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Supplemental Material

Estimated Effect of Temperature on Years of Life Lost: A Retrospective Time-Series Study of Low-, Middle-, and High-Income Regions

Maquins Odhiambo Sewe, Aditi Bunker, Vijendra Ingole, Thaddaeus Egondi, Daniel Oudin Åström, David M. Hondula, Joacim Rocklöv, and Barbara Schumann

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Table S1. Total AIC summed across all sites by different combinations of degree of freedom for the spline function of trend and percentile positions for the knots in the b-spline function of maximum temperature.

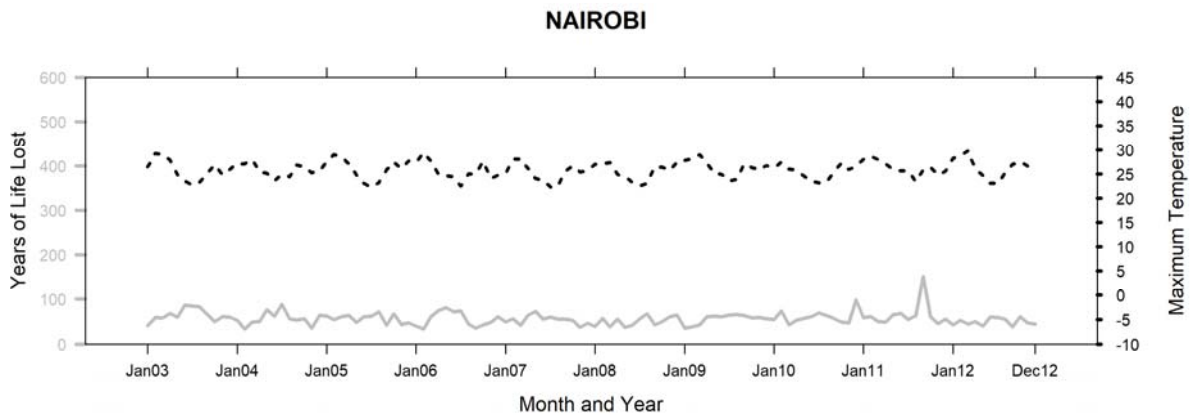
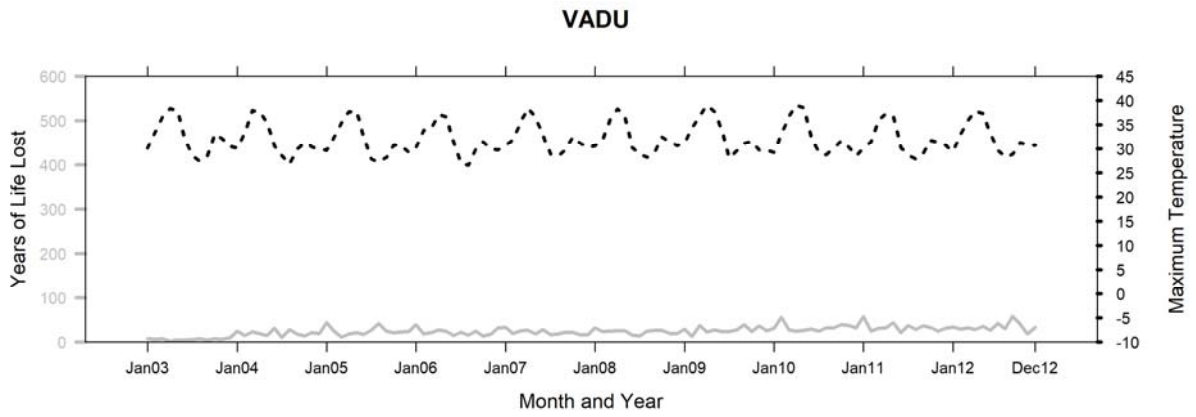
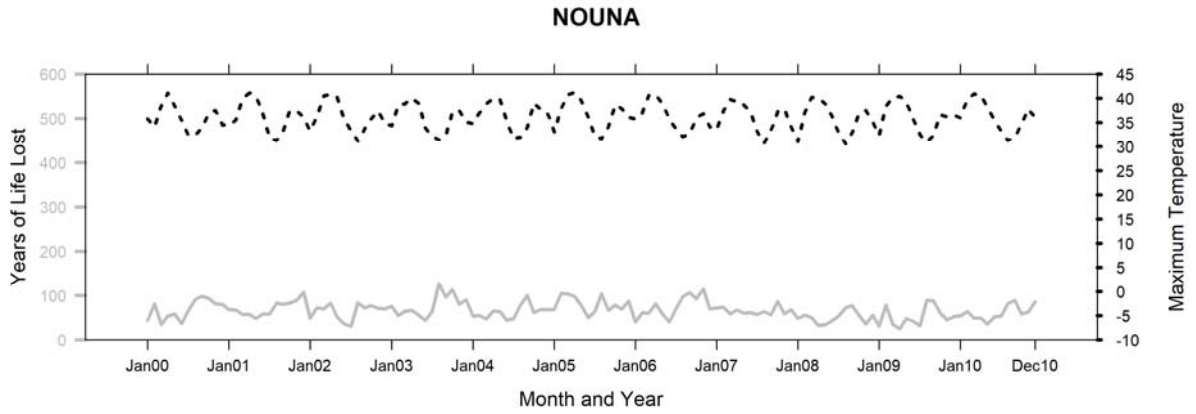
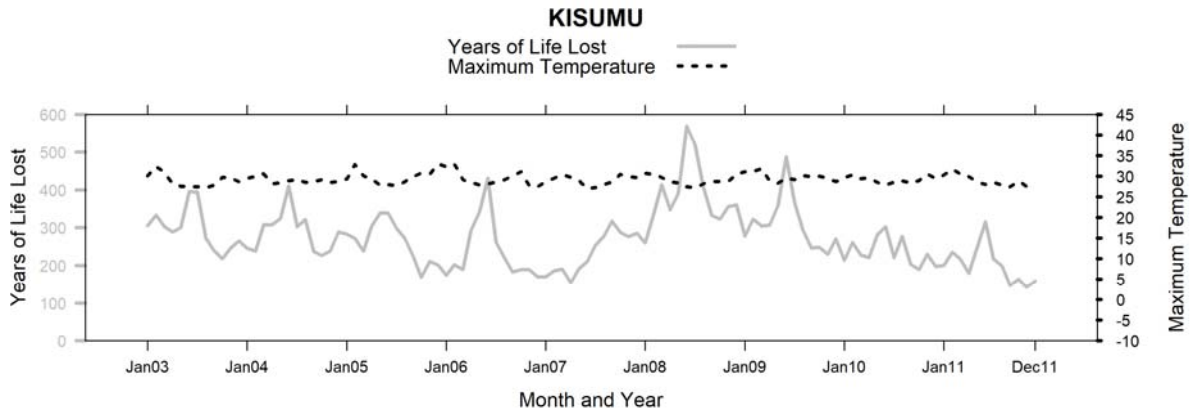
Degrees of freedom for time trend	Knot percentile position	Total AIC summed across all sites
4	2, 98	292441.8
4	5, 25, 95	292464.1
4	10, 70, 90	292451.4
4	2, 70, 98	292469.7
4	2, 25, 70, 90	292495.8
4	5, 50, 70, 95	292501.5
6	2, 98	292432.7 ^a
6	5, 25, 95	292464.6
6	10, 70, 90	292453.8
6	2, 70, 98	292465
6	2, 25, 70, 90	292500.6
6	5, 50, 70, 95	292501.1
8	2, 98	292524.2
8	5, 25, 95	292557.5
8	10, 70, 90	292544
8	2, 70, 98	292559.2
8	2, 25, 70, 90	292591.3
8	5, 50, 70, 95	292595.6
10	2, 98	292636.3
10	5, 25, 95	292672
10	10, 70, 90	292656.8
10	2, 70, 98	292672.3
10	2, 25, 70, 90	292705.6
10	5, 50, 70, 95	292705.9

^a Shows combinations that resulted in the lowest AIC

Table S2. Proportion of deaths occurring on heaping days by HDSS site

HDSS site	Deaths on heaping days	Total deaths	Proportion deaths on heaping days
KISUMU	5606	28436	19.71
NOUNA	1843	6670	27.63
VADU	98	3394	2.89
NAIROBI	885	4671	18.95

HDSS is Health and Demographic Surveillance Site



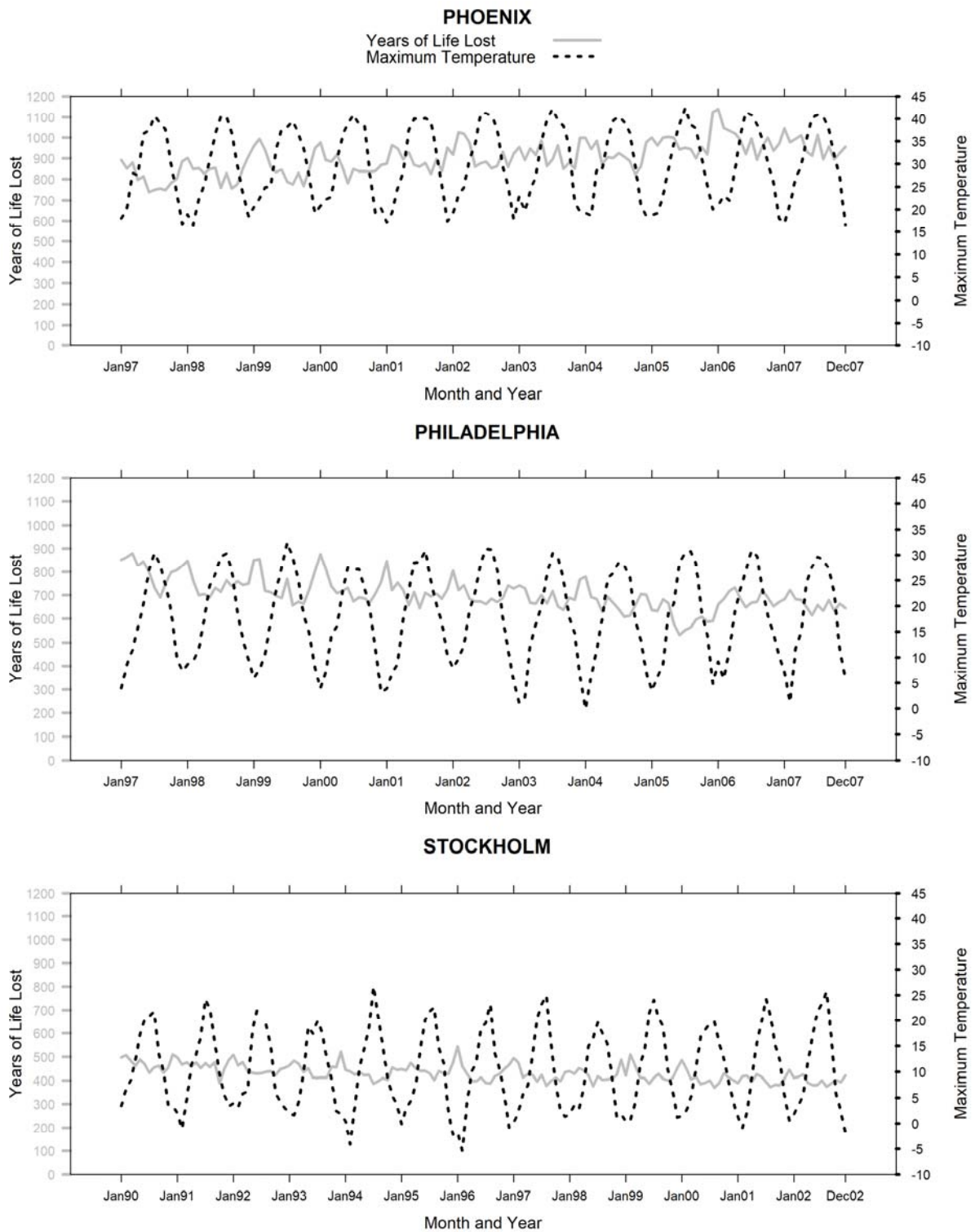


Figure S1. Time series of daily maximum temperature and years of life lost. The years of life lost range vary between the sites in the HDSS and in high income sites

YLL is years of life lost at the age at death, based on conditional life expectancies. YLL were calculated separately for each as the difference between years of age at the time of death and estimated life expectancy given the decedent's age and gender.

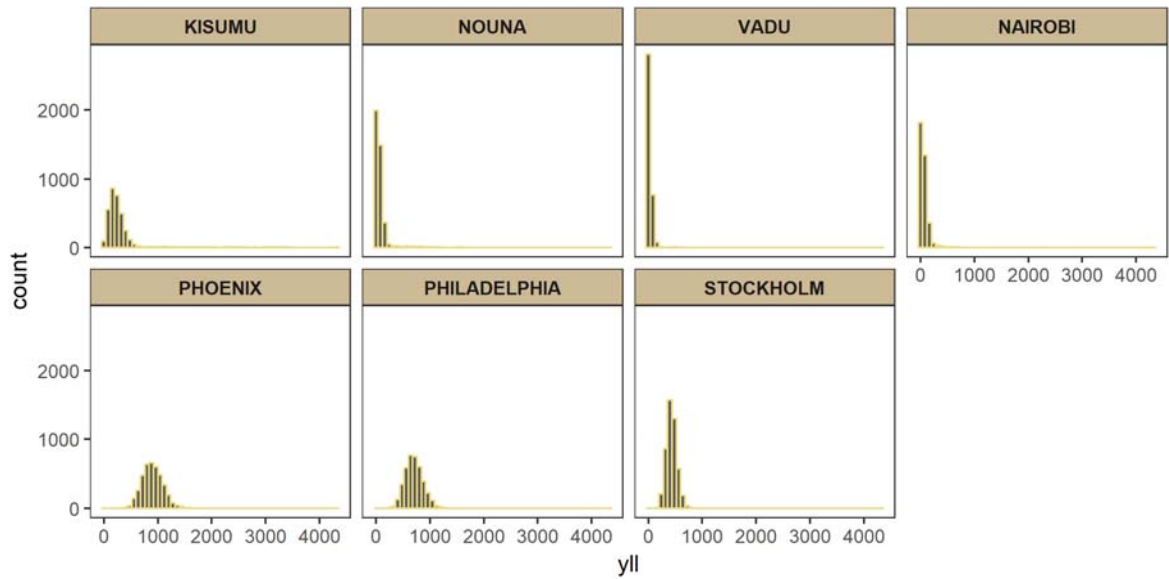
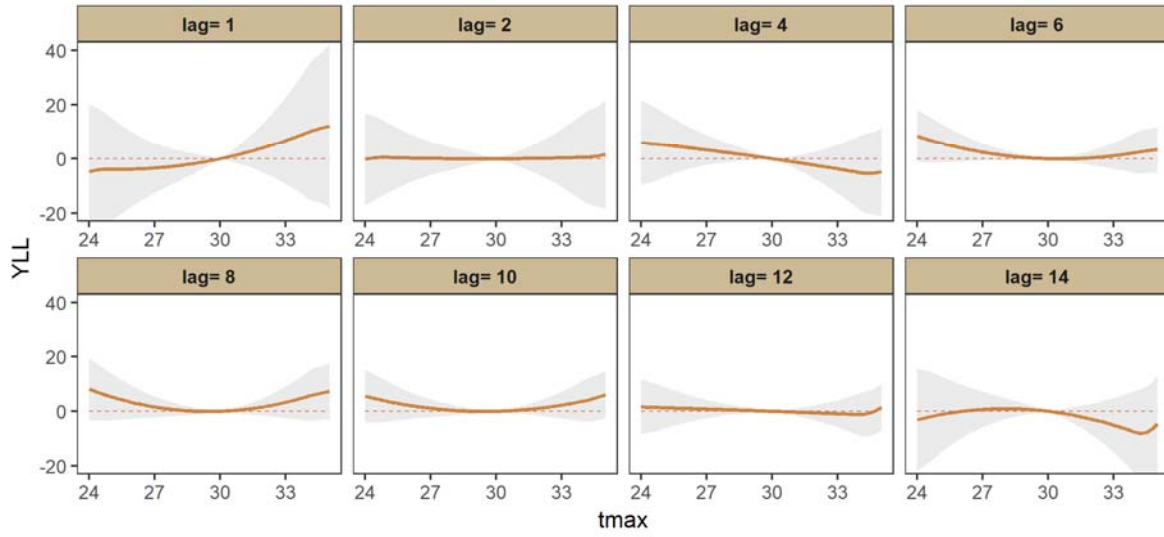


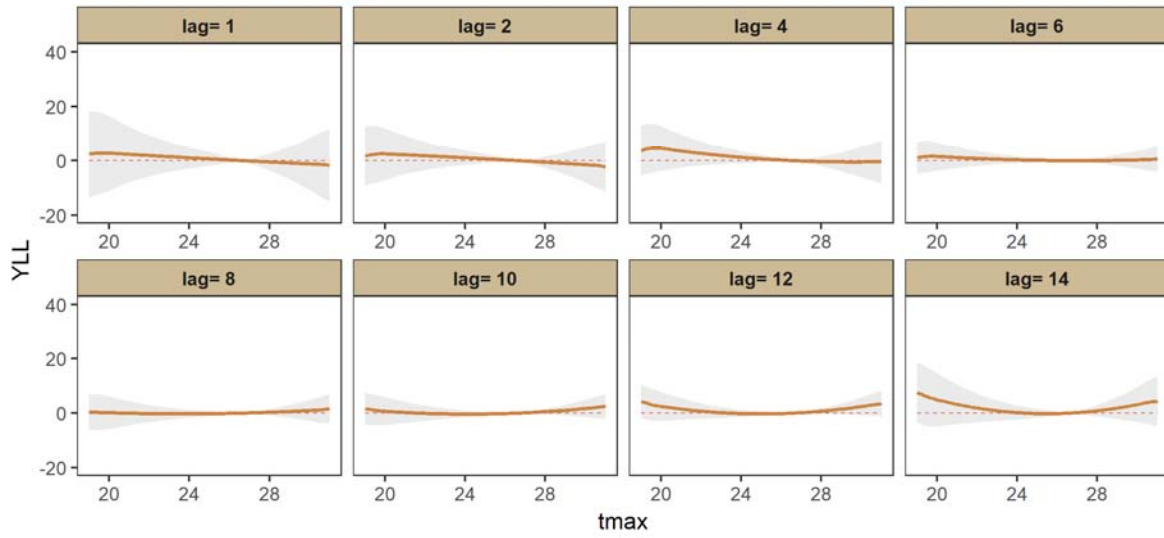
Figure S2. Distribution of estimated YLL per day at each site

YLL is years of life lost at the age at death, based on conditional life expectancies. YLL were calculated separately for each as the difference between years of age at the time of death and estimated life expectancy given the decedent's age and gender.

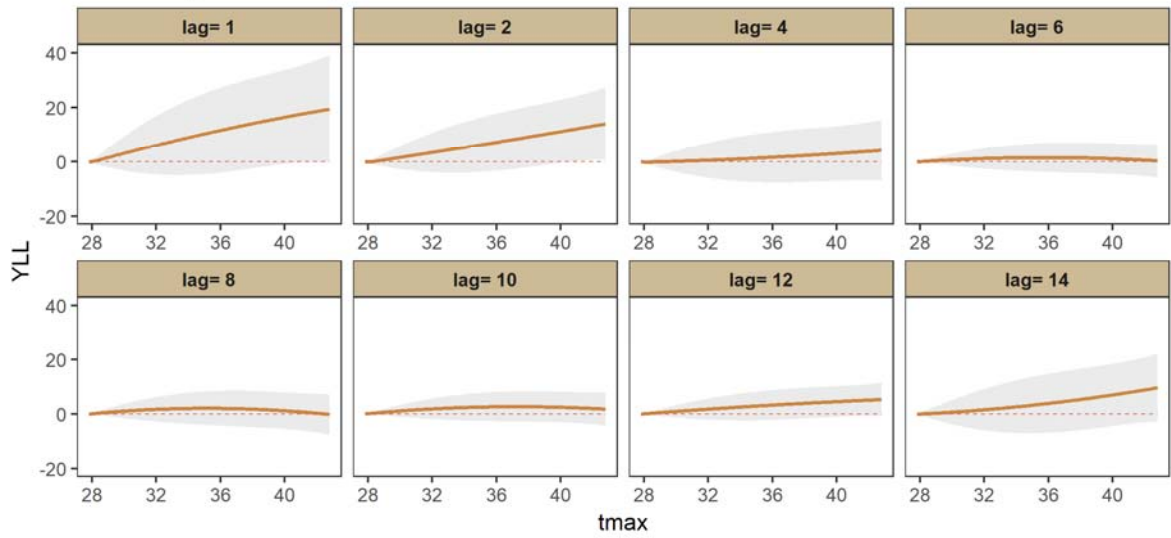
KISUMU (ref=30 °C)



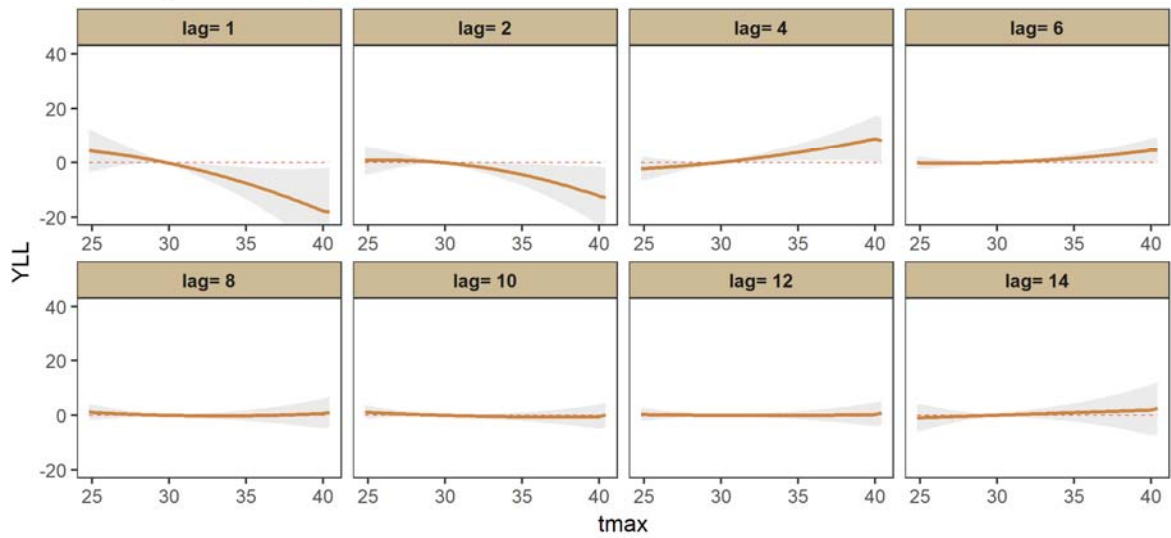
NAIROBI (ref=26.6 °C)



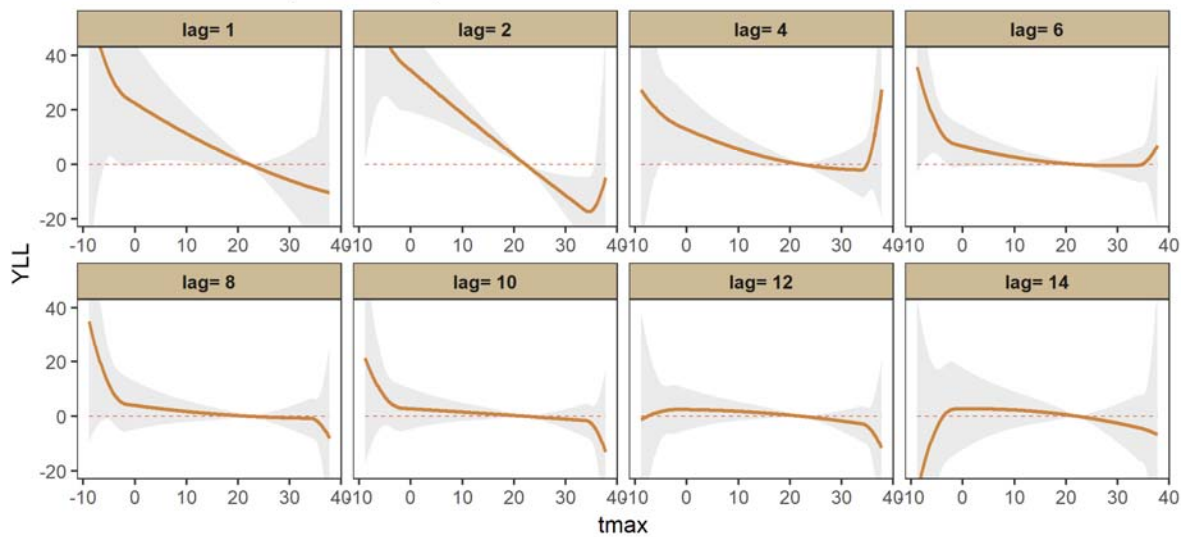
NOUNA (ref=27.8 °C)



VADU (ref=29.8 °C)



PHILADELPHIA (ref=22.2 °C)



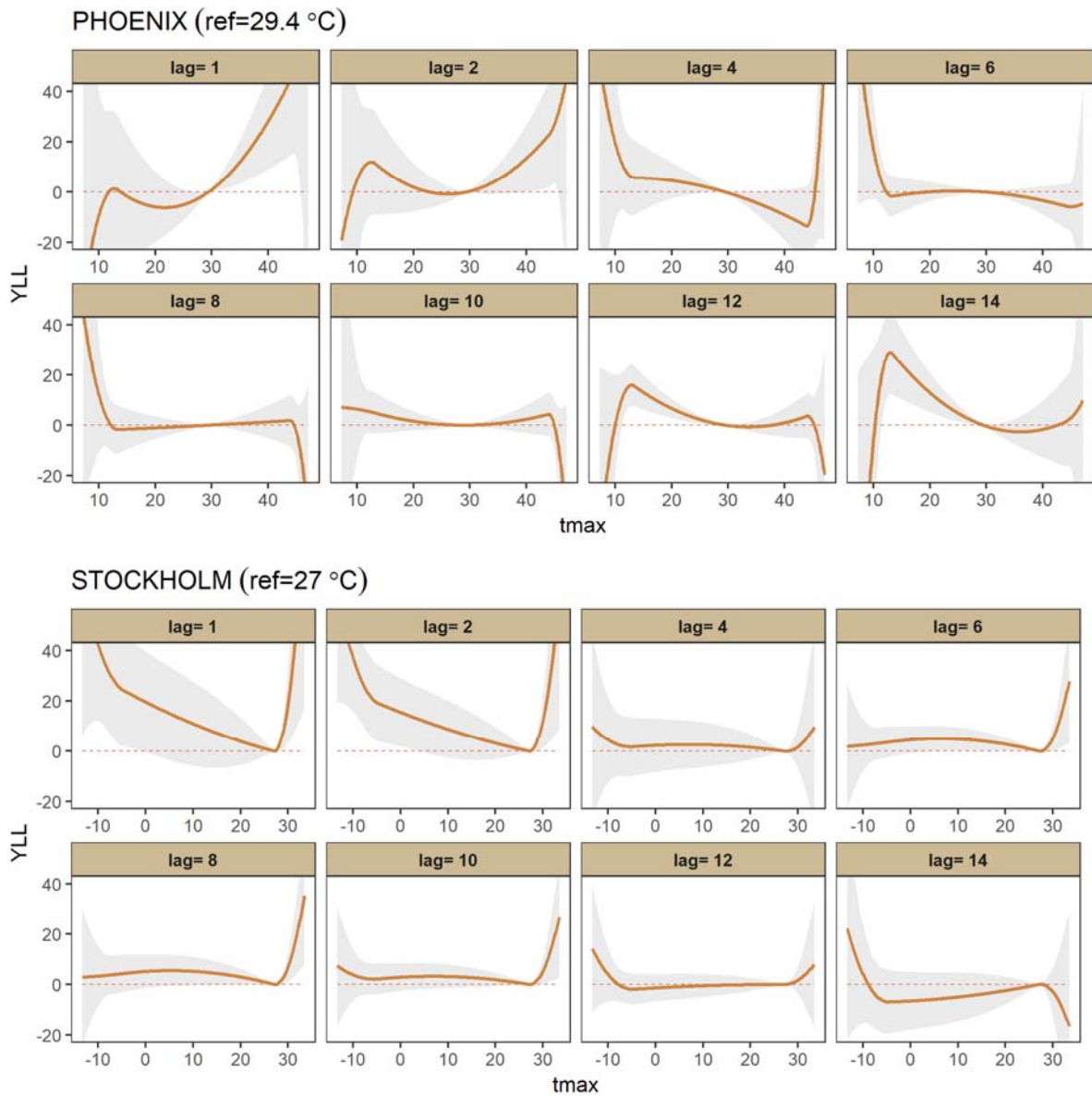


Figure S3. Estimated differences in YLL relative to the YLL at the reference temperature (the daily maximum temperature with the lowest YLL) at selected lags at seven study sites

The shaded grey areas represent the 95% confidence intervals of estimates. The estimated YLL are derived from the TOBIT model with the defined cross-basis function, spline function of trend time and heaping in HDSS sites as covariates. Tmax is daily maximum temperature (°C); YLL is years of life lost at the age at death, based on conditional life expectancies. YLL were calculated separately for each as the difference between years of age at the time of death and estimated life expectancy given the decedent's age and gender.

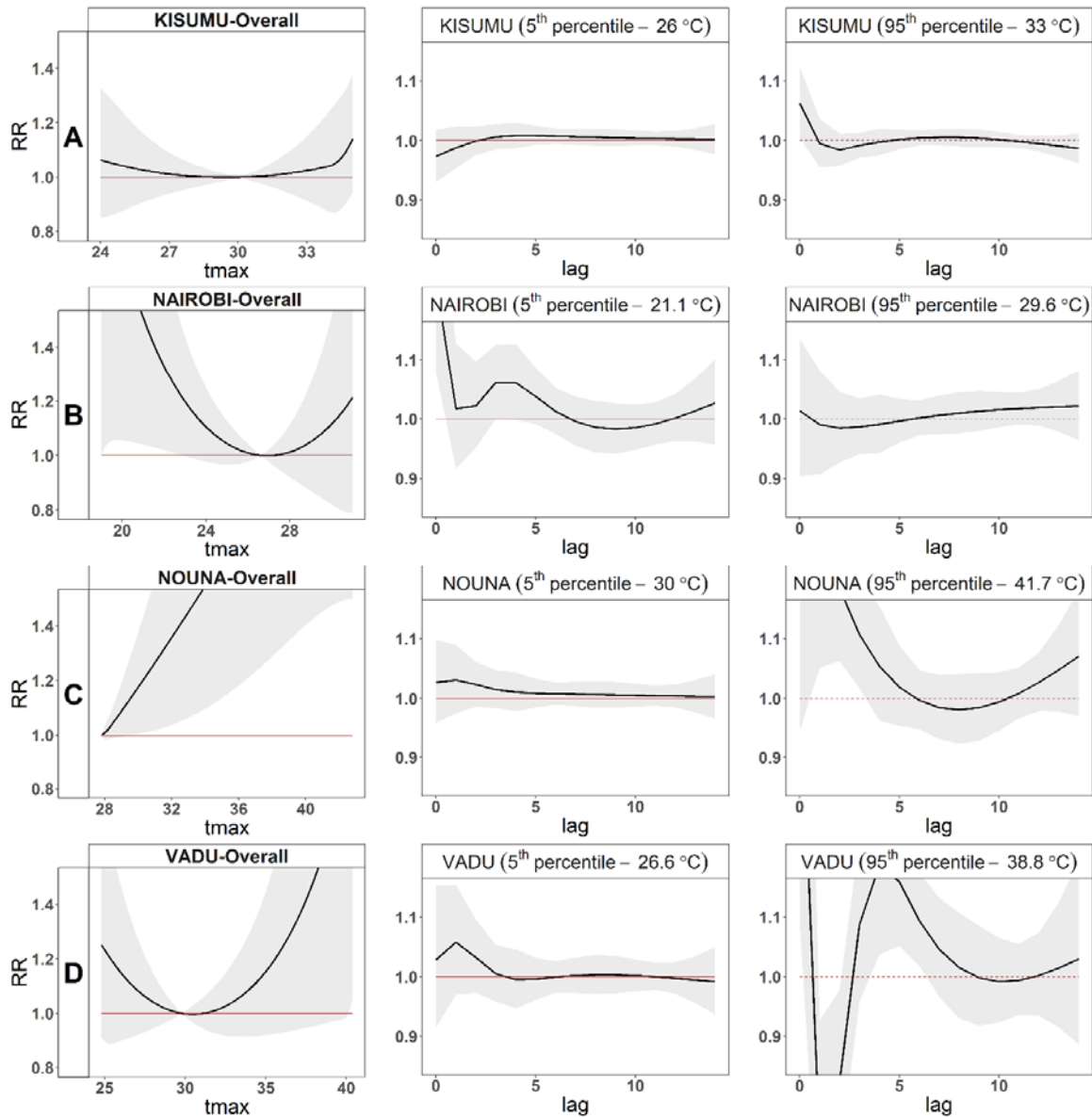


Figure S4. Association between daily maximum temperature and mortality, HDSS sites

The overall estimates for each location (first panel) show RR of mortality by daily maximum temperature, cumulative over 14 days. The second and third panels show relative risks at the 5th and 95th percentile of daily maximum temperature, respectively, relative to the reference temperature at each site, on the day of death (lag=0) and up to 14 days prior to death.

RR is relative risk, tmax is daily maximum temperature. Reference is daily maximum temperature with the lowest YLL. Relative risks are estimated using a quasi-poisson model with cross-basis function of maximum temperature, spline function of time trend and heaping indicator for the HDSS sites as covariates. The shaded areas are the 95% confidence intervals of the RR.

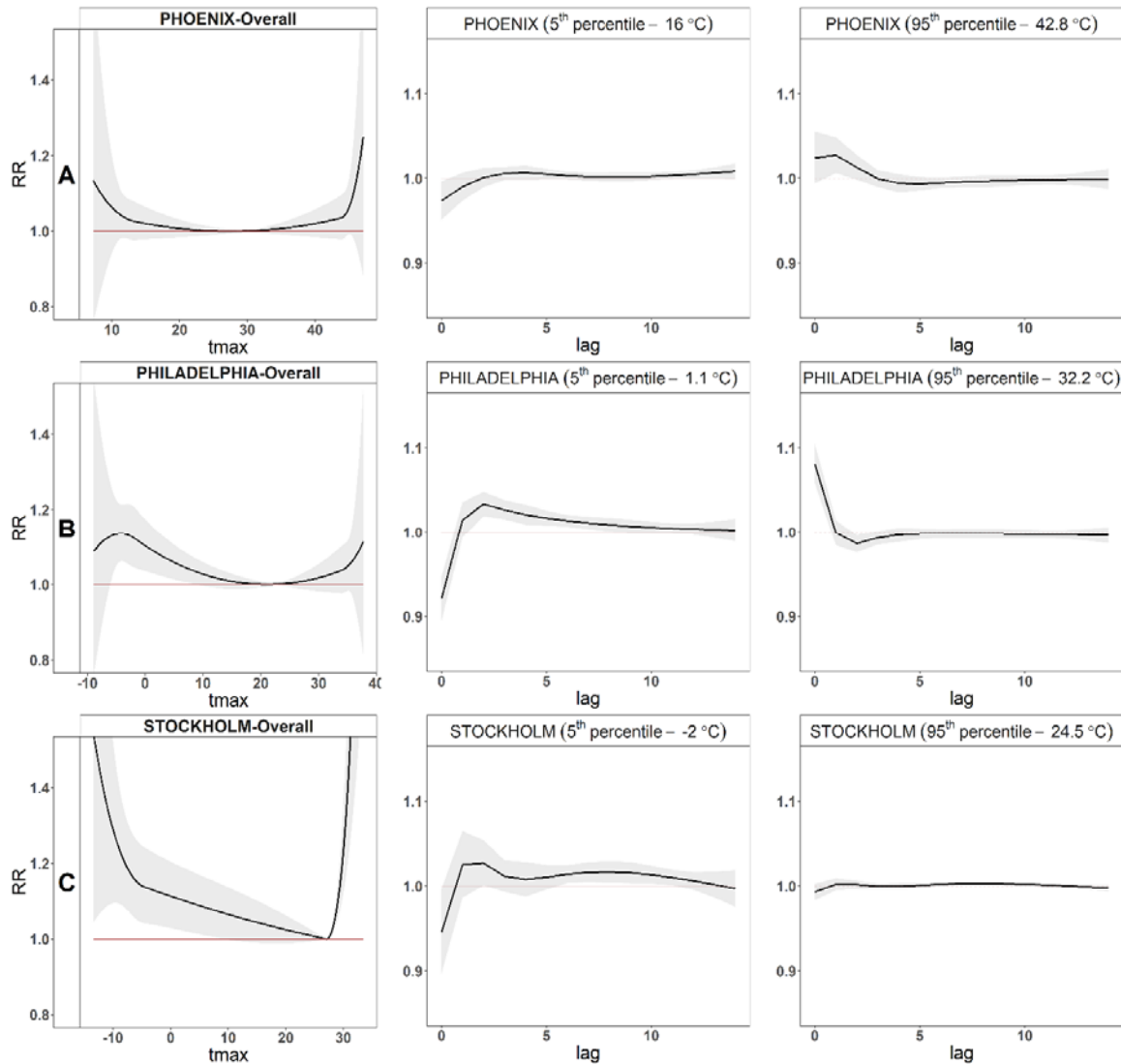


Figure S5. Association between daily maximum temperature and mortality, USA and Swedish sites

The overall estimates for each location (first panel) show RR of mortality by daily maximum temperature, cumulative over 14 days. The second and third panels show relative risks at the 5th and 95th percentile of daily maximum temperature, respectively, relative to the reference temperature at each site, on the day of death (lag=0) and up to 14 days prior to death.

RR is relative risk, tmax is daily maximum temperature. Reference is daily maximum temperature with the lowest YLL. Relative risks were estimated using a quasi-poisson model with cross-basis function of maximum temperature, spline function of of time trend and heaping indicator for the HDSS sites as covariates. The shaded areas are the 95% confidence intervals of the RR.

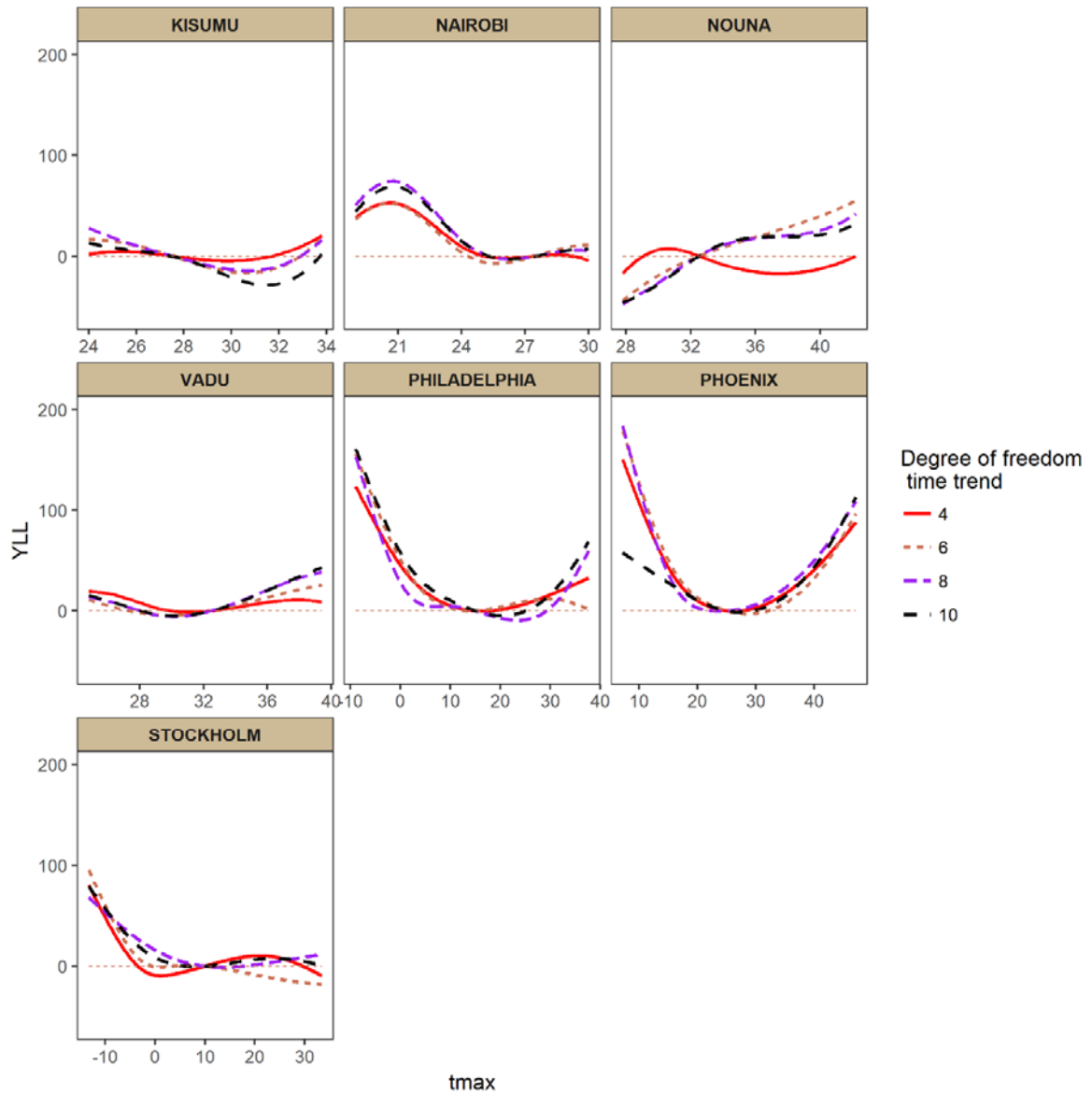


Figure S6. Association of daily maximum temperature with YLL with natural cubic spline basis with knots at 5th, 25th and 95th percentiles, all sites

The degree of freedom for time trend represents the degree of freedom for the spline function of time trend in the model.

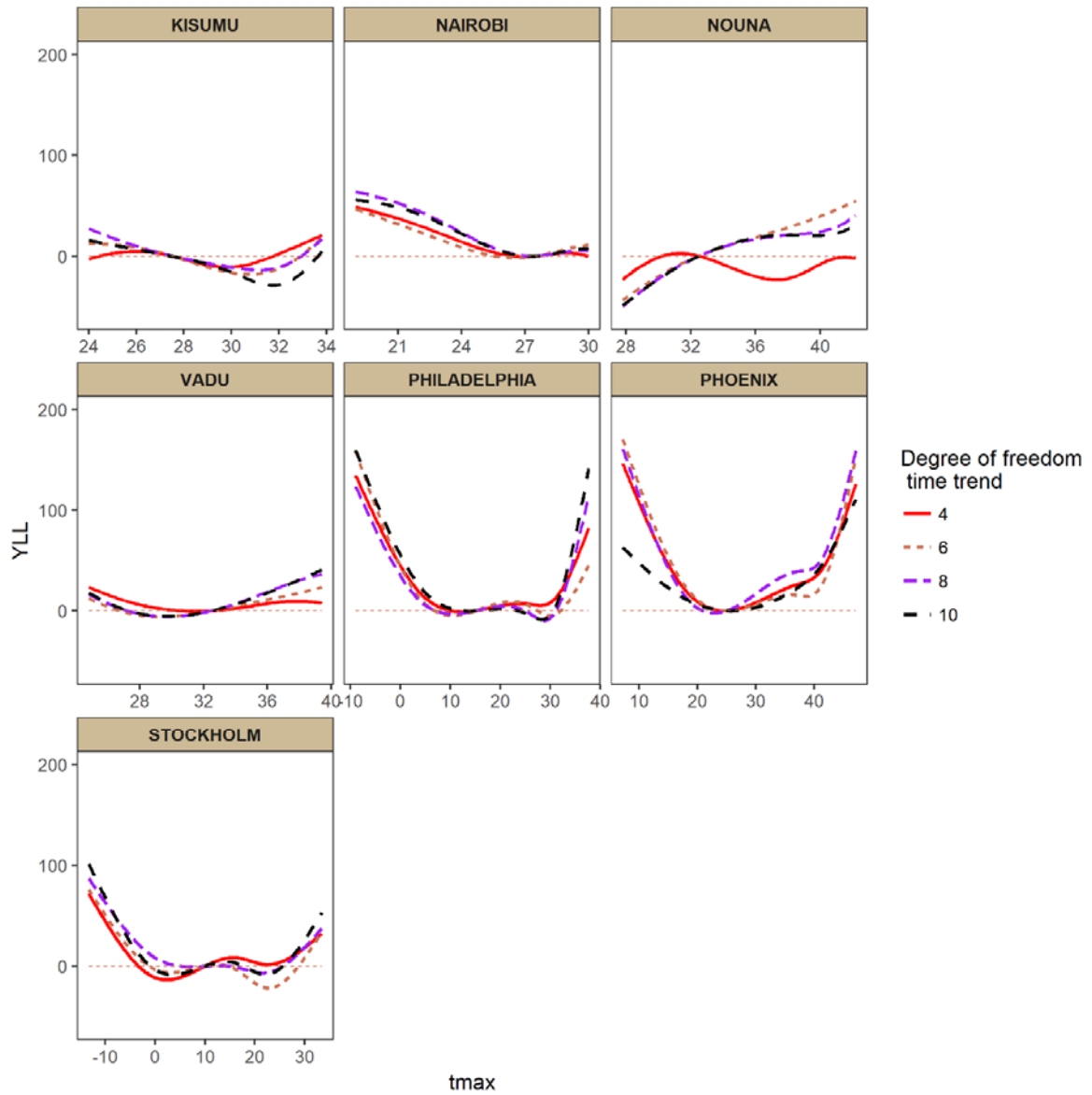


Figure S7. Association of daily maximum temperature with YLL with natural cubic spline basis with knots at 10th, 70th and 90th percentiles, all sites

The degree of freedom for time trend represents the degree of freedom for the spline function of time trend in the model.

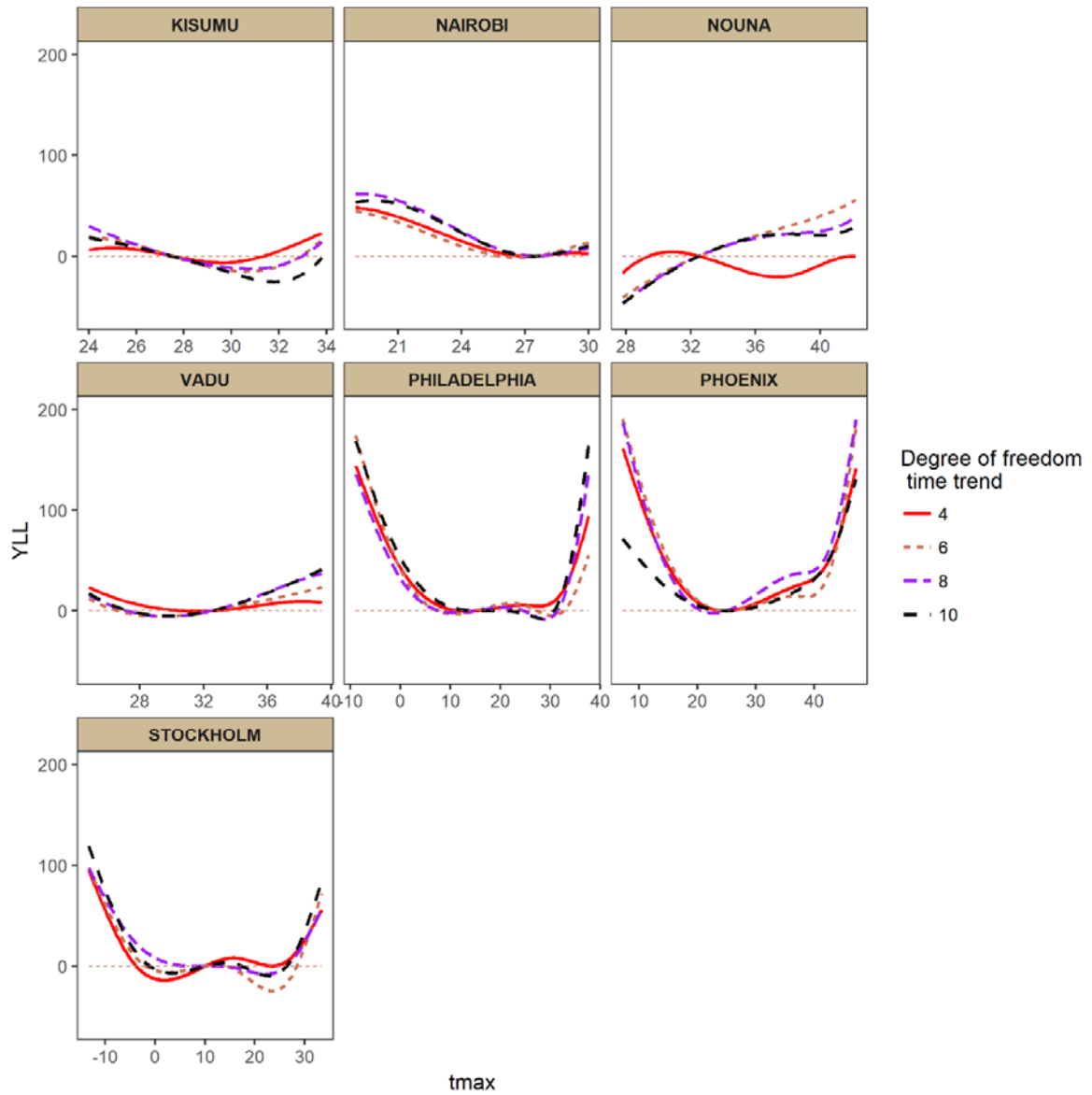


Figure S8. Association of daily maximum temperature with YLL with natural cubic spline basis with knots at 2nd, 70th and 98th percentiles, all sites

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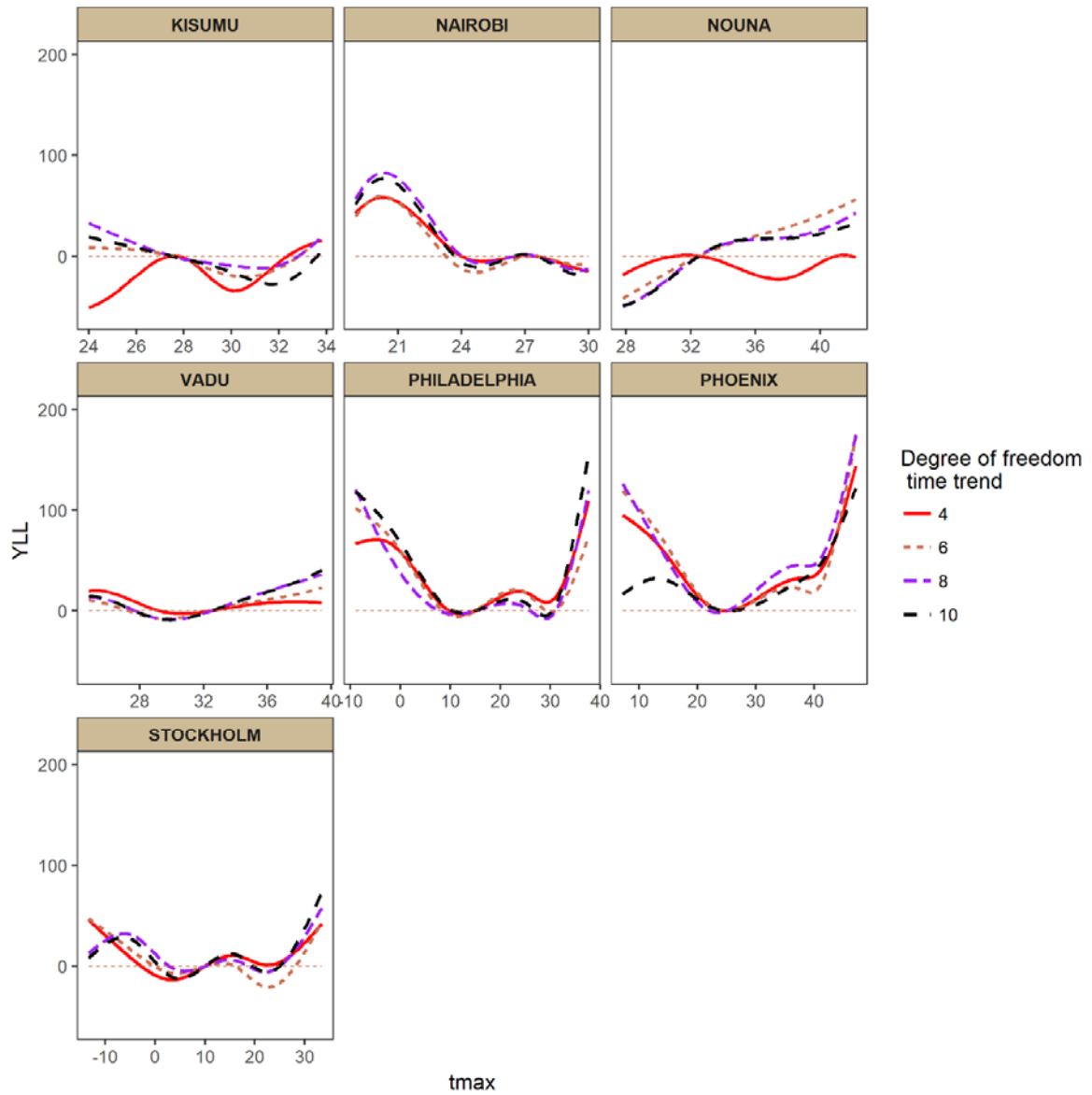


Figure S9. Association of daily maximum temperature with YLL with natural cubic spline basis with knots at 2nd, 25th, 70th and 90th percentiles, all sites

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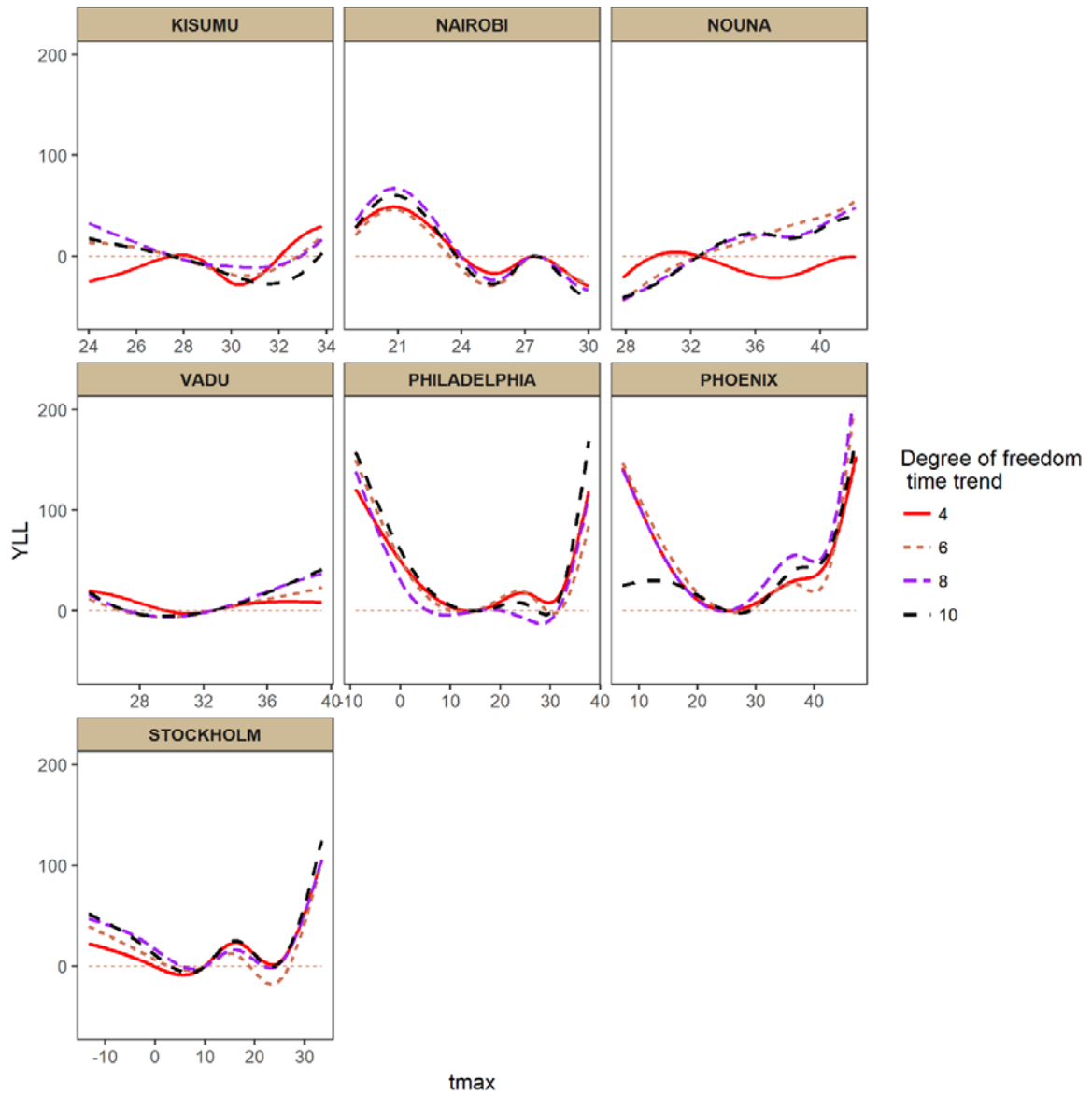


Figure S10. Association of daily maximum temperature with YLL with natural cubic spline basis with knots at 5th, 50th, 70th and 95th percentiles, all sites

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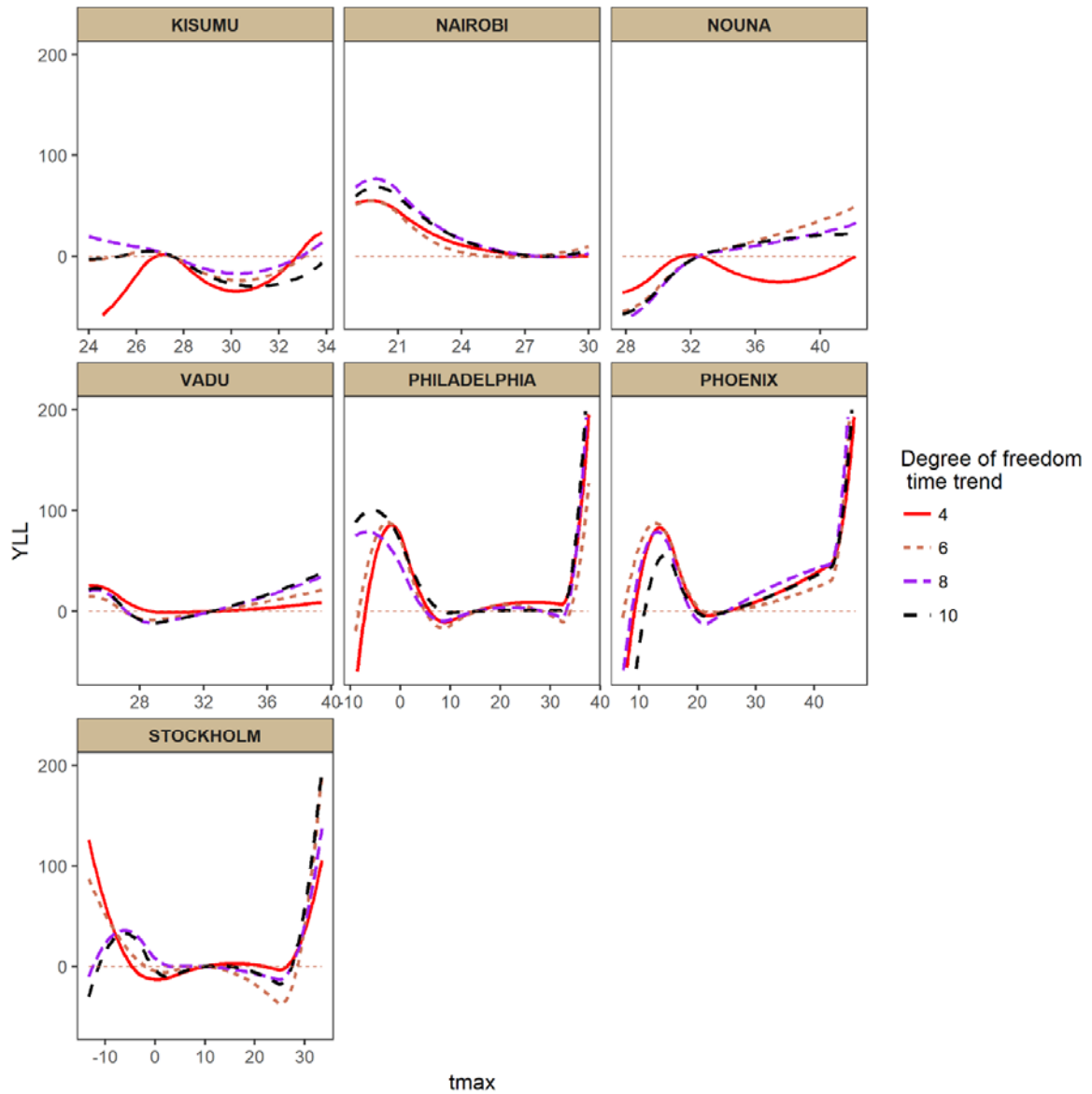


Figure S11. Association of daily maximum temperature with YLL with B spline basis with knots at 5th, 25th and 95th percentiles, all sites

The degree of freedom for time trend represents the degree of freedom for the spline function of time trend in the model.

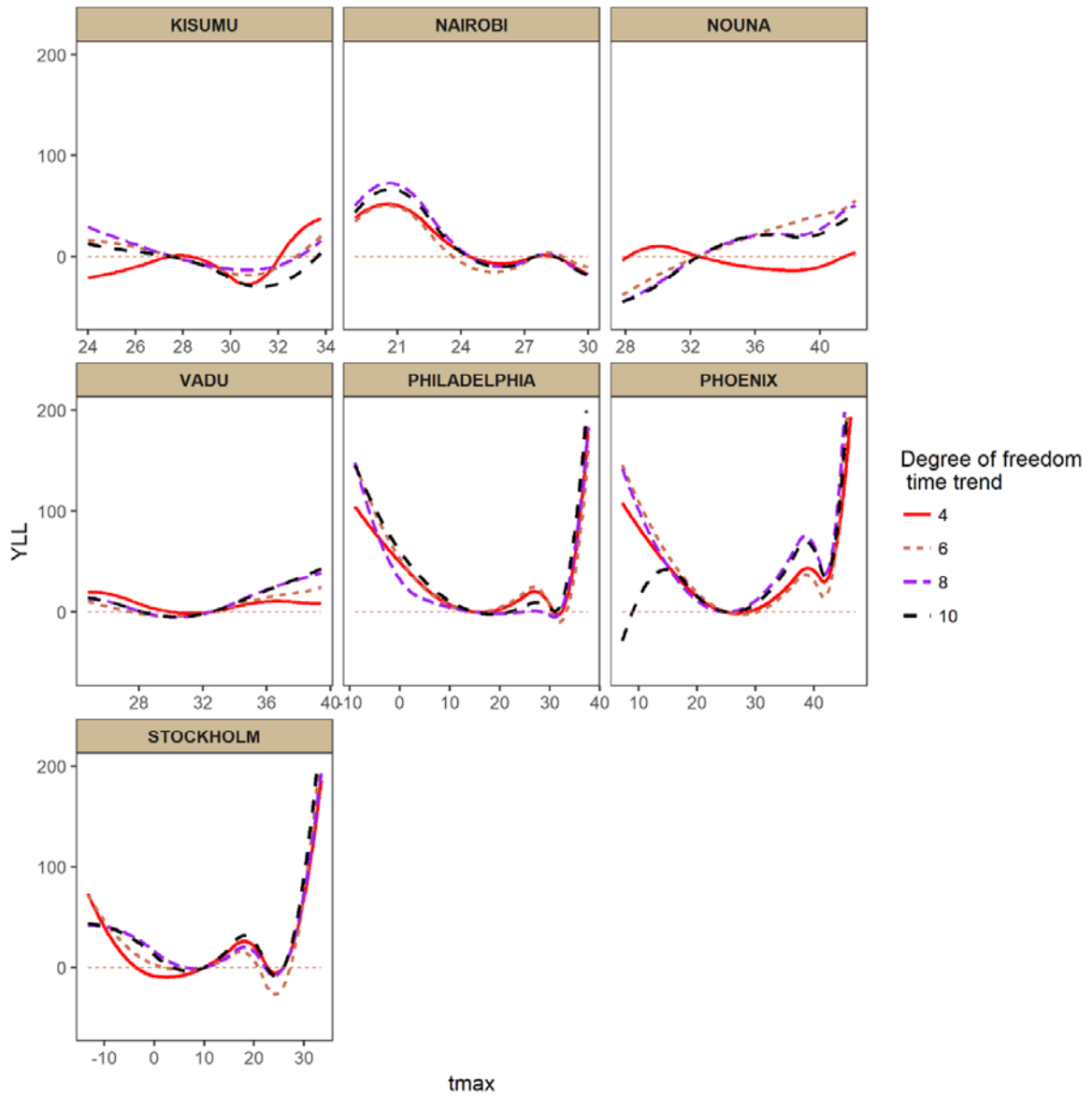


Figure S12. Association of daily maximum temperature with YLL with B spline basis with knots at 10th, 70th and 90th percentiles, all sites

The degree of freedom for time trend represents the degree of freedom for the spline function of time trend in the model.

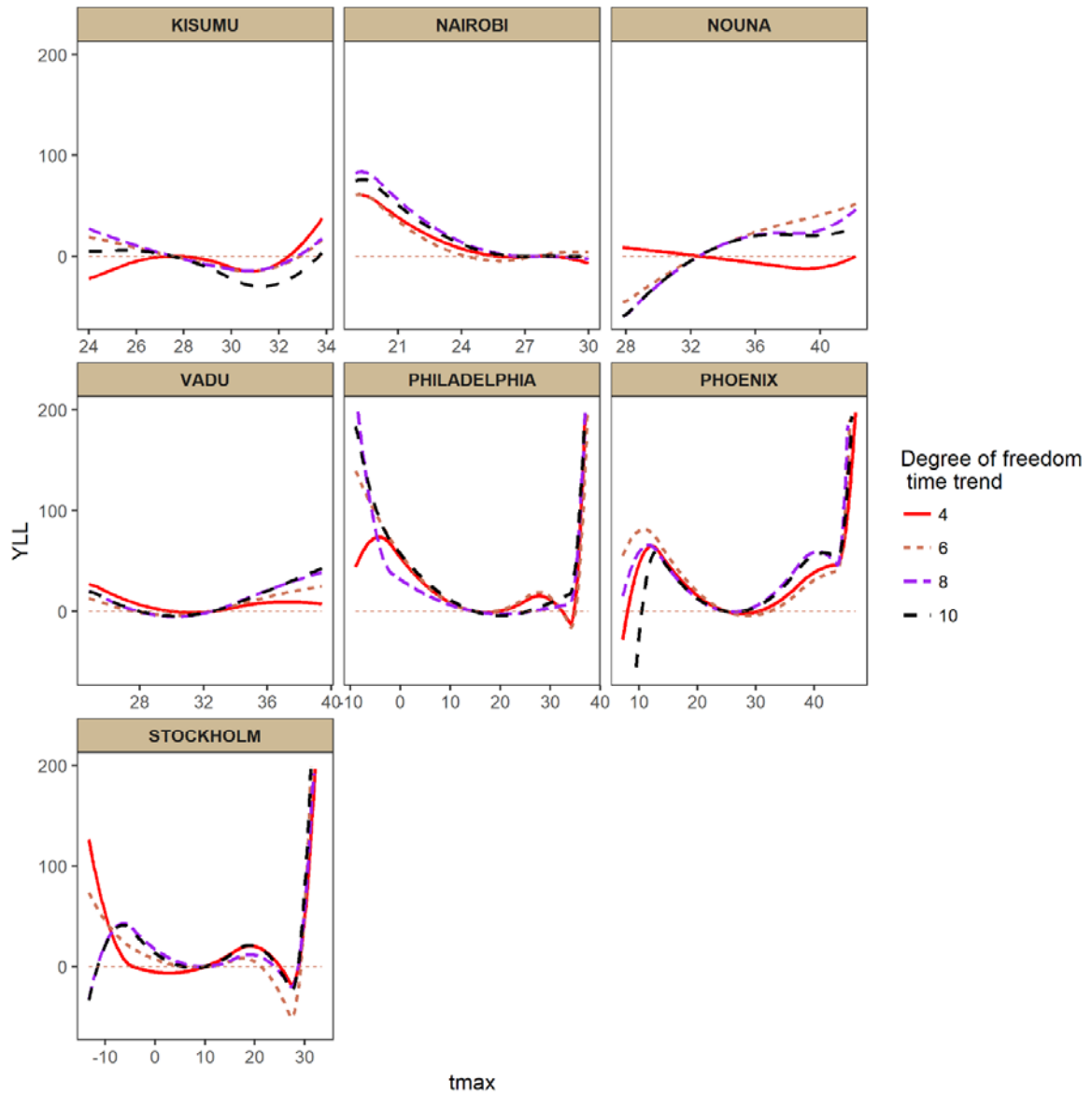


Figure S13. Association of daily maximum temperature with YLL with B spline basis with knots at 2nd, 70th and 98th percentiles, all sites

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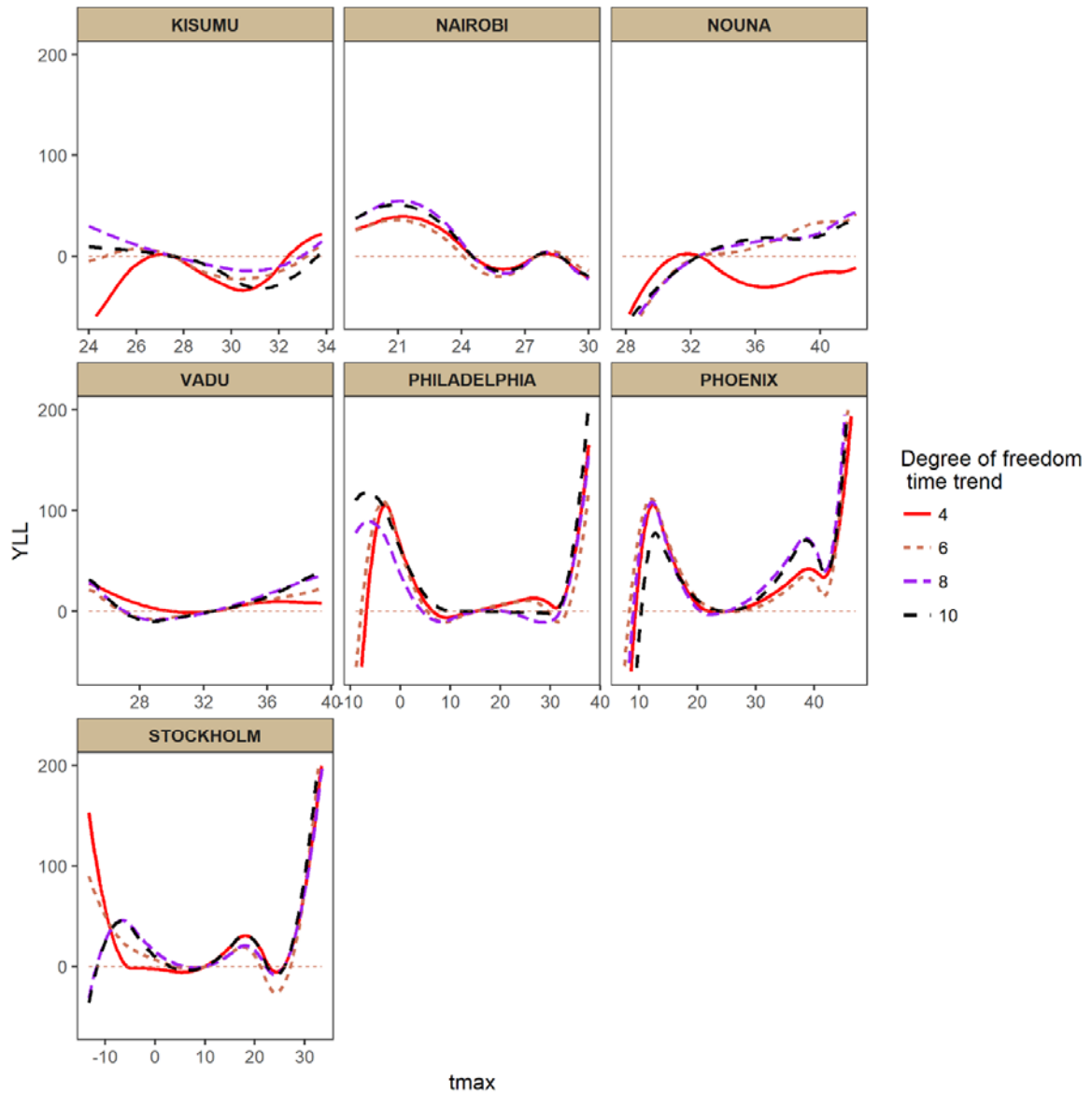


Figure S14. Association of daily maximum temperature with YLL with B spline basis with knots at 2nd, 25th, 70th and 90th percentiles, all sites

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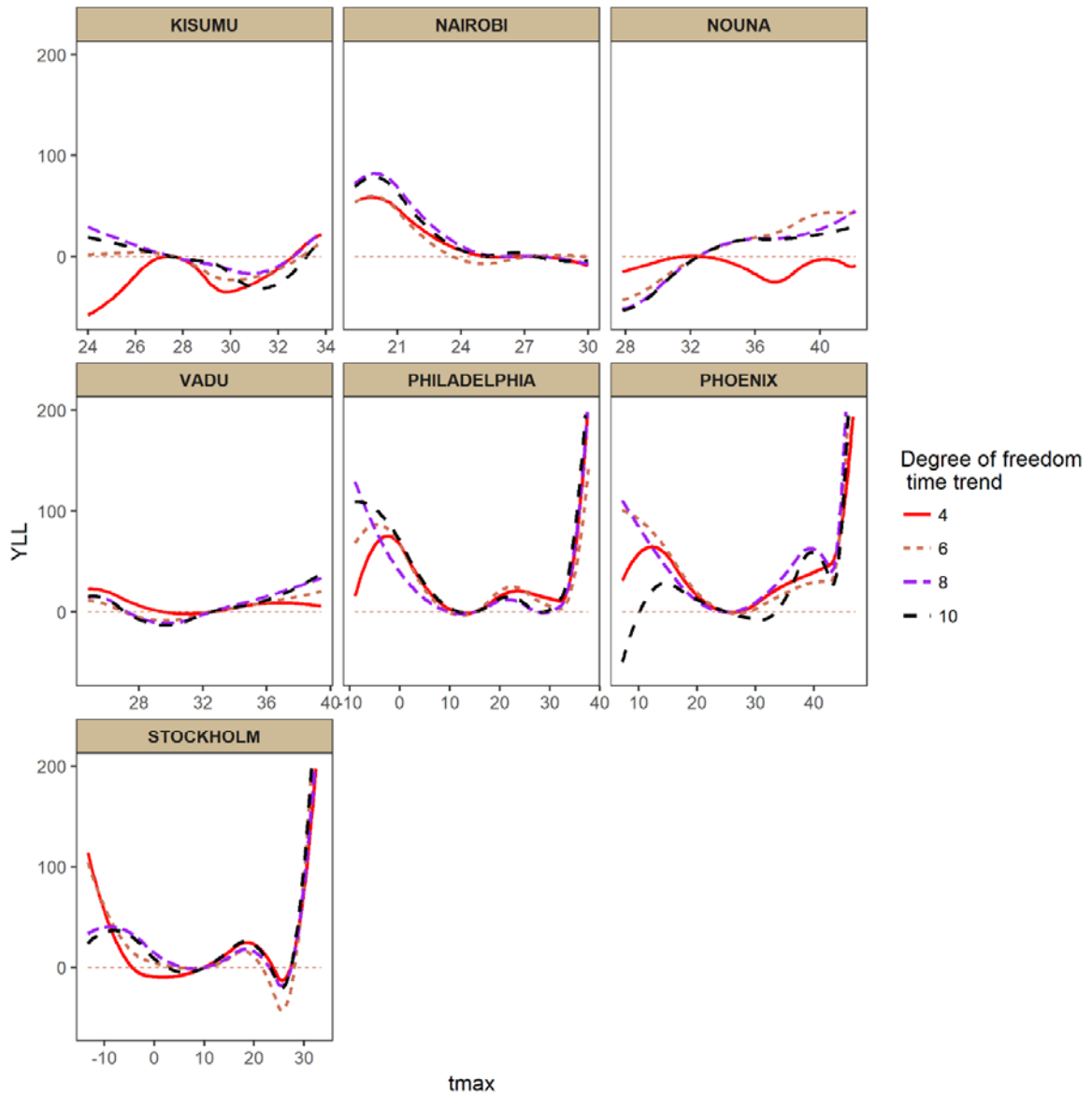


Figure S15. Association of daily maximum temperature with YLL with B spline basis with knots at 5th, 50th, 70th and 95th percentiles, all sites

The degree of freedom for time trend represents the degree of freedom for the spline function of time trend in the model.