APPENDIX AVAILABLE ON THE HEI WEB SITE

Research Report 171

Multicity Study of Air Pollution and Mortality in Latin America

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Appendix H. Methods Tables

Note: Appendices Available on the Web may appear in a different order than in the original Investigators' Report, and some remnants of their original names may be apparent. HEI has not changed the content of these documents, only the letter identifier.*

Appendix G was originally Appendix I
Appendix H was originally Appendix II
Appendix I was originally Appendix III
Appendix J was originally Appendix IV

*Edited tables were moved from the Investigators' Report to Appendix G with the investigators' approval.

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Multi-city study of air pollution and health effects in Latin America
ESCALA

Appendix H

Final report review

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Methods

1.1 **Seasonal Stratification**

Temperature variations between months were used to define “warm months” and “cold months”. These months were analyzed separately including the maximum daily temperature for the models of cold months and the minimum daily temperature for the models of warm months. These definitions were based on the monthly temperature of each country but because of the different geographical position of each city, “warm season” and “cold season” varied across countries:

In Brazil and Chile, warm months were defined from October to March and the cold season: from April to September. In Mexico, warm season was defined from May to September and cold season from October to April.

In relation to seasonal analysis, GAM’s with Poisson errors were used to fit data. Time trends and seasonality were adjusted by natural splines with a specific number of dof per year of analysis. This number varied among cities because of the variability of daily mortality data. The initial choice was 2df per year for all cities (stratifying by season), however, this number varied per city for some causes of death, as long as the model showed a better fit. In Mexican cities, we used 2 or 4 dof, in Brazil we used from 2 up to 5 dof whereas in Chilean cities we used from 3 up to 6 dof. Indicator variables of the weekdays and holidays were used in order to account for the short term cyclic fluctuation.

With respect to smooth functions to adjust for meteorological factors, the analysis was conducted as follows:

1.- for mean temperature (daily 24hr) : natural splines of 1-day lagged and

2. - for mean humidity (daily 24hr): natural splines of 1-day lagged with 1 df per year

1.2 **Diagnostic test for goodness of fits**

Traditionally, the modeling process in time series analysis is based upon the utilization of a set of hypothesis tests that allows the stepwise definition of the model with better adjustment. Akaike (Akaike, 1974) proposed to study the problem of "identification" or "selection" of a model, from the perspective of the statistical decision theory, which moves the problem of fitting a model to the selection of the most suitable function of loss (or criterion of specification). The solution given by Akaike is to choose as specification criteria the minimum of the Akaike Information Criterion (AIC). The diagnostics tests used in this project to validate our fitted models, were the following:

a) Standardized deviance residuals.

Deviance residuals are based on the deviance or likelihood ratio chi-squared statistic. It is defined as:

$$r_d = signo(y_i - \hat{y}_i) * \sqrt{d_i}$$

Where

$$d_i = 2\left[y_i \ln\left(\frac{y_i}{\hat{y}_i}\right) + (n_i - y_i)\ln\left(\frac{n_i - y_i}{n_i - \hat{y}_i}\right)\right] \quad i = 1,2,...$$

with the same sign as the raw residual $(y_i - \hat{y}_i)$. Observations with a deviance residual in excess of 3 units may indicate lack of fit.

b) Cook's distance.

The Cook's distance of an observation is a measure of the global influence of this observation on all the predicted values, i.e. Cook's distance measures the effect of deleting a given observation.

Cook's distance can be shown to be a simple function of the leverage of the observation and the standardized residuals.

Data points with large residuals (outliers) and/or high leverage may distort the accuracy of regression coefficients.

c) Partial autocorrelation function (PACF)

For complete air pollution time series (i.e., the series without systematic missing values), we used the minimization of the sum of the absolute values of the PACF of the model’s residuals as a criterion to select the optimal number of degrees of freedom. The values of the PACF will vary between -1 and +1, with values near 1 or -1, indicating stronger correlation. The PACF removes the effect of shorter lag autocorrelation from the correlation estimate at longer lags.

d) Periodogram of standardized deviance residuals.

The periodogram is a plot of mean square amplitude against frequency for daily deaths. If a time series contains a sinusoidal component with a specific frequency, then the periodogram exhibits a peak at that frequency. If a time series does not contain a periodic component, then the periodogram approximates to a straight line.

e) Normal probability plot.

It can be shown that in GLM or GAM, when the models are well specified in different aspects, standardized residuals are asymptotically normally distributed. This property is even more adequate for standardized deviance residuals.

The normal probability plot is a graphical technique for assessing whether or not a data set is approximately normally distributed. To build these plots the quantiles from the set of standardized residuals are plotted against those of the standard normal distribution in such a way that, given that the model is well specified, the points should lie close to the 45^o straight line. Departures from this straight line indicate departures from normality; hence it would suggest problems of model specification and/or outliers.

Based on the diagnostics above one can perform a visual evaluation of how good the model is fitted. The basic diagnostics used throughout this work were: 1. Standardized deviance residuals (red lines denote the “limits” for outliers), 2. Cook’s distances (red line denotes the “limits” for outliers), 3. Plot of the PACF (blue lines denote the 95% confidence limits for PACF values), 4. Periodogram, 5. Normal probability plot.

1.3 **Meta analysis approaches**

The assessment of heterogeneity is necessary because presence versus absence of true heterogeneity (between-studies variability) affects the meta-analysis model to apply. When the studies' results only differ by the sampling error (homogeneous case), a fixed-effects model ought to be applied to obtain a combined effect size. By contrast, if the study results differ not only by mere sampling errors (presence of heterogeneity), then a random-effects model is more appropriate so as to take into account both within- and between-studies variability. Further, one can test explaining such heterogeneity using moderator variables from either a fixed effects model or a random effects model.(Field 2003; Field et al. 2001; Hedges 1994; Hedges and Olkin 1985; Hedges and Vevea 1998; Overton 1998; Raudenbush 1994).

1.1.1.4.1 Fixed effects meta-analysis

Methods of fixed effect meta-analysis are based on the mathematical assumption that single common (or 'fixed') effect underlies every study (city) in the meta-analysis. In other words, since we were doing a meta-analysis of excess risks, we would assume that every study is estimating the same excess risk. Under this assumption, if every study were infinitely large, every study would yield an identical result. This is the same as assuming there is no (statistical) heterogeneity among the studies.

1.1.1.4.2 Random effects meta-analysis

A random effects analysis makes the assumption that individual studies (cities) are estimating different air pollution effects. In order to make some sense of the different effects we assumed they have a distribution with some central value and some degree of variability. The idea of a random effects meta-analysis is to learn about this distribution of effects across different studies. It is also important to know the variability of effects.

ESCALA random effects meta-analysis is based on the DerSimonian & Laird method. (DerSimonian and Laird 1986) Formulas for applying the DerSimonian & Lair method summarizing studies (assumption: the effects are measured as odd ratios) are as follows:

Let $\{\beta_i : i = 1,...,n\}$ be the set of estimates, where *n* is the number of studies (cities).

Let $\beta_i = \mu_i + e_i$ where e_i is the sampling error and $e_i \sim N(0, s_i^2)$ and s_i is the effect estimate standard error.

Let $\mu_i = \mu + \delta_i$ where $\delta_i \sim N(0, \tau^2)$, μ is the overall (fixed/true) true, and τ^2 measures the between/study variability.

Homogeneity of the studies may be evaluated by Cochran's Q-statistic, as follows:

$$Q = \sum_{i¨1}^{n} \omega_i \left(\beta_i - \beta^*\right)^2$$

Where $\omega_i = 1/s_i^2$ and $\beta^* = \sum_{i¨1}^{n} \omega_i \beta_i$.

Under the null hypothesis of homogeneity, $Q \sim \chi^2_{n-1}$.

Besides, to explore the extent of heterogeneity; we computed the I^2 index by dividing the difference between the result of the Q statistic and its df (*k -1*) by the Q value itself and multiplying by 100, as follows:

$$I^2 = \frac{Q - (\,k - 1\,)}{Q} * \ 100$$

Furthermore, in order to estimate the between-study variability, the following holds:

$$\hat{\tau} = \max\left[0, \frac{Q-(n-1)}{\sum_i \omega_i - \left(\frac{\sum_i \omega_1^2}{\sum_i \omega_i}\right)}\right]$$

Finally, let $\omega_i^* = \frac{1}{s_i^2 + \hat{\tau}^2}$ be the set of new weights, and define the overall effect estimate as $\hat{\mu} = \sum_{i=1}^{n} \omega_i^* \beta_i$

The ω_i^*'s and $\hat{\mu}$'s are the weights and the combined random effects used in random effects models respectively.

1.4 **Meta regression models**

Regarding the same notation as before, in meta-analysis fixed effects models; it is assumed that $\beta_i = \mu + e_i$ whereas in meta-analysis random effects models, this is slightly changed to the following:

$$\beta_i = \mu_i + e_i$$

$$\mu_i = \mu + \delta_i$$

Therefore,

$$\beta_i = \mu + \delta_i + e_i$$

Generalizing this procedure, suppose that in meta-analysis random effects models, assuming a set of several covariates, $\mu_i = W_i^T \gamma + \delta_i$

Therefore,

$$\beta_i = W_i^T \gamma + \delta_i + \varepsilon_i$$

Hence, for a single covariate X_1,

$$\mu_i = \alpha_0 + \alpha_1 X_{1i} + \delta_i$$

Therefore,

$$\beta_i = \alpha_0 + \alpha_1 X_{1i} + \delta_i + \varepsilon_i$$

where α_0 represents the air pollution reference effect, adjusted by the contribution of X_1 to explain heterogeneity of the set of effect estimates.

Then, it follows:

$$\exp\left(E\left(\beta_i\right)\right) = \exp\left(\alpha_0 + \alpha_1 X_{1i}\right) = \exp\left(\alpha_0\right) \times \exp\left(\alpha_1 X_{1i}\right)$$

However, the standard of 10 ug/m^3 of PM_{10} used to report time series results, is a range that corresponds to 25% of the actual range of PM_{10} annual average in the nine cities of the study. Hence, this range was also considered for the other covariates.

Then, let R_{25} be the number of units corresponding to the 25% of full range for each covariate considered for applying meta regression models, then, for an increase R_{25} units in covariate X_1, it follows:

$$\exp\left(\alpha_0 + \alpha_1 (X_{1i} + R_{25})\right) = \exp(\alpha_0) * \exp(\alpha_1 (X_{1i} + R_{25}))$$

and therefore,

$$\frac{\exp(\alpha_0 + \alpha_1 (X_{1i} + R_{25}))}{\exp(\alpha_0 + \alpha_1 X_{1i})} = \exp(R_{25} * \alpha_1)$$

$\exp(R_{25} * \alpha_1) \Rightarrow$ Risk ratio for an increase of R_{25} (the 25% of full range) units in X_1 levels. The values e^{α_0} (95%CI) and $e^{R_{25} * \alpha_1}$(95%CI) were obtained with beta-coefficients from DLM choices (lag0-lag3, lag0-lag5 and lag0-lag10); and they are respectively the overall effect (reference risk) estimate for 1 unit increase, adjusted by the contribution of

X_1 in explaining heterogeneity of the set of effect estimates, and the risk ratio ($e^{R_{25}*\alpha_1}$) for an increase of 25% in the range of X_1.

1.5 **Strategy analysis**

Table 1. Strategy of analysis for the time-series data.

Item	Method	Main Values	Obs
Seasonal analysis	2 per year	warm cold All	Def varies from city to city
Seasonality	Splines	NS: 4 dof	
		NS: 3, 6, 9, 12 dof/yr	Sensitivity analysis. Select with (minPACF, periodogram)
	Influenza epidemics	NS(4) on linear variable indicating the epidemic period (1,2,3..L epidemic)	based on surveillance data, or adm hosp Pneum, or pneumonia deaths in elder
	AP missing data	*test => fit spline with seasonal data and put it back as an offset	test it with full data - if it works, use it in all Analysis
Temporal	Day of week	Base is sunday	
	Holidays	Religious, National,	

Item	Method	Main Values	Obs
		Carnival	
	School holidays	Sec analysis	
		Sec analysis	
Temperature	Full year	*Mean	
	Season (2 per year)	Min for warm	
		Max for cold	
	Lags	Candidates: Lags: 0, 1, 2, 3 combined with Mav: up to 3 days (01,012, 12)	
		Selection criteria: AIC	The most frequent combination across all cities
Pollution	Shape	Linear	
		loess(span=1/2)	
	Lags	lag 0, lag 1 for CVD	
		lag 1, 2, 3 for RSP and CPM	
		Distributed lags up to 5	

Item	Method	Main Values	Obs
		days	
Models	copollutants	Single pollutant	
		Two Pollutants	
		Two Pollutants stratified	
		In metaregression	
Algorithm	gam() with ns()	For plots and analysis?	
	glm() with ns()		

1.6 **Degrees of freedom model specification**

Table 2. Minimum, maximum, and range of total degrees of freedom used on the models for each city, to control time trends and seasonality. All seasons.

Country	City	MIN dof	Cause_MIN	MAX dof	Cause_MAX	RANGE
Brazil	Porto Alegre	8 dof	LRI, < 1 yr old	16 dof	All causes, all ages	8 dof
	Rio de Janeiro	8 dof	LRI, < 1 yr old	32 dof	All causes, all ages	24 dof
	Sao Paulo	24 dof	LRI, < 1 yr old	48 dof	All causes, all ages	24 dof
Chile	Concepcion	12 dof	CVE causes, ≥65 yrs old	46 dof	COPD causes, all ages	34 dof
	Santiago	27 dof	LRI, <1 yr old	72 dof	All causes, all ages	54 dof
	Temuco	10 dof	CVE causes, all ages	35 dof	All causes, all ages	25 dof
Mexico	Mexico City	36 dof	CVE causes, all ages	63 dof	CPM causes, all ages	27 dof
	Monterrey	9 dof	CVE causes, all ages	45 dof	All causes, all ages	36 dof
	Toluca	9 dof	CVE causes, all ages	36 dof	CPM causes, all ages	27 dof

CPM= Cardiopulmonary causes; CVE= Cerebrovascular/stroke causes; LRI= Lower Respiratory Infections; COPD= Chronic Obstructive Pulmonary Diseases.

Table 3. Minimum, maximum, and range of total degrees of freedom used on the models for each city, to control time trends and seasonality. Warm season.

Contry	City	MIN dof	Cause_MIN	MAX dof	Cause_MAX	RANGE
Brazil	Porto Alegre	8 dof	LRI, < 1 yr old	12 dof	CVE causes, ≥65 yrs old	4 dof
	Rio de Janeiro	15 dof	COPD, ≥65 yrs old	20 dof	All causes, all ages	5 dof
	Sao Paulo	16 dof	COPD, ≥65 yrs old	24 dof	All causes, all ages	8 dof
Chile	Concepcion	6 dof	LRI, < 1 yr old	18 dof	All causes, all ages	12 dof
	Santiago	18 dof	LRI, < 1 yr old	54 dof	All causes, all ages	36 dof
	Temuco	10 dof	CVE causes, all ages	30 dof	COPD, ≥65 yrs old	20 dof
Mexico	Mexico City	9 dof	COPD, ≥65 yrs old	36 dof	CPM causes, all ages	27 dof
	Monterrey	9 dof	RSP causes, ≥65 yrs old	27 dof	CPM causes, ≥65 yrs old	18 dof
	Toluca	6 dof	RSP causes, all ages	9 dof	All causes, all ages	3 dof

CPM= Cardiopulmonary causes; RSP= Respiratory causes; CVE= Cerebrovascular/stroke causes; LRI= Lower Respiratory Infections; COPD= Chronic Obstructive Pulmonary Diseases.

Table 4. Minimum, maximum, and range of total degrees of freedom used on the models for each city, to control time trends and seasonality. Cold season.

Country	City	MIN dof	Cause_MIN	MAX dof	Cause_MAX	RANGE
Brazil	Porto Alegre	4 dof	LRI, <1 yr old	16 dof	CPM, all ages	12 dof
	Rio de Janeiro	10 dof	LRI, <1 yr old	15 dof	All causes, all ages	5 dof
	Sao Paulo	8 dof	CVE causes, all ages	32 dof	CPM, all ages	24 dof
Chile	Concepcion	9 dof	LRI, <1 yr old	30 dof	COPD, ≥65 yrs old	21 dof
	Santiago	9 dof	COPD, ≥65 yrs old	27 dof	CVE, ≥65 yrs old	18 dof
	Temuco	10 dof	LRI, <1 yr old	30 dof	COPD, ≥65 yrs old	20 dof
		27 dof	LRI, <1 yr old	54 dof	All causes, all ages	27 dof
		9 dof	LRI, <1 yr old	36 dof	All causes, all ages	27 dof
Mexico	Mexico City	18 dof	COPD causes, all ages	27 dof	CPM, ≥65 yrs old	9 dof
	Monterrey	9 dof	LRI, <1 yr old	36 dof	All causes, all ages	27 dof
	Toluca	18 dof	COPD causes, all ages	27 dof	CPM, ≥65 yrs old	9 dof

CPM= Cardiopulmonary causes; CEV= Cerebrovascular/stroke causes; LRI= Lower Respiratory Infections; COPD= Chronic Obstructive Pulmonary Diseases.

Table 5. Minimum, maximum, and range of total degrees of freedom used on the models for each city, to control time trends and seasonality. All seasons. Socioeconomic Position.

SEP categories	MIN dof	Cause_MIN	MAX dof	Cause_MAX	RANGE
Low	9 dof	CVE causes, all ages	36 dof	All causes, all ages	27 dof
Medium	9 dof	CVE causes, all ages	54 dof	CPM causes, all ages	45 dof
High	9 dof	CVE causes, ≥65 yrs old	54 dof	All causes, all ages	45 dof

CPM= Cardiopulmonary causes; CEV= Cerebrovascular/stroke causes

1.7 **Summary of model fits and comparison of main model by cause of death and age group**

Table 6. Summary of model fits and comparison of main model, all causes, all ages.

	Brazil						Chile						Mexico					
	Porto Alegre		Rio de Janeiro		Sao Paulo		Santiago		Concepción		Temuco		Mexico City		Monterrey		Toluca	
Model Characteristics	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach
Degree of freedom (per year) in the time smooth	4	4	32/5	4	6	4	8	4	7	4	7	4	8	4	5	4	4	4
Dispersion	1.05	1.05	1.15	1.18	1.25	1.28	1.13	1.21	1.09	1.10	1.03	1.02	1.85	2.34	1.58	2.64	1.77	1.77
Percentage of deviance explained	16.0	16.0	27.7	25.0	36.7	34.9	50.1	47.5	18.8	18.0	5.8	5.9	67.8	62.3	37.8	36.3	21.9	21.9
First - order PACF	-0.002	-0.002	0.092	0.123	0.090	0.116	1.129	1.140	0.821	0.793	0.789	0.742	0.095	0.248	0.037	0.058	0.029	0.029
Sum of first 20 PACFs	-0.223	-0.223	0.096	0.432	0.066	0.361	-0.047	0.643	-0.029	0.037	-0.039	0.144	0.123	0.928	0.248	0.392	0.022	0.022

Main models are the base models fitted from the main analysis for each city; the Common Aproach is the base model fitted from the Common Protocol but restricted to a fixed set of procedures and degrees of freedom

Table 7. Summary of model fits and comparison of main model, cardiopulmonary, all ages.

	Brazil						Chile						Mexico					
	Porto Alegre		Rio de Janeiro		Sao Paulo		Santiago		Concepción		Temuco		Mexico City		Monterrey		Toluca	
Model Characteristics	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach
Degree of freedom (per year) in the time smooth	4	4	32/5	4	6	4	7	4	5	4	6	4	8	4	5	4	4	4
Dispersion	1.09	1.09	1.09	1.10	1.18	1.22	1.12	1.19	1.10	1.11	1.11	1.11	1.19	1.34	1.03	1.06	1.06	1.06
Percentage of deviance explained	19.8	19.8	22.4	21.2	41.7	39.8	49.2	47.4	9.8	9.5	46.8	46.0	66.8	61.1	37.8	36.3	20.7	20.7
First - order PACF	-0.028	-0.028	0.062	0.076	0.070	0.099	1.022	1.239	0.711	0.692	0.818	0.785	0.098	0.250	0.031	0.052	0.030	0.030
Sum of first 20 PACFs	-0.302	-0.302	-0.079	0.111	0.031	0.361	0.119	0.721	-0.132	-0.077	-0.138	-0.105	0.069	0.910	0.156	0.380	-0.070	-0.070

Main models are the base models fitted from the main analysis for each city; the Common Aproach is the base model fitted from the Common Protocol but restricted to a fixed set of procedures and degrees of freedom

Table 8. Summary of model fits and comparison of main model, cardiopulmonary, ≥65 years old.

	Brazil						Chile						Mexico					
	Porto Alegre		Rio de Janeiro		Sao Paulo		Santiago		Concepción		Temuco		Mexico City		Monterrey		Toluca	
Model Characteristics	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach
Degree of freedom (per year) in the time smooth	14/4	4	8	4	6	4	7	4	3	4	3	4	8	4	5	4	4	4
Dispersion	1.11	1.10	1.04	1.05	1.12	1.15	1.12	1.17	1.16	1.16	1.14	1.13	1.13	1.29	1.06	1.08	1.04	1.04
Percentage of deviance explained	17.5	18.2	21.8	20.3	39.6	37.6	47.2	45.4	46.8	46.0	44.3	44.4	62.3	56.2	33.4	31.9	11.8	11.8
First - order PACF	0.011	0.002	0.056	0.072	0.055	0.085	0.938	1.125	0.696	0.696	0.788	0.854	0.072	0.199	0.018	0.037	0.016	0.016
Sum of first 20 PACFs	-0.173	-0.362	-0.099	0.125	0.029	0.369	0.043	0.606	-0.051	-0.051	-0.142	-0.196	0.110	0.860	0.110	0.340	-0.030	-0.030

Main models are the base models fitted from the main analysis for each city; the Common Aproach is the base model fitted from the Common Protocol but restricted to a fixed set of procedures and degrees of freedom

Table 9. Summary of model fits and comparison of main model, respiratory, all ages.

	Brazil						Chile						Mexico					
	Porto Alegre		Rio de Janeiro		Sao Paulo		Santiago		Concepción		Temuco		Mexico City		Monterrey		Toluca	
Model Characteristics	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach
Degree of freedom (per year) in the time smooth	10/4	4	4	4	44/8	4	7	4	4	4	3	4	8	4	5	4	2	4
Dispersion	1.06	1.06	1.06	1.06	1.09	1.11	1.10	1.16	1.03	1.03	0.94	0.93	1.06	1.18	1.05	1.07	1.04	1.05
Percentage of deviance explained	12.6	13.2	13.7	13.7	32.7	31.4	42.4	40.2	38.9	38.9	38.5	38.5	62.8	58.6	23.8	22.6	12.1	21.0
First - order PACF	-0.014	-0.022	0.069	0.069	0.020	0.039	0.938	1.205	0.755	0.755	0.683	0.705	0.070	0.160	0.017	0.033	0.040	0.022
Sum of first 20 PACFs	-0.304	-0.540	0.021	0.021	-0.114	0.189	0.204	0.731	0.063	0.063	0.104	-0.003	0.060	0.640	0.024	0.250	0.080	-0.180

Main models are the base models fitted from the main analysis for each city; the Common Aproach is the base model fitted from the Common Protocol but restricted to a fixed set of procedures and degrees of freedom

Table 10. Summary of model fits and comparison of main model, respiratory, <1 year old.

	Brazil						Chile						Mexico					
	Porto Alegre		Rio de Janeiro		Sao Paulo		Santiago		Concepción		Temuco		Mexico City		Monterrey		Toluca	
Model Characteristics	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach
Degree of freedom (per year) in the time smooth	2	4	2	4	2	4	3	4	5	4	6	4	4	4	2	4	4	4
Dispersion	0.98	0.91	1.06	1.05	1.06	1.06	0.48	0.47	0.08	0.08	0.08	0.09	1.05	1.05	1.15	1.07	1.00	1.00
Percentage of deviance explained	11.8	14.5	3.5	4.6	11.1	11.8	10.9	11.1	14.7	14.4	8.3	8.3	39.7	39.7	15.6	34.2	22.6	22.6
First - order PACF	0.006	-0.003	0.033	0.027	0.020	0.011	0.574	0.596	0.699	0.560	0.699	0.692	0.050	0.050	0.027	0.016	0.012	0.012
Sum of first 20 PACFs	0.002	-0.032	-0.001	-0.162	0.156	-0.005	0.027	-0.165	0.401	0.275	0.401	0.345	0.012	0.012	-0.020	-0.330	0.020	0.020

Main models are the base models fitted from the main analysis for each city; the Common Aproach is the base model fitted from the Common Protocol but restricted to a fixed set of procedures and degrees of freedom

Table 11. Summary of model fits and comparison of main model, respiratory, 1-4 years old.

	Brazil						Chile						Mexico					
	Porto Alegre		Rio de Janeiro		Sao Paulo		Santiago		Concepción		Temuco		Mexico City		Monterrey		Toluca	
Model Characteristics	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach
Degree of freedom (per year) in the time smooth	1	4	1	4	2	4	3	4	6	4	3	4	3	4	2	4	2	4
Dispersion	0.77	0.41	1.03	1.01	0.98	0.98	0.21	0.20	0.07	0.08	0.02	0.02	1.00	1.01	1.04	1.09	1.00	0.97
Percentage of deviance explained	23.8	38.8	3.5	4.6	3.7	4.3	7.6	7.6	39.6	39.5	25.5	36.7	6.0	5.9	5.1	8.8	5.2	7.0
First - order PACF	0.007	0.026	-0.024	-0.028	0.009	0.004	0.579	0.608	1.255	1.269	1.411	1.600	0.035	0.010	0.016	0.005	-0.010	-0.015
Sum of first 20 PACFs	-0.084	0.426	-0.091	-0.145	-0.077	-0.163	0.173	0.209	0.746	0.803	0.488	0.691	-0.010	-0.120	0.060	-0.010	-0.110	-0.200

Main models are the base models fitted from the main analysis for each city; the Common Aproach is the base model fitted from the Common Protocol but restricted to a fixed set of procedures and degrees of freedom

Table 12. Summary of model fits and comparison of main model, respiratory, ≥65 years old.

	Brazil						Chile						Mexico					
	Porto Alegre		Rio de Janeiro		Sao Paulo		Santiago		Concepción		Temuco		Mexico City		Monterrey		Toluca	
Model Characteristics	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach
Degree of freedom (per year) in the time smooth	10/4	4	4	4	4	4	6	4	4	4	4	4	7	4	4	4	2	4
Dispersion	1.02	1.02	1.05	1.05	1.07	1.07	1.11	1.15	0.99	0.99	0.86	0.86	1.09	1.18	1.07	1.07	1.08	1.04
Percentage of deviance explained	12.5	12.9	12.3	12.3	30.6	30.6	38.0	36.9	35.7	35.3	35.3	35.3	51.6	47.2	18.0	18.0	6.1	9.2
First - order PACF	-0.022	-0.030	0.071	0.071	0.025	0.025	0.867	1.087	0.801	0.801	0.793	0.793	0.052	0.140	0.038	0.038	0.020	-0.010
Sum of first 20 PACFs	-0.215	-0.386	-0.008	-0.008	0.097	0.097	0.284	0.649	-0.004	-0.004	-0.052	-0.052	0.210	0.710	0.180	0.180	0.220	-0.240

Main models are the base models fitted from the main analysis for each city; the Common Aproach is the base model fitted from the Common Protocol but restricted to a fixed set of procedures and degrees of freedom

Table 13. Summary of model fits and comparison of main model, cardiovascular, all ages.

	Brazil						Chile						Mexico					
	Porto Alegre		Rio de Janeiro		Sao Paulo		Santiago		Concepción		Temuco		Mexico City		Monterrey		Toluca	
Model Characteristics	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach
Degree of freedom (per year) in the time smooth	4	4	32/5	4	6	4	5	4	8	4	3	4	7	4	4	4	3	4
Dispersion	1.05	1.05	1.06	1.07	1.15	1.17	1.06	1.08	1.12	1.12	1.11	1.11	1.10	1.16	1.01	1.01	1.06	1.05
Percentage of deviance explained	14.6	14.6	17.7	16.3	31.2	29.8	32.1	32.6	32.1	31.8	31.1	31.2	48.0	44.3	27.1	27.1	6.0	6.6
First - order PACF	-0.007	-0.007	-0.015	0.002	0.055	0.074	0.685	0.680	0.897	0.738	0.741	0.754	0.060	0.130	0.010	0.140	0.030	0.020
Sum of first 20 PACFs	-0.232	-0.232	-0.212	0.052	-0.056	0.203	-0.075	0.234	-0.310	-0.133	-0.094	-0.117	0.063	0.610	0.130	0.130	0.060	-0.050

Main models are the base models fitted from the main analysis for each city; the Common Aproach is the base model fitted from the Common Protocol but restricted to a fixed set of procedures and degrees of freedom

Table 14. Summary of model fits and comparison of main model, cardiovascular, ≥65 years old.

	Brazil						Chile						Mexico					
	Porto Alegre		Rio de Janeiro		Sao Paulo		Santiago		Concepción		Temuco		Mexico City		Monterrey		Toluca	
Model Characteristics	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach
Degree of freedom (per year) in the time smooth	3	4	4	4	6	4	4	4	3	4	5	4	7	4	5	4	3	4
Dispersion	1.08	1.07	1.04	1.04	1.11	1.12	1.06	1.06	1.16	1.16	1.12	1.12	1.09	1.16	1.03	1.06	1.03	1.03
Percentage of deviance explained	12.4	13.6	14.6	14.6	28.6	26.9	30.7	30.7	29.9	30.3	31.3	32.1	46.2	42.7	23.3	21.1	5.2	5.8
First - order PACF	0.030	0.017	-0.019	-0.019	0.050	0.071	0.671	0.671	0.842	0.858	0.993	0.990	0.030	0.090	0.005	0.030	0.020	0.012
Sum of first 20 PACFs	0.013	-0.206	0.015	0.015	-0.074	0.219	0.115	0.115	-0.072	-0.109	-0.165	-0.163	0.010	0.560	0.080	0.360	0.040	-0.110

Main models are the base models fitted from the main analysis for each city; the Common Aproach is the base model fitted from the Common Protocol but restricted to a fixed set of procedures and degrees of freedom

Table 15. Summary of model fits and comparison of main model, cerebrovascularstroke, all ages.

	Brazil						Chile						Mexico					
	Porto Alegre		Rio de Janeiro		Sao Paulo		Santiago		Concepción		Temuco		Mexico City		Monterrey		Toluca	
Model Characteristics	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach
Degree of freedom (per year) in the time smooth	4	4	4	4	4	4	3	4	2	4	3	4	4	4	2	4	2	4
Dispersion	1.00	1.00	1.06	1.06	1.08	1.08	1.03	1.03	1.07	1.07	0.95	0.95	1.00	1.00	1.01	0.99	1.02	1.02
Percentage of deviance explained	5.6	5.6	8.8	8.8	8.1	8.1	10.7	10.4	9.9	10.2	9.9	9.9	11.4	11.4	5.1	7.1	2.4	2.2
First - order PACF	-0.031	-0.031	-0.001	-0.001	0.035	0.035	0.578	0.598	0.645	0.705	0.737	0.735	-0.015	-0.015	0.018	-0.004	-0.020	-0.030
Sum of first 20 PACFs	-0.288	-0.288	-0.095	-0.095	-0.092	-0.092	0.103	-0.021	-0.183	-0.273	-0.233	-0.228	-0.021	-0.021	0.070	-0.200	0.030	-0.015

Main models are the base models fitted from the main analysis for each city; the Common Aproach is the base model fitted from the Common Protocol but restricted to a fixed set of procedures and degrees of freedom

Table 16. Summary of model fits and comparison of main model, cerebrovascularstroke, ≥65 years old.

	Brazil						Chile						Mexico					
	Porto Alegre		**Rio de Janeiro**		**Sao Paulo**		**Santiago**		**Concepción**		**Temuco**		**Mexico City**		**Monterrey**		**Toluca**	
Model Characteristics	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach
Degree of freedom (per year) in the time smooth	3	4	4	4	4	4	5	4	2	4	2	4	4	4	2	4	2	4
Dispersion	0.98	0.99	1.03	1.03	1.04	1.04	1.06	1.06	1.01	1.01	0.86	0.86	1.01	1.01	1.00	0.98	1.03	1.03
Percentage of deviance explained	4.8	5.2	7.3	7.3	6.5	6.5	11.0	10.2	9.4	9.7	9.6	9.9	10.7	10.7	4.2	5.7	6.3	2.3
First - order PACF	-0.023	-0.028	0.017	0.017	0.033	0.033	0.652	0.587	0.705	0.806	0.733	0.742	-0.001	-0.001	0.015	0.000	-0.020	-0.035
Sum of first 20 PACFs	-0.112	-0.204	-0.036	-0.036	-0.103	-0.103	-0.111	-0.023	-0.210	-0.314	-0.215	-0.223	-0.040	-0.040	-0.001	-0.260	-0.050	-0.260

Main models are the base models fitted from the main analysis for each city; the Common Aproach is the base model fitted from the Common Protocol but restricted to a fixed set of procedures and degrees of freedom

Table 17. Summary of model fits and comparison of main model, lower respiratory infections, <1 year old.

	Brazil						Chile						Mexico					
	Porto Alegre		Rio de Janeiro		Sao Paulo		Santiago		Concepción		Temuco		Mexico City		Monterrey		Toluca	
Model Characteristics	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach
Degree of freedom (per year) in the time smooth	2	4	8/5	4	3	4	3	4	3	4	3	4	3	4	1	4	4	4
Dispersion	0.97	0.87	1.05	1.04	1.07	1.07	0.43	0.43	0.07	0.08	112.50	113.40	1.06	1.04	1.03	1.02	1.03	1.03
Percentage of deviance explained	8.6	13.0	4.1	5.6	11.2	11.3	11.90	11.90	10.86	11.74	9.88	9.88	35.8	36.7	8.1	10.6	22.0	22.0
First - order PACF	0.027	0.020	0.044	0.036	0.003	0.001	0.532	0.529	1.232	1.269	0.063	0.063	0.036	0.020	0.019	0.010	0.012	0.012
Sum of first 20 PACFs	0.025	-0.005	-0.014	-0.175	0.056	0.027	0.039	-0.121	0.710	0.803	0.167	0.130	0.250	0.063	-0.080	-0.250	-0.008	-0.008

Main models are the base models fitted from the main analysis for each city; the Common Aproach is the base model fitted from the Common Protocol but restricted to a fixed set of procedures and degrees of freedom

Table 18. Summary of model fits and comparison of main model, lower respiratory infections, 1-14 years old.

	Brazil						Chile						Mexico					
	Porto Alegre		Rio de Janeiro		Sao Paulo		Santiago		Concepción		Temuco		Mexico City		Monterrey		Toluca	
Model Characteristics	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach
Degree of freedom (per year) in the time smooth	1/4	4	1	4	1	4	3	4	3	4			2	4	1	4	1	4
Dispersion	1.12	0.77	1.04	1.03	0.98	0.98	0.22	0.21	0.02	0.02			1.01	1.01	1.01	0.96	1.02	0.91
Percentage of deviance explained	7.3	20.0	3.4	5.8	3.2	5.1	9.2	9.2	34.2	48.9			6.1	8.0	5.9	10.0	4.2	9.9
First - order PACF	-0.005	0.017	0.018	0.009	0.023	0.011	0.647	0.761	1.499	1.497			-0.020	-0.030	-0.020	-0.011	0.024	0.007
Sum of first 20 PACFs	-0.048	0.465	0.001	-0.136	0.071	-0.174	0.209	0.344	0.553	0.548			0.043	-0.160	-0.110	0.070	-0.140	-0.050

Main models are the base models fitted from the main analysis for each city; the Common Aproach is the base model fitted from the Common Protocol but restricted to a fixed set of procedures and degrees of freedom

Table 19. Summary of model fits and comparison of main model, chronic obstructive pulmonary disease, all ages.

	Brazil						Chile						Mexico					
	Porto Alegre		Rio de Janeiro		Sao Paulo		Santiago		Concepción		Temuco		Mexico City		Monterrey		Toluca	
Model Characteristics	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach
Degree of freedom (per year) in the time smooth	10/4	4	4	4	4	4	5	4	8	4	4	4	7	4	2	4	2	4
Dispersion	1.05	1.04	1.00	1.00	1.03	1.03	1.11	1.12	0.57	0.58	0.51	0.51	1.05	1.10	1.03	1.07	1.04	1.03
Percentage of deviance explained	9.2	9.9	6.3	6.3	11.6	11.6	22.0	21.8	21.0	21.8	20.7	20.7	41.0	37.6	12.2	9.6	5.5	6.6
First - order PACF	0.006	-0.004	0.002	0.002	0.018	0.018	0.621	0.611	0.885	0.782	0.671	0.671	0.008	0.060	0.061	0.090	-0.015	-0.022
Sum of first 20 PACFs	-0.176	-0.406	-0.109	-0.109	-0.018	-0.018	0.007	0.151	-0.147	0.059	-0.037	-0.037	0.057	0.520	0.060	0.410	0.020	-0.210

Main models are the base models fitted from the main analysis for each city; the Common Aproach is the base model fitted from the Common Protocol but restricted to a fixed set of procedures and degrees of freedom

Table 20. Summary of model fits and comparison of main model, chronic obstructive pulmonary disease, ≥65 years old.

	Brazil						Chile						Mexico					
	Porto Alegre		Rio de Janeiro		Sao Paulo		Santiago		Concepción		Temuco		Mexico City		Monterrey		Toluca	
Model Characteristics	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach	Main Model	Comon Approach
Degree of freedom (per year) in the time smooth	10/4	4	4	4	4	4	6	4	5	4	4	4	6	4	4	4	2	4
Dispersion	1.05	1.04	1.00	1.00	0.99	0.99	1.15	1.16	0.54	0.55	0.48	0.48	1.07	1.11	1.05	1.05	1.03	1.02
Percentage of deviance explained	8.4	9.2	5.2	5.2	10.5	10.5	20.0	19.2	21.0	18.4	18.1	18.1	37.5	34.8	11.6	11.6	5.1	6.4
First - order PACF	-0.009	-0.018	0.011	0.011	0.012	0.012	0.631	0.574	0.784	0.768	0.678	0.678	0.018	0.060	0.060	0.060	-0.010	-0.020
Sum of first 20 PACFs	-0.077	-0.267	-0.138	-0.138	-0.059	-0.059	-0.129	0.089	-0.053	0.037	-0.049	-0.049	0.160	0.550	0.110	0.110	-0.037	-0.222

Main models are the base models fitted from the main analysis for each city; the Common Aproach is the base model fitted from the Common Protocol but restricted to a fixed set of procedures and degrees of freedom

1.8 **Effect of the exposure by season**

Table 21. Effect of PM_{10} exposure (a), all causes, all ages.

	Brazil			Chile			Mexico		
	Porto Alegre	Rio de Janeiro	Sao Paulo	Santiago	Concepción	Temuco	Mexico City	Monterrey	Toluca
Main Analysis (DLM 0 - 3 days)	0.8774	0.7393	0.7863	0.4799	-0.0491	0.3237	1.0190	1.0134	1.2559
Exclusion of PM10 concentration if									
> 95th percentile	0.9775	0.8523	1.0117	0.1234	-0.5154	0.5179	1.1527	1.0308	1.3241
>75th percentile	-1.4046	1.1810	1.1679	0.0336	1.7668	7.2936	1.1125	1.2418	1.1617
> 160 μg/m^3	0.9660	0.7535	0.8370	0.0902	0.1144	0.8578	1.2545	1.1753	0.7648
Weather Control									
Addition of temperature at lag 1 - 2 days (average)with lag0 day	0.9207	0.9737	0.9553	0.1398	-0.0627	0.4313	1.0510	1.0947	1.2355
Addition of temperature at lag 3- 7 days (average) with lag0 day	0.7808	1.3307	0.5338	0.0388	1.1158	0.5244	1.2210	0.6850	1.2651
Control of Seasonality									
Natural spline	0.8774	0.7393	0.7863	0.4799	-0.0491	0.3237	1.0190	1.0134	1.0134
Penalized Spline	1.2438	0.6465	0.7737	0.0953	0.0143	0.5312	0.9950	1.0920	1.5418
Common Approach (b)	0.9077	0.7291	0.8997	0.0869	-0.0345	0.5458	0.5560	0.7873	1.2559

a Data are presented as excess risk of mortality in % (95%) per 10 μg/m^3 increase in average concentration of DLM 0–3.

b Use of natural spline with degrees of freedom of time trend per year, daily mean average of temperature and relative humidity fixed at dof = 4 respectively

Table 22. Effect of PM_{10} exposure, cardiovascular (a), ≥65 years old.

	Brazil			Chile			Mexico		
	Porto Alegre	Rio de Janeiro	Sao Paulo	Santiago	Concepción	Temuco	Mexico City	Monterrey	Toluca
Main Analysis (DLM 0 - 3 days)	2.9686	0.9509	0.8074	0.9981	-0.8290	0.3792	0.6295	0.7405	1.5533
Exclusion of PM10 concentration if									
> 95th percentile	3.0883	1.3525	1.0953	0.3242	-3.0163	3.6878	0.9361	0.6893	1.5190
>75th percentile	0.9815	2.2995	0.8288	0.1933	-4.0582	12.6618	0.7685	1.1214	0.6812
> 160 µg/m^3	2.9298	1.0279	0.8628	0.2339	-2.0100	4.0419	0.8423	0.8835	0.2766
Weather Control									
Addition of temperature at lag 1 - 2 days (average)with lag0 day	2.9784	1.1655	0.9193	0.2512	0.2884	0.3394	0.6649	0.8148	1.5402
Addition of temperature at lag 3- 7 days (average) with lag0 day	2.6891	1.3049	0.0948	0.0719	1.6546	-1.0391	0.9254	0.6458	1.5149
Control of Seasonality									
Natural spline	2.9686	0.9509	0.8074	0.9981	-0.8290	0.3792	0.6295	0.7405	1.5533
Penalized Spline	2.3908	1.3083	0.7433	0.1997	0.3520	0.5759	0.9338	1.3838	1.3495
Common Approach (c)	2.1954	0.9054	1.0359	0.1679	0.3298	0.6192	0.4582	0.7405	1.5931

a Data are presented as excess risk of mortality in % (95%) per 10 µg/m^3 increase in average concentration of DLM 0–3.

b Use of natural spline with degrees of freedom of time trend per year, daily mean average of temperature and relative humidity fixed at dof = 4 respectively

Table 23. Effect of PM_{10} exposure, cardiopulmonar causes (a), all ages.

	Brazil			Chile			Mexico		
	Porto Alegre	Rio de Janeiro	Sao Paulo	Santiago	Concepción	Temuco	Mexico City	Monterrey	Toluca
Main Analysis (DLM 0 - 3 days)	1.2928	0.9918	0.9340	0.8529	0.0942	1.3188	0.9489	1.0506	1.1683
Exclusion of PM10 concentration if									
> 95th percentile	1.0175	1.1767	1.2895	0.0365	-1.6530	2.4394	1.2849	0.9835	1.3094
>75th percentile	-1.2177	1.0609	1.3392	-0.2982	0.1741	2.5892	1.0081	1.2092	1.2866
> 160 µg/m^3	1.0246	1.0373	1.0178	0.0501	-0.8404	2.7760	1.1742	1.1714	0.8761
Weather Control									
Addition of temperature at lag 1 - 2 days (average)with lag0 day	1.2735	1.2663	1.0551	0.1390	0.2376	0.8450	0.9816	1.1274	1.1555
Addition of temperature at lag 3- 7 days (average) with lag0 day	1.1615	1.4116	0.3947	-0.0119	2.0151	-0.6429	1.1629	0.7133	1.1863
Control of Seasonality									
Natural spline	1.2928	0.9918	0.9340	0.8529	0.0942	1.3188	0.9489	1.0506	1.1683
Penalized Spline	2.0052	0.7881	0.9270	0.0443	0.3425	1.0183	0.9298	1.1308	1.4375
Common Approach (c)	1.3221	0.8011	1.0618	0.0692	0.2338	0.9764	0.4973	0.8081	1.1683

a Data are presented as excess risk of mortality in % (95%) per 10 µg/m^3 increase in average concentration of DLM 0–3.

b Use of natural spline with degrees of freedom of time trend per year, daily mean average of temperature and relative humidity fixed at dof = 4 respectively

Table 24. Effect of PM_{10} exposure, respiratory (a), 1-4 years old.

	Brazil			Chile			Mexico		
	Porto Alegre	Rio de Janeiro	Sao Paulo	Santiago	Concepción	Temuco	Mexico City	Monterrey	Toluca
Main Analysis (DLM 0 - 3 days)	33.7591	21.3665	-3.0337	2.704662	0.32767797	0.67609	-0.2389	11.7691	-3.8942
Exclusion of PM10 concentration if									
> 95th percentile	12.1736	22.7904	-0.2152	5.631449	-3.01633168	3.68777	3.8729	19.0410	-9.9751
>75th percentile	-47.1068	42.1284	-1.1229	7.591042	-4.05823324	12.6618	12.5301	8.3898	-3.8619
> 160 µg/m^3	28.6695	22.2641	-2.9743	3.282731	-2.00999161	4.04194	1.4276	17.8169	-1.4677
Weather Control									
Addition of temperature at lag 1 - 2 days (average)with lag0 day	37.9469	21.3665	-3.0938	2.819718	0.28839449	0.33942	-0.4878	11.0090	-4.1585
Addition of temperature at lag 3- 7 days (average) with lag0 day	26.4421	21.2261	-1.8980	2.426736	1.65459321	-1.0391	-0.5960	12.6398	-4.3963
Control of Seasonality									
Natural spline	33.7591	21.3665	-3.0337	2.704662	0.32767797	0.67609	-0.2389	11.7691	-3.8942
Penalized Spline	29.3761	21.2492	3.9697	2.653445	0.35203055	0.57593	-0.2778	12.6745	-3.2834
Common Approach (c)	-10.9521	24.1770	-4.4752	0.994853	0.32983916	0.6192	-1.9857	16.7073	-4.4722

a Data are presented as excess risk of mortality in % (95%) per 10 µg/m^3 increase in average concentration of DLM 0–3.

b Use of natural spline with degrees of freedom of time trend per year, daily mean average of temperature and relative humidity fixed at dof = 4 respectively

Table 25. Effect of O_3 exposure (a) during warm season (b), all causes, all ages.

	Brazil (d)		Chile (d)	Mexico		
	Rio de Janeiro	Sao Paulo	Santiago	Mexico City	Monterrey	Toluca
Main Analysis (DLM 0 - 3 days)	0.3073	0.6355	-0.1113	0.1624	1.0321	0.3432
Exclusion of O_3 concentration if						
> 95th percentile	0.2107	0.8490	-0.6476	0.2392	1.1361	0.4760
>75th percentile	-0.1963	1.0182	-0.8580	0.2821	1.7860	0.3491
> 100 μg/m^3	0.6018	1.0557	-0.7730	0.1786	1.0965	0.0889
Weather Control						
Addition of temperature at lag 1 - 2 days (average)with lag0 day	0.2822	0.6130	-0.8230	0.1644	1.0849	0.3004
Addition of temperature at lag 3- 7 days (average) with lag0 day	0.2937	0.4475	-0.4704	0.1357	1.3541	0.1964
Control of Seasonality						
Natural spline	0.3073	0.6355	-0.1113	0.1624	1.0321	0.3432
Penalized Spline	0.2576	0.6886	-0.6365	0.1847	1.2118	-0.0554
Common Approach (c)	0.1194	0.6398	-0.5292	0.1537	1.0465	0.4195

a Data are presented as excess risk of mortality in % (95%) per 10 μg/m^3 increase in average concentration of DLM 0–3.

b "Warm season" defined as extending approximately from May to September in Mexico and from October to March in Brazil and Chile, with adjustment for time trends using indicators variables for each year in the core model

c Use of natural spline with degrees of freedom of time trend per year, daily minimum of temperature and relative humidity fixed at dof = 4 respectively

d. For Brazil ozone data available from 1997 to 2005 to Rio Janeiro and Sao Paulo only. For Chile, ozone data available from 1997 to 2005 to Santiago

Table 26. Effect of O_3 exposure (a) during warm season (b), cardiovascular, ≥65 years old.

	Brazil (d)		Chile (d)	Mexico		
	Rio de Janeiro	**Sao Paulo**	**Santiago**	**Mexico City**	**Monterrey**	**Toluca**
Main Analysis (DLM 0 - 3 days)	0.5632	0.4140	0.1389	0.1193	1.9091	0.4272
Exclusion of O_3 concentration if						
> 95th percentile	0.2573	0.2356	-0.3415	0.1182	1.8752	0.0726
>75th percentile	-1.0049	-0.0679	-0.5042	0.0662	2.5348	0.8371
> 100 µg/m^3	0.2118	0.2937	-0.4938	-0.0423	2.1442	0.1699
Weather Control						
Addition of temperature at lag 1 - 2 days (average)with lag0 day	0.5220	0.4199	-0.6844	0.1189	1.9729	0.4073
Addition of temperature at lag 3- 7 days (average) with lag0 day	0.5481	0.3468	-0.5384	0.1351	2.1963	0.0485
Control of Seasonality						
Natural spline	0.5632	0.4140	0.1389	0.1193	1.9091	0.4272
Penalized Spline	0.2566	0.4963	-0.4585	0.0706	1.7795	0.3965
Common Approach (c)	0.5587	0.4002	-0.4585	0.1256	1.3906	0.3444

a Data are presented as excess risk of mortality in % (95%) per 10 µg/m^3 increase in average concentration of DLM 0–3.

b "Warm season" defined as extending approximately from May to September in Mexico and from October to March in Brazil and Chile, with adjustment for time trends using indicators variables for each year in the core model

c Use of natural spline with degrees of freedom of time trend per year, daily minimum of temperature and relative humidity fixed at dof = 4 respectively

d. For Brazil ozone data available from 1997 to 2005 to Rio Janeiro and Sao Paulo only. For Chile, ozone data available from 1997 to 2005 to Santiago

Table 27. Effect of O_3 exposure (a) during warm season (b), cardiopulmonary causes, all ages.

	Brazil (d)		Chile (d)	Mexico		
	Rio de Janeiro	Sao Paulo	Santiago	Mexico City	Monterrey	Toluca
Main Analysis (DLM 0 - 3 days)	0.4360	0.6663	0.1640	0.1515	1.0426	0.3708
Exclusion of O_3 concentration if						
> 95th percentile	0.1519	0.4051	-0.8989	0.2401	1.1333	0.3959
>75th percentile	-1.3976	0.5555	-1.2825	0.2969	1.5981	0.5405
> 100 µg/m^3	0.3005	0.6983	-1.2529	0.2252	1.0997	0.4363
Weather Control						
Addition of temperature at lag 1 - 2 days (average)with lag0 day	0.4309	0.6046	-1.3226	0.1464	1.0991	0.3328
Addition of temperature at lag 3- 7 days (average) with lag0 day	0.4857	0.5893	-0.8865	0.0989	1.3716	0.1807
Control of Seasonality						
Natural spline	0.4360	0.6663	0.1640	0.1515	1.0426	0.3708
Penalized Spline	0.1608	0.6471	-1.0671	0.1057	1.5130	0.3886
Common Approach (c)	0.3589	0.6661	-0.8785	0.1922	1.0426	0.4409

a Data are presented as excess risk of mortality in % (95%) per 10 µg/m^3 increase in average concentration of DLM 0–3.

b "Warm season" defined as extending approximately from May to September in Mexico and from October to March in Brazil and Chile, with adjustment for time trends using indicators variables for each year in the core model

c Use of natural spline with degrees of freedom of time trend per year, daily minimum of temperature and relative humidity fixed at dof = 4 respectively

d. For Brazil ozone data available from 1997 to 2005 to Rio Janeiro and Sao Paulo only. For Chile, ozone data available from 1997 to 2005 to Santiago

Table 28. Effect of O_3 exposure (a) during warm season (b), respiratory, 1-4 years old.

	Brazil (d)		Chile (d)	Mexico		
	Rio de Janeiro	**Sao Paulo**	**Santiago**	**Mexico City**	**Monterrey**	**Toluca**
Main Analysis (DLM 0 - 3 days)	-2.3475	2.6938	-1.5021	3.4611	-7.2024	1.9448
Exclusion of O_3 concentration if						
> 95th percentile	-5.2709	4.9403	2.5862	6.8788	13.3963	1.2018
>75th percentile	-18.0540	11.5836	2.6166	8.7894	13.7581	1.8564
> 100 µg/m^3	-4.3825	3.7946	2.9228	6.6401	13.4984	1.6597
Weather Control						
Addition of temperature at lag 1 - 2 days (average)with lag0 day	-3.7945	2.7187	1.6345	3.2498	-8.0412	1.7731
Addition of temperature at lag 3- 7 days (average) with lag0 day	-3.0449	4.1418	1.9277	2.5514	-7.6021	2.9381
Control of Seasonality						
Natural spline	-2.3475	2.6938	-1.5021	3.4611	-7.2024	1.9448
Penalized Spline	-1.8434	4.1852	2.1226	3.2885	-4.0024	3.5654
Common Approach (c)	-0.8534	2.8020	-0.4585	3.3858	-7.8192	-1.5761

a Data are presented as excess risk of mortality in % (95%) per 10 µg/m^3 increase in average concentration of DLM 0–3.

b "Warm season" defined as extending approximately from May to September in Mexico and from October to March in Brazil and Chile, with adjustment for time trends using indicators variables for each year in the core model

c Use of natural spline with degrees of freedom of time trend per year, daily minimum of temperature and relative humidity fixed at dof = 4 respectively

d. For Brazil ozone data available from 1997 to 2005 to Rio Janeiro and Sao Paulo only. For Chile, ozone data available from 1997 to 2005 to Santiago