables	Mortality	Mean	SD	Min	P25	P50	P75	Max
MMP	Total	79	23	5	80	84	91	99
	CVD	80	22	5	82	86	91	99
	CHD	78	22	5	80	83	87	99
	Stroke	80	24	1	82	86	91	99
	Ischemic stroke	71	25	1	76	79	81	99
	Hemorrhagic stroke	85	24	1	91	92	93	99
	Respiratory disease	78	27	6	71	78	91	99
	COPD	80	19	6	77	80	91	99
MMT	Total	22.8	8.7	-17.3	23.1	25.6	27.8	32.0
	CVD	22.8	8.7	-12.4	22.7	26.1	28.2	32.0
	CHD	23.1	8.8	-17.3	22.5	25.9	27.6	32.0
	Stroke	22.6	8.8	-22.2	23.0	26.1	28.0	32.0
	Ischemic stroke	21.8	10.9	-33.1	21.4	24.4	26.0	31
	Hemorrhagic stroke	23.7	7.7	-10.6	24.1	27.3	28.8	33.6
	Respiratory disease	21.6	9.7	-25.4	22.4	24.4	25.7	29.5
	COPD	21.7	6.1	-7.9	24．0	25．0	26.6	29.5

Abbreviations: MMP, minimum-mortality (total) percentiles,%; MMT, minimum-mortality (total) temperatures, ℃; CVD, cardiovascular disease; CHD, coronary heart disease; COPD, chronic obstructive pulmonary disease; SD, standard deviation.

Table SM2. The numbers of premature deaths (×1000) of different causes attributable to moderate and extreme non-optimum temperature in 272 Chinese cities from 2013 to 2015.

Causes	Overall deaths	Attributable deaths			
		Moderate cold	Moderate heat	Extreme cold	Extreme heat
Total	1826	192	38	21	12
CVD	857	112	21	12	4
CHD	307	46	5	5	2
Stroke	415	52	8	5	2
Ischemic stroke	125	11	4	1	1
Hemorrhagic stroke	187	28	3	2	1
Respiratory disease	217	15	5	2	1
COPD	159	15	2	2	1

Abbreviations: CVD, cardiovascular disease; CHD, coronary heart disease; COPD, chronic obstructive pulmonary disease.

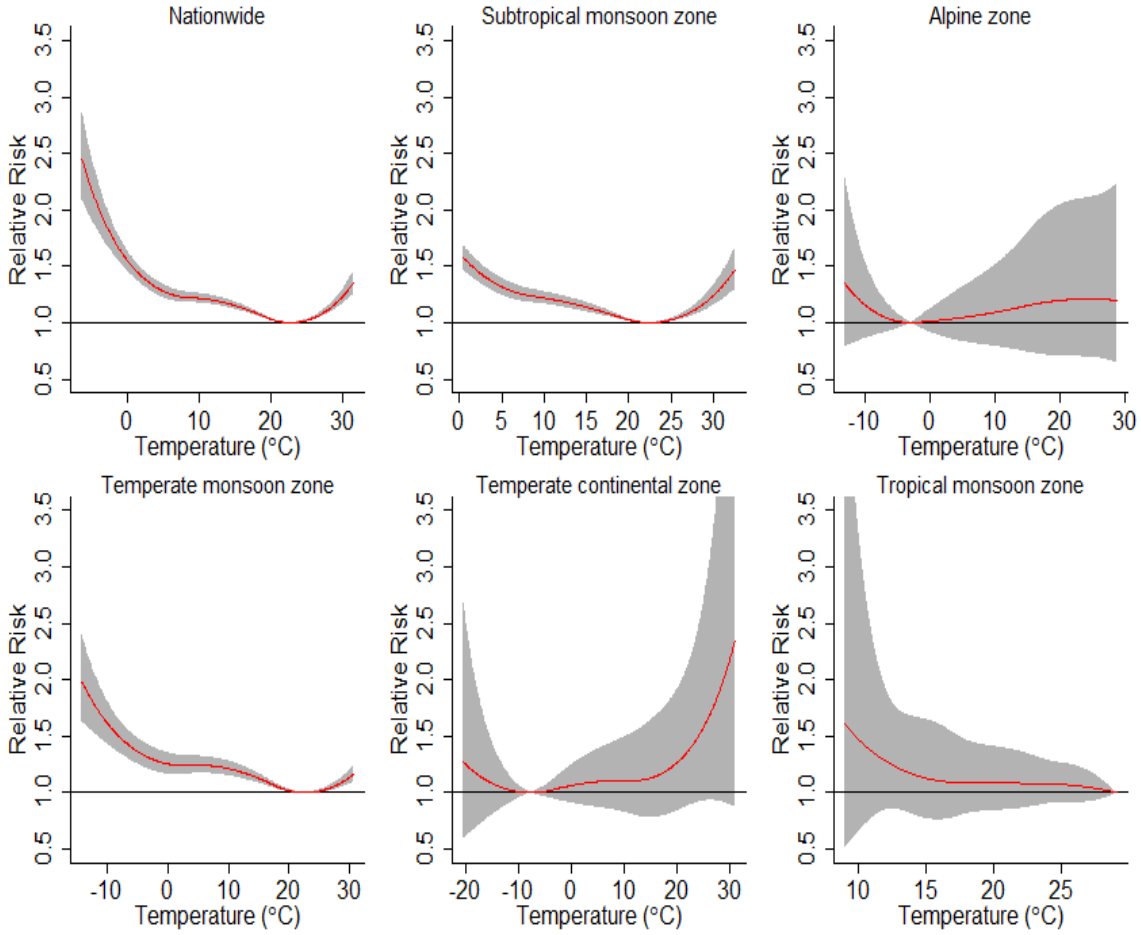

Figure SM2. The pooled cumulative exposure-response curves for the associations between daily temperature and total mortality over lag 0 to 21 days in different climatic zones.

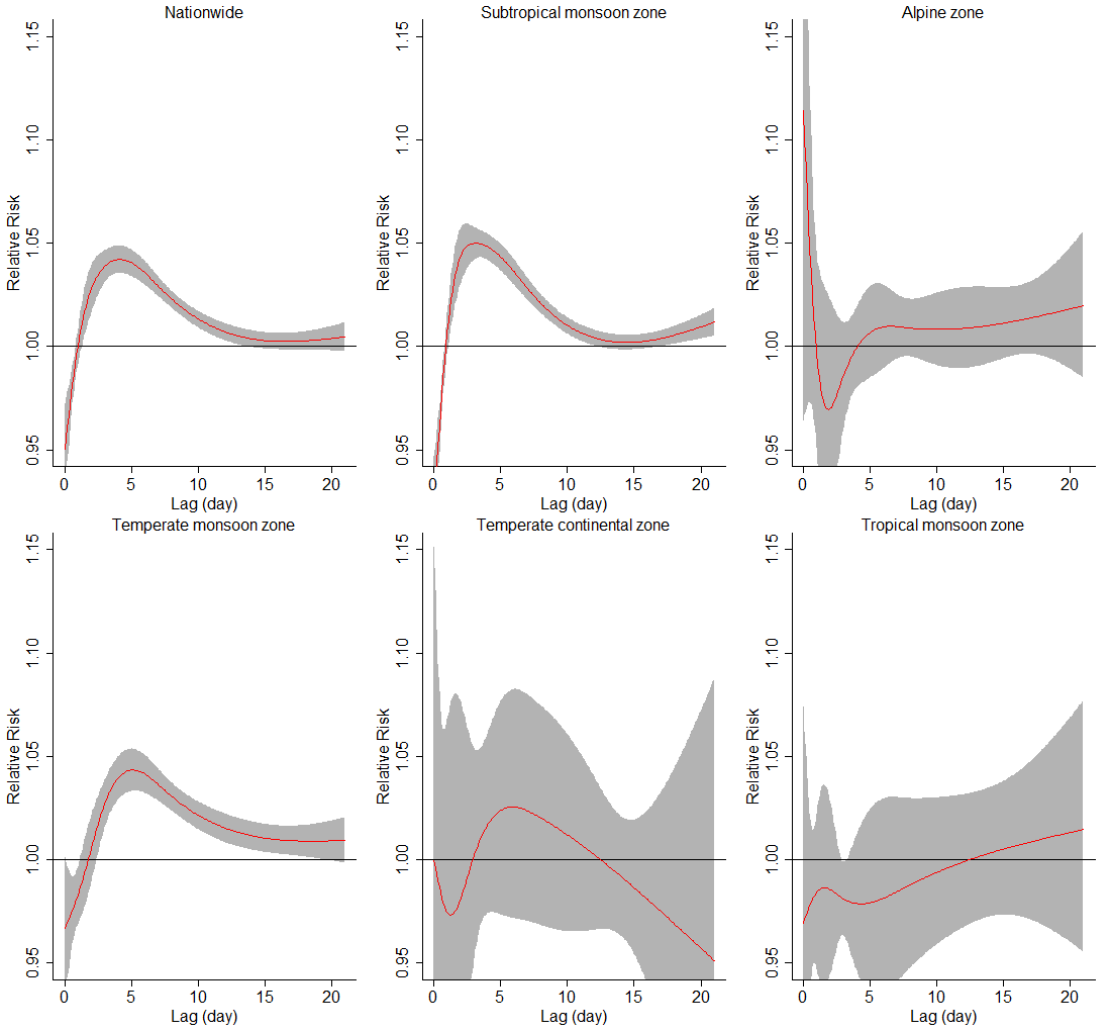

Figure SM3. The lag structure in the effects of extreme cold temperature on daily total mortality in different climatic zones. The effects were defined as the risks at the mean of the 2.5th percentile of temperature distributions, compared with the estimated minimum-mortality temperature in each zone.

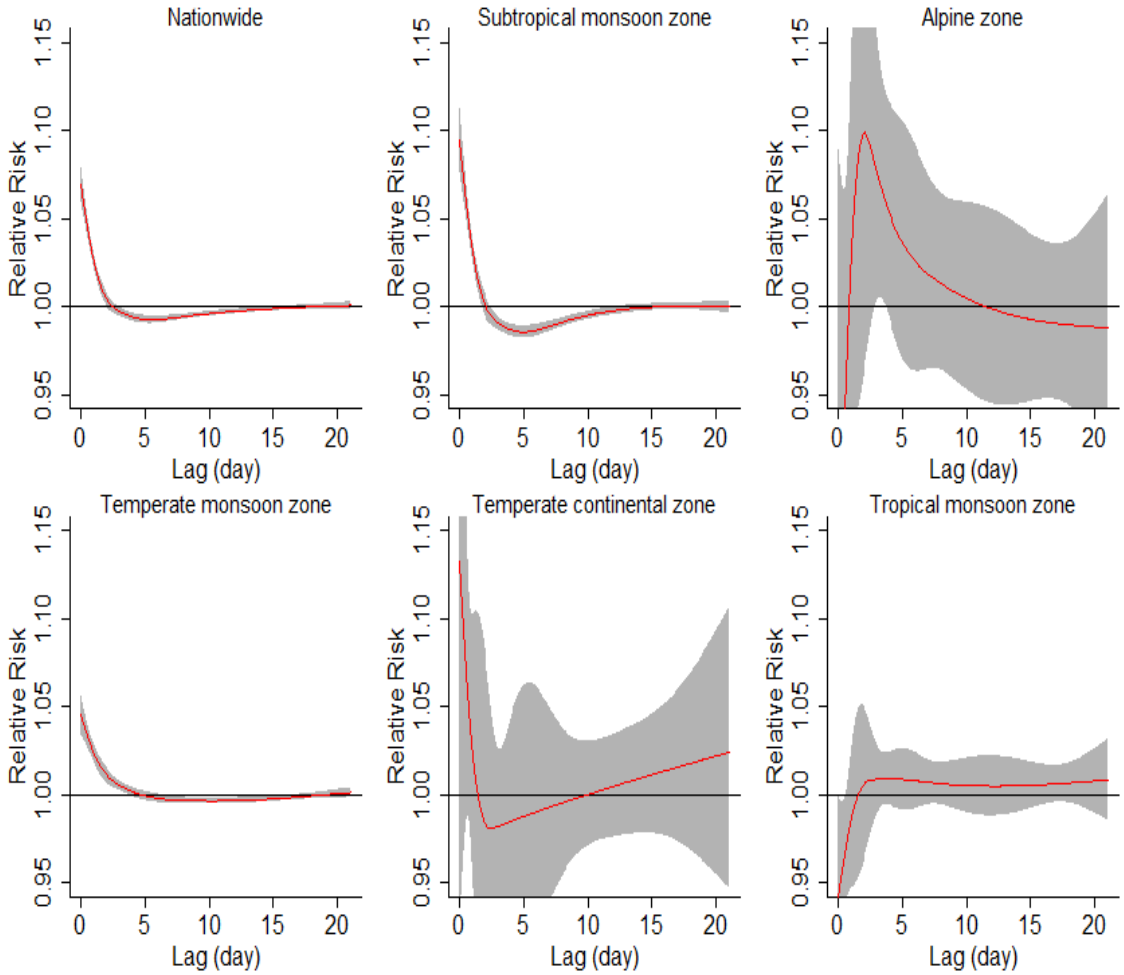

Figure SM4. **The lag structure in the effects of extreme hot temperature on daily total mortality in different climatic zones.** The effects were defined as the risks at the mean of the 97.5th percentile of temperature distributions, compared with the estimated minimum-mortality temperature in each zone.

Table SM3. The numbers of premature deaths (×1000) among total nonaccidental deaths (N=1826 thousands) attributable to moderate and extreme non-optimum temperature in 272 Chinese cities from 2013 to 2015, classified by age, gender, and education.

Subgroups	Moderate cold	Moderate heat	Extreme cold	Extreme heat
5-64	172	17	18	4
65-74	177	21	19	7
≥75	216	50	24	19
Males	181	33	19	8
Females	239	42	27	16
≤9 years of education	199	48	27	13
>9 years of education	59	21	15	2

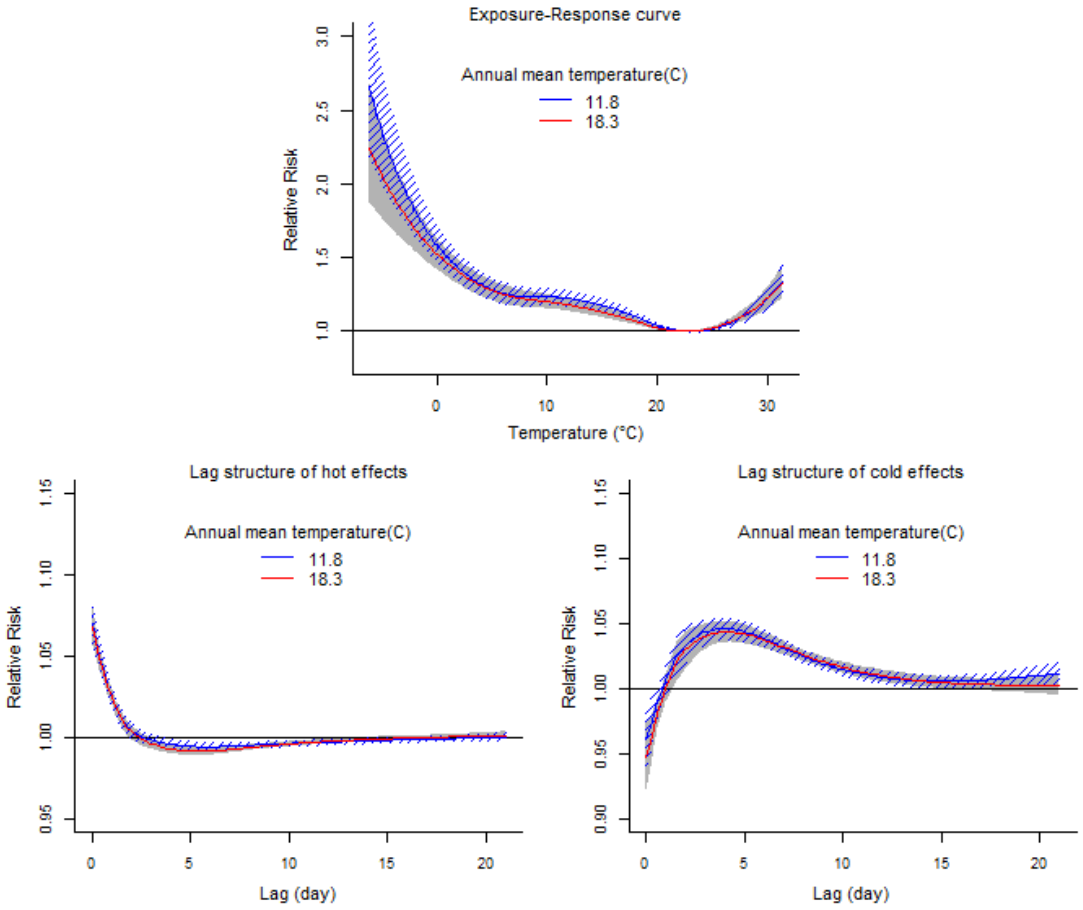

Figure SM5. Pooled curves for the temperature-mortality (total) associations and for the lag structure of hot effects and cold effects, classified by annual-mean temperature (25th VS 75th percentiles). The hot effects were defined as the risks at 29 ℃ (the mean of the 97.5th percentile of temperature distributions), compared with the estimated minimum-mortality temperature (22.8℃) . The cold effects were defined as the risks at -1.4 ℃ (the mean of the 2.5th percentile of temperature distributions), compared with the estimated minimum-mortality temperature (22.8℃).

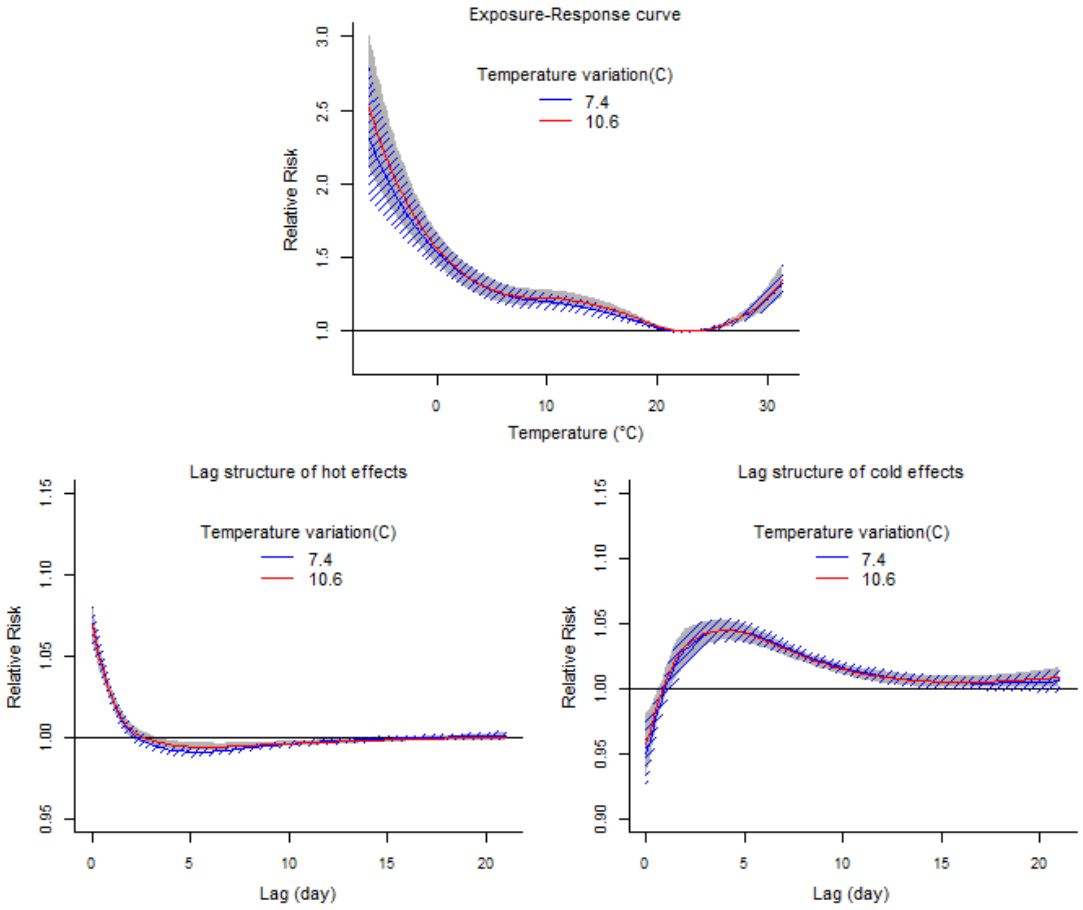

Figure SM6. Pooled curves for the temperature-mortality (total) associations and for the lag structure of hot effects and cold effects, classified by temperature variations (standard deviations) (25th VS 75th percentiles). The hot effects were defined as the risks at 29 ℃ (the mean of the 97.5th percentile of temperature distributions), compared with the estimated minimum-mortality temperature (22.8℃) . The cold effects were defined as the risks at -1.4 ℃ (the mean of the 2.5th percentile of temperature distributions), compared with the estimated minimum-mortality temperature (22.8℃). SD, standard deviation.

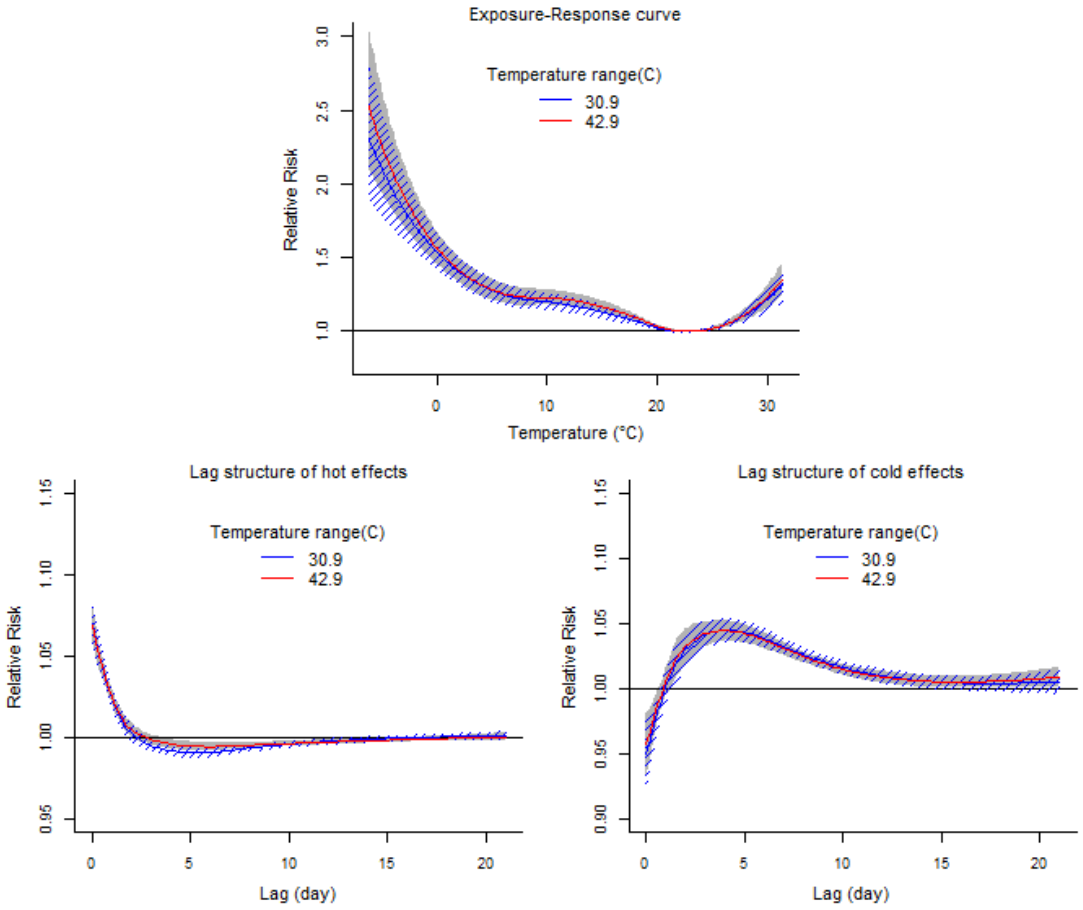

Figure SM7. Pooled curves for the temperature-mortality (total) associations and for the lag structure of hot effects and cold effects, classified by temperature range (25th VS 75th percentiles). The hot effects were defined as the risks at 29 ℃ (the mean of the 97.5th percentile of temperature distributions), compared with the estimated minimum-mortality temperature (22.8℃) . The cold effects were defined as the risks at -1.4 ℃ (the mean of the 2.5th percentile of temperature distributions), compared with the estimated minimum-mortality temperature (22.8℃).

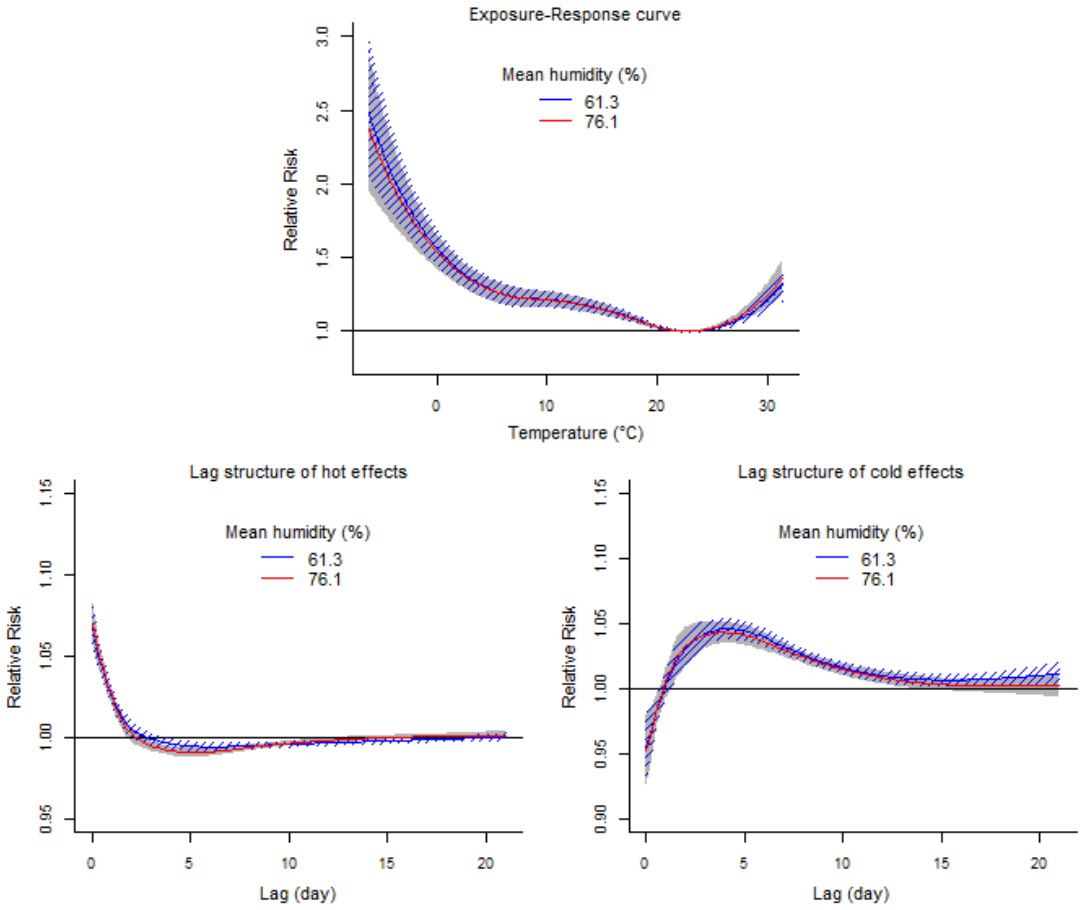

Figure SM8. Pooled curves for the temperature-mortality (total) associations and for the lag structure of hot effects and cold effects, classified by annual-mean humidity (25th VS 75th percentiles). The hot effects were defined as the risks at 29 ℃ (the mean of the 97.5th percentile of temperature distributions), compared with the estimated minimum-mortality temperature (22.8℃) . The cold effects were defined as the risks at -1.4 ℃ (the mean of the 2.5th percentile of temperature distributions), compared with the estimated minimum-mortality temperature (22.8℃).

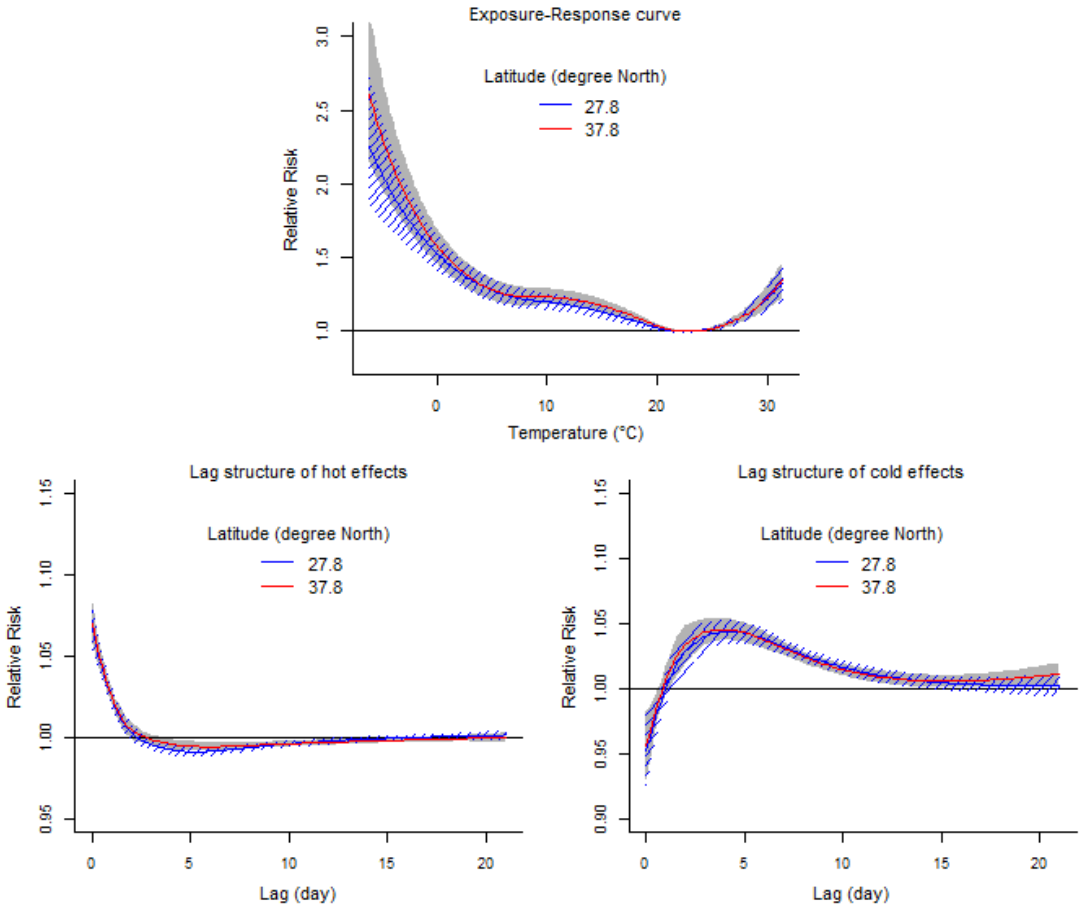

Figure SM9. **Pooled curves for the temperature-mortality (total) associations and for the lag structure of hot effects and cold effects, classified by latitude (25th VS 75th percentiles).** The hot effects were defined as the risks at 29 ℃ (the mean of the 97.5th percentile of temperature distributions), compared with the estimated minimum-mortality temperature (22.8℃) . The cold effects were defined as the risks at -1.4 ℃ (the mean of the 2.5th percentile of temperature distributions), compared with the estimated minimum-mortality temperature (22.8℃).

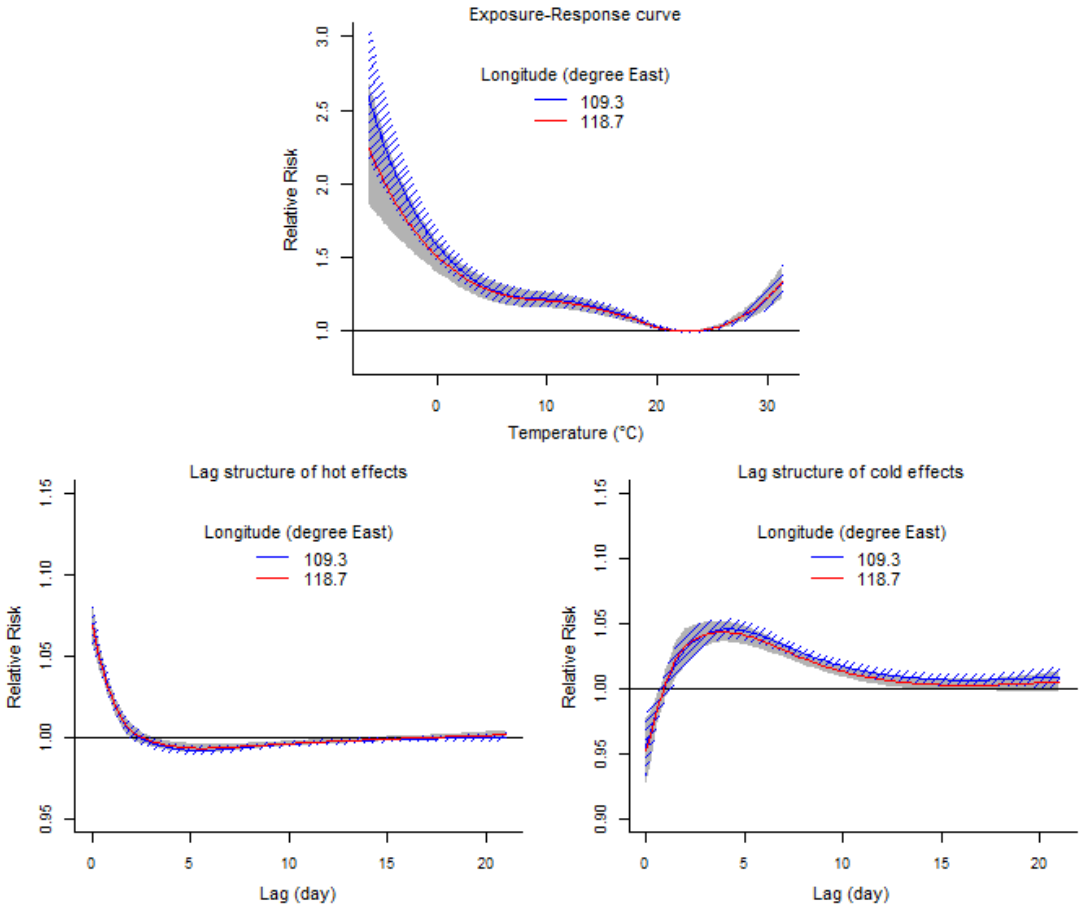

Figure SM10. Pooled curves for the temperature-mortality (total) associations and for the lag structure of hot effects and cold effects, classified by longitude (25th VS 75th percentiles). The hot effects were defined as the risks at 29 ℃ (the mean of the 97.5th percentile of temperature distributions), compared with the estimated minimum-mortality temperature (22.8℃) . The cold effects were defined as the risks at -1.4 ℃ (the mean of the 2.5th percentile of temperature distributions), compared with the estimated minimum-mortality temperature (22.8℃).

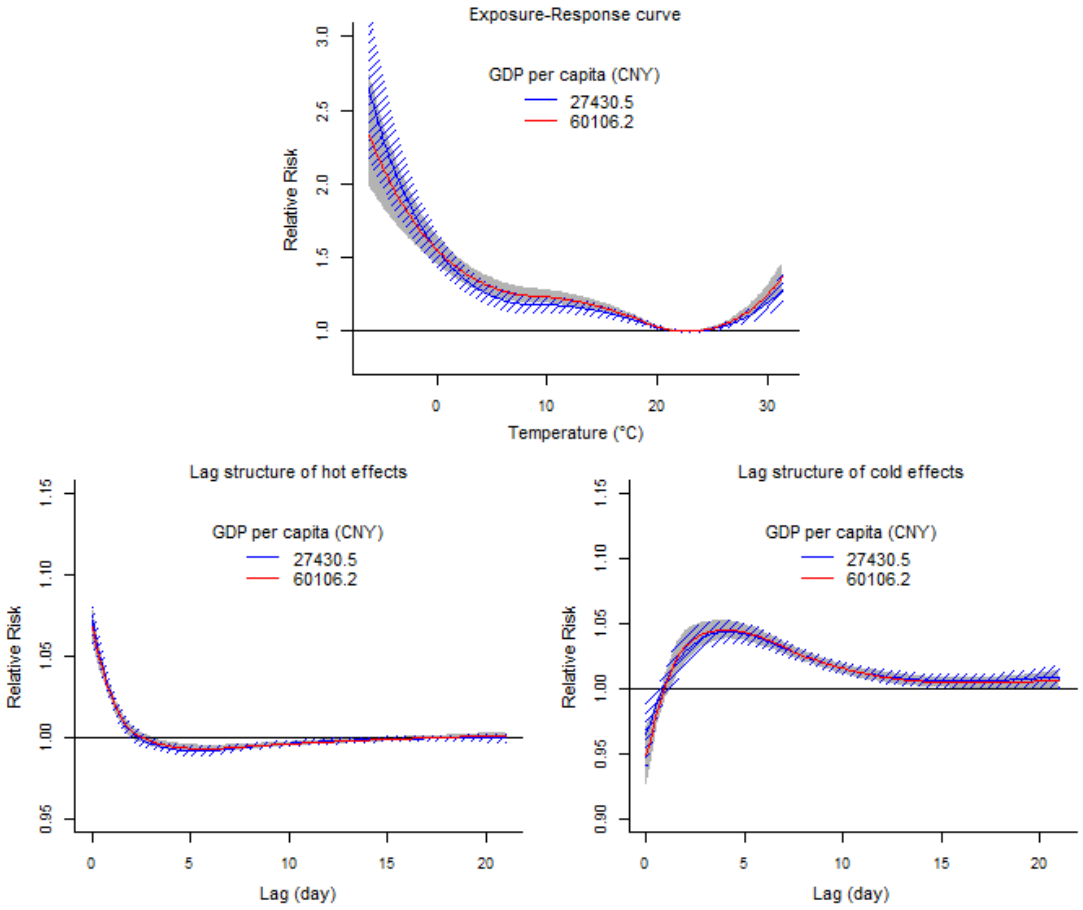

Figure SM11. Pooled curves for the temperature-mortality (total) associations and for the lag structure of hot effects and cold effects, classified by GDP per capita (25th VS 75th percentiles). The hot effects were defined as the risks at 29 ℃ (the mean of the 97.5th percentile of temperature distributions), compared with the estimated minimum-mortality temperature (22.8℃) . The cold effects were defined as the risks at -1.4 ℃ (the mean of the 2.5th percentile of temperature distributions), compared with the estimated minimum-mortality temperature (22.8℃). GDP, gross domestic product.

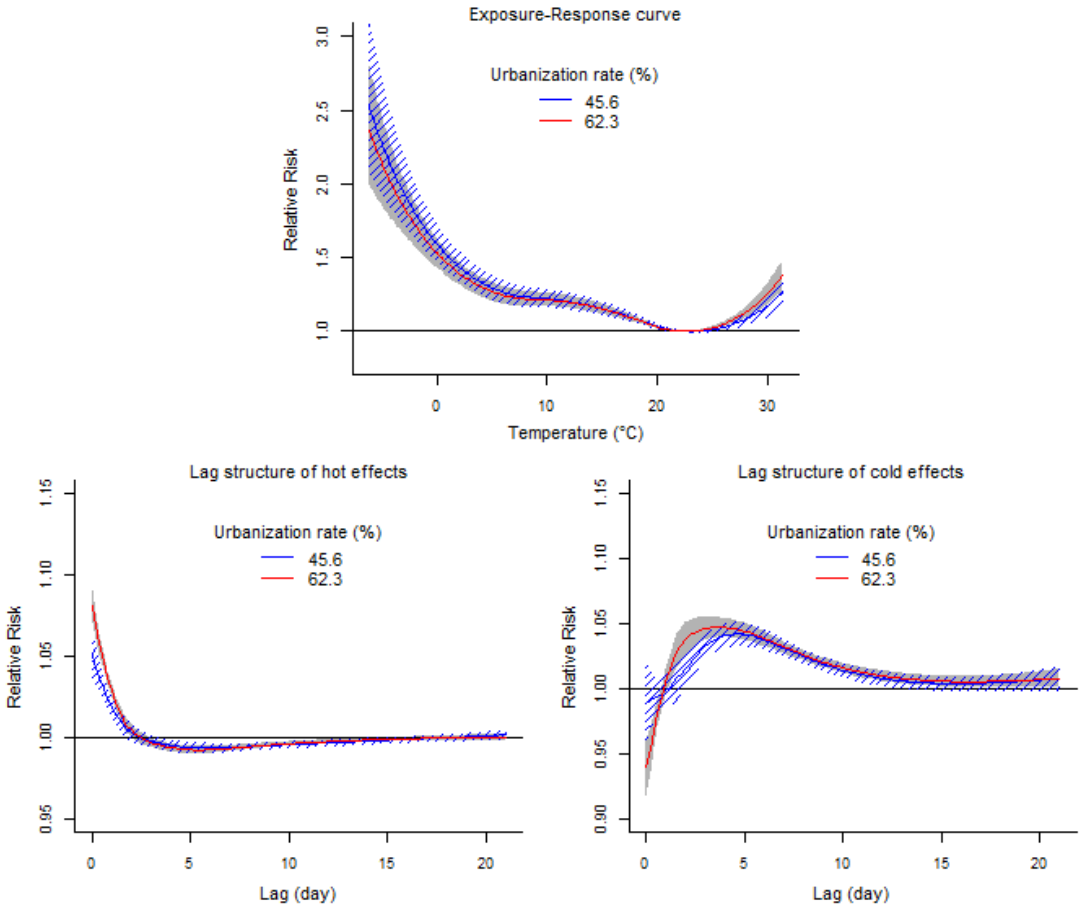

Figure SM12. Pooled curves for the temperature-mortality (total) associations and for the lag structure of hot effects and cold effects, classified by urbanization rate (25th VS 75th percentiles). The hot effects were defined as the risks at 29 ℃ (the mean of the 97.5th percentile of temperature distributions), compared with the estimated minimum-mortality temperature (22.8℃) . The cold effects were defined as the risks at -1.4 ℃ (the mean of the 2.5th percentile of temperature distributions), compared with the estimated minimum-mortality temperature (22.8℃).

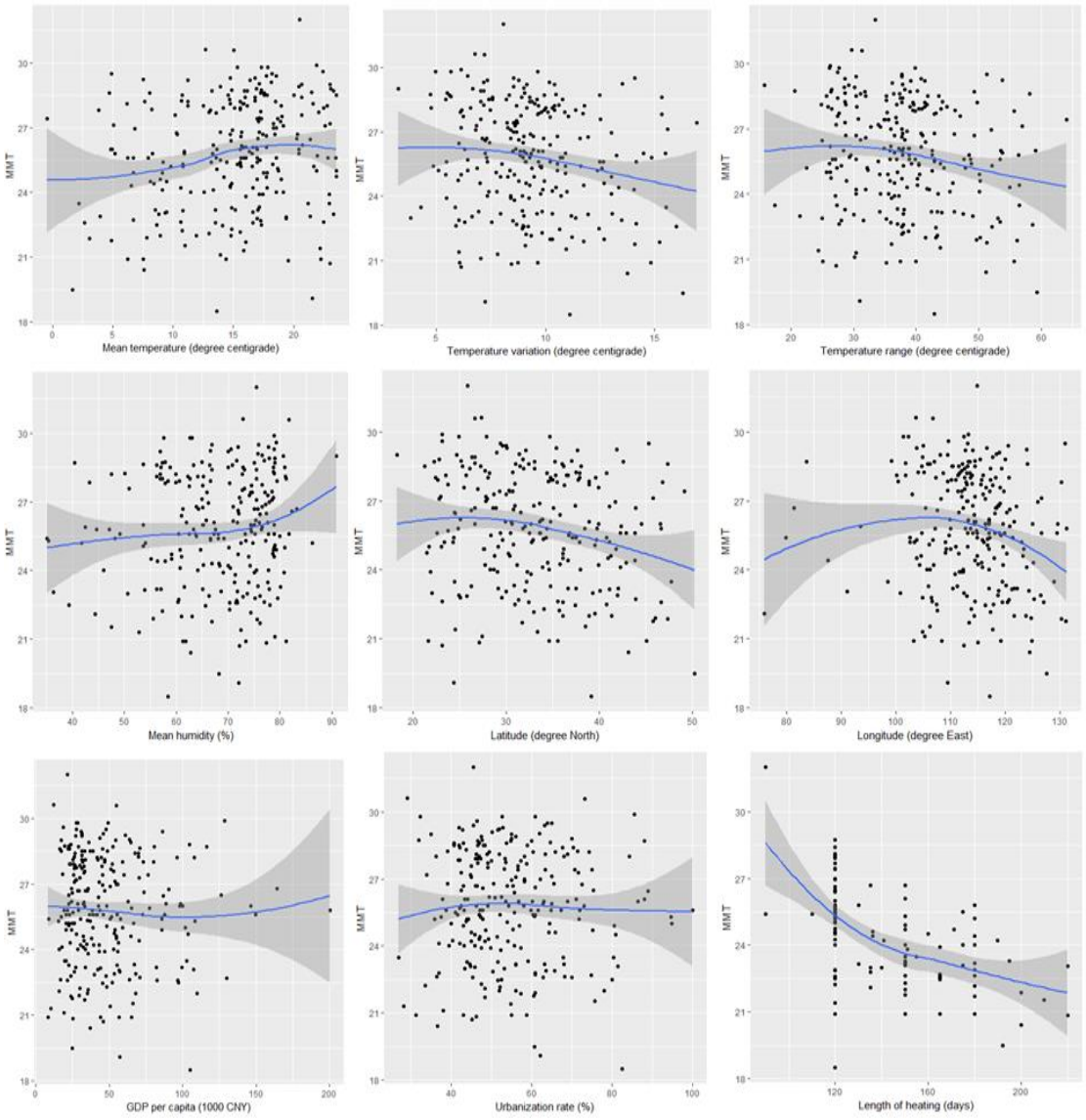

Figure SM13. The correlation plots between city-specific minimum-mortality (total) temperatures and city characteristics. These plots excluded cities (N=23) with outliers of minimum-mortality temperature less than 10th percentile. The data on length of central heating was available in 121 northern cities.

Table SM4. The national-average attributable fractions and relative risks (means and 95% empirical confidence intervals) of daily total mortality associated with non-optimum ambient temperatures, using alternative maximum lags

Lags (d)	MMP	MMT	Relative risks		Attributable fractions (%)		
			Extreme low	Extreme high	Overall	Cold	Heat
7	69.2	21.3	1.23 (1.19 to 1.28)	1.15 (1.12 to 1.19)	6.15 (5.51 to 6.73)	4.63 (4.09 to 5.11)	1.58 (1.23 to 1.87)
14	77.4	22.6	1.40 (1.33 to 1.47)	1.16 (1.12 to 1.19)	11.03 (10.08 to 11.87)	9.01 (8.27 to 9.67)	2.03 (1.56 to 2.48)
21	79.1	22.8	1.68 (1.57 to 1.81)	1.16 (1.12 to 1.21)	14.12 (13.06 to 15.14)	11.50 (10.64 to 12.38)	2.48 (1.98 to 2.98)
28	81.5	23.0	1.76 (1.58 to 1.96)	1.14 (1.08 to 1.20)	14.88 (13.24 to 16.52)	12.23 (10.78 to 13.68)	2.15 (1.46 to 2.77)

Abbreviations: MMP, minimum-mortality percentiles; MMT, minimum-mortality temperatures.

Table SM5. The national-average relative risks and attributable fractions (mean sand 95% empirical confidence intervals) of daily total mortality associated with non-optimum ambient temperatures, with and without the adjustment of air pollutants

Adjustment [a]	Mortality	MMP	MMT	Relative risk		Attributable fractions (%)		
				Extreme low	Extreme high	Overall	Cold	Heat
Without	Total	75.3	21.8	1.46 (1.35 to 1.57)	1.15 (1.09 to 1.22)	13.14 (11.99 to 14.15)	10.20 (9.40 to 10.97)	2.94 (2.24 to 3.57)
	CVD	78.7	21.9	1.62 (1.45 to 1.80)	1.20 (1.11 to 1.29)	15.12 (13.89 to 16.31)	12.53 (11.36 to 13.61)	2.59 (2.03 to 3.06)
	Respiratory	59.0	20.7	1.23 (1.06 to 1.43)	1.42 (1.28 to 1.59)	9.98 (7.76 to 11.97)	6.68 (4.97 to 8.30)	3.30 (2.09 to 4.49)
With	Total	76.5	21.8	1.48 (1.36 to 1.60）	1.17 (1.11 to 1.24)	13.28 (12.07 to 14.30)	10.65 (9.77 to 10.61)	2.63 (1.99 to 2.61)
	CVD	79.9	22.0	1.61 (1.44 to 1.81)	1.20 (1.11 to 1.29)	15.69 (14.12 to 16.95)	12.98 (11.63 to 14.09)	2.71 (1.97 to 3.40)
	Respiratory	59.3	20.6	1.31 (1.12 to 1.53)	1.47 (1.31 to 1.65)	9.86 (7.77 to 11.73)	6.72 (4.90 to 8.47)	3.14 (2.12 to 4.18)

[a] The adjustment of the two-day average concentrations of fine particulate matter and ozone, which were conducted in 69 cities with 3-year data, 74 cities with 2-year data and 129 cities with 1-year data.

Abbreviations: MMP, minimum-mortality percentiles; MMT, minimum-mortality temperatures; CVD, cardiovascular disease.