APPENDIX

Joint effect of heat and air pollution on mortality in 620 cities of 36 countries

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Additional information on data collection

In total, we analysed 22,630,598 deaths from non-external causes (284 cities) or all causes (336) occurring in 620 cities from 36 countries: Australia (3 cities), Asia (China: 14 cities; Iran: 1 city; Japan: 49 cities; Kuwait: 1 city; South Korea: 7 cities; Taiwan: 3 cities; Thailand: 18 cities); Europe (Cyprus: 5 cities; Czech Republic: 1 city; Estonia: 4 cities; Finland: 1 city; France: 20 cities; Germany: 12 cities; Greece: 1 city; Iceland: 1 city; Italy: 18 cities; Malta: 1 city; Norway: 1 city; Portugal: 6 cities; Romania: 8 cities; Spain: 51 cities; Sweden: 1 city; Switzerland: 8 cities; UK: 123 cites), South Africa (7 cities), South and Central America (Brazil: 1 city; Chile: 3 cities; Colombia: 1 city; Ecuador: 1 city; Peru: 1 city; Puerto Rico: 1 city); and North America (Canada: 25 cities; Mexico: 9 cities; U.S.: 209 cities). The study periods started in most countries from 1995 and ended between 2006 (US) and 2020 (Estonia and Israel).

372 cities (18,036,297 deaths) contributed to the analysis of air temperature-PM_{10} association, 486 cities (18,101,451 deaths) contributed to the analysis of air temperature-$PM_{2.5}$ association, 376 cities (16,516,385) contributed to the analysis of air temperature-O_3 association, and 411 cities (19,217,502) contributed to the analysis of air temperature-NO_2 association.

For Japanese cities, ozone data was derived from the measurements of photochemical oxidant, which is primarily ozone (≥ 90%), followed by others such as peroxyacetyl nitrate, hydrogen peroxide, and organic hydroperoxides.

The following section reports details on country-specific data; Table S1 reports descriptive statistics for all the cities included in the study.

Australia: Daily mortality, gathered from the Australian Bureau of Statistics, is represented by counts of deaths due to non-external causes (ICD-9: 0-799; ICD-10: A00-R99). Mean daily temperature (˚C) and relative humidity (%) were obtained from the Australian Bureau of Meteorology. Hourly measurements of inhalable particulate matter with an aerodynamic diameter of 10 µm or less (PM10), inhalable particulate matter with an aerodynamic diameter of 2.5 µm or less (PM2.5) only between 2003 and 2009, nitrogen dioxide (NO2), and ozone (O3) were collected from urban monitoring stations run by local EPA. Daily PM10, PM2.5 and NO2 measurements were computed as 24-hour average and daily maximum 8-hour average for O3.

Brazil: Daily mortality was obtained from the Ministry of Health as non-external causes only (ICD-9: 0- 799; ICD-10: A00-R99). Mean daily temperature (in ˚C), computed from the 24-h average of hourly measurements, were weather stations located within the urban area provided by National Institute of Meteorology of Brazil. All pollutant measurements were collected in the field and brought for analysis in the CETESB (Company of Technology of Environmental Sanitation) laboratory. All urban monitors are averaged together to obtain city-wide measurements. Daily measurements for PM10 and NO2 were recorded as 24-h averages.

Canada: Daily mortality data was obtained from Statistics Canada through access to the Canadian Mortality Database. Mean daily temperature (in ˚C), computed as the 24-hour average based on hourly measurements, was obtained from Environment Canada. A single weather station was selected for each city using the airport monitoring station located closest to the CMA center. Hourly measures of PM10, PM2.5, O3, and NO2 were collected from monitors located in urban areas of the National Air Pollution Surveillance (NAPS) network of Environment Canada, a government institution that operates ground monitoring stations across Canada. Daily PM10, PM2.5, and NO2 levels were computed as the 24-h average and O3 as the daily maximum 8-hour running average from hourly measurements in different stations and then averaged across stations within the same CMA with no missing data, with an average of 4 stations per city.

Chile: Daily mortality counts have been provided by the Departamento de Estadisticas e Información de Salud of Chile. Data sets for air temperature came from SINCA (Sistema de Información Nacional de Calidad del Aire): http://sinca.mma.gob.cl/index.php/region/index/id/M. Data are calculated from hourly measurements in one monitoring station per city. Daily mean air pollutants concentrations (PM10, PM2.5 and NO2) were also obtained from SINCA, and were based on hourly averages for every public monitory station (all of those stations are located in urban areas).

China: Daily mortality data was obtained from the Municipal Center for Disease Control. Mean daily temperature (in ˚C), computed as the 24-hour average from hourly measurements, was collected from the meteorological departments of each city. Measures of PM10, PM2.5, O3, and NO2 were collected from urban monitoring stations run by China National Environmental Monitoring Center. Daily PM10, PM2.5, O3, and NO2 levels were computed as the 24-h average.
Colombia: Daily mortality data was obtained from Administrativo Nacional de Estadistica (DANE). Mean daily temperature (in ˚C), computed as the 24-hour average based on hourly measurements, was obtained from the Instituto de Hidrología, Meteorología y Estudios Ambientales de Colombia (IDEAM). A single weather station was selected for each

city. Measurements for PM10, NO2, and O3 were available from the Environmental Secretary of Bogotá. Monitoring stations measured hourly air pollutants for each station, and 24-h averages were calculated. For each city, the average among monitoring stations was calculated.

Colombia: Daily mortality was obtained from the National Administrative Department of Statistics DANE as all-cause. Mean daily temperature (in ˚C), computed as 24-hour average based on hourly measurements, was obtained from Instituto de Hidrología, Meteorología y Estudios Ambientales de Colombia (IDEAM). Daily measurements for PM10 and NO2 were recorded as 24-h averages.

Cyprus: Daily mortality used in this study was collected by the Health Monitoring Unit of the Ministry of Health of Cyprus. Deaths refer to citizens of each city. Daily mean air temperature data are provided by the Department of Meteorology, Ministry of Agriculture, Rural Development, and the Environment. Air pollution daily concentrations are provided by the Air Quality and Strategic Planning Section, Department of Labour Inspection, Ministry of Labour, Welfare and Social Insurance. These come from one traffic station in each city, PM concentrations are gravimetric, and all concentrations are expressed in μg/m3.

Czech Republic: Daily mortality data was obtained from the Czech Statistical Office and the Institute of Health Information and Statistics. Mean daily temperature (in ˚C), computed as the average of observations in standard climatic terms (7:00, 14:00, and 21:00 local time), was collected by the Czech Hydrometeorological Institute. The average value was calculated according to the formula (T07 + T14 + 2*T21)/4. Information about daily PM10 and NO2 levels, computed as 24-hour averages and the maximum 8-hour running average for O3, were provided by the Czech Hydrometeorological Institute. The daily values were calculated from 4 stations (2 urban + 2 suburban).

Ecuador: Daily mortality was provided by the Instituto Nacional de Estadística y Censos as all-cause. Meterological data were obtained from WMONOAA (Surface Data Hourly Global, DS3505). Twenty four-hour averages are used as daily values for PM2.5, and NO2.

Estonia: Daily mortality data was obtained from the Estonian Causes of Death Registry. Mean daily temperature (in ˚C) was computed as the 24-h average of hourly measurements collected from the Estonian Environment Agency. A single weather station located nearby the urban area was selected for each city. Hourly measurements of PM10, PM2.5, NO2, and O3 were collected from urban background stations run by the Estonian Environmental Research Centre. Daily PM10, PM2.5 and NO2 levels were computed as 24-hour averages and O3 as the daily maximum 8-hour running average from hourly measurements; for each pollutant, the city average among monitoring stations was calculated.

Finland: The daily number of deaths was obtained from Statistics Finland. A dataset containing weather variables was obtained from Helsinki Region Environmental Services Authority. Measures of PM10, PM2.5, O3, and NO2 were extracted, from a nationwide dataset compiled by the Finnish Meteorological Institute, for a single coordinate at Helsinki city center using GIS.

France: Daily mortality data was obtained from the French National Institute of Health and Medical Research (CepiDC). Mean daily temperature (in ˚C), computed as the mean of the minimum and maximum temperature, and relative humidity (%) was obtained from Meteo France. Hourly measurements of PM10 and O3 were collected through the French local air quality monitoring network (Associations Agréées de Surveillance de la Qualité de l'Air AASQA). For PM10, we used only urban stations, and for O3, urban and peri-urban stations. Daily PM10 levels were computed as 24-h averages and O3 as the daily maximum 8-hour running average from hourly measurements. Measurements were obtained from multiple stations (with different numbers for each city).

Germany: Daily mortality data was obtained from the Research Data Centers of the Federation and the Federal States of Germany (Forschungsdatenzentrum der Statistischen Ämter des Bundes und der Länder). Mean daily temperature (in ˚C), computed as the 24-h average based on hourly measurements, was obtained from the Climate Data Centre of the German National Meteorological Service (Deutscher Wetterdienst). Where several weather stations existed within the city boundaries, stations closest to the city center were chosen, provided that measurements were available for the whole study period. Hourly measurements of PM10, PM2.5, O3, and NO2 were collected through the German Environment Agency (Umweltbundesamt) from urban background stations. Daily PM10, PM2.5, and NO2 levels were computed as the 24-h average and O3 as the daily maximum 8-hour running average from hourly measurements. Measurements were obtained from multiple stations (with different numbers for each city).

Greece: Daily mortality data was collected by Hellenic Statistical Authority. Mean daily temperature (in ˚C) and relative humidity (%) were computed as the 24-h average based on hourly measurements collected from the National Observatory of Athens from site "Thisio", located in the city of Athens. Hourly measurements of PM10, PM2.5, NO2, and O3 were obtained from the Ministry of Environment and Energy fixed-site monitoring network. Urban or suburban fixed monitoring background or traffic sites were selected. Daily PM10, PM2.5, and NO2 levels were computed as 24-hour averages and O3 as the daily maximum 8-hour running average from hourly measurements.

Iceland: Daily mortality data for one city, Reykjavik, are provided by the Directorate of Health in Iceland, Causes of Death Register. They include deaths from non-external causes among all individuals aged 18+ years. Daily mean air temperature data have been provided by the Icelandic Meteorological Institute from one station located in proximity of the capital city. Daily mean concentrations of PM10 have been measured in one monitoring station and provided by the Icelandic EPA (umhverfisstofnun) and by City of Reykjavik municipality.

Iran: Daily mortality of all causes was provided by the Ferdows organization of Mashhad Municipality. Mean, maximum, and mininum daily temperature (in ˚C) and relative humidity (in %), computed as the 24- hour average based on hourly measurements collected from IRAN Meteorological Organization (IRIMO) (http://www.irimo.ir). Twenty four-hour averages are used as daily values for PM10 and NO2.

Israel: Daily mortality for Tel Aviv and Haifa are at district level, for Jerusalem and Beer Sheva are at the city level. Daily death counts sourced from the Israeli Central Bureau of Statistics. Mean daily temperature (in ˚C) was computed as the 24-h average based on hourly measurements in one station per city. Daily mean air pollution measurements of NO2 PM10 and PM2.5are sourced from one population monitoring station in each district/city which has the longest and fullest records. Records start in 1/01/2000 and are reasonably complete.

Italy: Daily mortality data was obtained from local mortality registries and the rapid mortality surveillance system. Mean daily temperature (in ˚C) was computed as the 24-h average based on 6-h measurements obtained from the Meteorological Service of the Italian Air Force. A single weather station was selected for each city, using the airport monitoring station located closest to the city center. Hourly measurements of PM10, PM2.5, O3, and NO2 were obtained from the same period. Daily PM10, PM2.5, and NO2 levels were computed as 24-hour averages and O3 as the daily maximum 8-hour running average from hourly measurements.

Japan: Daily mortality data was obtained from computerized death certificate data from the Ministry of Health, Labour and Welfare, Japan. Mean daily temperature (in ˚C), computed as the 24-h average based on hourly measurements, was obtained from the Japan Meteorological Agency. A single weather station located within the urban area of the city was selected. Hourly measurements of PM10, PM2.5, O3, and NO2 were collected from the urban monitors within the capital cities maintained by the Ministry of the Environment of Japan. Daily PM10, PM2.5, and NO2 levels were computed as 24-hour averages and O3 as the daily maximum 8-hour running average from hourly measurements.

Kuwait: Hourly measurements of PM10 and O3 were obtained from measurement stations of the Environmental Public Authority, Kuwait (KEPA). Daily PM10 levels were computed as the 24-hour mean and the daily maximum 8-hour running average for O3 from hourly measurements.

Malta: Daily mortality counts have been provided by the Maltese Department of Health Information. Air temperature data are collected from one airport station, the standard location for temperature records Air pollution data have been selected from the station with the most complete data, and that with the highest pollution level recorded: it represents the air pollution levels to which more than half of the entire Maltese population is generally exposed to, as it is in the most urbanised area of Malta.

Mexico: Daily mortality data was obtained from the National Institute of Statistics, Geography and Informatics. Mean daily temperature (in ˚C) were computed as the 24-hour average based on hourly measurements collected through the Servicio Meteorológico Nacional (SMN) and the Instituto Nacional de Ecología y Cambio Climático (INECC). Hourly measurements of PM10, PM2.5, and O3 were obtained from urban monitors of the local monitoring network. Daily PM10, PM2.5, and NO2 levels were computed as 24-hour averages and O3 as the daily maximum 8-hour running average from hourly measurements.

Norway: Aggregated daily mortality data was obtained from the Cause of Death Registry of Norway. Daily mean air temperatures on a 1 km grid across Norway were obtained from the observationally gridded se-norge 2 dataset of the Norwegian Meteorological Institute (MET Norway). The dataset is continuously updated based on measurement data from stations. Daily values for Norway of PM10, PM2.5, O3, and NO2 at a1 km resolution were sourced from the Nordic DEHM-UBM (Danish Eulerian Hemispheric Model- Urban Background Model) setup (insert reference). Daily PM10, PM2.5, and NO2 levels were computed as 24-hour averages and O3 as the daily maximum 8-hour running average from hourly measurements.

Peru: Daily mortality of all causes was provided by the Peruvian Ministry of Health (MINSA in Spanish). Mean daily temperature (in ˚C) was obtained from the National Meteorology and Hydrology Service of Peru (SENAMHI in Spanish).

Weather stations (one station per region) contributed data to each department series. Twenty four-hour averages are used as daily values for PM10 and NO2.

Portugal: Daily mortality was obtained from Statistics Portugal. Mean daily temperature (in ˚C) was computed as the 24-h average based on hourly measurements collected from the National Oceanic and Atmospheric Administration (NOAA). Hourly measurements of pollutants were gathered from the "online database of air quality" through the Portuguese Environment Agency from urban monitors. Daily PM10, PM2.5, and NO2 levels were computed as 24-hour averages and O3 as the daily maximum 8-hour running average from hourly measurements. The year 2016 was removed from the analysis due to anomalies in the mortality data.

Puerto Rico: Daily mortality of all causes was provided by Instituto de Estadísticas Vitales de Puerto Rico, Área de Estadísticas Vitales del Departamento de Salud. Temperature data was obtained from the Global Historical Climatology Network (NOAA/WMO). Twenty four-hour averages are used as daily values for PM10.

Romania: Daily mortality, obtained from the National Institute for Statistics (NIS) in Romania, is represented by counts of deaths for all causes. The mortality dataset includes the decedents with the stable residence (permanent) or normal residence (defined as the place/city where a person lived mostly in the last 12 months of his/her life) in the seven Romanian cities. Daily mean temperature was obtained from Romanian National Meteorological Administration (RNMA). From 2008, daily PM10, PM2.5 and NO2 levels were obtained from the National Monitoring and Air Quality Network (RNMCA). All invalid values have been deleted.

South Africa: Daily mortality data was obtained from Statistics South Africa. Mean daily temperature (in ˚C) was computed as the average between daily minimum and maximum temperature collected from the Agricultural Research Council of South Africa and the National Oceanic and Atmospheric Administration (NOAA). Hourly measurements of PM10, PM2.5, NO2, and O3 were collected at sites managed by the Department of Environmental Affairs (DEA). Daily PM10 levels were computed as the 24-hour mean, and O3 as the daily maximum 8-hour running average from the respective provided hourly measurements. The average 24-hour mean or daily maximum 8-hour running average values per district municipality (DM) were then calculated from all sites within each DM. Except for the ESKOM run stations, all air quality data were accessed through SAAQIS (http://www.saaqis.org.za/), which is run and hosted by the South African Weather Service.

South Korea: Daily mortality was obtained from the Korea National Statistics Office. Mean daily temperature (in ˚C) was computed as the 24-h average based on hourly measurements. Measures of PM10, PM2.5, O3, and NO2 were available from monitors of the National Institute of Environmental Research. Daily PM10, PM2.5, and NO2 levels were computed as 24-hour averages and O3 as the daily maximum 8-hour running average from hourly measurements.

Spain: Daily mortality was obtained from the Spain National Institute of Statistics. Mean daily temperature (in ˚C), computed as the 24-h average based on hourly measurements, was obtained from weather stations of the Spain National Meteorology Agency. A single weather station, located within the urban area or at the near airport, was selected for each city. Hourly measurements of PM10, PM2.5, O3, and NO2 were collected from the free national repository (Magrama) from urban and suburban monitors. Daily PM10, PM2.5, and NO2 levels were computed as 24-hour averages and O3 as the daily maximum 8-hour running average from hourly measurements.

Sweden: Daily mortality data was obtained from the Swedish Cause of Death Register at the Swedish National Board of Health and Welfare. Mean daily temperature (in °C), computed as the 24-hour average based on hourly measurements, was obtained from the Environment and Health Administration. A single weather station, located at Torkel Knutssongatan in Central Stockholm, was selected. Hourly measurements of PM10, PM2.5, and NO2 were collected from the main urban background (roof-top level) monitor run by the local monitoring network. Daily PM10, PM2.5, and NO2 levels were computed as 24-hour averages and O3 as the daily maximum 8-hour running average from hourly measurements.

Switzerland: Daily mortality data was provided by the Federal Office of Statistics (Switzerland). Mean daily temperature (in °C), computed as the 24-h average based on hourly measurements, was obtained from the IDAWEB database (a service provided by MeteoSwiss, the Swiss Federal Office of Meteorology and Climatology). A single weather station located within or near the urban area was selected for each city. Hourly measurements of PM10, PM2.5, O3, and NO2 were provided by the Immissionsdatenbank Luft (IDB, Federal Office of the Environment, Bern, Switzerland). Daily PM10, PM2.5, and NO2 levels were computed as 24-hour averages and O3 as the daily maximum 8-hour running average from hourly measurements from urban monitoring stations.

Taiwan: Daily mortality data was obtained from the Department of Health in Taiwan. Mean daily temperature (in ˚C) was computed as the 24-h average based on hourly measurements. Hourly measurements of PM10, PM2.5, O3, and NO2 were obtained from urban monitors of the local monitoring network. Daily PM10, PM2.5, and NO2 levels were computed as 24-hour averages and O3 as the daily maximum 8-hour running average from hourly measurements. Measurements were obtained from multiple stations (with different numbers for each city).

Thailand: Daily mortality data was obtained from the Ministry of Public Health, Thailand. Mean daily temperature (in ˚C), computed as the average between the daily minimum and maximum temperature, was obtained from the Meteorological Department, Ministry of Information and Communication Technology, Thailand. Daily data on PM10, PM2.5, O3, and NO2 were obtained from the Pollution Control Department, Ministry of Natural Resources and Environment. For each city and air pollutant, daily concentrations were averaged by fixed air quality monitoring stations within the city. If monitored data for a particular pollutant were insufficient to calculate a daily average, all measurements from that day were excluded for that pollutant and monitor.

United Kingdom: Daily mortality data was gathered from the Office for National Statistics. Mean daily temperature (in ˚C) was obtained from the British Atmospheric Data Centre. Daily PM10, PM2.5, O3, and NO2 levels were obtained from the Automatic Urban and Rural Network (AURN) repository, the Welsh Air Quality Network (WAQN) archive and the King's College London (KCL) dataset. The urban and sub-urban monitoring stations within the selected boundaries were considered. Those classified as “Roadside/Trac”, “Industrial”, “Portable/ Mobile”, and “Indoor” were excluded due to the unrepresentative nature of the average exposure.

United States: Daily mortality data was obtained from the National Center for Health Statistics (NCHS). Mean daily temperature (in ˚C), computed as the 24-h average based on hourly measurements, was obtained from the National Climatic Data Center (NCDC) of the National Oceanic and Atmospheric Administration (NOAA). Hourly measurements of PM10, PM2.5, O3, and NO2 were gathered from the US Environmental Protection Agency (EPA) Air Quality System (AQS), from urban and sub-urban monitoring stations. Daily PM10, PM2.5, and NO2 levels were computed as 24-hour averages and O3 as the daily maximum 8-hour running average, from urban monitoring stations from monitors located in the county or set of contiguous counties in which the city is located.

Detailed information on statistical methods

We adopted a two-stage analytical design, where city-specific models were fitted in the first stage, and multilevel meta-analysis of city-specific results was conducted in the second stage.

First-stage: city-specific analysis

Main approach

In each city, we applied generalized additive models with a quasi-Poisson distribution to evaluate the associations between air temperature, air pollutants and mortality. In all models, we assumed:

$$Y_i \sim quasiPoisson(\mathrm{E}(Y_i))$$

The following models were applied to estimate the main effect of air temperature (model 1), the main effect of air pollutants (model 2), and the effect of air temperature across levels of air pollutants equal to predefined concentrations, or, vice versa, the effect of air pollutants across levels of air temperature equal to predefined percentiles (model 3):

<u>Model 1:</u> $$ln[\mathrm{E}(Y_i)] = \alpha_o + ns(TMEAN_i, k1) + ns(DOS_i, k2) + ns(YEAR_i, k3) + \alpha DOW_i$$

where:
- Y_i represents the count of all-cause (or non-external) deaths on day *i*;
- α_o is the model intercept;
- $ns(TMEAN_i, k1)$ represents lag 0-1 mean air temperature on day i, modelled with a natural spline with $k1$ = 3 inner equally-spaced knots located at 25th, 50th and 75th percentile; from this, we extrapolated the effect of air temperature as increment in mortality at 99th percentile versus 75th percentile of city-specific air temperature distribution;
- $ns(DOS_i, k2)$ is a natural spline of day-of-season with *k*2 = 4 equally-spaced knots per year;
- $ns(YEAR_i, k3)$ is a natural spline of calendar year with *k*3 = *round*(period length/3);
- DOW_i represents a set of dummy variables identifying days of the week, from Tuesday to Sunday (Monday=REF); α denotes a vector of 6 regression coefficients

<u>Model 2:</u> $$ln[\mathrm{E}(Y_i)] = \alpha_o + \beta POLL_i + ns(TMEAN_i, k1) + ns(DOS_i, k2) + ns(YEAR_i, k3) + \alpha DOW_i$$

where $POLL_i$ represents lag 0-1 mean concentrations of air pollutant (one of PM_{10}, $PM_{2.5}$, O_3 or NO_2, one at a time) on day i; β is the corresponding regression coefficient representing the log-relative risk of mortality per 1-unit increment in the pollutant

<u>Model 3:</u> $$ln[\mathrm{E}(Y_i)] = \alpha_o + \beta POLL_i * ns(TMEAN_i, k1) + ns(DOS_i, k2) + ns(YEAR_i, k3) + \alpha DOW_i$$

In this model, the product term between air pollutant (linear) and air temperature (spline) allows to extrapolate the effect of air temperature (as increment of risk from 75th to 99th percentile of city-specific air temperature distributions) at pre-defined concentrations of air pollutant. The same product term also allows to extrapolate the effect of air pollutant (as increment of risk per 10 $\mu g/m^3$ increment in the pollutant) at pre-defined percentiles of air temperature

Sensitivity analyses

We conducted several sensitivity analyses on the main effects:

- Main effect of air temperature
    - We adjusted for PM_{10} (lag 0-1 linear term)
    - We adjusted for $PM_{2.5}$ (lag 0 linear term)
    - We adjusted for O_3 (lag 0-1 linear term)
    - We adjusted for NO_2 (lag 0-1 linear term)
    - We defined the "warm" season as the three consecutive warmest months, and we adjusted for day-of-season using only 2 knots per year
    - We modelled day-of-season using 2 knots per year (instead of 4 in the main approach)
    - We modelled day-of-season using 6 knots per year (instead of 4 in the main approach)
    - We modelled air temperature at lag 0-3 (instead of lag 0-1 in the main approach)
    - We modelled air temperature at lag 0-10 (instead of lag 0-1 in the main approach)

- Main effect of air pollutants
    - We defined the "warm" season as the three consecutive warmest months, and we adjusted for day-of-season using only 2 knots per year
    - We modelled day-of-season using 2 knots per year (instead of 4 in the main approach)
    - We modelled day-of-season using 6 knots per year (instead of 4 in the main approach)
    - We modelled air pollutant at lag 0-3 (instead of lag 0-1 in the main approach)

Second-stage: meta-analysis of city-specific results

We pooled city-specific estimates using a random-effects multilevel meta-analytical model that accounts for variations in risk across two nested groups (cities and countries). We applied restricted maximum likelihood (REML) estimator in this multilevel meta-analysis.
Similarly, we meta-analyzed the city-specific product terms in order to derive pooled estimates of interaction terms, and corresponding standard errors and p-values, as formal tests of effect modification on a continuous scale.

Table S1. Descriptive statistics of the 620 cities included in the study

Country	City	Period		Mortality		Air temperature			PM_{10}		$PM_{2.5}$		O_3		NO_2	
				No deaths	daily mean	daily mean	75th-99th percentiles		daily mean	SD	daily mean	SD	daily mean	SD	daily mean	SD
Australia	Brisbane	2,000	2,009	42,562	24	23	25	28	18	5	5	2	34	9	11	3
Australia	Melbourne	2,000	2,009	94,149	54	19	22	30	21	12	8	5	34	12	21	9
Australia	Sydney	2,000	2,009	105,009	60	22	23	28	22	11	7	5	31	11	21	10
Brazil	Sao Paulo	1,997	2,011	433,127	171	22	24	27	37	14					85	38
Canada	Abbotsford	1,995	2,015	19,177	5	15	18	24	15	6	6	4	71	26	20	7
Canada	Calgary	1,995	2,015	55,047	14	12	16	22	23	13	9	7	84	22	28	12
Canada	Edmonton	1,995	2,015	63,550	16	12	16	22	22	14	8	7	82	25	24	11
Canada	Halifax	1,995	2,015	24,386	7	15	19	24			7	4	58	22	25	11
Canada	Hamilton	1,995	2,015	40,820	11	17	21	27			11	8	95	33	27	14
Canada	Kingston	1,995	2,013	15,198	5	16	20	26			9	7	89	33	7	3
Canada	Kitchener-Waterloo	1,995	2,015	28,060	7	16	20	26			9	8	92	32	16	9
Canada	London Ontario	1,995	2,015	33,768	9	17	21	26			9	7	94	33	21	13
Canada	Montreal	1,995	2,015	141,636	37	17	21	27			10	7	88	31	23	10
Canada	Oakville	1,995	2,006	13,393	6	17	21	28			11	9	95	35	28	12
Canada	Oshawa	1,995	2,015	26,737	8	16	20	26			10	8	88	33	24	18
Canada	Ottawa	1,995	2,015	60,255	16	16	21	27			7	6	78	27	19	14
Canada	Regina	1,995	2,013	17,065	5	13	18	25	29	18	7	5	61	22	18	8
Canada	Saint John NB	1,995	2,015	16,487	4	13	17	22	17	9	8	6	74	21	12	8
Canada	Sarnia	1,995	2,015	11,535	3	17	21	27			12	9	98	36	22	13
Canada	Saskatoon	1,995	2,015	20,835	6	13	18	25			7	9	64	21	16	7
Canada	Sault Ste. Marie	1,995	2,015	11,843	3	14	18	24			7	7	78	26	11	8
Canada	St. John's NFL	1,995	2,012	18,135	5	12	16	22			5	3	60	19	12	8
Canada	Sudbury	1,995	2,015	15,529	4	14	19	25			5	5	81	29	11	6
Canada	Thunder Bay	1,995	2,015	13,473	4	13	17	24			6	4	71	21	14	8
Canada	Toronto	1,995	2,015	272,567	71	17	21	27			10	8	102	36	34	15
Canada	Vancouver	1,995	2,015	128,598	33	15	18	22	14	5	6	3	76	21	26	8
Canada	Victoria	1,995	2,015	32,004	8	14	17	22	15	9	6	4	68	20	18	10
Canada	Windsor	1,995	2,015	28,166	7	19	23	28			11	8	102	37	30	14
Canada	Winnipeg	1,995	2,015	64,088	17	15	20	27	17	12	7	5	70	22	15	8
Chile	Santiago	2,008	2,014	115,419	91	20	22	26	64	25	22	10			30	15
Chile	Temuco	2,004	2,013	7,582	5	14	16	22	34	25	19	19			7	5
Chile	Valparaiso	2,004	2,013	21,476	13	17	18	22	39	14	17	7			16	9
China	Anshan	2,004	2,006	14,352	26	22	25	32	100	50					19	12
China	Beijing	2,007	2,015	78,851	86	23	27	31	114	66	67	44			67	26
China	Fuzhou	2,004	2,006	8,318	15	26	29	32	63	29					42	8
China	Guangzhou	2,007	2,015	63,999	56	27	28	32	60	24	36	17			64	23
China	Hangzhou	2,002	2,004	9,738	18	25	28	33	107	43					48	14

China	Hong Kong	1,996	2,002	101,432	79	28	29	31	42	21					52	19
China	Lanzhou	2,004	2,008	15,967	17	16	19	24	121	93					34	15
China	Shanghai	2,001	2,015	129,602	101	25	28	34	77	41	46	25			63	25
China	Shenyang	2,005	2,008	46,341	63	19	23	27	102	38					31	13
China	Suzhu	2,005	2,008	22,115	30	25	29	33	79	37					40	14
China	Taiyuan	2,004	2,008	20,755	23	20	24	28	123	56					20	6
China	Tianjin	2,005	2,008	7,490	10	23	26	31	95	48					38	12
China	Wuhan	2,003	2,005	26,442	48	25	29	34	111	45					43	13
China	Xian	2,004	2,008	21,682	24	22	25	31	110	39					33	12
Colombia	Bogota	1,998	2,013	183,207	63	14	15	16	62	20					30	10
Cyprus	Famagusta	2,010	2,019	1,174	1	26	28	32	39	52	18	32			17	5
Cyprus	Larnaca	2,005	2,019	5,658	2	26	28	31	47	61					23	8
Cyprus	Limassol	2,005	2,019	9,927	4	26	29	32	43	34					28	9
Cyprus	Nicosia	2,005	2,019	13,302	5	27	30	34	41	29	18	11			26	10
Cyprus	Pafos	2,005	2,019	3,716	1	24	26	29	36	17					17	9
Czech Republic	Prague	1,995	2,009	95,671	35	15	19	25	30	16			96	27	28	9
Ecuador	Quito	2,014	2,018	21,987	24	16	16	19			15	5			25	7
Estonia	Kohtla-Järve linn	2,002	2,020	7,172	2	13	16	24	16	12	5	4	56	16	5	3
Estonia	Narva linn	2,009	2,020	4,940	2	13	16	24	14	7	6	4	53	16	7	4
Estonia	Tallinn	2,005	2,020	35,649	12	13	17	24	19	13			47	16	20	11
Estonia	Tartu linn	2,008	2,020	6,598	3	14	17	24	15	8	6	5	53	17	8	4
Finland	Helsinki	1,995	2,014	60,750	17	13	17	24	17	14	14	12			8	6
France	Bordeaux	2,000	2,017	39,170	12	19	21	28	18	7	11	5			14	8
France	Clermont-Ferrand	2,000	2,017	17,646	5	17	20	28	16	7	10	5			19	10
France	Dijon	2,000	2,017	14,177	4	17	20	27	15	7	10	5			19	9
France	Grenoble	2,000	2,017	24,454	7	17	20	26	20	9	13	7			16	7
France	Le Havre	2,000	2,017	17,946	5	16	18	24	19	9	12	7			17	10
France	Lens-Douai	2,000	2,017	26,400	8	16	18	25	21	10	14	10			17	9
France	Lille	2,000	2,017	65,317	20	16	18	25	24	11	14	8			21	9
France	Lyon	2,000	2,017	57,285	17	19	22	29	21	9	14	7			24	11
France	Marseille	2,000	2,017	68,177	21	21	25	29	29	11	14	7			31	13
France	Montpellier	2,000	2,017	20,103	6	21	24	29	19	10	13	6			23	10
France	Nancy	2,000	2,017	21,199	6	16	20	26	20	9	11	7			23	9
France	Nantes	2,000	2,017	32,634	10	17	19	26	16	7	12	5			12	7
France	Nice	2,000	2,017	37,653	11	21	24	28	27	8	13	4			25	8
France	Orleans	2,000	2,017	15,332	5	17	19	26	16	8	12	6				
France	Paris	2,000	2,017	333,242	101	18	20	28	21	9	12	7			29	12
France	Rennes	2,000	2,017	12,144	4	17	19	25	17	7	8	5			14	8
France	Rouen	2,000	2,017	30,670	9	15	18	25	20	8	13	7			20	8
France	Strasbourg	2,000	2,017	26,463	8	17	20	27	19	8	14	7			24	10
France	Toulouse	2,000	2,017	37,378	11	19	22	28	18	7	12	5			16	9
France	Tours	2,000	2,017	16,638	5	17	20	27	17	7	11	6				

Germany	Berlin	1,995	2,015	345,636	89	16	20	27	25	12	14	6	72	31	26	10
Germany	Bremen	1,995	2,015	65,893	17	15	18	25	19	9	12	7	70	29	20	8
Germany	Dortmund	1,995	2,015	67,184	17	15	18	25	27	16	13	7	70	33	29	11
Germany	Dresden	1,995	2,015	54,912	14	16	19	26	27	16	11	6	79	31	24	9
Germany	Dusseldorf	1,995	2,015	69,538	18	16	19	26	26	14	12	6	69	33	27	12
Germany	Frankfurt	1,995	2,015	72,882	19	17	20	27	22	10	12	6	79	30	38	14
Germany	Hamburg	1,995	2,015	192,501	50	15	18	24	25	12	13	7	65	27	28	11
Germany	Hannover	1,995	2,015	121,370	31	15	18	25	21	11	10	6	75	30	21	10
Germany	Koeln	1,995	2,015	98,997	26	16	19	26	27	16			73	35	27	11
Germany	Leipzig	1,995	2,015	66,706	17	16	19	26	19	9	10	6	81	31	18	7
Germany	Muenchen	1,995	2,015	126,779	33	16	19	27	23	12	11	5	76	33	34	12
Germany	Stuttgart	1,995	2,015	59,457	15	16	20	27	19	10	11	6	81	36	30	11
Greece	Athens	2,001	2,010	137,232	75	25	29	33	45	19	23	10	93	22	51	17
Iceland	Reykjavik	2,002	2,018	10,364	3	9	11	15	17	14						
Iran	Tehran	2,002	2,015	315,677	132	26	29	35	88	51					87	73
Israel	Beer Sheva	2,000	2,020	13,229	3	26	28	32	47	54					15	7
Israel	Haifa	2,000	2,020	45,298	12	26	29	31	37	45	18	10			14	9
Israel	Jerusalem	2,000	2,020	31,352	9	24	26	32	49	85	23	30			25	12
Israel	Tel Aviv	2,000	2,020	94,536	24	25	28	30	42	39	21	12			24	15
Italy	Ancona	2,006	2,014	4,016	2	20	24	29	35	15			80	22		
Italy	Bari	2,006	2,015	10,808	6	22	25	31	26	11			93	21		
Italy	Bologna	2,006	2,015	20,672	11	21	25	31	23	11			88	36		
Italy	Cagliari	2,006	2,015	5,884	3	22	25	29	29	10			68	14		
Italy	Catania	2,008	2,015	10,943	7	22	25	29	28	10						
Italy	Civitavecchia	2,008	2,015	1,696	1	23	26	29	23	8						
Italy	Florence	2,006	2,015	18,525	10	21	25	30	26	10			97	29		
Italy	Frosinone	2,006	2,015	1,738	1	22	25	31	26	11			105	26		
Italy	Genoa	2,006	2,015	35,981	20	21	24	28	27	9			95	23		
Italy	Latina	2,006	2,015	4,143	2	23	26	31	25	9			88	22		
Italy	Milan	2,006	2,015	50,981	28	21	24	30	28	12			94	32		
Italy	Naples	2,009	2,015	31,457	24	23	26	30	32	13						
Italy	Palermo	2,008	2,015	19,716	13	23	26	30	33	11						
Italy	Rieti	2,008	2,015	1,547	1	23	27	34	17	8			94	26		
Italy	Rome	2,006	2,015	106,825	58	22	25	30	28	10			94	26		
Italy	Trieste	2,006	2,015	12,062	7	21	25	30	22	10			95	25		
Italy	Turin	2,006	2,015	37,518	20	19	23	28	31	19			99	37		
Italy	Viterbo	2,006	2,015	2,449	1	21	25	30	21	8			81	20		
Japan	Aikita	2,011	2,019	15,077	9	20	24	29	25	14	13	8	86	24	8	3
Japan	Aomori	2,013	2,019	11,762	9	19	22	28	18	14	11	6	77	23	8	4
Japan	Chiba	2,011	2,019	34,322	21	23	27	30	30	16	11	7	84	32	17	8
Japan	Fukui	2,011	2,019	11,712	7	23	27	31	33	17	13	8	90	28	10	4
Japan	Fukuoka	1,995	2,019	101,334	23	24	27	31	34	17	17	10	85	32	17	7

Japan	Fukushima	2,011	2,019	12,889	8	21	25	30	25	12	10	6	77	26	12	5
Japan	Gifu	2,011	2,019	17,782	11	24	27	32	25	14	14	8	95	32	13	5
Japan	Hiroshima	2,011	2,019	41,881	25	24	27	31	38	19	17	9	92	34	16	7
Japan	Kagoshima	2,011	2,019	24,946	15	25	28	31	39	19	17	9	66	28	18	8
Japan	Kanazawa	2,011	2,019	18,319	11	23	26	31	26	15	11	6	94	26	10	4
Japan	Kitakyushu	1,995	2,009	56,965	21	24	27	31	33	17			74	30	19	7
Japan	Kobe	2,011	2,019	63,090	38	24	28	31	32	18	13	7	87	31	28	12
Japan	Kochi	2,011	2,019	15,505	9	24	27	30	29	17	14	7	75	30	7	3
Japan	Kofu	2,011	2,019	9,092	5	23	27	30	32	17	12	7	90	29	14	5
Japan	Kumamoto	2,011	2,019	28,147	17	24	28	31	34	20	14	8	85	34	11	5
Japan	Kyoto	2,011	2,019	58,939	36	24	28	32	28	15	13	7	90	32	18	7
Japan	Maebashi	2,011	2,019	15,002	9	23	26	32	28	14	14	8	101	36	13	5
Japan	Matsue	2,011	2,019	9,462	6	23	26	31	23	14	13	7	95	29	4	2
Japan	Matsuyama	2,011	2,019	21,959	13	24	27	31	36	19	16	9	78	32	21	9
Japan	Mito	2,011	2,019	10,838	7	22	25	30	27	15	10	7	89	30	11	4
Japan	Miyazaki	2,014	2,019	11,011	10	24	27	30	32	16	12	7	65	28	5	2
Japan	Morioka	2,011	2,019	12,410	7	19	23	28	21	12	12	7	77	24	9	4
Japan	Nagano	2,011	2,019	17,166	10	21	25	29	23	13	11	7	84	25	9	3
Japan	Nagasaki	2,011	2,019	21,158	13	24	27	31	32	16	12	7	73	29	11	4
Japan	Nagoya	1,995	2,019	191,848	43	23	27	32	40	18	15	8	82	33	24	9
Japan	Naha	2,011	2,019	11,519	7	27	29	31	36	17	8	4	50	31	9	5
Japan	Nara	2,011	2,019	14,730	9	23	27	31	25	14	12	7	93	34	12	5
Japan	Niigata	2,011	2,019	35,810	22	22	25	30	25	13	12	7	89	25	11	4
Japan	Oita	2,011	2,019	17,393	11	23	27	31	31	16	15	9	78	31	12	5
Japan	Okayama	2,011	2,019	27,583	17	24	28	31	34	19	16	8	88	31	17	7
Japan	Osaka	1,995	2,019	273,648	62	24	28	31	35	17	15	9	87	35	29	11
Japan	Otsu	2,011	2,019	12,018	7	23	27	31	31	16	11	7	93	30	14	7
Japan	Saga	2,011	2,019	10,526	6	24	27	31	31	16	14	8	88	31	10	4
Japan	Saitama	2,011	2,019	41,696	25	23	26	32	32	16	12	7	94	37	23	9
Japan	Sapporo	1,995	2,019	156,845	36	17	21	27	16	9	9	6	63	22	15	6
Japan	Sendai	1,995	2,019	73,259	17	20	23	29	28	14	13	7	76	25	11	5
Japan	Shimonoseki	2,012	2,019	13,455	9	23	26	31	35	19	16	8	85	30	5	3
Japan	Shizuoka	2,011	2,019	32,037	19	24	27	30	36	18	12	7	89	31	16	5
Japan	Takamatsu	2,011	2,019	17,693	11	24	28	32	36	19	17	9	81	28	19	10
Japan	Tokushima	2,011	2,019	11,807	7	24	27	31	32	19	12	8	91	33	9	4
Japan	Tokyo	1,995	2,019	725,866	164	23	27	31	38	20	18	10	79	36	27	10
Japan	Tottori	2,012	2,019	7,815	5	23	26	31	27	19	16	8	82	28	5	3
Japan	Toyama	2,011	2,019	19,038	11	22	26	31	26	15	10	7	91	27	10	4
Japan	Tsu	2,011	2,019	12,677	8	24	27	32	35	18	13	8	90	31	12	5
Japan	Utsunomiya	2,011	2,019	18,598	11	22	25	30	30	15	12	7	96	34	16	5
Japan	Wakayama	2,011	2,019	18,278	11	24	28	31	34	16	15	10	89	34	14	5
Japan	Yamagata	2,011	2,019	11,560	7	20	24	29	25	13	11	7	83	26	12	5

Japan	Yamaguchi	2,011	2,015	4,850	5	23	27	30	15	11	15	9	83	31	14	6
Japan	Yokohama	2,011	2,019	130,281	79	23	27	30	37	18	16	8	84	36	24	10
Kuwait	Kuwait	2,010	2,016	15,903	12	36	39	43	220	202						
Malta	Malta	2,006	2,019	18,816	8	24	27	31	39	15	18	8			36	15
Mexico	Ciudad Juarez	2,002	2,009	19,246	13	26	29	34	39	15			105	24		
Mexico	Guadalajara	2,000	2,009	94,008	51	23	24	27	42	18			122	47		
Mexico	Leon	2,005	2,012	25,420	17	22	23	27	49	22			115	35		
Mexico	Monterrey	2,003	2,009	54,274	42	26	28	31	78	24	30	13	109	33		
Mexico	Puebla-Tlaxcala	2,001	2,009	49,675	30	18	19	22	41	20			108	38		
Mexico	San Luis Potosi	2,006	2,009	8,566	12	20	21	25					74	28		
Mexico	Tijuana	2,000	2,011	31,519	14	20	22	27					82	19		
Mexico	Toluca de Lerdo	2,000	2,008	29,706	18	15	16	19	51	27			115	31		
Mexico	Valley of Mexico	2,000	2,012	545,077	228	18	19	23	49	19	25	9	175	54		
Norway	Oslo	2,000	2,018	36,656	11	12	15	22	18	8	9	4				
Peru	Lima	2,010	2,014	88,703	97	21	22	24	82	26					25	11
Portugal	Beja	2,005	2,018	14,557	6	22	24	31	25	14	12	7	68	17	5	3
Portugal	Castelobranco	2,003	2,018	20,818	7	21	25	32	17	14	7	6	95	21	7	3
Portugal	Coimbra	2,003	2,018	36,164	12	19	21	29	22	14			80	25	14	7
Portugal	Faro	2,004	2,018	28,778	12	22	24	29			11	8	90	18	10	5
Portugal	Lisboa	1,995	2,018	230,880	52	21	23	30	25	14	11	8	77	22	25	14
Portugal	Porto	1,999	2,018	130,009	35	18	20	27	29	20			69	23	23	12
Puerto Rico	San Juan	2,009	2,016	13,241	9	28	29	30	30	18						
Romania	Brasov	2,008	2,016	10,244	7	16	19	24			12	5			34	14
Romania	Bucharest	2,008	2,016	92,857	56	19	23	28	30	13					19	12
Romania	Cluj-Napoca	2,008	2,016	10,869	7	17	21	26			13	7			26	14
Romania	Constanta	2,008	2,016	14,382	9	20	24	28			12	6			25	12
Romania	Craiova	2,009	2,016	10,091	7	20	23	29	22	11	16	8			21	9
Romania	Galati	2,008	2,016	11,175	7	20	24	29			7	3			11	6
Romania	Lasi	2,008	2,016	11,861	7	19	23	29			17	7			20	7
Romania	Timisoara	2,008	2,016	12,906	8	19	23	28	30	14	11	7			24	10
South Africa	City of Johannesburg	2,004	2,013	158,387	87	20	21	24	47	29	32	18	75	29		
South Africa	City of Tshwane	2,009	2,013	50,899	56	20	22	24	48	21			74	27		
South Africa	eThekwini	2,004	2,013	145,617	100	24	25	28					49	21		
South Africa	Fezile Dabi	2,008	2,013	17,396	16	21	23	26	65	29	26	12				
South Africa	Gert Sibande	2,008	2,013	35,052	32	19	21	24	36	27	19	10	85	26		
South Africa	Nkangala	2,008	2,013	35,439	32	20	22	24	27	18	14	7	76	32		
South Africa	Sedibeng	2,007	2,013	35,990	28	21	23	25	50	30	32	26	80	23		
South Korea	Busan	1,999	2,015	156,875	50	22	24	29	50	23			74	26	39	14
South Korea	Daegu	1,999	2,015	96,063	31	22	26	31	46	22			79	35	37	14
South Korea	Daejeon	1,999	2,015	50,110	16	21	25	29	39	21			75	33	33	13
South Korea	Gwangju	1,999	2,015	51,095	16	22	25	30	42	23			74	31	32	12
South Korea	Incheon	1,999	2,015	96,408	31	21	24	29	50	26			72	30	48	18

South Korea	Seoul	1,999	2,015	325,293	104	22	25	29	49	29			68	32	60	20
South Korea	Ulsan	1,999	2,015	35,110	11	22	25	30	45	20			76	29	34	11
Spain	A Coruna	2,005	2,014	10,613	6	18	20	24	25	9			66	25	26	11
Spain	Albacete	2,001	2,014	7,007	3	21	25	29	45	17	13	6	98	21	12	7
Spain	Alicante	2,001	2,014	15,841	6	23	26	29					82	14	28	8
Spain	Almeria	2,004	2,014	6,822	3	24	26	31					86	16	20	7
Spain	Avila	2,001	2,014	2,110	1	17	21	26	24	6			79	15	22	7
Spain	Badajoz	2,002	2,014	6,178	3	23	26	32	52	43			52	21	9	7
Spain	Barcelona	2,001	2,014	99,830	39	22	25	29	32	15	20	9	70	17	42	14
Spain	Bilbao	2,001	2,014	22,975	9	19	21	27	37	8			62	17	34	11
Spain	Burgos	2,001	2,014	10,009	4	16	20	26	28	8	10	6	86	24	23	9
Spain	Caceres	2,002	2,014	3,895	2	22	26	32	61	38			67	12	11	7
Spain	Cadiz	2,004	2,014	5,540	3	23	25	29					86	18	17	8
Spain	Castellon	2,001	2,014	7,975	3	23	26	29	32	8			69	9	38	9
Spain	Ceuta	2,004	2,014	2,423	1	22	24	28					92	25		
Spain	Ciudad Real	2,008	2,014	1,824	1	22	27	31	24	11			95	20	8	6
Spain	Cordoba	2,001	2,014	15,990	6	24	28	32	47	12			86	14	28	6
Spain	Cuenca	2,008	2,014	1,592	1	20	24	29	29	13			94	20	15	9
Spain	Girona	2,005	2,014	2,113	2	21	24	28							30	5
Spain	Granada	2,001	2,014	13,304	5	22	25	29	38	16			82	17	35	10
Spain	Guadalajara	2,001	2,013	3,182	1	19	23	28	28	15			102	29	23	13
Spain	Huesca	2,003	2,014	2,737	1	21	24	30	20	9			94	21	17	8
Spain	Jaen	2,003	2,014	4,785	2	23	27	32	40	18			102	21	17	7
Spain	Leon	2,001	2,014	8,860	3	16	20	26	24	9			72	20	27	10
Spain	Lleida	2,001	2,014	6,923	3	22	25	30					87	24	22	10
Spain	Logrono	2,001	2,014	7,496	3	20	23	29	28	13					15	12
Spain	Lugo	2,005	2,014	3,992	2	16	19	24	21	9			60	23	21	5
Spain	Madrid	2,001	2,014	170,142	66	21	26	30	32	15	12	4	73	22	43	14
Spain	Malaga	2,001	2,014	28,227	11	24	26	32	30	8			84	15	31	7
Spain	Melilla	2,004	2,014	2,141	1	23	25	30					100	30		
Spain	Murcia	2,003	2,014	15,235	7	25	28	31	20	6			92	19	39	6
Spain	Ourense	2,004	2,014	5,340	3	20	23	28	15	9			77	24	28	14
Spain	Oviedo	2,001	2,014	13,619	5	17	19	24	35	21	11	5	64	19	28	11
Spain	Palencia	2,001	2,014	4,255	2	18	21	27	28	6			75	12	28	8
Spain	Palma Mallorca	2,001	2,014	18,157	7	22	25	29	25	10	12	4	75	16	26	9
Spain	Palmas G. Canaria	2,001	2,014	17,326	7	23	25	29	27	13	8	3	49	12	23	10
Spain	Pamplona	2,004	2,014	8,289	4	19	22	28					74	19		
Spain	Pontevedra	2,005	2,014	2,907	2	18	21	27	19	9					18	9
Spain	Salamanca	2,001	2,014	9,855	4	18	21	26	22	9			70	18	31	8
Spain	San Sebastian	2,001	2,014	11,311	4	17	20	26	25	9			61	17	26	10
Spain	Santander	2,001	2,014	11,563	4	18	20	25	29	11			57	17	25	8
Spain	Segovia	2,002	2,014	2,771	1	18	22	28	23	8			80	12	29	7

Spain	Sevilla	2,001	2,014	36,835	14	25	28	33	43	13			92	23	29	10
Spain	Soria	2,004	2,014	1,797	1	17	20	25	26	13			76	20	25	10
Spain	Tarragona	2,001	2,014	6,098	2	23	27	30					89	19	21	8
Spain	Tenerife	2,004	2,014	8,608	4	24	25	30	21	12	8	6	67	15	20	11
Spain	Teruel	2,003	2,014	1,753	1	19	22	26	25	13			91	19	14	7
Spain	Toledo	2,001	2,014	3,387	1	23	27	31	36	9	12	5	92	15	23	6
Spain	Valencia	2,001	2,014	44,674	17	23	26	29	28	10	18	11	66	14	36	11
Spain	Valladolid	2,001	2,014	17,425	7	19	22	28	21	10	12	5	87	22	28	11
Spain	Vitoria	2,001	2,014	10,895	4	17	19	26	25	12			74	20	26	10
Spain	Zamora	2,001	2,014	3,805	2	19	22	28	24	6			75	12	28	6
Spain	Zaragoza	2,001	2,014	38,102	15	22	26	30	32	15			57	18	41	12
Sweden	Stockholm	1,995	2,010	71,764	24	14	17	23	14	7	8	5	69	19	27	11
Switzerland	Basel	1,995	2,013	17,266	5	16	20	26	18	9	13	7	88	36	19	10
Switzerland	Bern	1,995	2,013	12,704	4	15	19	24	27	11	17	7	88	31	46	13
Switzerland	Geneve	1,995	2,013	12,059	3	17	20	26	20	9			81	30	33	12
Switzerland	Lausanne	1,995	2,013	9,535	3	17	20	26	23	12			91	30	42	13
Switzerland	Lugano	1,995	2,013	12,933	4	19	22	27	24	14	18	11	107	48	28	11
Switzerland	Luzern	1,995	2,013	6,812	2	16	19	25	18	8			85	36	21	7
Switzerland	St. Gallen	1,995	2,013	6,146	2	14	18	24	16	8			98	29	10	5
Switzerland	Zürich	1,995	2,013	33,165	9	15	19	25	20	10	14	7	91	33	30	11
Taiwan	Kaohsiung	1,995	2,014	144,406	39	28	29	31	55	27	30	15	120	48	31	11
Taiwan	Taichung	1,995	2,014	109,060	30	27	29	31	50	22	28	13	115	39	33	12
Taiwan	Taipei	1,995	2,014	270,148	73	27	30	32	45	17	24	10	108	38	44	14
Thailand	Ayutthaya	1,999	2,008	7,748	7	29	30	33	48	22					20	9
Thailand	Bangkok	1,999	2,008	122,960	67	30	31	33	50	13					39	11
Thailand	Chachoengsao	2,004	2,008	5,341	6	28	29	32	29	11					8	4
Thailand	Chiang Mai	1,999	2,005	28,868	23	28	29	31	41	24					14	8
Thailand	Chon Buri	1,999	2,008	21,547	13	29	30	31	38	14					21	7
Thailand	Khon Kaen	1,999	2,008	30,443	17	29	30	33	31	19					31	13
Thailand	Lampang	1,999	2,008	19,300	10	29	30	33	49	40					10	6
Thailand	Nakhon Ratchasima	1,999	2,008	37,893	21	29	29	32	47	22					16	7
Thailand	Nakhon Sawan	1,999	2,008	19,282	10	30	31	33	41	18					18	7
Thailand	Nonthaburi	1,999	2,008	15,698	9	29	30	33	38	12					30	12
Thailand	Pathum Thani	1,999	2,008	11,262	6	29	30	33	47	25					26	11
Thailand	Ratchaburi	1,999	2,008	15,079	8	29	29	33	36	17					10	5
Thailand	Rayong	1,999	2,008	9,417	5	27	28	31	36	19					14	6
Thailand	Samut Sakhon	1,999	2,008	7,697	4	29	30	31	38	13					26	8
Thailand	Samutprakan	1,999	2,008	15,263	8	29	30	31	79	32					25	10
Thailand	Saraburi	1,999	2,008	11,416	6	29	30	33	52	22					25	8
Thailand	Songkhla	1,999	2,008	15,422	9	29	29	30	41	16					17	6
Thailand	Surat Thani	1,999	2,008	10,217	6	29	30	33	29	12					9	5
UK	Barnsley	2,008	2,018	4,387	2	14	16	21			11	4				

UK	Barnsley/Dearne Valley	1,997	2,016	8,428	2	14	16	22					18	9
UK	Basildon	2,008	2,018	4,700	2	15	18	23			13	5		
UK	Basingstoke	2,008	2,018	3,429	2	15	17	22			12	4		
UK	Bath	2,008	2,018	3,997	2	15	17	22			11	4		
UK	Bedford	2,008	2,018	4,231	2	15	17	23			12	5		
UK	Birkenhead	2,000	2,018	8,327	2	15	17	21	18	10	10	4	17	9
UK	Birmingham	2,008	2,018	40,665	20	14	17	22			12	4		
UK	Blackburn	2,008	2,018	4,886	2	13	16	20			10	4		
UK	Blackpool	2,000	2,018	16,514	5	14	16	21	21	9	10	4	14	8
UK	Bolton	2,008	2,018	7,601	4	13	16	20			11	4		
UK	Bournemouth	2,008	2,018	9,759	5	15	17	22			11	4		
UK	Bournemouth/Poole	2,001	2,016	28,492	10	15	17	22					12	7
UK	Bracknell	2,008	2,018	2,417	1	15	17	22			12	5		
UK	Bradford	2,008	2,018	13,020	6	13	16	21			11	4		
UK	Brighton and Hove	2,002	2,018	13,803	4	15	17	22			13	4	15	8
UK	Bristol	1,995	2,018	48,963	11	15	17	23	21	11	12	4	30	16
UK	Burnley	2,008	2,018	4,210	2	13	15	20			10	4		
UK	Burton upon Trent	2,008	2,018	3,325	2	14	17	22			11	4		
UK	Bury	2,008	2,018	3,548	2	14	16	20			11	4		
UK	Cambridge	2,008	2,018	4,877	2	15	18	23			12	4		
UK	Cardiff	1,995	2,018	28,460	7	15	17	22	24	12	11	4	28	10
UK	Carlisle	2,008	2,018	3,868	2	14	16	20			9	3		
UK	Chatham	2,008	2,018	2,558	1	15	18	23			13	5		
UK	Chelmsford	2,008	2,018	4,345	2	15	17	22			13	5		
UK	Cheltenham	2,008	2,018	5,172	3	15	17	22			11	4		
UK	Chester	2,008	2,018	3,996	2	14	17	21			10	4		
UK	Chesterfield	2,008	2,018	4,817	2	14	16	21	15	7	10	4	14	7
UK	Colchester	2,008	2,018	5,009	2	15	18	23			12	4		
UK	Coventry	1,997	2,018	19,491	7	14	17	22			12	4		
UK	Crawley	2,000	2,018	6,512	2	15	17	23	19	8	12	5	27	8
UK	Darlington	2,008	2,018	4,646	2	14	16	20			9	4		
UK	Derby	2,008	2,018	11,066	5	15	17	22			11	4		
UK	Doncaster	2,008	2,018	4,960	2	15	17	22			11	4		
UK	Dudley	2,008	2,018	4,022	2	14	17	22			11	4		
UK	Eastbourne	2,000	2,018	11,812	3	15	17	22	20	9	13	5	12	8
UK	Exeter	2,008	2,018	4,701	2	15	17	21			10	4		
UK	Gateshead	2,008	2,018	6,162	3	14	16	20			9	4		
UK	Gillingham	2,008	2,018	4,147	2	16	18	23			13	5		
UK	Gloucester	2,008	2,018	5,936	3	15	18	22			11	4		
UK	Grimsby	2,008	2,018	4,360	2	15	17	21			11	4		
UK	Guildford	2,008	2,018	2,352	1	15	17	22			12	4		
UK	Halifax	2,008	2,018	4,311	2	13	15	20			10	4		

UK	Harlow	2,008	2,018	3,315	2	15	17	23			13	5		
UK	Harrogate	2,008	2,018	3,623	2	13	15	20			10	4		
UK	Hartlepool	2,008	2,018	4,412	2	14	16	20			10	4		
UK	Hastings	2,008	2,018	4,824	2	15	17	22			13	5		
UK	Hemel Hempstead	2,008	2,018	3,863	2	15	17	22			12	5		
UK	High Wycombe	2,008	2,018	3,302	2	15	17	22			12	4		
UK	Huddersfield	2,008	2,018	7,558	4	14	16	21			11	4		
UK	Ipswich	2,008	2,018	5,894	3	15	18	23			12	4		
UK	Kingston upon Hull	1,995	2,018	29,243	7	15	17	22	22	12	11	4	26	12
UK	Leeds	2,008	2,018	19,077	9	14	16	21			11	4		
UK	Leicester	1,995	2,018	33,531	8	14	17	22	20	9	12	4	30	12
UK	Lincoln	2,008	2,018	4,383	2	14	17	22			11	4		
UK	Liverpool	1,995	2,018	51,065	14	15	17	22	19	12	11	4	33	18
UK	London	1,995	2,018	573,284	130	16	18	24	23	11	14	5	35	13
UK	Luton	2,008	2,018	7,103	4	15	17	22			12	5		
UK	Maidstone	2,008	2,018	4,892	2	15	17	23			13	5		
UK	Manchester	1,995	2,018	42,762	10	15	17	22	20	9	12	4	31	11
UK	Mansfield	2,008	2,018	3,782	2	14	16	21			11	4		
UK	Medway Towns	1,997	2,009	9,013	4	16	18	23	19	10			21	10
UK	Middlesbrough	2,008	2,018	8,758	4	14	16	21			10	4		
UK	Milton Keynes	2,008	2,018	4,700	2	15	17	22			12	4		
UK	Newcastle upon Tyne	2,008	2,018	11,231	6	14	16	20			9	4		
UK	Newcastle-under-Lyme	2,008	2,018	3,938	2	14	16	21			11	4		
UK	Newport	2,001	2,018	9,990	3	15	17	22	17	8	11	4	17	8
UK	Northampton	2,001	2,018	14,156	4	15	17	23	20	8	12	4	15	8
UK	Norwich	1,997	2,018	16,856	4	15	17	22	18	9	12	4	16	8
UK	Nottingham	1,996	2,018	23,327	6	15	17	23	22	10	12	4	32	11
UK	Nuneaton	2,008	2,018	3,789	2	14	17	22			11	4		
UK	Oldham	2,008	2,018	4,645	2	13	16	20			11	4		
UK	Oxford	2,008	2,018	4,944	2	15	18	23			12	4	50	21
UK	Peterborough	2,008	2,018	6,403	3	15	17	23			12	4		
UK	Plymouth	1,998	2,018	23,237	6	15	17	21	17	9	10	3	22	10
UK	Poole	2,008	2,018	8,281	4	15	17	22			11	4		
UK	Portsmouth	2,008	2,018	8,784	4	16	18	22			13	5		
UK	Preston	2,000	2,018	9,959	3	14	16	21	18	8	10	4	20	8
UK	Reading	1,997	2,018	15,269	4	15	17	23	18	10	12	5	24	12
UK	Redditch	2,008	2,018	3,148	2	14	17	22			11	4		
UK	Rochdale	2,008	2,018	4,488	2	13	15	20			11	4		
UK	Rotherham	2,008	2,018	5,505	3	14	16	21			11	4		
UK	Salford	2,008	2,018	3,809	2	15	17	22			12	4		
UK	Scunthorpe	2,008	2,018	3,941	2	15	17	22			11	4		
UK	Sheffield	1,995	2,018	53,112	12	14	16	22	21	11	11	4	31	13

UK	Shrewsbury	2,008	2,018	3,489	2	14	17	21			10	4				
UK	Slough	2,008	2,018	4,231	2	15	18	23			12	5				
UK	Solihull	2,008	2,018	5,031	2	14	16	21			11	4				
UK	South Hampshire	1,995	2,016	52,897	13	16	18	22	22	9	11	6			27	11
UK	South Shields	2,008	2,018	4,160	2	13	15	19			9	4				
UK	Southampton	2,008	2,018	9,638	5	16	18	23			13	5				
UK	Southend-on-Sea	2,000	2,016	17,929	6	16	18	23	20	9	10	6			18	9
UK	Southend-on-Sea	2,008	2,018	9,197	5	16	18	23			13	5				
UK	Southport	2,008	2,018	5,902	3	14	16	20			10	4				
UK	St Albans	2,008	2,018	2,900	1	15	17	22			12	5				
UK	St Helens	2,008	2,018	5,548	3	15	17	21			10	4				
UK	Stevenage	2,008	2,018	3,618	2	15	17	23			12	5				
UK	Stockport	2,008	2,018	4,704	2	15	17	21			12	4				
UK	Stockton-on-Tees	2,008	2,018	4,258	2	14	16	20			9	4				
UK	Stoke-on-Trent	1,997	2,016	22,762	6	14	16	21	20	10	12	6			26	10
UK	Stoke-on-Trent	2,008	2,018	13,042	6	14	16	21			11	4				
UK	Sunderland	2,005	2,018	12,099	5	14	16	20			10	4			13	8
UK	Sutton Coldfield	2,008	2,018	5,094	3	14	17	21			11	4				
UK	Swansea	1,995	2,018	20,626	5	15	17	22	24	13	10	3			23	10
UK	Swindon	2,008	2,018	6,643	3	15	17	22			11	4				
UK	Teesside	1,997	2,016	24,465	7	14	16	21	20	11	9	6			17	8
UK	Telford	2,008	2,018	5,299	3	14	16	21			10	4				
UK	Thanet	2,003	2,009	2,855	2	16	18	23							20	11
UK	Tyneside	1,995	2,016	62,008	15	14	16	20	17	10	9	5			30	11
UK	Wakefield	2,008	2,018	4,549	2	14	17	21			11	4				
UK	Walsall	2,008	2,018	2,517	1	15	17	22			11	4				
UK	Warrington	2,008	2,018	7,292	4	15	17	21	15	7	11	4				
UK	Watford	2,008	2,018	5,117	3	15	17	23			12	5				
UK	West Bromwich	2,008	2,018	3,420	2	15	17	22			12	4				
UK	West Midlands	1,995	2,016	193,219	48	14	16	22	20	11	11	6			28	13
UK	West Yorkshire	1,995	2,016	111,462	28	14	16	22	23	12	12	6			35	13
UK	Weston-Super-Mare	2,008	2,018	5,058	2	15	17	21			10	4				
UK	Wigan	2,005	2,018	4,978	2	14	16	21			10	4			19	10
UK	Woking	2,008	2,018	3,967	2	15	17	23			12	5				
UK	Wolverhampton	2,008	2,018	11,430	6	14	17	21			11	4				
UK	Worcester	2,008	2,018	4,166	2	15	17	22			11	4				
UK	Worthing	2,008	2,018	6,940	3	15	17	22			13	4				
UK	York	2,008	2,018	6,460	3	15	17	21	14	7	10	4				
USA	akron (OH)	1,995	2,006	28,265	13	18	22	27	25	11	17	9	97	39		
USA	albany (NY)	1,995	2,006	15,102	7	18	22	27			11	8	82	33	24	10
USA	albuquerque (NM)	1,995	2,006	20,719	9	22	25	30	29	15	6	3	102	20	27	11
USA	allentown (PA)	1,995	2,006	16,211	7	19	23	28	27	15	15	9	94	39	25	10

USA	anaheim (CA)	1,995	2,006	87,322	40	21	23	30			15	8	93	24	38	19
USA	anchorage (AK)	1,995	2,006	5,172	2	11	15	20	22	15	5	5				
USA	ann arbor (MI)	1,995	2,006	9,436	4	18	22	28			13	8	95	32		
USA	annandale (VA)	1,995	2,006	20,619	9	22	26	31			16	8	95	38	27	10
USA	atlanta (GA)	1,995	2,006	86,225	39	23	26	30	30	12	19	8	106	40	29	14
USA	atlantic city (NJ)	1,995	2,006	12,941	6	20	24	29					99	36		
USA	augusta (GA)	1,995	2,006	9,906	4	24	27	31			18	8	100	35		
USA	austin (TX)	1,995	2,006	19,992	9	26	29	32			11	6	94	32	11	11
USA	aztec (NM)	2,001	2,006	1,840	2	20	24	29			6	3	105	21	18	6
USA	bakersfield (CA)	1,995	2,006	25,455	12	25	28	34	42	17	13	7	136	31	27	9
USA	baltimore (MD)	1,995	2,006	81,593	37	21	25	31			16	9	95	39	37	12
USA	bangor (ME)	1,995	2,006	7,103	3	16	20	26			9	6	78	27		
USA	barnstable (MA)	1,995	2,006	14,365	7	17	21	26					97	34	4	4
USA	bath (NY)	2,001	2,006	2,579	2	17	21	27			11	8				
USA	baton rouge (LA)	1,995	2,006	17,606	8	25	27	30			14	7	90	35	21	7
USA	beaver dam (WI)	2,001	2,006	2,271	2	17	22	27			10	7	91	28		
USA	birmingham (AL)	1,995	2,006	44,094	20	23	27	31	35	17	19	9	99	35	19	8
USA	boise city (ID)	1,996	2,000	3,552	4	19	24	30							37	13
USA	boston (MA)	1,995	2,006	118,291	54	18	22	29	24	11	12	7	80	34	36	14
USA	boulder (CO)	1,995	2,006	7,124	3	20	25	31	21	9	8	3	95	29		
USA	brownsville (TX)	1,995	2,006	9,898	4	27	29	31	29	17	10	6	57	27		
USA	buffalo (NY)	1,995	2,006	53,716	24	17	21	26			14	9	93	36	29	11
USA	burlington (VT)	1,995	2,006	4,769	2	17	21	27			9	7	80	26	24	9
USA	canton (OH)	1,995	2,006	20,363	9	18	22	27	25	12	18	9	98	35		
USA	carlisle (PA)	2,000	2,006	6,360	5	20	24	30			16	9				
USA	cedar rapids (IA)	1,995	2,006	7,550	3	18	22	28			10	7	79	26	7	4
USA	charleston (SC)	1,995	2,006	13,676	6	24	27	30	20	8	13	7	86	29	10	6
USA	charleston (WV)	1,995	2,006	13,108	6	20	23	27	27	11	19	9	100	32	39	10
USA	charlotte (NC)	1,995	2,006	23,056	10	22	25	29			17	7	106	38	27	11
USA	chattanooga (TN)	1,995	2,006	16,318	7	22	26	29			16	7	104	34		
USA	chicago (IL)	1,995	2,006	284,232	129	20	24	31	31	16	15	8	78	30	42	14
USA	cincinnati (OH)	1,995	2,006	43,758	20	20	24	29	31	13	19	9	95	37	41	14
USA	cleveland (OH)	1,995	2,006	104,918	48	19	23	29	32	16	16	9	90	34	39	15
USA	colorado springs (CO)	1,995	2,006	15,348	7	17	21	26	18	7	7	2	94	24	27	11
USA	columbia (SC)	1,995	2,006	21,441	10	24	27	31	27	14	15	7	104	31	10	5
USA	columbus (OH)	1,995	2,006	43,112	20	20	24	29	33	16	17	9	95	37		
USA	corpus christi (TX)	1,995	2,006	12,870	6	27	29	31			11	5	70	33		
USA	dallas (TX)	1,995	2,006	70,725	32	27	30	34			13	6	101	36	27	12
USA	davenport (IA)	1,995	2,006	14,136	6	19	23	29	34	18	12	7	91	28	10	5
USA	dayton (OH)	1,995	2,006	28,458	13	19	23	28			17	9	97	37		
USA	daytona beach (FL)	1,995	2,006	30,225	14	26	27	29	21	15	10	6	78	28		
USA	denver (CO)	1,995	2,006	50,235	23	18	22	28	25	12	9	4	95	30	34	15

USA	des moines (IA)	1,995	2,006	14,595	7	19	24	30	31	14	9	6	72	25	20	8
USA	detroit (MI)	1,995	2,006	190,698	86	19	23	29	35	21	15	9	90	34	33	15
USA	dover (DE)	1,995	2,006	5,538	3	20	24	29			14	9	103	35		
USA	durham (NC)	1,995	2,006	8,727	4	22	25	30			16	7	102	34		
USA	east st. louis (IL)	1,995	2,006	12,215	6	22	26	32			16	9			33	10
USA	el centro (CA)	1,995	2,006	4,277	2	30	34	38			11	4	102	27	18	11
USA	el paso (TX)	1,995	2,006	20,808	9	25	29	33	34	23	10	5	100	21	30	13
USA	elizabeth (NJ)	1,995	2,006	23,937	11	20	25	31			15	9	81	37	68	23
USA	elkhart (IN)	1,995	2,006	7,328	3	20	25	30			14	8	97	31		
USA	erie (PA)	1,995	2,006	14,313	6	18	22	27	20	12	14	9	96	35	22	9
USA	essex (MA)	1,995	2,006	33,829	15	17	21	28			10	8	82	30	15	8
USA	eugene (OR)	1,995	2,006	14,882	7	16	19	25	19	11	6	5	75	25		
USA	evansville (IN)	1,995	2,006	9,565	4	21	25	30			17	9	107	31	20	8
USA	everett (WA)	1,995	2,006	18,565	9	15	17	24	15	7	8	4	62	23		
USA	fargo (ND)	1,995	2,006	3,871	2	16	22	28	21	12	7	4	76	23	10	6
USA	fayetteville (NC)	1,995	2,006	9,855	4	23	27	31			15	7	106	32		
USA	flint (MI)	1,995	2,006	20,695	9	17	22	28			12	8	94	32		
USA	fort lauderdale (FL)	1,995	2,006	83,282	38	28	29	31	18	9	8	4	58	25	13	8
USA	fort myers (FL)	1,995	2,006	25,897	12	27	28	30	19	8	8	5	71	25		
USA	fort pierce (FL)	1,995	2,006	19,711	9	26	27	29			8	5	68	27	15	6
USA	fort wayne (IN)	1,995	2,006	13,432	6	18	23	28			14	8	103	31		
USA	fort worth (TX)	1,995	2,006	48,600	22	26	30	34			13	6	106	38	24	13
USA	fresno (CA)	1,995	2,006	28,552	13	24	28	34			13	7	134	33	29	13
USA	gainesville (FL)	1,997	2,006	6,728	4	25	27	29	20	8	10	5	83	31		
USA	gary (IN)	1,995	2,006	23,622	11	20	24	30	24	12	15	8	98	33	33	14
USA	gettysburg (PA)	2,001	2,006	2,221	2	19	23	28			15	9	93	33	6	4
USA	grand haven (MI)	1,995	2,006	7,775	4	17	21	27			12	8	96	33		
USA	grand junction (CO)	2,001	2,006	3,123	3	21	25	31	26	12	7	3				
USA	grand rapids (MI)	1,995	2,006	21,249	10	17	22	28			13	8	92	33	26	10
USA	green bay (WI)	1,995	2,006	8,144	4	16	21	27			10	7	85	28		
USA	greensboro (NC)	1,995	2,006	17,819	8	21	25	29			17	8	104	35		
USA	greensburg (PA)	1,995	2,006	22,969	10	20	24	29	28	12	18	10	87	35	26	10
USA	greenville (SC)	1,995	2,006	16,193	7	23	26	31	26	10	17	8			23	11
USA	harrisburg (PA)	1,995	2,006	13,021	6	20	24	30	24	12	16	9	94	38	27	11
USA	hartford (CT)	1,995	2,006	41,396	19	19	23	29			12	8	88	36	27	12
USA	hickory (NC)	1,999	2,006	4,487	3	21	24	28			18	8				
USA	holland (MI)	2,001	2,006	2,195	2	17	22	27			12	9	103	36		
USA	honolulu (HI)	1,995	2,000	15,146	14	26	27	29	14	4					5	3
USA	houston (TX)	1,995	2,006	103,277	47	26	28	31			14	6	89	42	26	12
USA	indianapolis (IN)	1,995	2,006	39,746	18	20	24	29			17	9	105	32	30	12
USA	iowa city (IA)	2,001	2,006	1,349	1	19	23	29			11	7				
USA	jacksonville (FL)	1,995	2,006	34,329	16	26	28	32			11	6	85	30	24	10

USA	jersey city (NJ)	1,995	2,006	24,044	11	17	21	26			16	9	85	40	42	17
USA	kalamazoo (MI)	1,995	2,006	9,620	4	18	23	29			13	8	98	31		
USA	kansas city (KS)	1,995	2,006	57,902	26	22	27	33			12	6	95	33	24	9
USA	kenosha (WI)	1,995	2,006	6,191	3	18	22	29			11	7	97	34		
USA	klamath falls (OR)	2,001	2,006	1,910	2	15	19	25			7	6				
USA	knoxville (TN)	1,995	2,006	21,188	10	22	25	29	29	11	18	8	106	31		
USA	la porte (IN)	1,995	2,006	5,395	2	18	23	28			13	8	101	34		
USA	lafayette (IN)	1,999	2,006	3,127	2	19	23	29			14	8				
USA	lafayette (LA)	1,995	2,006	7,142	3	25	28	30			12	7	92	35		
USA	lake charles (LA)	1,995	2,006	8,667	4	27	30	33			12	7	82	32	10	5
USA	lakeland (FL)	1,995	2,006	26,687	12	27	29	31	21	9	10	5	81	29		
USA	lancaster (PA)	1,995	2,006	22,072	10	20	24	29	24	12	17	10	101	40	22	9
USA	lansing (MI)	1,999	2,006	6,702	5	17	22	27			12	8				
USA	las vegas (NV)	1,995	2,006	58,525	27	29	33	38	36	16	7	3	106	23	24	16
USA	layton (UT)	1,995	2,006	5,557	3	19	24	30			7	3	110	25	27	11
USA	little rock (AR)	1,995	2,006	17,020	8	24	28	32			16	7	97	31	21	9
USA	logan (UT)	2,001	2,006	1,053	1	16	21	27			6	3	103	19	21	9
USA	los angeles (CA)	1,995	2,006	312,552	142	20	21	27	38	13	18	9	101	29	54	19
USA	louisville (KY)	1,995	2,006	36,165	16	22	26	30	29	12	18	9	96	34	30	10
USA	macon (GA)	1,997	2,006	7,228	4	24	27	30			17	8	103	36		
USA	madison (IL)	1,995	2,006	12,387	6	22	26	32	39	20	17	8	95	33		
USA	madison (WI)	1,995	2,006	13,487	6	17	22	28			11	7	89	28		
USA	mcallen (TX)	1,997	2,006	12,536	7	28	30	32	30	16	11	6	66	26		
USA	medford (OR)	1,995	2,006	9,843	4	19	23	29	22	10	7	5	91	24		
USA	melbourne (FL)	1,995	2,006	26,616	12	26	27	30	19	10	8	5	75	27		
USA	melville (NY)	1,995	2,006	119,140	54	19	23	29			12	8	88	36	36	16
USA	memphis (TN)	1,995	2,006	40,576	18	24	28	32	28	11	15	8	105	33	42	23
USA	mercer (PA)	1,995	2,006	7,417	3	17	21	26			15	9	99	37		
USA	miami (FL)	1,995	2,006	99,940	45	27	29	30			9	5	62	24	17	8
USA	middlesex (NJ)	1,995	2,006	29,047	13	20	24	31			13	9	99	43	28	12
USA	middletown (OH)	1,995	2,006	13,785	6	20	23	28			18	9	98	37		
USA	milwaukee (WI)	1,995	2,006	60,243	27	18	23	30	25	13	12	8	86	31	31	13
USA	minneapolis (MN)	1,995	2,006	62,460	28	18	23	30	26	12	10	6			36	14
USA	mobile (AL)	1,995	2,006	19,857	9	25	28	31	29	12	14	7	89	31		
USA	modesto (CA)	1,995	2,006	17,797	8	23	27	34	35	17	11	7	108	32	30	13
USA	monroe (LA)	1,995	2,006	7,111	3	25	28	31			14	7	98	29		
USA	montgomery (AL)	1,995	2,006	10,791	5	26	29	33			17	8	92	31	19	7
USA	muncie (IN)	2,000	2,006	3,695	3	19	23	28			14	8	103	29		
USA	muskegon (MI)	1,995	2,006	8,391	4	17	21	27			12	8	99	36		
USA	myrtle beach (SC)	2,001	2,006	5,251	5	24	26	30			12	7				
USA	nashua (NH)	1,995	2,006	13,676	6	19	24	30			10	8	83	30	19	11
USA	nashville (TN)	1,995	2,006	26,029	12	22	26	30	32	12	16	7	92	32	30	17

USA	new haven (CT)	1,995	2,006	40,449	18	19	23	29	23	12	13	8	91	36	39	16
USA	new london (CT)	1,995	2,006	10,558	5	18	21	26			11	7	97	33		
USA	new orleans (LA)	1,995	2,006	46,378	21	27	29	32			14	7			25	10
USA	new york (NY)	1,995	2,006	321,859	146	17	21	26	25	13	15	9	78	36	58	18
USA	newark (NJ)	1,995	2,006	54,876	25	20	25	31			14	9	91	38	37	14
USA	newburgh (NY)	1,995	2,006	12,971	6	18	22	28			12	8	93	34		
USA	niles (MI)	1,995	2,006	7,926	4	18	23	28			12	8	106	34		
USA	norfolk (VA)	1,995	2,006	50,736	23	22	26	30			14	8			29	11
USA	oakland (CA)	1,995	2,006	85,765	39	17	18	23			10	6	71	20	25	12
USA	ocala (FL)	1,998	2,006	13,972	8	25	27	29			10	5	83	28		
USA	ogden (UT)	1,995	2,006	6,934	3	20	25	31	27	13	8	3	110	21	40	13
USA	oklahoma city (OK)	1,995	2,006	32,557	15	24	28	33					103	29	19	9
USA	omaha (NE)	1,995	2,006	18,646	8	20	24	31	37	17	9	5	72	25		
USA	orlando (FL)	1,995	2,006	45,487	21	26	28	30	20	9	10	5	84	30	17	8
USA	ottawa (IL)	1,995	2,006	6,489	3	19	23	30	30	17	13	7				
USA	palm beach (FL)	1,995	2,006	67,071	30	27	28	30			8	4	62	24	22	8
USA	paterson (NJ)	1,995	2,006	59,376	27	20	24	30			14	9	87	38	40	18
USA	pensacola (FL)	1,995	2,006	14,598	7	26	28	31			14	7	94	33	13	6
USA	philadelphia (PA)	1,995	2,006	231,189	105	20	25	31	28	14	15	9	95	40	38	12
USA	phoenix (AZ)	1,995	2,006	112,977	51	31	35	39	44	21	9	4	110	22	41	16
USA	pittsburgh (PA)	1,995	2,006	79,682	36	19	23	28	31	17	18	11	96	38	38	16
USA	plymouth (MA)	1,995	2,006	17,418	9	17	21	27			11	8	58	33		
USA	port arthur (TX)	1,995	2,006	13,627	6	26	28	30			13	7	82	39	13	8
USA	portage (IN)	1,995	2,006	5,766	3	20	24	30	21	12	13	8	100	34		
USA	portland (ME)	1,995	2,006	12,299	6	16	20	26			11	7	80	30	26	13
USA	portland (OR)	1,995	2,006	57,127	26	17	20	26	20	8	8	5	69	25	24	10
USA	providence (RI)	1,995	2,006	64,779	29	18	22	28			11	7	90	34	18	9
USA	provo (UT)	1,995	2,006	8,158	4	18	23	28	29	14	7	4	112	20	36	11
USA	raleigh (NC)	1,995	2,006	16,978	8	22	25	30	24	10	16	7	103	35		
USA	reading (PA)	1,995	2,006	18,875	9	20	24	30	25	12	16	10	92	38	33	10
USA	reno (NV)	1,995	2,006	13,337	6	19	23	29			7	4	95	20	20	13
USA	richmond (VA)	1,995	2,006	31,230	14	21	25	30			16	8	100	35	31	13
USA	riverside (CA)	1,995	2,006	124,241	56	22	25	30	41	15	19	10	127	30	40	13
USA	rochester (NY)	1,995	2,006	33,704	15	17	21	27			12	8	82	32		
USA	rockville (MD)	1,995	2,006	25,019	11	22	25	31			15	8	99	40		
USA	sacramento (CA)	1,995	2,006	48,240	22	21	23	30	26	11	9	6	105	30	23	11
USA	salt lake city (UT)	1,995	2,006	25,583	12	20	26	31	30	14	8	3	108	23	38	13
USA	san antonio (TX)	1,996	2,006	48,114	24	27	30	34	24	13	10	5	90	31	15	8
USA	san diego (CA)	1,995	2,006	101,387	46	20	22	27			12	5	93	19	30	12
USA	san francisco (CA)	1,995	2,006	60,345	27	16	17	23			9	6	56	16	27	15
USA	san jose (CA)	1,995	2,006	46,529	21	21	23	31			10	7	74	22	37	19
USA	sarasota (FL)	1,995	2,006	40,891	19	27	28	31	21	9	9	5	80	30	8	5

USA	scranton (PA)	1,995	2,006	38,483	17	18	22	27	22	12	13	9	90	33	23	9
USA	seattle (WA)	1,995	2,006	60,211	27	14	16	21	20	8	9	5	65	25	30	14
USA	sioux city (IA)	2,001	2,006	2,305	2	19	24	30			10	6				
USA	south bend (IN)	1,995	2,006	12,662	6	18	23	28			13	8	102	31	23	9
USA	spartanburg (SC)	1,995	2,006	12,747	6	22	25	29			17	7	107	35		
USA	spokane (WA)	1,995	2,006	18,730	8	16	21	27	24	15	8	5	91	20		
USA	springfield (MA)	1,995	2,006	24,110	11	19	23	29			12	8	87	34	25	10
USA	springfield (MO)	1,995	2,006	12,001	5	21	25	30			12	6	93	26	20	9
USA	st. charles (MO)	1,995	2,006	8,715	4	22	26	32			14	8	105	35	15	8
USA	st. louis (MO)	1,995	2,006	79,882	36	22	26	32	32	22	15	8	94	34	32	11
USA	st. petersburg (FL)	1,995	2,006	44,384	20	27	29	31			10	5	77	29	17	10
USA	stamford (CT)	1,995	2,006	35,873	16	18	22	28			13	8	96	36	31	14
USA	state college (PA)	1,996	2,006	4,069	2	18	22	27			14	10	94	32	12	5
USA	steubenville (OH)	2,001	2,006	3,797	3	18	22	27	32	16	19	10	100	31		
USA	stockton (CA)	1,995	2,006	22,529	10	22	25	31	31	16	11	5	94	29	29	13
USA	tacoma (WA)	1,995	2,006	27,001	12	16	18	26	21	11	9	5	69	23		
USA	tallahassee (FL)	1,995	2,006	7,075	3	25	27	30	19	10	13	7	83	30		
USA	tampa (FL)	1,995	2,006	44,384	20	27	28	30	25	9	11	5	84	31	13	6
USA	terre haute (IN)	1,995	2,006	6,120	3	20	24	29			15	8	100	30		
USA	toledo (OH)	1,995	2,006	23,603	11	18	23	29	26	13	15	9	88	33		
USA	toms river (NJ)	1,995	2,006	63,448	29	21	25	31			13	9	106	41		
USA	topeka (KS)	1,999	2,006	5,057	4	22	26	32			11	6				
USA	trenton (NJ)	1,995	2,006	14,474	7	20	24	30			13	9	99	42	25	9
USA	tucson (AZ)	1,995	2,006	37,194	17	28	31	35	25	12	6	2	97	20	24	8
USA	tulsa (OK)	1,995	2,006	26,474	12	24	28	33					102	29	18	10
USA	upper marlboro (MD)	1,995	2,006	21,791	10	21	25	30			16	9	100	41		
USA	vancouver (WA)	1,995	2,006	11,446	5	17	20	26			7	4	69	24		
USA	ventura (CA)	1,995	2,006	24,290	11	18	19	25			14	6	110	22	20	8
USA	visalia (CA)	1,995	2,006	13,616	6	23	26	32			15	8	137	32	33	13
USA	washington (DC)	1,995	2,006	31,998	14	22	25	31			16	9	92	40	38	12
USA	washington (PA)	1,995	2,006	12,662	6	17	21	27	25	13	17	9	98	35	22	9
USA	wichita (KS)	1,995	2,006	18,829	9	22	27	32	26	12	11	5	94	28	16	7
USA	wilmington (DE)	1,995	2,006	20,498	9	20	24	29	26	13	15	9	93	38	26	13
USA	winston-salem (NC)	1,995	2,006	14,231	6	22	26	31	26	10	17	8	100	33	23	11
USA	worcester (MA)	1,995	2,006	35,083	16	17	21	26			11	7	91	33	30	13
USA	york (PA)	1,995	2,006	16,818	8	19	23	29	27	13	17	10	97	38	29	12
USA	youngstown (OH)	1,995	2,006	22,419	10	17	21	27			17	9	95	36	31	13

Table S2. Association between daily mean air temperature and all-cause mortality by levels of air pollutants: % change in mortality, and 95% confidence intervals, per increments of air temperature from the 75th to the 99th percentile of city-specific distributions, estimated at predefined concentrations of the air pollutants. Meta-analytical results

Effect modifier	Level ($\mu g/m^3$)	n. cities	% change	95% CI	
	10	304	5.35	3.78	6.95
	20	359	7.12	5.67	8.59
	30	367	8.28	6.54	10.05
	40	368	9.21	7.14	11.32
PM_{10}	50	357	10.20	7.74	12.72
	60	332	10.77	8.08	13.53
	70	282	11.19	8.22	14.23
	80	248	11.27	7.92	14.73
	90	207	12.79	8.74	16.99
	1	202	3.93	2.72	5.15
	5	462	5.82	4.19	7.48
	10	485	6.89	5.26	8.54
	15	485	7.97	6.10	9.88
$PM_{2.5}$	20	483	8.93	6.78	11.12
	25	481	9.84	7.39	12.35
	30	465	10.68	7.86	13.58
	35	409	11.37	8.13	14.70
	40	345	12.26	8.57	16.08
	40	367	2.89	1.13	4.69
	50	384	3.99	2.28	5.73
	60	386	5.27	3.35	7.22
	70	385	6.76	4.41	9.16
	80	384	7.94	5.33	10.62
	90	383	8.94	6.10	11.86
O_3	100	379	8.93	6.13	11.80
	110	374	9.58	6.57	12.68
	120	370	10.11	6.79	13.54
	130	359	10.74	7.05	14.56
	140	344	11.30	7.17	15.59
	150	324	11.96	7.09	17.04
	160	301	12.54	6.91	18.47
	1	94	5.36	1.91	8.93
	5	260	6.47	4.21	8.77
	10	364	7.37	5.66	9.10
	15	393	8.12	6.34	9.93
	20	397	8.74	6.98	10.53
	25	397	9.18	7.52	10.86
NO_2	30	383	9.56	7.83	11.32
	35	370	9.87	8.04	11.73
	40	351	10.07	8.11	12.06
	45	332	10.42	8.31	12.57
	50	315	10.68	8.39	13.02
	55	282	10.81	8.36	13.31
	60	250	11.05	8.36	13.81

PM_{10} and $PM_{2.5}$ denote daily mean concentrations of particulate matter consisting of particles that are 10 and 2.5 µm or less in aerodynamic diameter, respectively. O_3 is ozone (maximum of the daily 8-hour moving average). NO_2 denotes daily mean concentrations of nitrogen dioxide. Results from city-specific models adjusted for time trend, day of the week, and product terms between non-linear air temperature and linear air pollutant (one at a time) (details on the city-specific and meta-analytical models are reported in the appendix).

The p-values of the pooled estimates of interaction terms were: 3.6e-10 for TEMP*PM_{10}; 3.2e-05 for TEMP*$PM_{2.5}$; 1.6e-08 for TEMP*O_3; 5.0e-04 for TEMP*NO_2

Table S3. Association between daily mean air pollutants (daily max-8h moving average for ozone) and all-cause mortality by percentiles of air temperature: % change in mortality, and 95% confidence intervals, per 10 μg/m^3 increments of air pollutants, estimated at predefined percentiles of air temperature. Meta-analytical results

Exposure	Percentile of air temperature	n. cities	% change	95% CI	
	1	370	0.54	0.10	0.98
	5	370	0.48	0.09	0.87
	15	371	0.31	0.03	0.58
	25	372	0.19	-0.02	0.39
PM_{10}	50	372	0.43	0.23	0.63
	75	372	0.09	-0.09	0.27
	85	371	0.31	0.11	0.50
	95	371	0.90	0.50	1.30
	99	371	1.21	0.69	1.72
	1	480	-0.41	-1.59	0.79
	5	481	-0.25	-1.34	0.85
	15	482	0.14	-0.60	0.88
	25	483	0.30	-0.33	0.94
$PM_{2.5}$	50	483	0.29	-0.20	0.78
	75	484	-0.10	-0.63	0.42
	85	484	0.18	-0.36	0.73
	95	483	0.81	0.08	1.54
	99	483	1.11	0.27	1.95
	1	386	0.00	-0.44	0.44
	5	386	-0.04	-0.45	0.38
	15	386	-0.08	-0.42	0.25
	25	386	-0.05	-0.32	0.21
O_3	50	386	0.17	-0.03	0.38
	75	386	-0.08	-0.37	0.21
	85	386	0.12	-0.07	0.31
	95	386	0.42	0.28	0.56
	99	386	0.53	0.38	0.68
	1	410	0.99	0.35	1.64
	5	410	0.95	0.37	1.53
	15	411	0.78	0.33	1.24
	25	411	0.70	0.28	1.13
NO_2	50	410	0.62	0.34	0.89
	75	411	0.31	0.09	0.54
	85	411	0.44	0.20	0.68
	95	411	0.81	0.47	1.16
	99	410	1.00	0.58	1.42

PM_{10} and $PM_{2.5}$ denote daily mean concentrations of particulate matter consisting of particles that are 10 and 2.5 μm or less in aerodynamic diameter, respectively. O_3 is ozone (maximum of the daily 8-hour moving average). NO_2 denotes daily mean concentrations of nitrogen dioxide. Results from city-specific models adjusted for time trend, day of the week, and product terms between non-linear air temperature and linear air pollutant (one at a time) (details on the city-specific and meta-analytical models are reported in the supplementary Text S2)

The p-values of the pooled estimates of interaction terms were: 3.6e-10 for TEMP*PM_{10}; 3.2e-05 for TEMP*$PM_{2.5}$; 1.6e-08 for TEMP*O_3; 5.0e-04 for TEMP*NO_2

Figure S1. Distribution of cities based on their daily air pollution concentrations on days with air temperature between 75th and 99th percentile (during the warm period): white histograms represent the 50th percentile, the blue line represents the density plot of the 25th percentile, the orange line represents the density plot of the 75th percentile, the dashed red vertical lines delimit the range of air pollutant concentrations used in the effect modification analysis

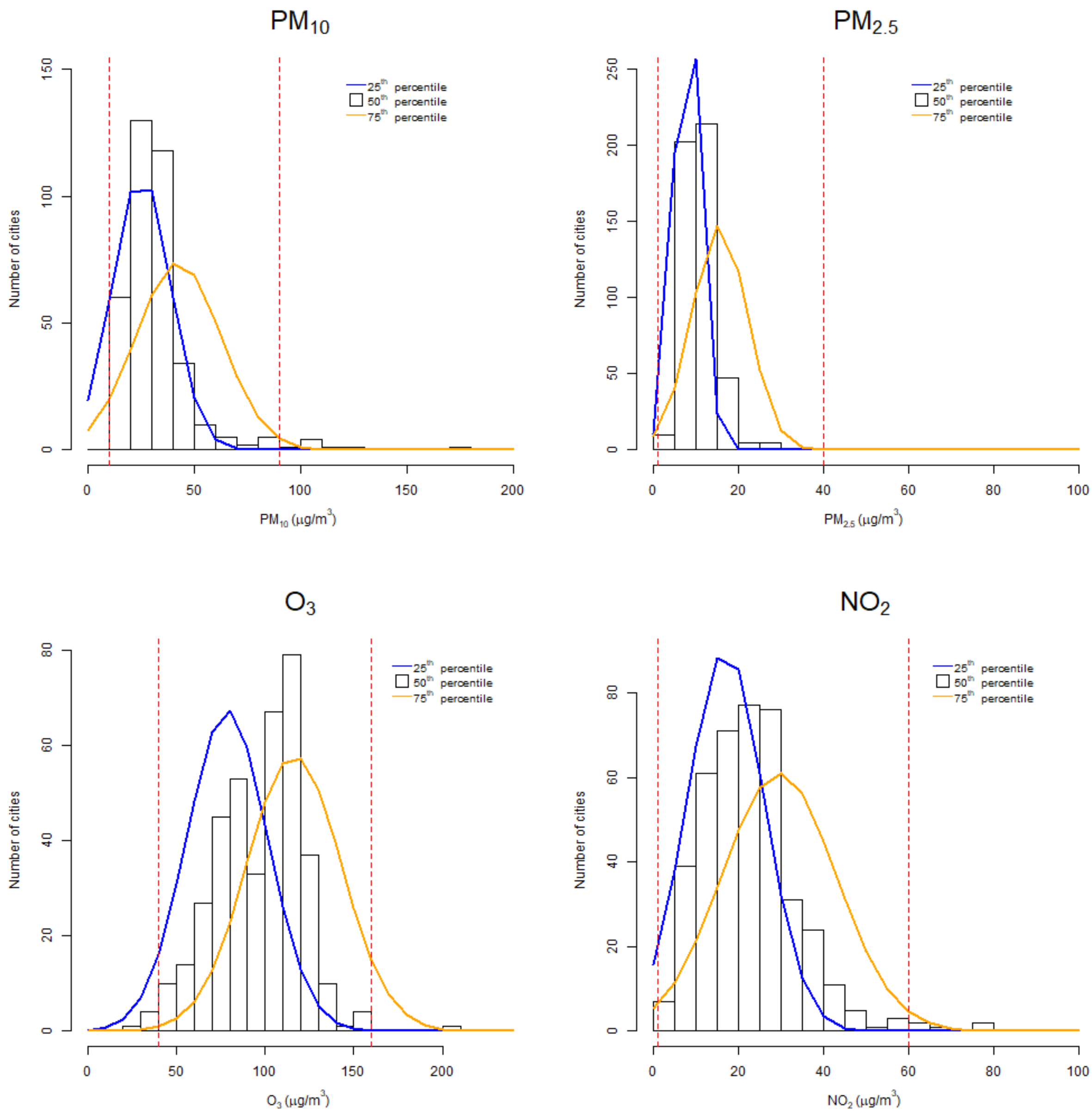

Figure S2. Distribution of the cities with data on air temperature and PM_{10} (top left), $PM_{2.5}$ (top right), O_3 (bottom left) and NO_2 (bottom right). Colour shading represents average of daily mean concentrations of the four pollutants over the study period

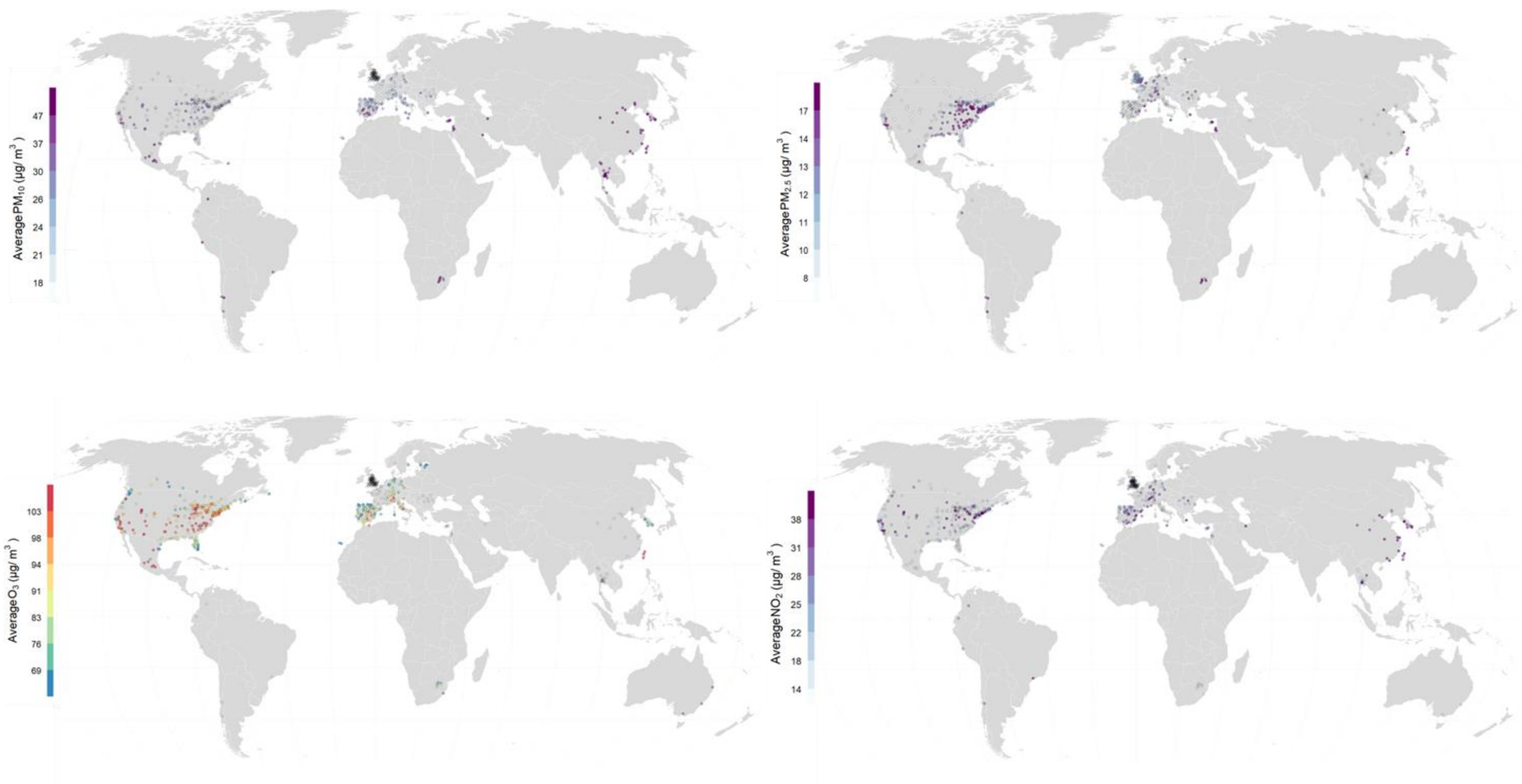

Figure S3. Exposure-response function between air temperature and all-cause mortality, at predefined values of air pollutants. Meta-analytical results. Curves represent % change in mortality at different air temperature percentiles, compared to the 75th, for predefined values of air pollutant concentrations

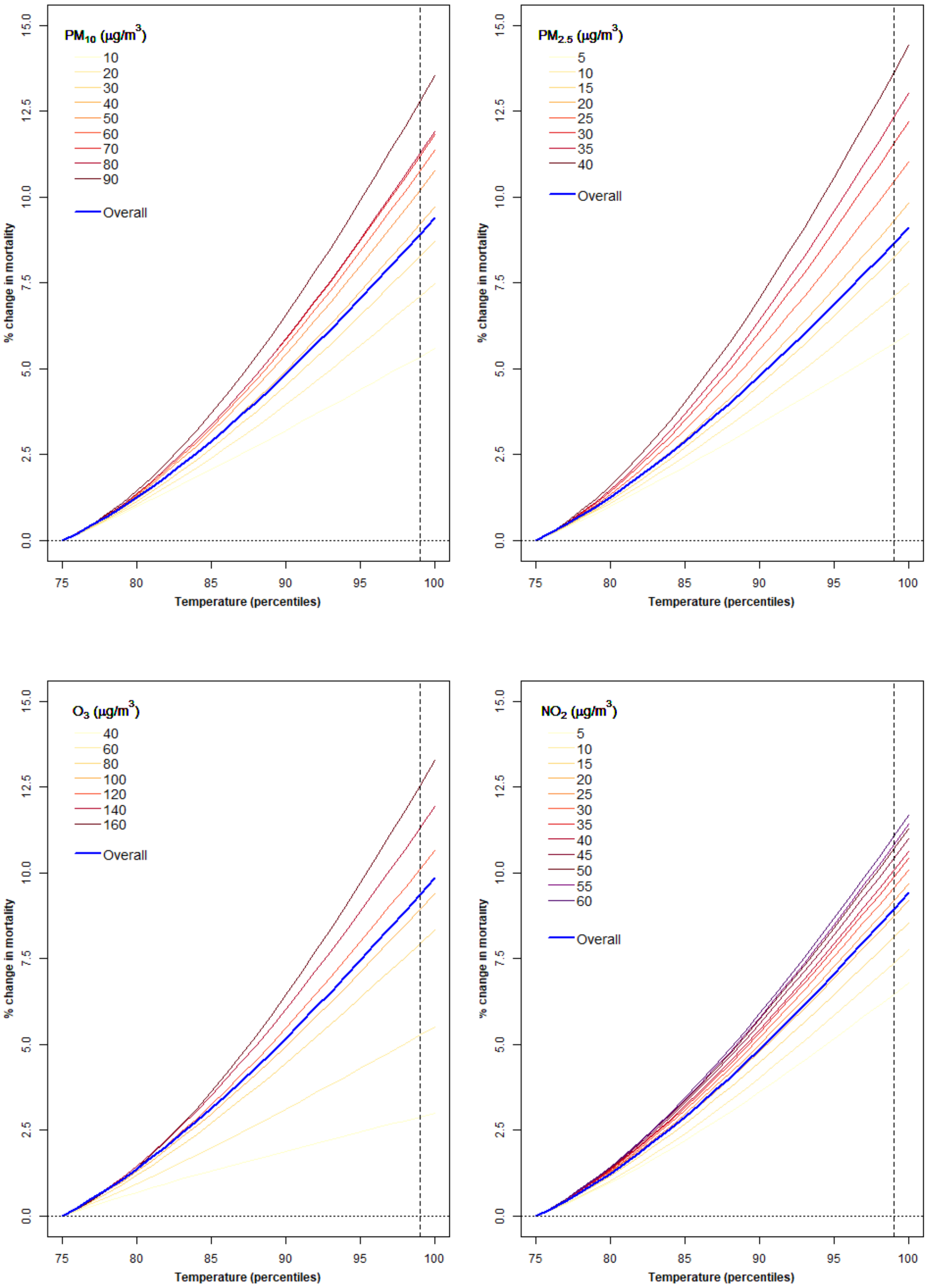

Figure S4. Association between daily mean air temperature and all-cause mortality by levels of daily mean air pollutants: % change in mortality, and 95% confidence intervals, per increments of air temperature from the 75th to the 99th percentile of city-specific distributions, for different daily mean concentrations of the four pollutants. Results by continent

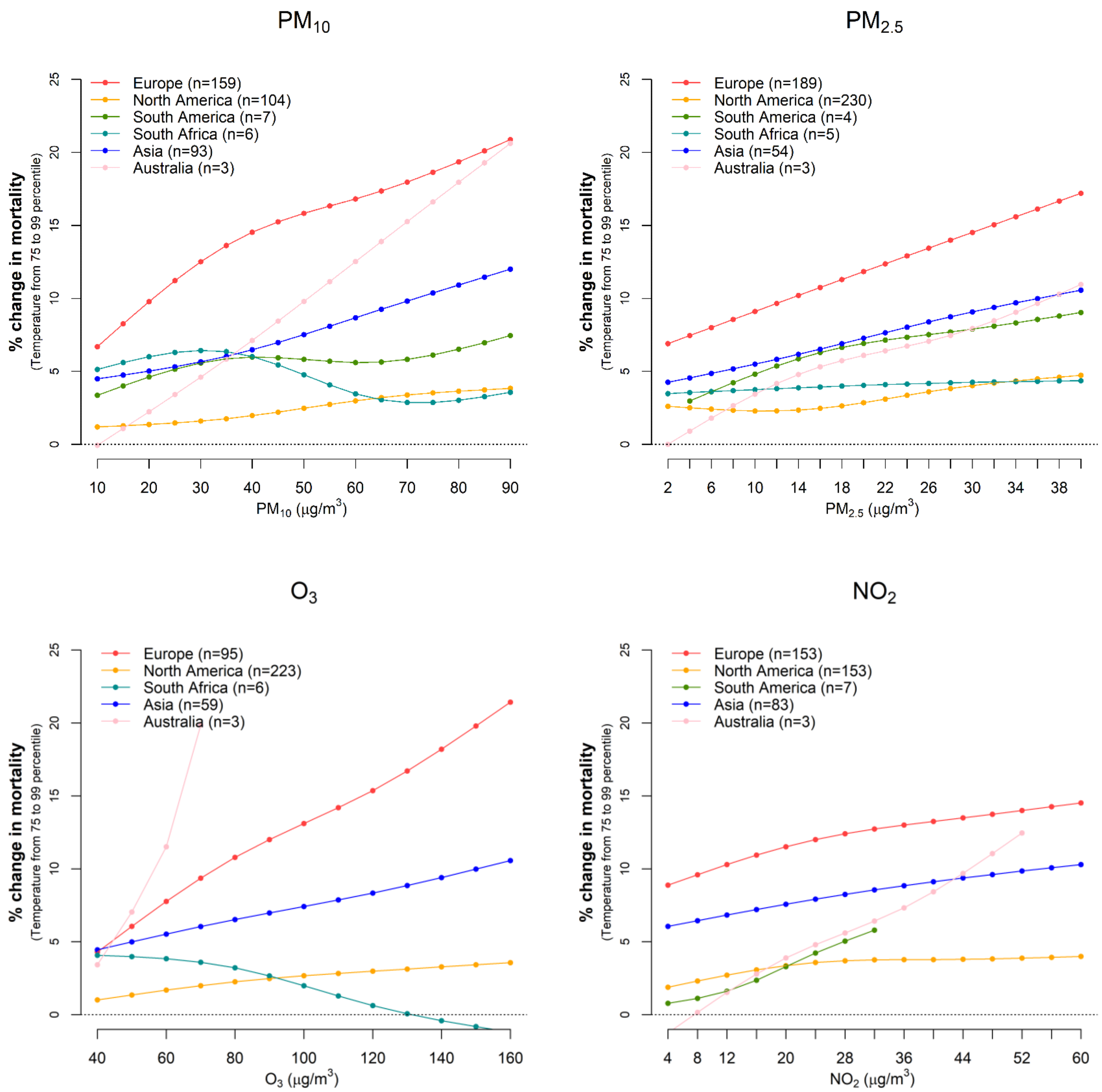

Figure S5. Association between daily mean air pollutants and all-cause mortality by percentiles of daily mean air temperature: % change in mortality, and 95% confidence intervals, per 10 μg/m^3 increments of air pollutants, for different percentiles of air temperature city-specific distributions. Results of the random-effects meta-analysis