

Table S1 Varying degree of freedom (df) of temperature, lag structure, and time with qAIC result for non-accidental mortality

Temperature	Lag structure	Time trend	qAIC result
2	2	2	41108.6311
2	2	3	40852.989
2	2	4	40648.9552
2	2	5	40088.903
2	3	2	41013.8056
2	3	3	40774.7284
2	3	4	40562.574
2	3	5	39999.2941
2	4	2	40972.5845
2	4	3	40736.9173
2	4	4	40523.6978
2	4	5	39959.7453
2	5	2	40961.96
2	5	3	40728.3655
2	5	4	40513.62
2	5	5	39948.7271
3	2	2	41104.4906
3	2	3	40857.8399
3	2	4	40651.9251
3	2	5	40092.2265
3	3	2	41010.0324
3	3	3	40781.7501
3	3	4	40566.8513
3	3	5	40005.1777
3	4	2	40970.587
3	4	3	40745.7751
3	4	4	40529.6934
3	4	5	39967.3022
3	5	2	40962.102
3	5	3	40739.6875
3	5	4	40521.7493
3	5	5	39958.5304
4	2	2	41109.9321
4	2	3	40857.2844
4	2	4	40655.2494
4	2	5	40090.1552

Table S1 *(continued)*

Temperature	Lag structure	Time trend	qAIC result
4	3	2	41017.5374
4	3	3	40783.2151
4	3	4	40572.0985
4	3	5	40005.1078
4	4	2	40976.1232
4	4	3	40745.3324
4	4	4	40533.2558
4	4	5	39965.0556
4	5	2	40966.5611
4	5	3	40737.9197
4	5	4	40524.2559
4	5	5	39954.8411
5	2	2	41113.4101
5	2	3	40857.2184
5	2	4	40656.9724
5	2	5	40094.52
5	3	2	41021.3243
5	3	3	40783.8286
5	3	4	40574.3277
5	3	5	40009.8482
5	4	2	40982.2511
5	4	3	40748.594
5	4	4	40537.995
5	4	5	39971.7761
5	5	2	40975.0359
5	5	3	40743.5211
5	5	4	40531.1724
5	5	5	39963.6396

qAIC, quasi-Akaike information criterion.

Table S2 Varying degree of freedom (df) of temperature, lag structure, and time with qAIC result for cardiovascular mortality

Temperature	Lag structure	Time trend	qAIC result
2	2	5	32658.2949
2	2	4	32719.4842
2	2	3	32728.7937
2	2	2	32861.8253
3	2	5	32662.5364
3	2	4	32723.1264
3	2	3	32733.0719
3	2	2	32861.9935
4	2	5	32662.7841
4	2	4	32725.5547
4	2	3	32735.9301
4	2	2	32863.6637
5	2	5	32666.8873
5	2	4	32728.5693
5	2	3	32739.2282
5	2	2	32867.9118
2	3	5	32647.6877
2	3	4	32708.9639
2	3	3	32719.0057
2	3	2	32845.4618
3	3	5	32653.3608
3	3	4	32713.9308
3	3	3	32724.7896
3	3	2	32846.7034
4	3	5	32655.5538
4	3	4	32718.301
4	3	3	32729.6825
4	3	2	32850.7365
5	3	5	32661.2661
5	3	4	32722.9388
5	3	3	32734.5371
5	3	2	32856.4227
2	4	5	32635.1602
2	4	4	32696.3608
2	4	3	32706.523
2	4	2	32831.4074

Table S2 *(continued)*

Temperature	Lag structure	Time trend	qAIC result
3	4	5	32641.3358
3	4	4	32701.8712
3	4	3	32712.8557
3	4	2	32833.2153
4	4	5	32639.9636
4	4	4	32702.8853
4	4	3	32714.4193
4	4	2	32833.881
5	4	5	32647.521
5	4	4	32709.477
5	4	3	32721.142
5	4	2	32841.3478
2	5	5	32636.4682
2	5	4	32697.7246
2	5	3	32707.9913
2	5	2	32831.6665
3	5	5	32644.6807
3	5	4	32705.2511
3	5	3	32716.3738
3	5	2	32835.4431
4	5	5	32644.3142
4	5	4	32707.3625
4	5	3	32719.0398
4	5	2	32837.4172
5	5	5	32651.6827
5	5	4	32713.7457
5	5	3	32725.6265
5	5	2	32844.667

qAIC, quasi-Akaike information criterion.

Table S3 Varying degree of freedom (df) of temperature, lag structure, and time with qAIC result for respiratory mortality

Temperature	Lag structure	Time trend	qAIC result
2	2	2	30646.4296
2	2	3	30514.857
2	2	4	30237.6511
2	2	5	29809.6206
3	2	2	30636.8547
3	2	3	30506.8401
3	2	4	30232.0797
3	2	5	29801.6455
4	2	2	30637.267
4	2	3	30506.2822
4	2	4	30234.9754
4	2	5	29804.9676
5	2	2	30636.9966
5	2	3	30506.8904
5	2	4	30237.4992
5	2	5	29808.6659
2	3	2	30622.356
2	3	3	30491.6751
2	3	4	30210.7171
2	3	5	29777.5229
3	3	2	30611.9557
3	3	3	30483.2852
3	3	4	30204.6241
3	3	5	29769.7252
4	3	2	30610.7676
4	3	3	30481.4481
4	3	4	30206.6395
4	3	5	29772.2724
5	3	2	30612.7672
5	3	3	30484.3696
5	3	4	30211.3621
5	3	5	29777.9866
2	4	2	30610.63
2	4	3	30480.1843
2	4	4	30198.1029
2	4	5	29764.3253

Table S3 *(continued)*

Temperature	Lag structure	Time trend	qAIC result
3	4	2	30600.7747
3	4	3	30472.4306
3	4	4	30192.433
3	4	5	29756.9835
4	4	2	30599.0886
4	4	3	30470.1182
4	4	4	30194.2456
4	4	5	29759.0892
5	4	2	30603.4244
5	4	3	30475.2958
5	4	4	30200.9438
5	4	5	29766.4884
2	5	2	30609.7772
2	5	3	30479.2786
2	5	4	30196.2359
2	5	5	29761.2974
3	5	2	30602.1478
3	5	3	30473.8659
3	5	4	30192.6219
3	5	5	29756.2348
4	5	2	30602.9576
4	5	3	30474.0674
4	5	4	30196.9501
4	5	5	29760.6886
5	5	2	30609.604
5	5	3	30481.5656
5	5	4	30205.9537
5	5	5	29770.2529

qAIC, quasi-Akaike information criterion.

Table S4 qAIC: comparison between model mean, maximum and minimum temperature

Model	qAIC
Model mean temperature	6751
Model maximum temperature	6792
Model minimum temperature	6836

qAIC, quasi-Akaike information criterion.

Table S5 Lag-window sensitivity of cumulative heat and cold relative risks

Outcome	Effect	Lag window	Classification	Full model, RR (95% CI)	P value	Reduced model , RR (95% CI)	P value
Non-accidental	Heat	Lags 0–1	Sensitivity	1.038 (1.026, 1.051)	<0.001	1.038 (1.027, 1.049)	<0.001
Non-accidental	Heat	Lags 0–3	Primary	1.061 (1.044, 1.079)	<0.001	1.061 (1.046, 1.077)	<0.001
Non-accidental	Heat	Lags 0–5	Sensitivity	1.071 (1.052, 1.091)	<0.001	1.071 (1.054, 1.089)	<0.001
Non-accidental	Heat	Lags 0–7	Sensitivity	1.074 (1.053, 1.095)	<0.001	1.074 (1.054, 1.094)	<0.001
Non-accidental	Cold	Lags 0–14	Sensitivity	1.078 (1.040, 1.117)	<0.001	1.075 (1.038, 1.113)	<0.001
Non-accidental	Cold	Lags 0–21	Sensitivity	1.108 (1.062, 1.157)	<0.001	1.103 (1.058, 1.151)	<0.001
Non-accidental	Cold	Lags 0–28	Primary	1.151 (1.092, 1.213)	<0.001	1.145 (1.088, 1.206)	<0.001
Cardiovascular	Heat	Lags 0–1	Sensitivity	1.029 (1.008, 1.050)	0.007	1.024 (1.006, 1.043)	0.009
Cardiovascular	Heat	Lags 0–3	Primary	1.042 (1.012, 1.072)	0.006	1.036 (1.010, 1.062)	0.006
Cardiovascular	Heat	Lags 0–5	Sensitivity	1.042 (1.010, 1.076)	0.009	1.037 (1.008, 1.067)	0.01
Cardiovascular	Heat	Lags 0–7	Sensitivity	1.038 (1.004, 1.074)	0.03	1.034 (1.002, 1.068)	0.040
Cardiovascular	Cold	Lags 0–14	Sensitivity	1.138 (1.070, 1.210)	<0.001	1.125 (1.059, 1.196)	<0.001
Cardiovascular	Cold	Lags 0–21	Sensitivity	1.166 (1.083, 1.256)	<0.001	1.151 (1.069, 1.239)	<0.001
Cardiovascular	Cold	Lags 0–28	Primary	1.224 (1.119, 1.339)	<0.001	1.207 (1.104, 1.320)	<0.001
Respiratory	Heat	Lags 0–1	Sensitivity	1.063 (1.035, 1.091)	<0.001	1.062 (1.038, 1.086)	<0.001
Respiratory	Heat	Lags 0–3	Primary	1.115 (1.074, 1.158)	<0.001	1.113 (1.078, 1.150)	<0.001
Respiratory	Heat	Lags 0–5	Sensitivity	1.156 (1.110, 1.205)	<0.001	1.154 (1.112, 1.197)	<0.001

Table S5 (continued)

Outcome	Effect	Lag window	Classification	Full model, RR (95% CI)	P value	Reduced model , RR (95% CI)	P value
Respiratory	Heat	Lags 0–7	Sensitivity	1.187 (1.135, 1.240)	<0.001	1.184 (1.136, 1.234)	<0.001
Respiratory	Cold	Lags 0–14	Sensitivity	1.133 (1.045, 1.228)	0.002	1.144 (1.058, 1.237)	<0.001
Respiratory	Cold	Lags 0–21	Sensitivity	1.185 (1.074, 1.306)	<0.001	1.195 (1.086, 1.316)	<0.001
Respiratory	Cold	Lags 0–28	Primary	1.253 (1.111, 1.412)	<0.001	1.264 (1.124, 1.422)	<0.001

Note. The higher- and lower-temperature contrasts are defined in Methods. Full model: PM₁₀, SO₂, O₃, relative humidity, rainfall, day of week, holiday, COVID-19 period, and long-term/seasonal time trend. Reduced model: PM₁₀, O₃, day of week, holiday, COVID-19 period, and the same time trend. Abbreviations: CI, confidence interval; COVID-19, coronavirus disease 2019; O₃, ozone; PM₁₀, particulate matter with an aerodynamic diameter of 10 µm or less; RR, relative risk; SO₂, sulfur dioxide; WHO, World Health Organization. Bold indicate final result presented in the Table 2.

Table S6 Comparison of Interaction Models for Non-Accidental Mortality

Sensitivity Model	Outcome	Interaction Test	P value
Binary PM ₁₀ WHO threshold (45 µg/m ³)	Non-accidental	LRT	> 0.05
PM ₁₀ Quartiles	Non-accidental	LRT	0.039*
PM ₁₀ ≥ 95 th Percentile (Extreme pollution)	Non-accidental	LRT	0.869
Continuous PM ₁₀ (Linear)	Non-accidental	LRT	0.051
Continuous PM ₁₀ (Spline, df=3)	Non-accidental	LRT	> 0.05

LRT: likelihood ratio test; df: degree of freedom; PM₁₀:particulate matter with an aerodynamic diameter of 10 µm or less; WHO: World Health Organization *Although the quartile interaction model yielded P < 0.05, the exposure-response patterns did not show a monotonic gradient and were not reproduced in alternative sensitivity models.

Table S7 Model comparison using qAIC

Model	Covariates included	qAIC
Core model (CM)	DOW, holiday, COVID	5,970
Model 1	CM + RH	5,972
Model 2	CM + rainfall	5,972
Model 3	CM + O ₃	5,973
Model 4	CM + SO ₂	5,973
Model 5	CM + RH + rainfall	5,975
Model 6	CM + O ₃ + SO ₂	5,976
Model 7	CM + RH + rainfall + O ₃ + SO ₂	5,981

Note. RH: relative humidity; RF: rainfall; O₃: ozone; SO₂ :sulphur dioxide; PM₁₀: particulate matter less than 10 micrometers; DOW: day of week; qAIC: quasi-Akaike information criterion.

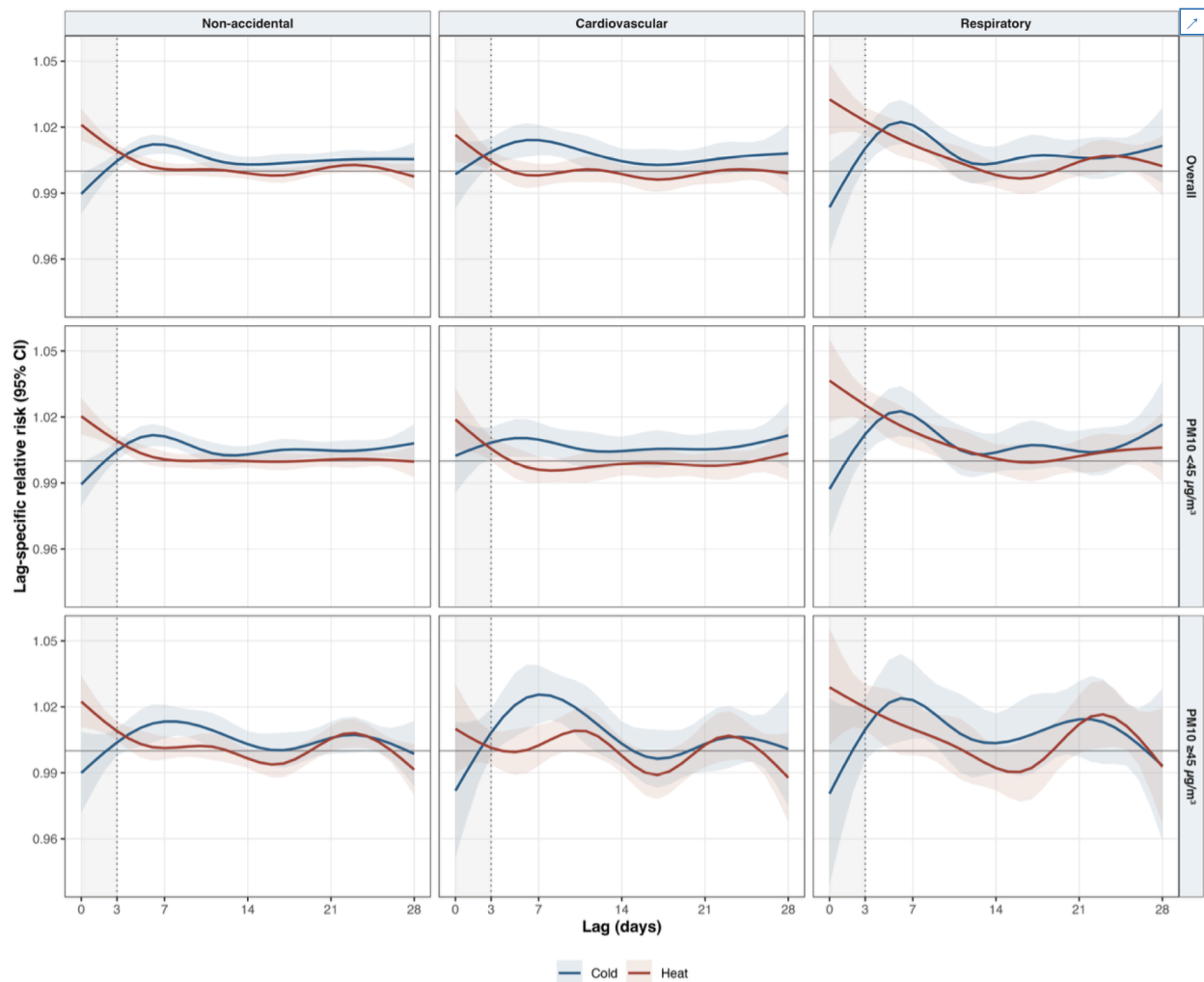
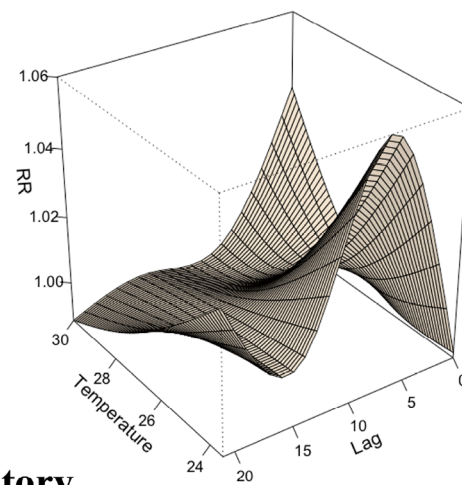
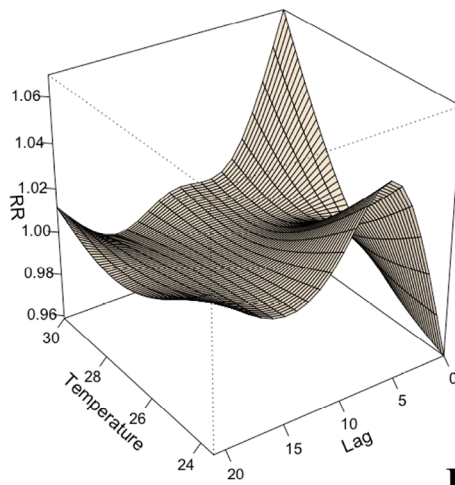


Figure S1 Lag-response associations for the higher- and lower-temperature contrasts by overall and by PM_{10} category. The grey region identifies the primary higher-temperature window, lags 0–3; the lower-temperature association is shown through lag 28. Lines and shaded bands show relative risks and 95% confidence intervals. Abbreviation: PM_{10} , particulate matter with an aerodynamic diameter of 10 μm or less.

Non-accidental

Cardiovascular



Respiratory

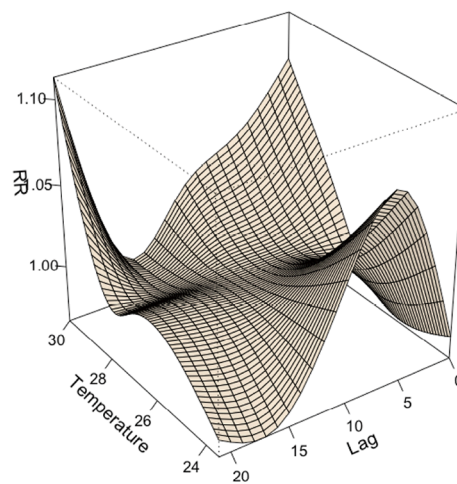


Figure S2 Three-dimensional plots illustrating the joint effects of temperature and lag (0–21 days) on mortality outcomes. The x-axis represents ambient temperature (°C), the y-axis represents lag days, and the z-axis shows the relative risk (RR) of mortality. The solid mesh surface denotes the estimated RR, while peaks and valleys indicate variations in risk over time and temperature.

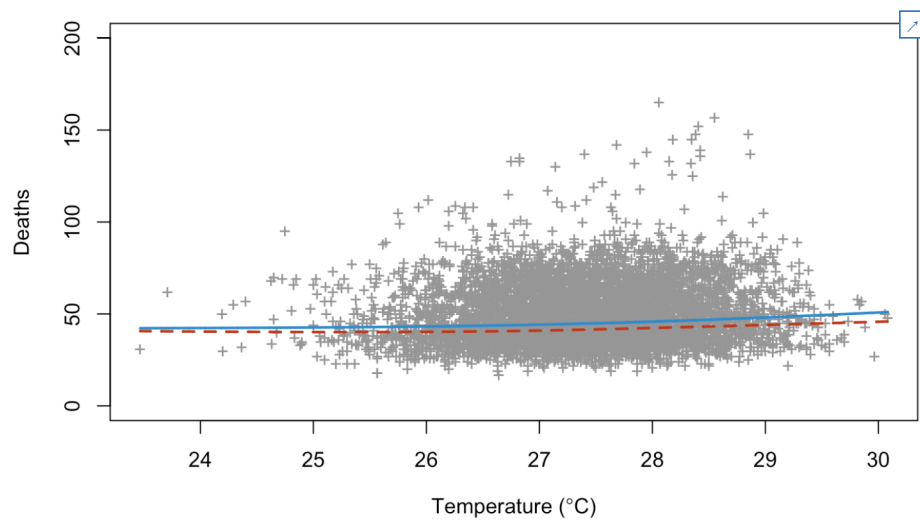


Figure S3 Sensitivity analysis of the temperature–mortality association across pandemic periods. The scatter plot illustrates daily non-accidental deaths relative to mean temperature, with regression lines comparing the pre-pandemic period (dashed line) to the COVID-19 pandemic period (solid line).