Roye et al. Short-term association between hot nights and mortality: a multicountry analysis in 178 locations.

SUPPLEMENTARY MATERIAL

TABLES

Table S4 Heterogeneity analysis and selected meta-predictors for Hot Night excess (HNe) and duration (HNd)

Fixed model	AIC	I2	pQ	Predictor test (p-value)	Random	Number of cities
HNe						
1	-3174.8	33.0	<0.001	-	1 | city	178
1 + avtmean	-3175.4	32.2	<0.001	0.07	1 | city	178
1 + rgtmean	-3169.0	33.2	<0.001	0.976	1 | city	178
1 + ahum	-3170.2	33.1	<0.001	0.689	1 | city	178
1 + rangeHNe	-3172.3	32.7	<0.001	0.251	1 | city	178
1 + p100HNd	-3170.9	32.5	<0.001	0.542	1 | city	178
1 + country	-3083.7	28.5	<0.001	0.077	1 | city	178
1 + Kz	-3164.3	33.1	<0.001	0.583	1 | city	178
1 + countrykgcl	-3056.1	28.3	<0.001	0.004	1 | city	178
1 + region	-3151.0	29.4	<0.001	0.238	1 | city	178
1 + deprivation	-3154.1	32.2	<0.001	0.187	1 | city	177
1 + human_develop	-3153.2	32.7	<0.001	0.271	1 | city	177
1 + human_modterrest	-3180.8	31.1	<0.001	0.002	1 | city	178
1 + lst_summer_mx	-3086.2	31.3	<0.001	0.095	1 | city	172
avtmean	-3170.8	32.2	<0.001	0.051	1|countrykgcl/city	178
HNd						
1	-5064.2	25.6	<0.001	-	1 | city	178
1 + avtmean	-5067.2	24.1	<0.001	0.022	1 | city	178
1 + rgtmean	-5059.9	25.8	<0.001	0.651	1 | city	178
1 + ahum	-5063.5	25.2	<0.001	0.151	1 | city	178
1 + rangeHNe	-5060.6	25.9	<0.001	0.493	1 | city	178
1 + p100HNd	-5058.6	26.0	<0.001	0.944	1 | city	178
1 + country	-4997.1	17.2	0.003	<0.001	1 | city	178
1 + Kz	-5054.5	25.6	<0.001	0.521	1 | city	178
1 + countrykgcl	-4962.7	17.4	0.004	0.002	1 | city	178
1 + region	-5052.9	21.7	<0.001	0.016	1 | city	178
1 + deprivation	-5030.4	25.8	<0.001	0.13	1 | city	177
1 + human_develop	-5030.0	25.8	<0.001	0.209	1 | city	177
1 + human_modterrest	-5061.8	25.4	<0.001	0.303	1 | city	178
1 + lst_summer_mx	-4885.9	24.4	<0.001	0.074	1 | city	172
avtmean	-5063.0	24.1	<0.001	0.02	1|countrykgcl/city	178

Table S5 Relative risks at 90th percentile with respect to 0 in each index by region and climate zone for Hot Night excess (HNe) and duration (HNd)

		HNe		HNd	
REGION	NUMBER OF CITIES	P90	RR (95% CI)	RR (95% CI)	P90
Northern America	23	25.8	1.025 (1.016 - 1.034)	1.023 (1.015 - 1.030)	93.1
Latin America and the Caribbean	24	21.8	1.023 (1.015 - 1.031)	1.023 (1.016 - 1.031)	87.6
Northern Europe	17	20.9	1.013 (1.000 - 1.026)	1.004 (0.988 - 1.021)	100.0
Western Europe	26	25.9	1.022 (1.012 - 1.032)	1.019 (1.010 - 1.028)	97.6
Southern Europe	52	29.8	1.030 (1.019 - 1.040)	1.024 (1.017 - 1.031)	93.0
Eastern Europe	6	27.6	1.025 (1.014 - 1.036)	1.020 (1.011 - 1.028)	94.4
Sub-Saharan Africa	1	19.2	1.019 (1.012 - 1.025)	1.023 (1.015 - 1.030)	91.7
Eastern Asia	17	17.4	1.019 (1.013 - 1.025)	1.028 (1.020 - 1.036)	92.3
South-eastern Asia	4	19.0	1.029 (1.016 - 1.041)	1.035 (1.022 - 1.048)	90.9
Western Asia	5	102.7	1.142 (1.082 - 1.205)	1.039 (1.027 - 1.052)	96.2
Australia	3	27.5	1.029 (1.018 - 1.039)	1.025 (1.018 - 1.033)	93.6

		HNe		HNd	
CLIMATE ZONE	NUMBER OF CITIES	P90	RR (95% CI)	P90	RR (95% CI)
(A) Tropical	13	16.1	1.022 (1.014 - 1.029)	89.2	1.031 (1.019 - 1.042)
(B) Arid	18	32.0	1.035 (1.023 - 1.046)	89.6	1.025 (1.017 - 1.033)
(C) Temperate	130	28.1	1.027 (1.017 - 1.037)	94.1	1.022 (1.015 - 1.030)
(D) Continental	17	24.1	1.018 (1.006 - 1.030)	97.6	1.013 (1.001 - 1.025)
Global	**178**	**27.2**	**1.026 (1.017 - 1.036)**	**93.7**	**1.026 (1.013 - 1.040)**

Table S6 Ranking of highest city-specific overall attributable fractions (%), six per continent, for Hot Night excess (HNe).

Region	Country	Location	AF (%)	95% CI
Western Asia	Cyprus	Nicosia	7.35	0.8-13.36
Southern Europe	Italy	Cagliari	6.69	2.37-10.68
Western Asia	Israel	Jerusalem	5.85	-1.09-12.28
Western Asia	Israel	Tel Aviv	3.84	-1.68-9.23
Southern Europe	Spain	Granada	3.56	2.32-4.73
Southern Europe	Spain	Madrid	3.45	2.2-4.53
Southern Europe	Spain	Cordoba	3.44	2.38-4.5
Western Asia	Kuwait	Kuwait	3.30	1.42-5.19
Southern Europe	Spain	Badajoz	3.18	2.29-4.11
Southern Europe	Spain	Ciudad Real	3.00	2.04-3.98
Northern America	USA	Phoenix, Az	2.02	0.57-3.5
Northern America	USA	Las Vegas, Nv-Az	1.55	0.44-2.65
South-eastern Asia	Philippines	Davao	1.47	-0.01-2.9
Latin America and the Caribbean	Mexico	Ciudad Juarez	1.40	0.04-2.66
Western Asia	Iran	Tehran	1.39	0.56-2.18
Latin America and the Caribbean	Chile	Santiago	1.26	-0.89-3.37
Latin America and the Caribbean	Brazil	Brasilia	1.24	-0.02-2.55
Latin America and the Caribbean	Mexico	Monterrey	1.19	-0.08-2.47
Australia	Australia	Melbourne	0.54	0.14-0.96
Australia	Australia	Brisbane	0.53	0.1-0.98
Australia	Australia	Sydney	0.47	0.06-0.88
Sub-Saharan Africa	South Africa	City Of Cape Town	0.28	-0.28-0.81

Table S7 Ranking of highest city-specific overall attributable fractions (%), six per continent, for Hot Night duration (HNd).

Region	Country	Location	AF (%)	95% CI
Western Asia	Cyprus	Nicosia	3.63	0.42-6.64
Western Asia	Israel	Jerusalem	3.51	0.28-6.6
Western Asia	Israel	Tel Aviv	3.26	0.11-6.39
South-eastern Asia	Philippines	Davao	2.65	0.49-4.83
Southern Europe	Spain	Cordoba	2.47	1.52-3.45
Southern Europe	Spain	Granada	2.26	1.32-3.18
Southern Europe	Malta	Malta	2.23	0.13-4.44
Southern Europe	Spain	Badajoz	2.20	1.3-3.15
Southern Europe	Spain	Madrid	2.05	1.15-2.89
Southern Europe	Italy	Cagliari	2.01	-0.24-4.25
South-eastern Asia	Thailand	Bangkok	1.99	0.09-3.78
Western Asia	Kuwait	Kuwait	1.95	0.18-3.73
Northern America	USA	Phoenix, Az	1.72	0.3-3.22
Latin America and the Caribbean	Chile	Santiago	1.49	-0.25-3.27
Latin America and the Caribbean	Puertorico	San Juan	1.40	-0.25-2.96
Australia	Australia	Brisbane	1.36	0.61-2.14
Northern America	USA	Las Vegas, Nv-Az	1.34	0.05-2.64
Latin America and the Caribbean	Panama	Panama	1.30	-0.12-2.7
Latin America and the Caribbean	Paraguay	Asuncion	1.17	0.01-2.36
Australia	Australia	Sydney	1.00	0.37-1.61
Australia	Australia	Melbourne	0.56	0.18-0.94
Sub-Saharan Africa	South Africa	City Of Cape Town	0.36	-0.46-1.18

Table S8 Sensitivity to the model specifications. See Figure S12.

Option	MaxL_HN	MaxL_mx	Lk_HN	LK_mx	Varper	HN	QAIC	Ranking	Group
option1	3	3	1	1	10, 95	HNe	17153.90	17	G4
option1	3	3	1	1	10, 95	HNd	17154.41	17	G4
option2	7	3	2	1	10, 95	HNe	17154.57	18	G4
option2	7	3	2	1	10, 95	HNd	17155.67	18	G4
option3	10	3	2	1	10, 95	HNe	17153.44	16	G4
option3	10	3	2	1	10, 95	HNd	17154.37	16	G4
option4	3	7	1	2	10, 95	HNe	17147.43	9	G2
option4	3	7	1	2	10, 95	HNd	17148.16	9	G2
option5	3	10	1	2	10, 95	HNe	17144.27	2	G1
option5	3	10	1	2	10, 95	HNd	17145.23	2	G1
option6	7	7	2	2	10, 95	HNe	17149.79	12	G3
option6	7	7	2	2	10, 95	HNd	17151.00	12	G3
option7	10	7	2	2	10, 95	HNe	17148.99	11	G3
option7	10	7	2	2	10, 95	HNd	17150.26	11	G3
option8	7	10	2	2	10, 95	HNe	17146.39	7	G2
option8	7	10	2	2	10, 95	HNd	17147.91	7	G2
option9	10	10	2	2	10, 95	HNe	17146.38	6	G2
option9	10	10	2	2	10, 95	HNd	17148.06	6	G2
option10	3	3	1	1	50, 95	HNe	17151.98	14	G4
option10	3	3	1	1	50, 95	HNd	17152.15	14	G4
option11	7	3	2	1	50, 95	HNe	17152.73	15	G4
option11	7	3	2	1	50, 95	HNd	17153.33	15	G4
option12	10	3	2	1	50, 95	HNe	17151.62	13	G3
option12	10	3	2	1	50, 95	HNd	17152.02	13	G3
option13	3	7	1	2	50, 95	HNe	17145.33	5	G1
option13	3	7	1	2	50, 95	HNd	17145.70	5	G1
option14	3	10	1	2	50, 95	HNe	17142.31	1	G1
option14	3	10	1	2	50, 95	HNd	17142.93	1	G1
option15	7	7	2	2	50, 95	HNe	17147.70	10	G3
option15	7	7	2	2	50, 95	HNd	17148.65	10	G3
option16	10	7	2	2	50, 95	HNe	17146.88	8	G2
option16	10	7	2	2	50, 95	HNd	17147.83	8	G2
option17	7	10	2	2	50, 95	HNe	17144.45	4	G1
option17	7	10	2	2	50, 95	HNd	17145.64	4	G1
option18	10	10	2	2	50, 95	HNe	17144.45	3	G1
option18	10	10	2	2	50, 95	HNd	17145.87	3	G1

FIGURES

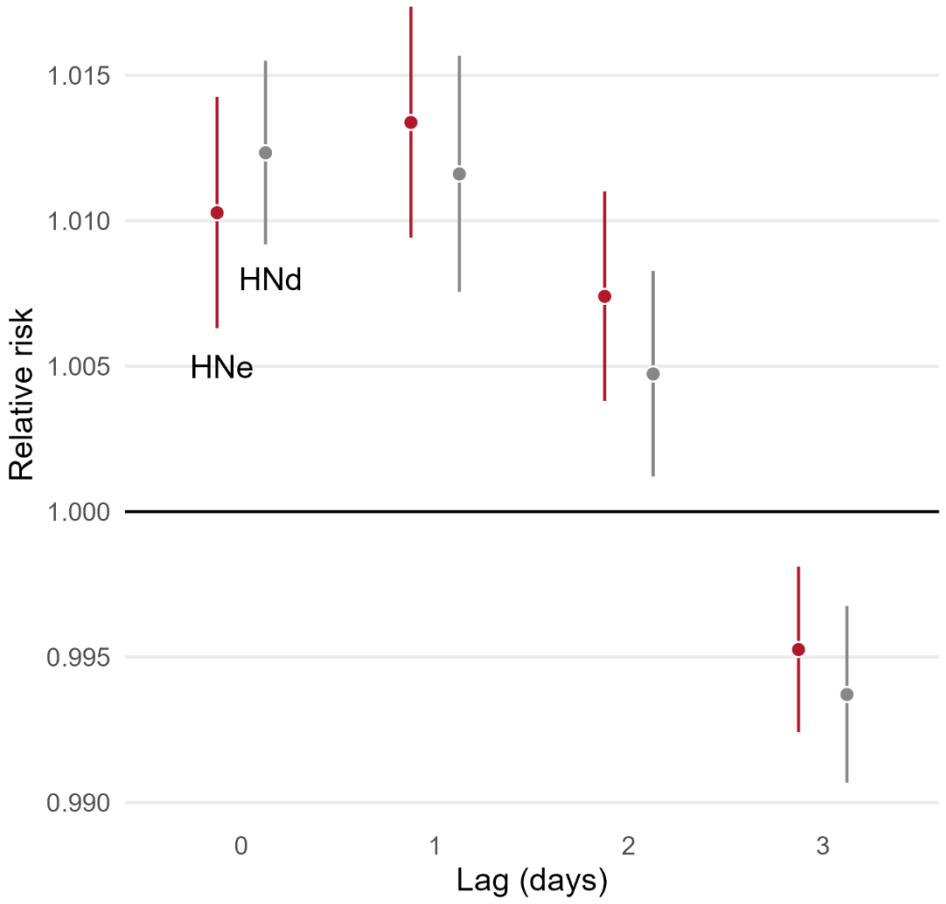

Figure S1 Relative risks for lag effects of Hot Night excess (HNe) and duration (HNd) for pooled results at the 90th percentile with respect to 0.

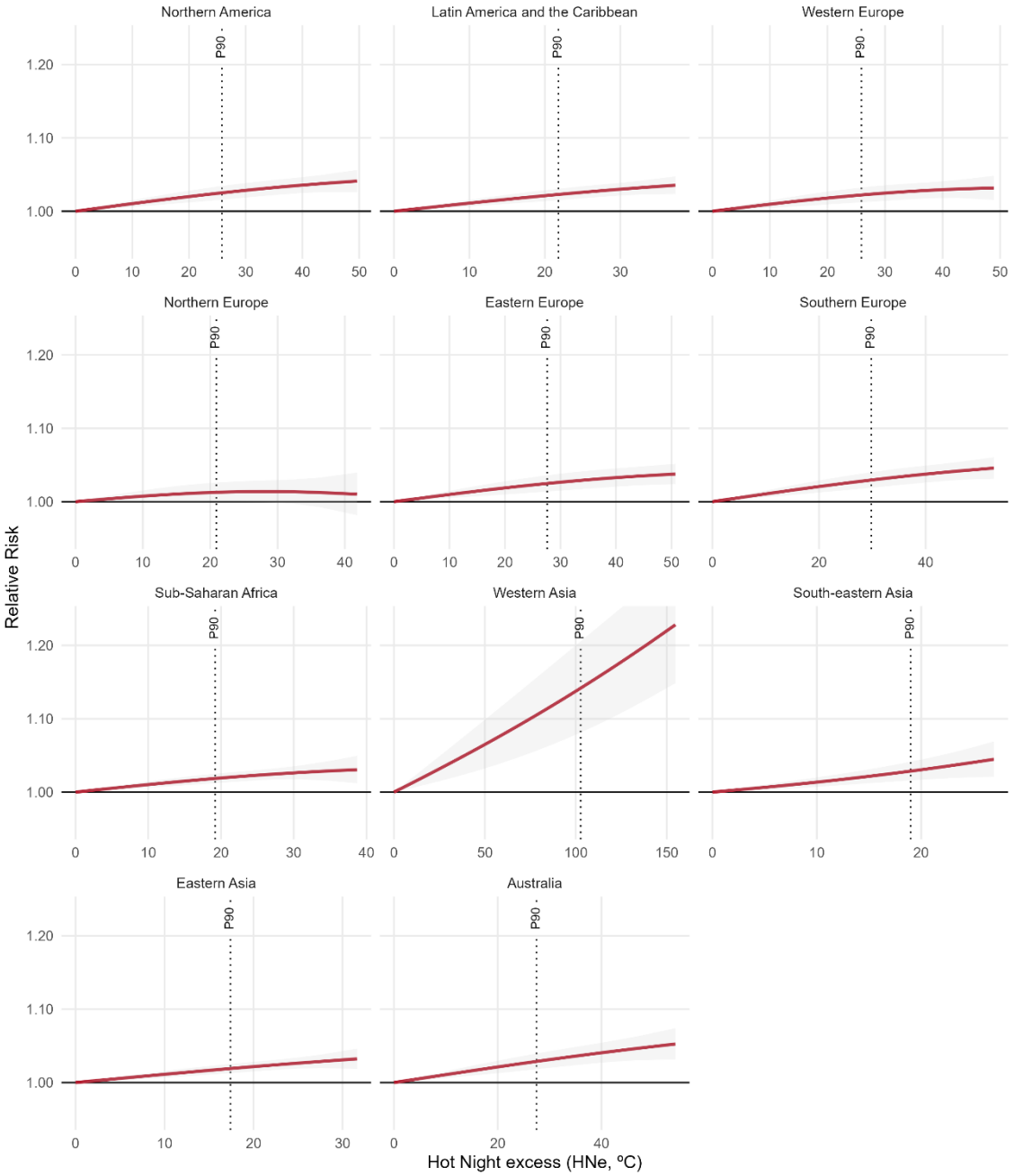

Figure S2 Region-specific exposure-response relationships between hot night excess (HNe) and mortality relative risk (RR) from 178 cities in 44 countries.

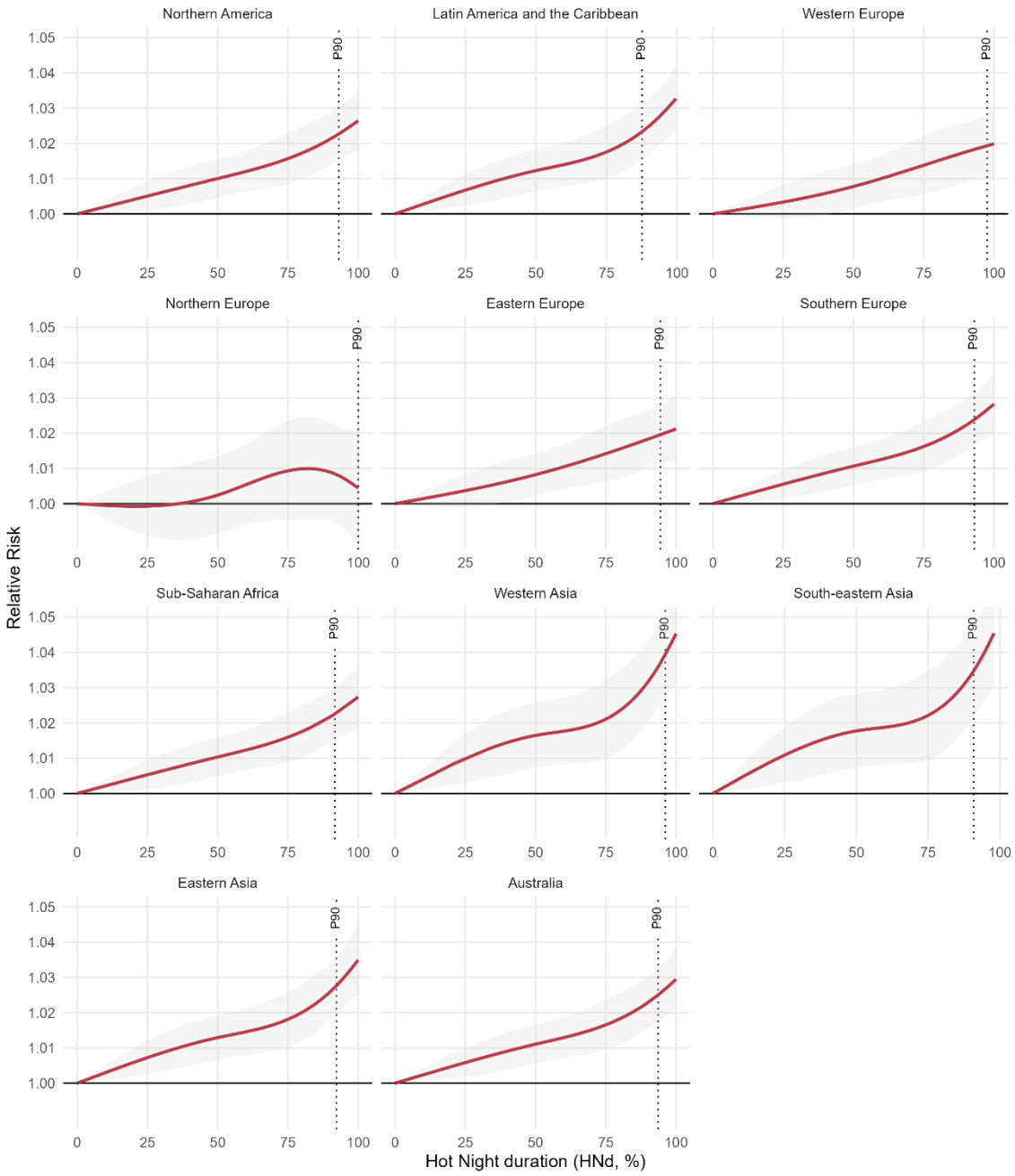

Figure S3 Region-specific exposure-response relationships between Hot Night duration (HNd) and mortality relative risk (RR) from 178 cities in 44 countries.

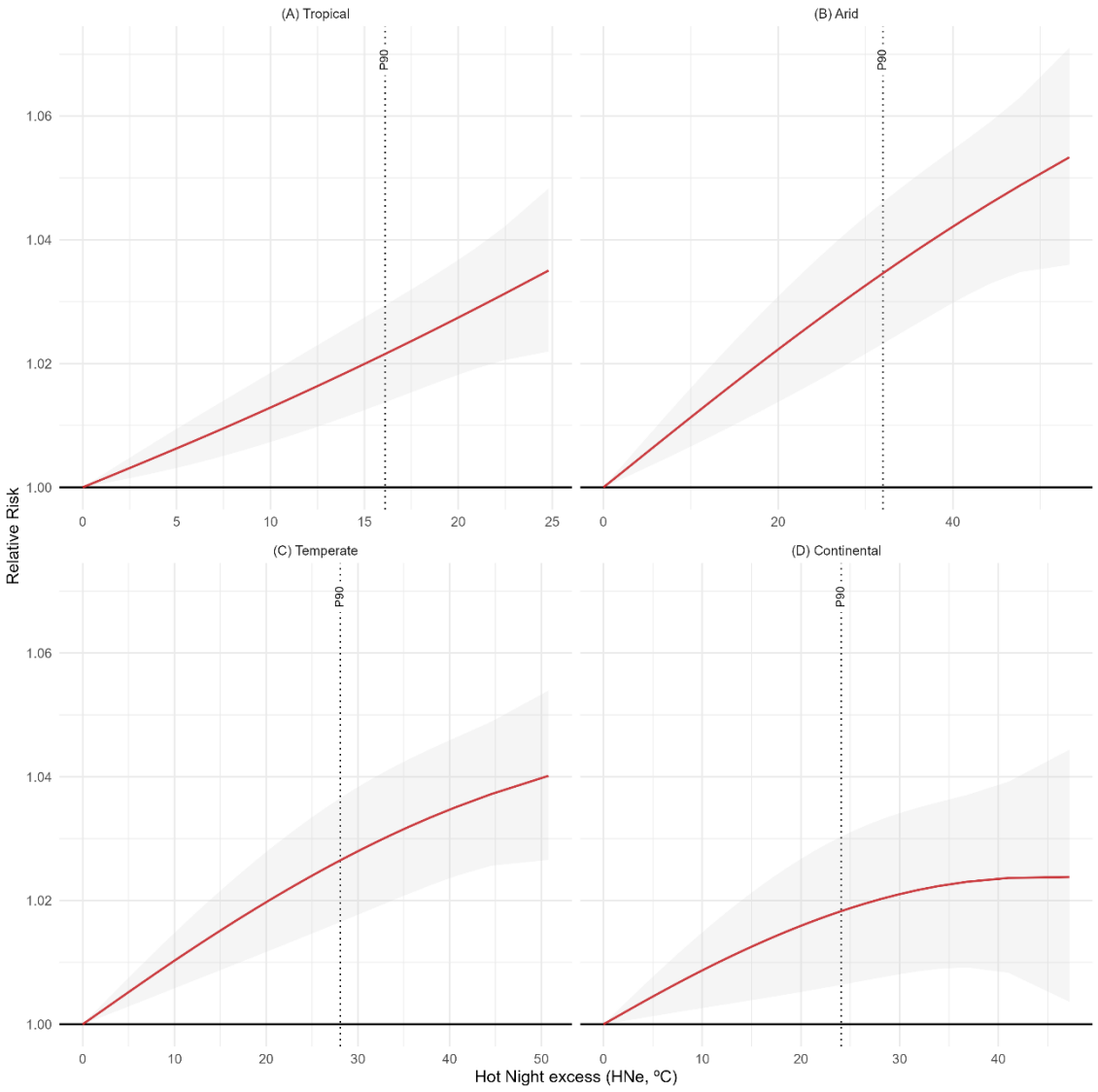

Figure S4 Pooled exposure-response relationships by climate zone between hot night excess (HNe) and mortality relative risk (RR) from 178 cities in 44 countries.

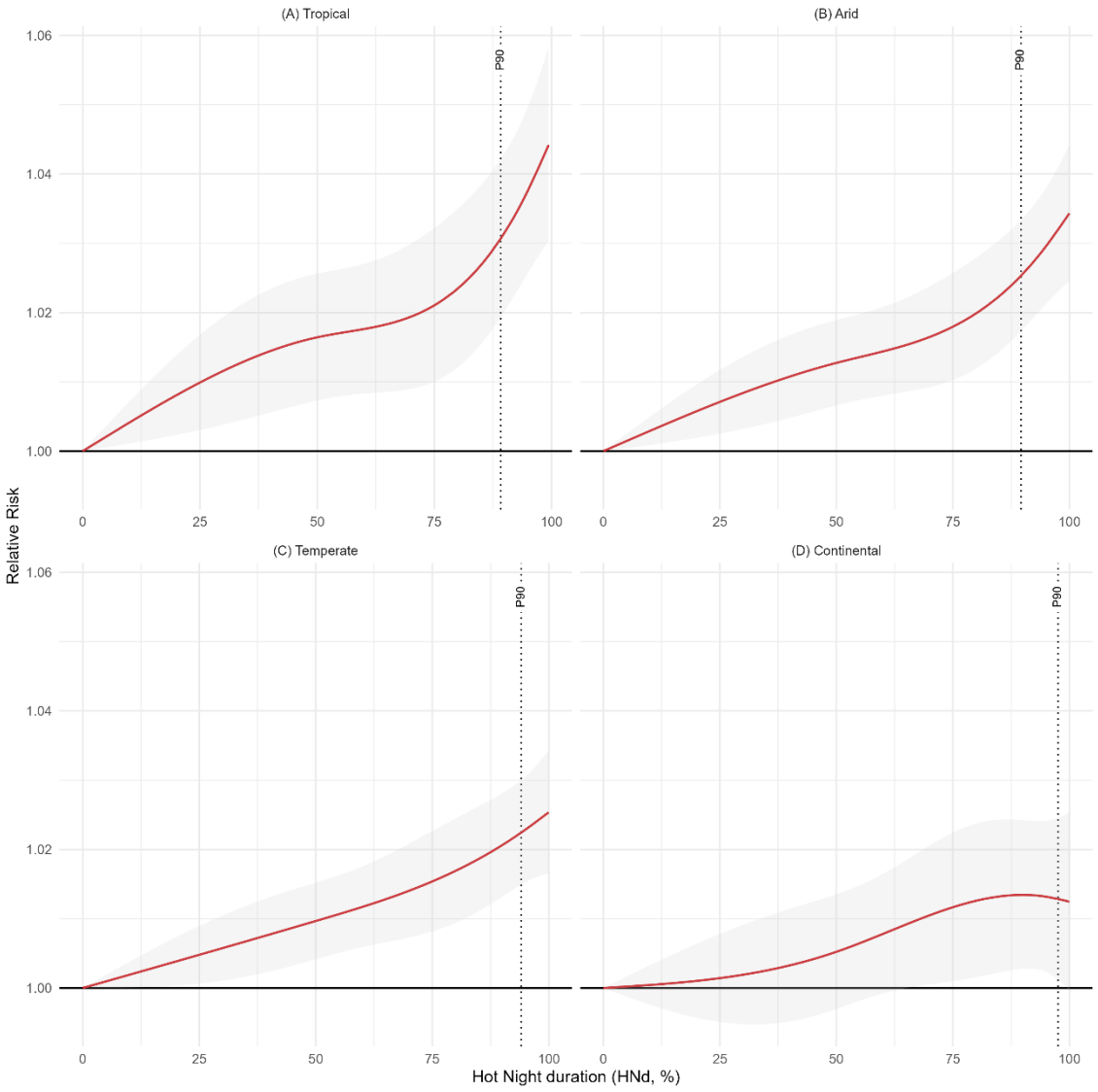

Figure S5 Climate zone-specific exposure-response relationships between Hot Night duration (HNd) and mortality relative risk (RR) from 178 cities in 44 countries.

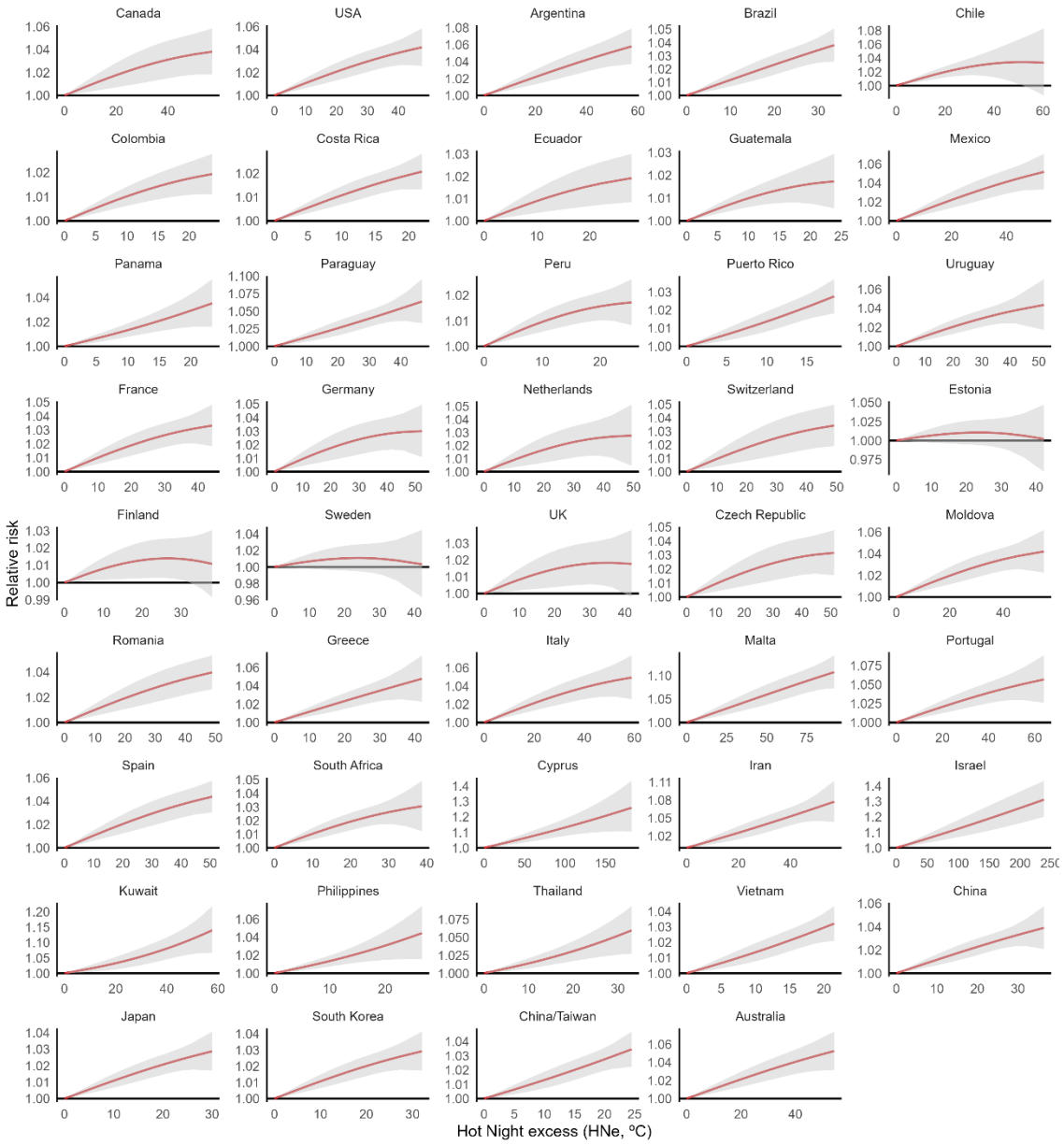

Figure S6 Country-specific exposure-response relationships between Hot Night excess (HNe) and mortality relative risk (RR) from 178 cities.

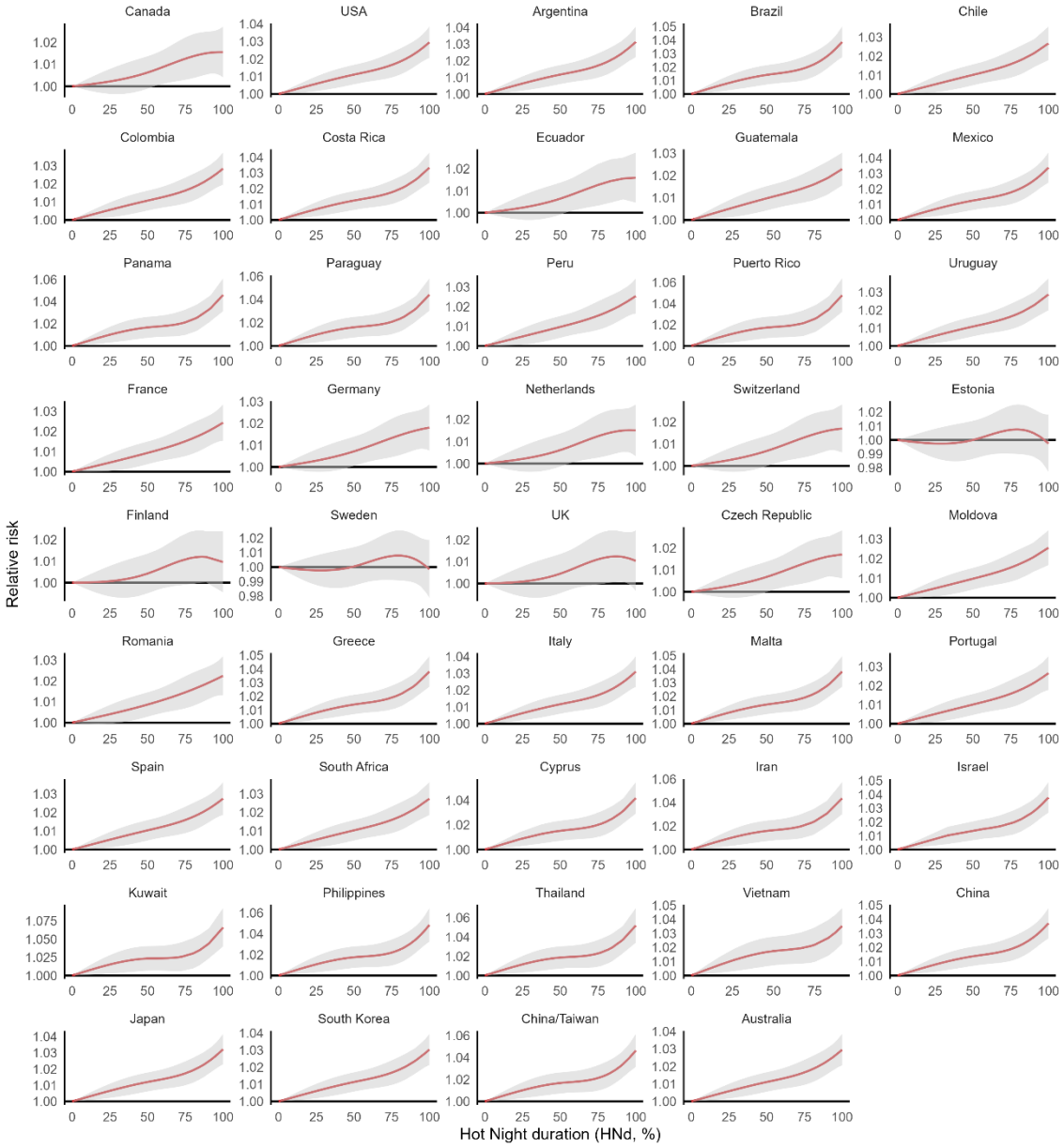

Figure S7 Country-specific exposure-response relationships between Hot Night duration (HNd) and mortality relative risk (RR) from 178 cities.

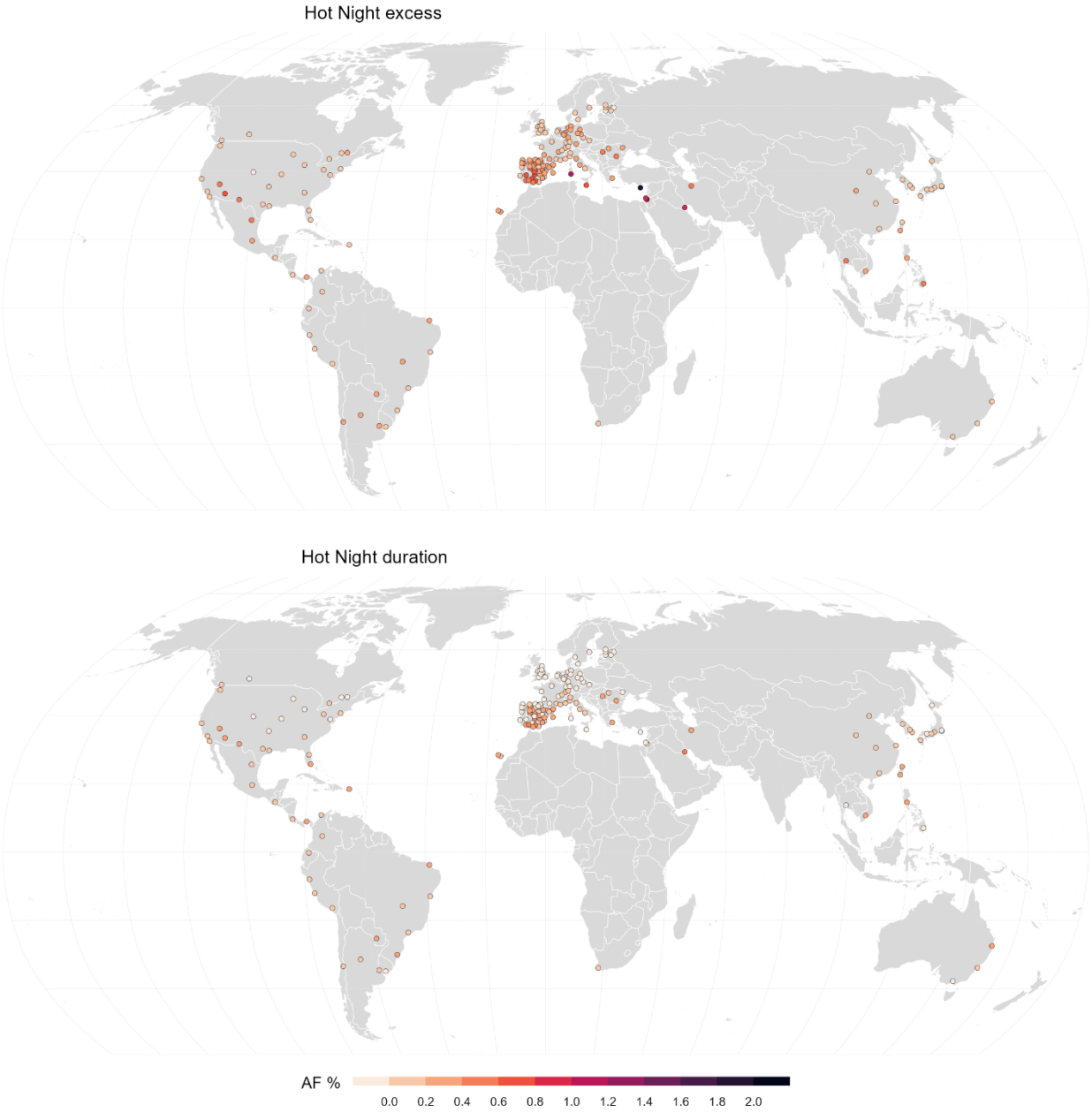

Figure S8 City-specific hot night-mortality extreme fraction (%) (> P90) in the 178 cities in 44 countries.

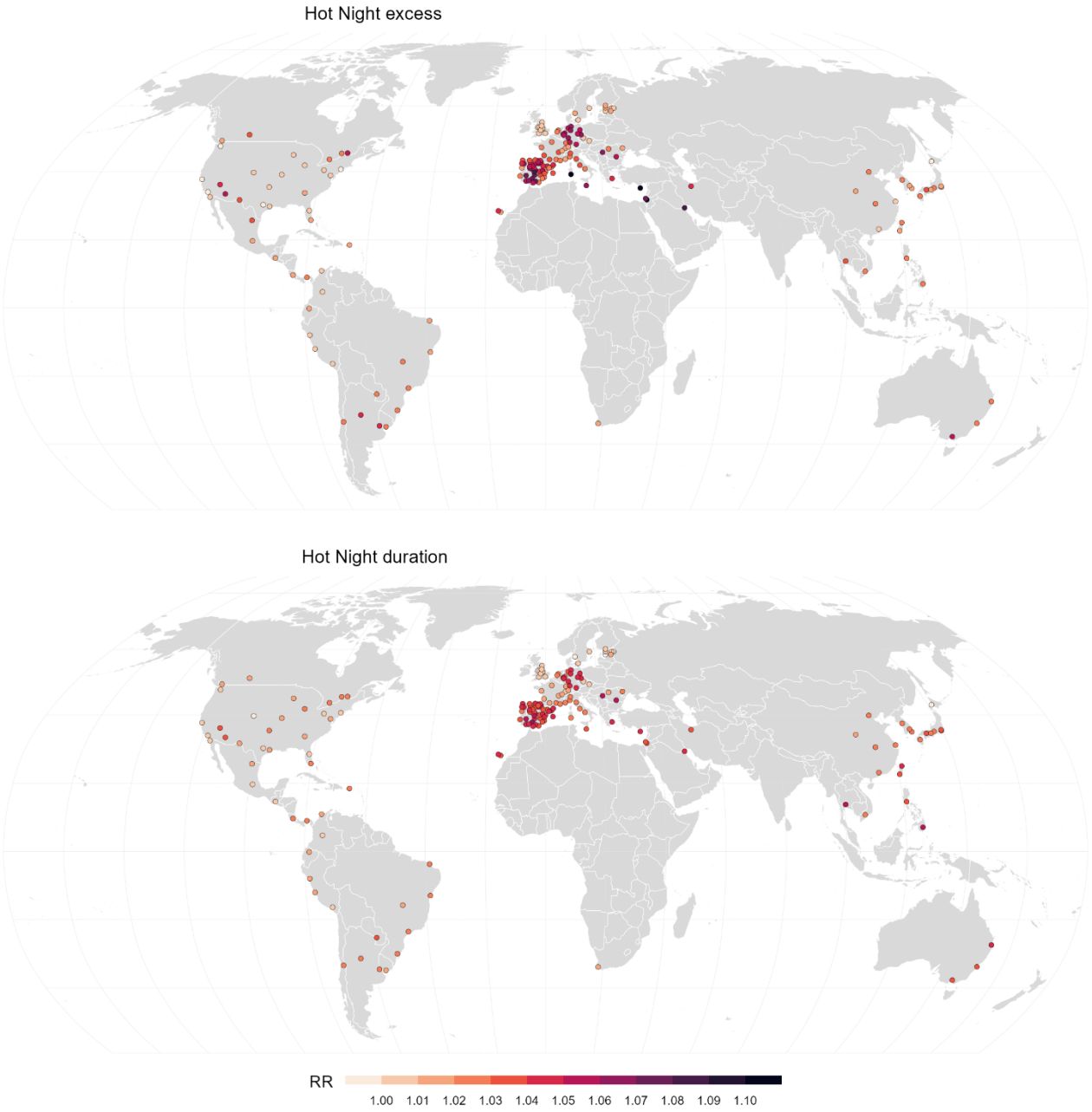

Figure S9 City-specific relative risks of mortality at the 90th percentile with respect to 0 for hot night excess and duration in the 178 analyzed cities from 44 countries.

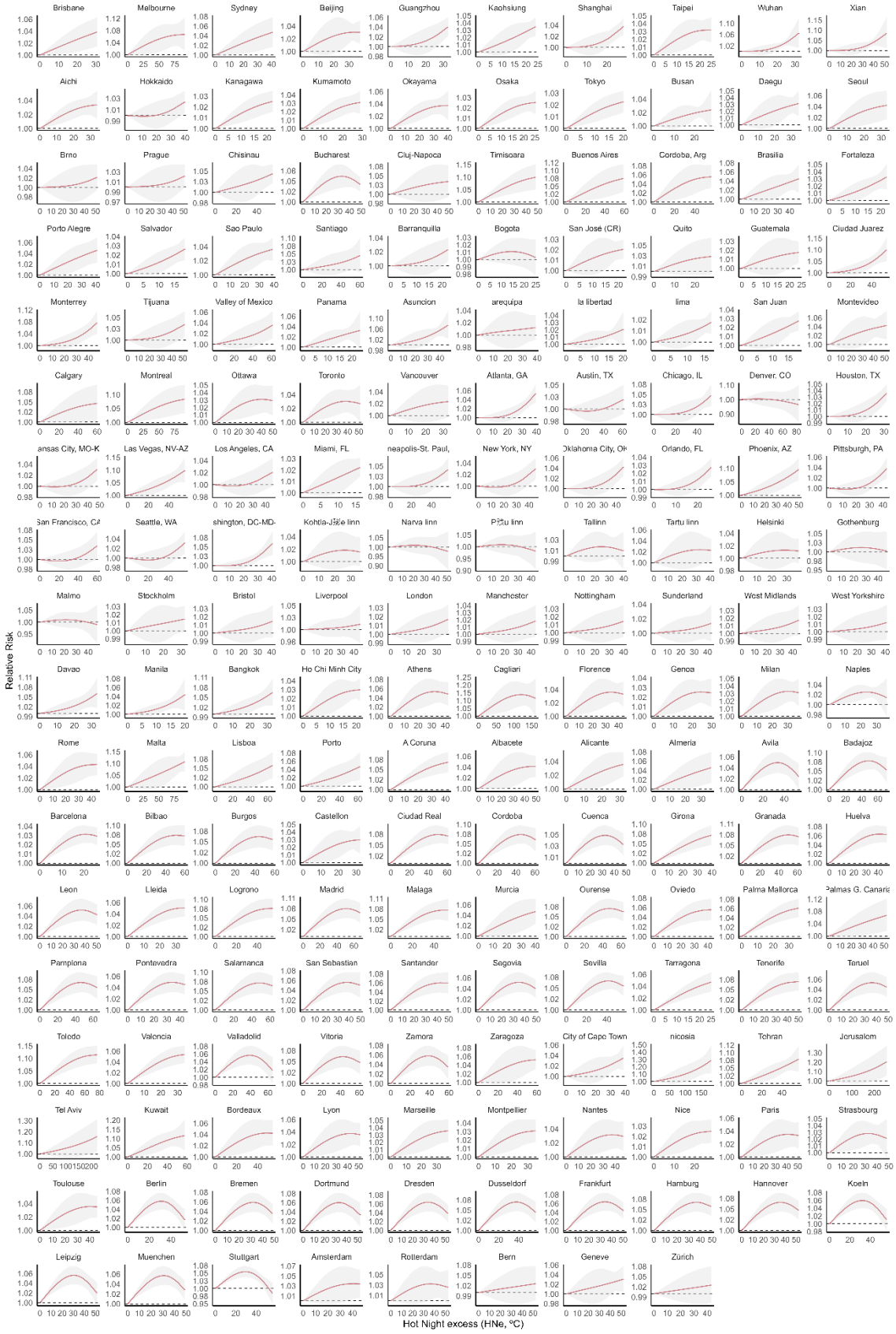

Figure S10 City-specific exposure-response relationships between Hot Night excess (HNe) and relative risk (RR) of mortality.

Figure S11 City-specific exposure-response relationships between Hot Night duration (HNd) and relative risk (RR) of mortality.

Sensitivity Analysis

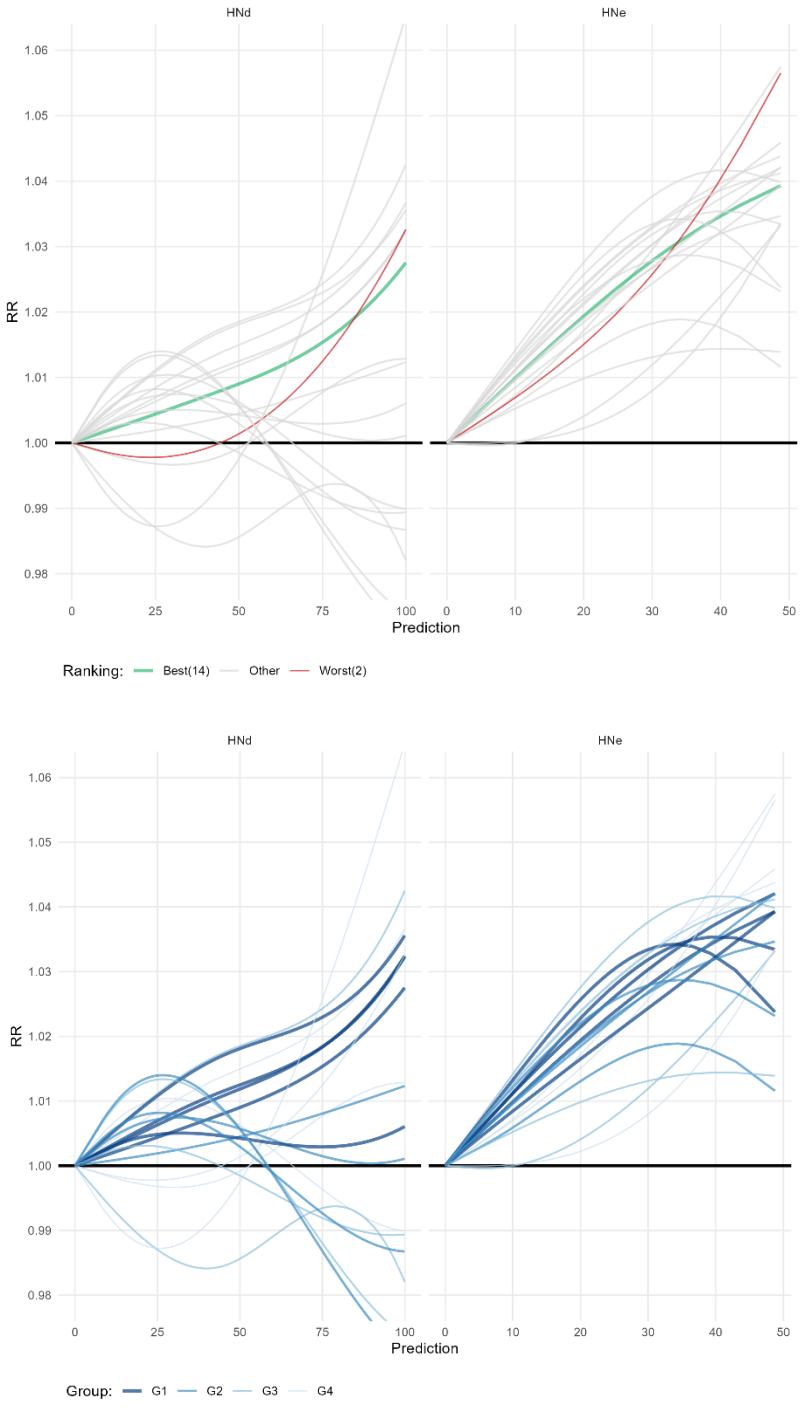

Figure S12 Sensitivity to the model specifications of the overall dose-response curves. See Table S8 for detailed specifications.

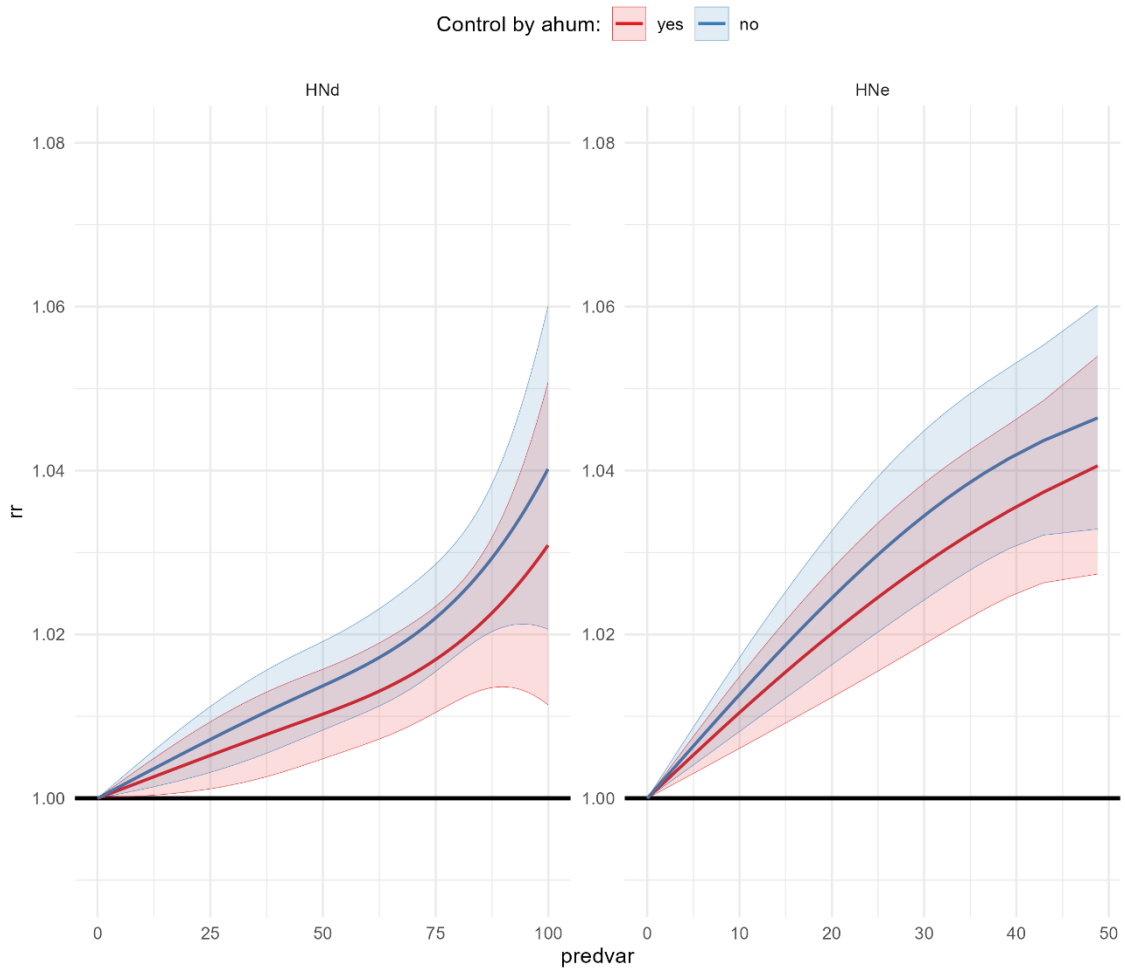

Figure S13 The overall dose-response curves controlling for or without absolute humidity.

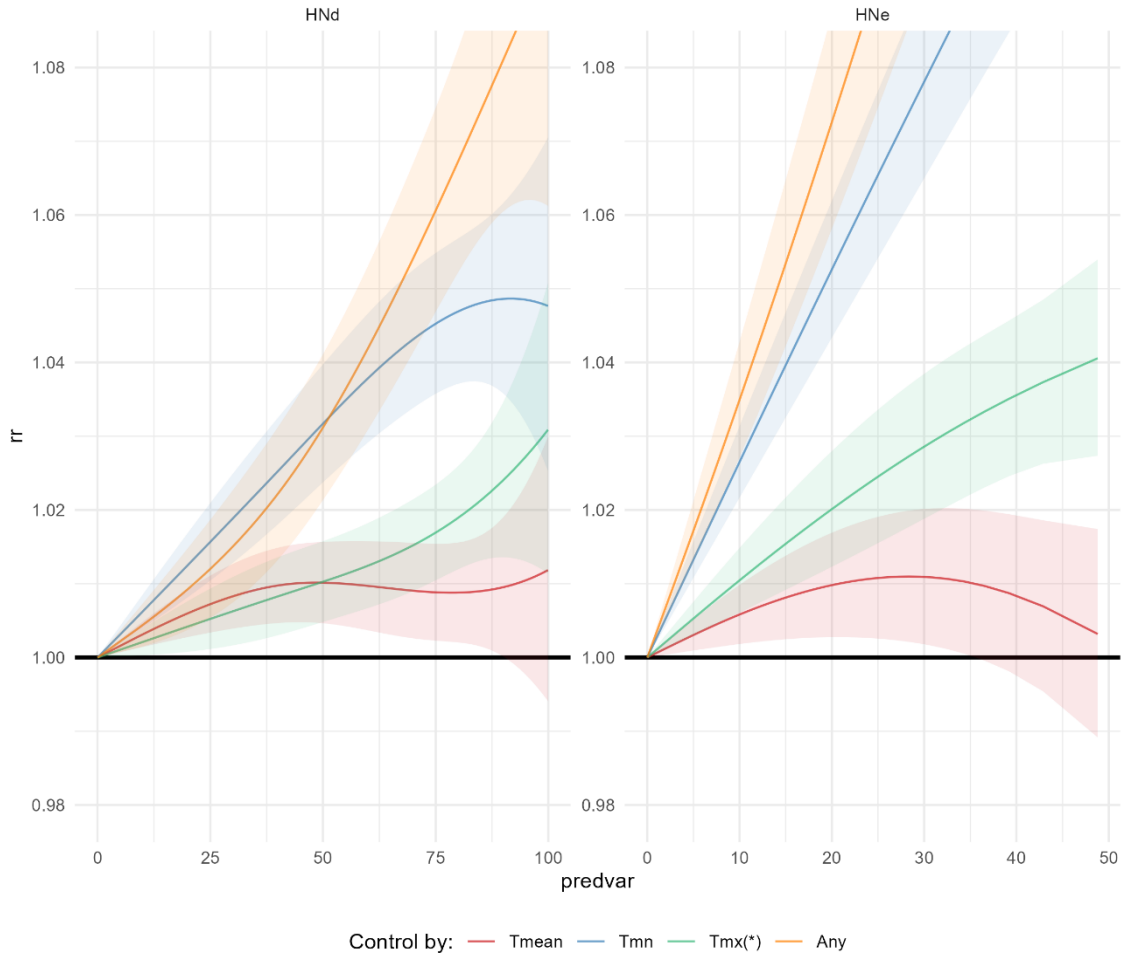

Figure S14 The overall dose-response curves controlling for traditional temperature metrics.

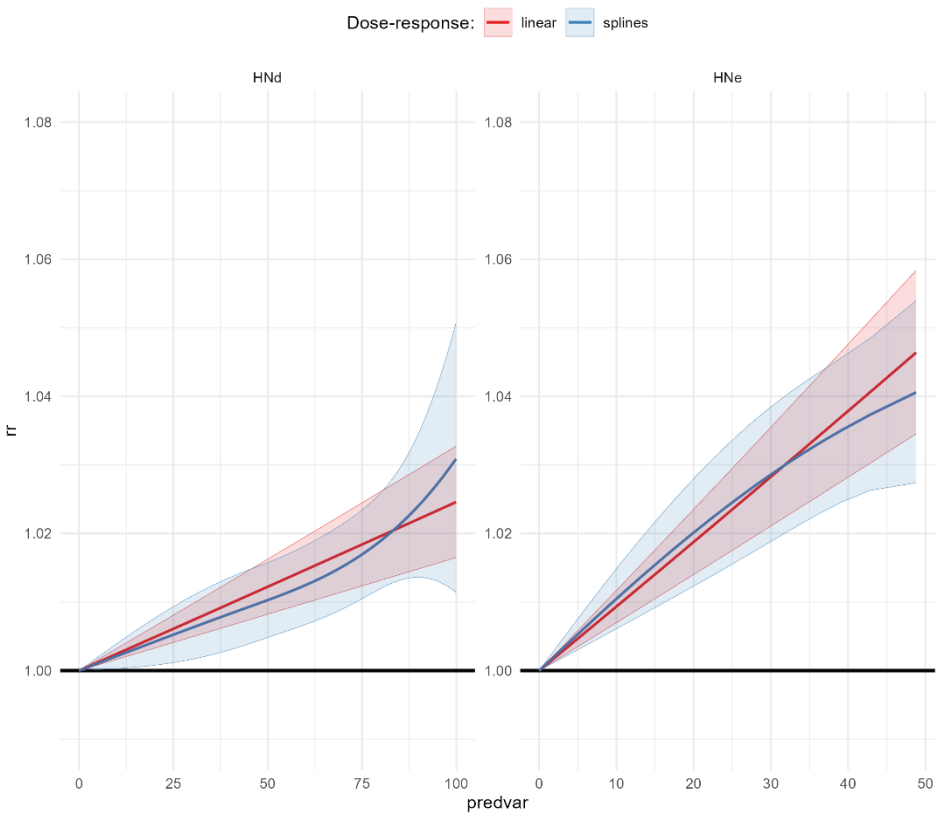

Figure S15 Comparison between linear terms and parametrization of a natural spline for the overall dose-response curves.