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Air pollution and daily mortality in The Netherlands over the period 1992 - 2002

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Rapport in het kort

Luchtverontreiniging en dagelijkse sterfte in Nederland in de periode 1992 - 2002

Dit technisch achtergrondrapport vergelijkt de risico's om te overlijden aan luchtverontreiniging in drie tijdperioden (1992-1994, 1995-1998 en 1999-2002) in Nederland. Hierbij is bekeken of het risico om te overlijden aan luchtverontreiniging in de laatste periode is veranderd ten opzichte van eerdere jaren. Er blijkt geen duidelijk patroon te zien in de tijd, hoewel de periodes onderling wel verschillen. Tijdens de zomermaanden blijkt het risico groter dan in de wintermaanden. Wonen in een van de vier grote steden was niet gerelateerd aan een hoger risico om te overlijden aan luchtverontreiniging dan het risico in de rest van Nederland. Op basis van deze risico's is geschat dat er in 2003 in Nederland 3.400 – 5.700 mensen vroegtijdig zijn overleden aan luchtverontreiniging. Deze gegevens zijn eerder dit jaar in de Milieubalans 2005 van het Milieu- en Natuurplanbureau gepubliceerd.

Om de risico's te berekenen zijn meetgegevens van het Landelijk Meetnet Luchtkwaliteit gekoppeld aan gegevens van de dagelijkse sterfte van het Centraal Bureau voor de Statistiek in de periode 1992 tot en met 2002. De totale dagelijkse sterfte is onderzocht. Dit zijn alle sterfgevallen, behalve die door niet-natuurlijke oorzaken. Naast de totale sterfte is de sterfte als gevolg van hart- en vaatziekten en longziekten apart beschreven.

Trefwoorden: Luchtverontreiniging, dagelijkse sterfte, Nederland, seizoenverschillen, stad

Abstract

Air pollution and daily mortality in the Netherlands over the period 1992 - 2002

This technical report describes the mortality risks for ambient air pollution during three time periods (1992-1994, 1995-1998 and 1999-2002) in the Netherlands. Changes in mortality risks in the last period compared to the earlier periods were assessed. No clear pattern was identified, although differences between the periods were found. During the summer months higher risks were found compared to the winter months. Living in the four largest cities was not related to higher risks for air pollution related mortality compared to living in the rest of the Netherlands. Based on these risks it was estimated that in 2003 in the Netherlands 3,400 – 5,700 people have died prematurely due to air pollution. These figures have been published earlier this year in the Environmental Balance of the Netherlands Environmental Assessment Agency. To assess the risks of dying from air pollution, measurements of the National Air Quality Monitoring Network were related to daily mortality data of the Dutch Central Bureau of Statistics over the period 1992 to 2002. Total daily mortality was investigated, which is all mortality except mortality due to non-natural causes. In addition to total mortality, mortality related to cardiovascular and lung diseases was analyzed.

Keywords: Air pollution, daily mortality, Netherlands, season differences, city

Contents

Summary

In this report we describe the methods and results of a time series analysis of mortality in relation to air pollution levels in the Netherlands. The report builds on earlier analyses on this subject, which have been described in the report 'Daily mortality and air pollution in the Netherlands, 1986-1994' (Hoek et al., 1997).

The aims of the present study were:

1. To quantify the associations, expressed as relative risk estimates, between daily excess mortality and ambient concentration of particulate and gaseous components: fine particulate matter (PM10), black smoke (BS), ammonium (NH_4^+), sulphate (SO_4^{2-}), nitrate (NO_3^-), and inorganic aerosol, defined as the sum of NH_4^+, SO_4^{2-}, NO_3^-, and chloride (Cl^-), carbon monoxide (CO), ammonia (NH_3), nitric oxide (NO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), and ozone (O_3) for the Dutch population, based on data from 1992-2002;
2. To quantify these associations for specific causes of death, including total respiratory diseases, chronic obstructive pulmonary diseases, pneumonia, and cardio-vascular diseases;
3. To quantify these associations for the four largest cities and for the Netherlands excluding the four largest cities;
4. To quantify these associations for the summer and winter seasons separately;
5. To evaluate the results of the different time periods 1992-1994, 1995-1998, and 1999-2002.

This study shows that all air pollutants are statistically significantly associated with total mortality and with cause-specific mortalities. These finding are consistent with the results of our earlier study. The weekly averaged lag is most strongly associated with mortality, except for O_3, NO, and NH_3 which generally show the strongest associations at a lag of 1 day. The results from the two-pollutant models indicate that the relative risk estimates for the main air pollutants PM10, BS, NO_2, and O_3 are not confounded by other pollutants, except in the model with PM10 and BS as co-pollutants.

In the four largest cities as well as in the rest of the Netherlands relative risk estimates larger than 1 were found. However, there was a tendency to more statistically significant estimates in the rest of the Netherlands.

In general, in both seasons statistically significant associations were found between mortality and air pollution except for O_3 and NH_3 for which no or just weak associations were found in the winter period. The estimated relative risks in the summer period were larger than in the winter period.

Results over time fluctuate between the different periods we investigated. The intermediate period 1995-1998 shows in general the largest estimates for total mortality, although for some pollutants the largest estimates were observed in the first or third period. Also, a large variation in time in the associations for the cause-specific mortalities was found. Our results show that the estimates vary over time without a clear trend. Also, no obvious patterns in these variations are observed. Because health impact assessments make use of relative risk estimates, it is obvious that variations in relative risks in time will have consequences on the estimated health effects, in this case the number of premature deaths, associated with air pollution. Knowledge of the factors that cause the observed fluctuations in more detail may reduce the variability over time and may increase the accuracy and robustness of the risk estimates. Therefore, we recommend additional research targeted to these variations in time.

1. Introduction

In this report we describe the methods and results of a time series analysis of mortality in relation to air pollution levels in the Netherlands. The report builds on previous analyses on this subject, which have been described in the report ‘Daily mortality and air pollution in the Netherlands, 1986-1994’ (Hoek et al., 1997). In the previous time series analyses, data on air pollution and mortality were analysed for the period 1986 up to 1994, except for the particulate air pollution parameter PM10 (particulate matter with a 50% cut off aerodynamic diameter of 10 μm), for which only data for the three years period 1992 – 1994 were available because routine measurements of PM10 began in the Netherlands in 1992.
The main conclusions of the first time series analyses were:

1. Short-term fluctuations of daily mortality in the Netherlands were associated with short term fluctuations in concentrations of all particulate and gaseous pollutants. These associations probably reflect a causal effect.
2. The most consistent associations were found with all-cause mortality and mortality from cardiovascular diseases, chronic obstructive pulmonary diseases (COPD) and pneumonia.
3. The relative risks for all pollutants were larger in the summer months than in the winter months.
4. In the summer months mortality was more consistently related to ozone (O_3) and particulate matter - especially black smoke (BS) - than to sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and carbon monoxide (CO). In analyses of the full year and the winter season the consistency of the associations for particles (BS and PM10) were comparable with those for the gaseous pollutants (NO_2, SO_2 and CO).
5. The relative risk of 1.02 for a 100 $\mu g/m^3$ change in PM10 concentration was lower than reported in previous studies in the USA, but similar to recent Western European studies.
6. Concentration response relationships did not show a threshold for any of the pollutants below which no effect on mortality was found.
7. There were no consistent differences in relative risks of air pollution between the four largest cities and less urban areas of the Netherlands.

In the scientific literature on the health effects of air pollution, extensive attention is being paid to the role of PM10 and other parameters of particulate matter air pollution (Samet, 2002). There is also special interest in particulate air pollution because of important regulatory decisions which have to be made, especially in the European Union (Buringh and Opperhuizen, 2002). In our first analysis PM10 results were based on 3 years of measurement data (1992-1994), being the only PM10 data available at that time. In a second, intermediate analysis (results not published) this series was extended with four additional years of data (1995-1998), and for the present analysis the data base was extended with another period of four years (1999-2002). It was decided to re-run the former analyses on the complete data base (1992-2002) to get more stable and more precise effect estimates and to be able to evaluate any temporal fluctuations over the different periods (1992-1994, 1995-1998, 1999-

2002). Associations for other particulate air pollution parameters (BS, inorganic aerosol) and for the gaseous components were also analysed for the various periods.

The aims of the present study were:
1. To quantify the association between daily excess mortality and ambient concentration of particulate matter parameters PM10, BS, ammonium (NH_4^+), sulphate (SO_4^{2-}), nitrate (NO_3^-), and inorganic aerosol (defined as the sum of NH_4^+, SO_4^{2-}, NO_3^-, and chloride (Cl^-) and of the gaseous compounds CO, NH_3, NO, NO_2, SO_2, and O_3 for the Dutch population, based on data from 1992-2002;
2. To quantify these associations for specific causes of death, including total respiratory diseases, chronic obstructive pulmonary diseases, pneumonia and cardio-vascular diseases (cause-specific mortality data);
3. To quantify these associations for the four largest cities and for the Netherlands excluding the four largest cities;
4. To quantify these associations for the summer and winter seasons separately;
5. To evaluate the results of the different time periods 1992-1994, 1995-1998 and 1999-2002.

In chapter 2 of this report we describe the methods for data collection and data analyses. In chapter 3 the results are described and discussed, respectively. The conclusion are summarised and discussed in chapter 4.

2. Methods

2.1 Data collection

2.1.1 Mortality data

Daily mortality data were obtained from the Central Bureau of Statistics (CBS) for the years 1992 – 2002. Dutch citizens who died outside the Netherlands and non-residents who died within the Netherlands were excluded, as well as those for whom the exact date of death was unknown. Also, individuals who died from accidents (ICD-10 code higher than R99) were excluded.
The following data were obtained:
1. Daily total mortality (ICD-10 A00-R99);
2. Daily respiratory mortality for the following primary causes of death
   - total respiratory diseases (ICD-10 J00-J99);
   - pneumonia (ICD-10 J12-J18);
   - chronic obstructive lung diseases, COPD (ICD-10 J40-J47, J67);
3. Daily cardio-vascular mortality for the following primary causes of death:
   - cardio-vascular diseases (ICD-10 I00-I79).

Mortality data were also obtained for the four largest cities (Amsterdam, Rotterdam, The Hague, and Utrecht).

2.1.2 Air quality data

Air quality data were obtained from our institute, which operates the ambient air quality monitoring network of the Netherlands (van Elzakker, 2001). This network comprises of 55 monitoring sites in both rural and urban areas. For the present study, monitoring sites with PM10 and/or BS measurements were selected. Six more sites were selected to provide for additional data on gaseous and particulate pollutants which are sparsely measured in the network, such as CO, NH_3 and inorganic aerosol. Table 1 shows some characteristics of the selected monitoring sites and of the pollutants measured at these sites.
Measurements of daily average PM10 concentrations started in 1992 at eight sites and were extended in 1993 with six additional sites. For the entire period included in this study, 24-hour average concentrations (midnight to midnight) were used, except for ozone, for which the 8-hour average concentrations (12.00 till 20.00 hours) were used.
Before calculating the mean concentrations of air pollution, the data were checked for possible missing values. For each missing average concentration of pollutant i at site x on day d an estimate of the average concentration $estC_{i,x,d}$ was calculated based on the data at the other sites according to:

$$estC_{i,x,d} = \left(avgC_{i,x} \middle/ avgC_i \right) \times avgC_{i,d}$$

where $avgC_{i,x}$ and $avgC_i$ equal the overall average concentration at site x and at all sites, respectively, and $avgC_{i,d}$ equals the average concentration of all available sites on day d.

Provided that from at least 75% of all sites a valid 24-hour average concentration was available, this estimated concentration was imputed into the air pollution data base.

2.1.2.1 Inorganic aerosol

From the monitoring network 24-hour average concentrations of inorganic salts were obtained. In the present analysis total inorganic aerosol equals the sum of the concentrations of NH_4^+, NO_3^-, SO_4^{2-}, and Cl^-. These data were only available for the rural monitoring sites.

2.1.3 Temperature, relative humidity and air pressure

Data on one hour mean temperature T (^oC), relative humidity rH (%), and atmospheric pressure P (hPa) were obtained from five weather stations of the national network of the Royal Dutch Meteorological Institute. Two stations were situated in the western and central region (Schiphol and De Bilt), the others in the north (Eelde), east (Twente), and south (Volkel). Daily averages of the 3 parameters were calculated as the mean of the 5 weather stations.

2.1.4 Influenza

Data on the weekly incidence of influenza-type illnesses in the Netherlands were obtained from the Dutch Institute for Research of Health Care in Utrecht and from the Centre for Infectious-diseases Epidemiology of RIVM.

2.1.5 Pollen

Data on airborne pollen counts have been obtained through dr Spieksma (Hospital Leiden) from the sites Helmond and Leiden. Data collection procedures have been described elsewhere (Spieksma et al., 1985). Most of the pollen that are counted do not have allergic potential. As potential important allergens for further analyses we selected *Betula, Poaceae,* and *Rumex*. Because of its abundance and the number of people allergic to it, *Poaceae* are the most important allergenic pollen.
Pollen are not counted throughout the entire year because of its very strong seasonal pattern. As the pollen counts are generally zero or extremely low outside the 'pollen season', these missing data have been set to zero (Hoek and Brunekreef, 1999).

2.2 Data analysis methodology

2.2.1 Overview of the overall study

The relationship between daily mortality and air pollution was investigated for five mortality variables: total non-external (ICD-10 < R100), total cardio-vascular (ICD-10 I00-I79), total respiratory (ICD-10 J00-J99), COPD (ICD-10 J40-J47, J67) and pneumonia (ICD-10 J12-J18) mortality. Pollutants evaluated were the particulate pollution parameters PM10, BS, NH_4^+, NO_3^-, SO_4^{2-}, and inorganic aerosol and the gaseous pollutants CO, NH_3, NO, NO_2, SO_2, and O_3. For all pollutants five lags have been evaluated (lags 0, 1, 2, 3 and the average of lags 0-6). Air pollution variables have been entered as continuous variables. Data for the total period 1992-

2002 and for different periods (1992-1994, 1995-1998, and 1999-2002) were analysed to assess variability over time for the different effect estimates. All pollution - mortality associations were adjusted for long term and seasonal trend, influenza incidence, temperature, relative humidity, barometric pressure, pollen, and indicators for day of the week and holidays.

2.2.2 Phases of analysis

The present analysis was an extension of the time-series from the earlier analysis of the 1992 – 1998 data, where we used Poisson GAM modeling, implemented in S-plus, as described by Hoek et al. (1997). Because relationships between confounders (e.g. temperature) and mortality are not necessarily linear, extensive use has been made of non-parametric smoothing functions (generalized additive models), allowing the specification of non-linear functions. Specifically, we applied locally weighted regression (LOESS). The latter technique can be considered as a more advanced version of using moving averages to adjust for longer term time trends. More background on the use of smooth, non-parametric functions can be found in the literature (Hastie and Tibshirani, 1986; Hastie and Tibshirani, 1987; Hastie and Tibshirani, 1990; Schwartz, 1993; Schwartz et al., 1996). This method has become the standard method of analysing daily mortality and hospital admission time-series, for example in the two major international studies APHEA-2 (Katsouyanni et al., 2001) and NMMAPS (Samet et al., 2000). We used the built-in GAM function of S-plus.

We used the same starting set of confounders as Hoek et al. (1997), adding barometric pressure, to build confounder models. As expected, the confounder models we arrived at, differed somewhat (but not relevantly) from those of Hoek. The confounder model parameters are presented in Appendix 1. We applied the same confounder models developed for the analysis of our earlier shorter time-series (1992-1998) to the present analysis of the extended data series (1992-2002), based on the fact that there was no reason to assume a major change in confounding factors over the extended period (cf. tables 3-6). See Appendix 2 for the S-plus code of the programs we used for the analysis of the total period for the Netherlands.
We made two technical adjustments in the present analysis: Firstly, the S-plus criteria for convergence and number of iterations were set to stricter values, complying with recent scientific discussions about these criteria (Health Effects Institute, 2003). As reported in Dominici et al. (2002) problems may arise with the default settings of the convergence parameters. We therefore used the new control parameters communicated by Hastie (2002). The convergence threshold for local scoring iterations and for back fitting iterations was set to 10^{-7}, the maximum number of scoring iterations and of back fitting iterations is set to 30 (in both inner and outer loop). These adjustments, however, have only a small effect on the outcomes. Secondly, the overdispersion correction, that used to be carried out afterwards on the results from the GAM-module, is now carried out by the GAM-module itself through the following specification of a different family for the link function: "family=quasi(link=log, variance='mu')". This adjustment has no effect on the outcomes.

Confounder models were developed for each of the five causes of death. Effect estimates and standard errors, were obtained by adding the air pollution concentration variables to each of the five confounder models. For presentation of the effects, regression coefficients (and standard errors) were transformed into relative risks (and 95% confidence intervals, CI) associated with concentrations changes guided by the difference between the 1st and 99th percentile of the concentration distribution in the Netherlands. Table 2 shows these selected ranges.

3. Results

3.1 Data description

Tables 3-6 show the distribution of mortality, influenza counts, pollen and meteorological conditions for the present study period (1992-2002), the earlier study period (1992-1998), the newly added period (1999-2002), and for different regions and both seasons. Table 3 also shows the mortality data by region. No regional differentiations were made for influenza, pollen, and meteorological parameters in the analyses.
On average, approximately 362 persons died daily during the overall study period (table 3); more than one third (38%) of the deaths are from cardio-vascular causes. During the winter period the numbers of death are about 12% higher than in the summer period. Depending on the cause of death, numbers for the four largest cities become very small which may have implications for the statistical power of the analyses.
Influenza incidence (table 4) was much higher during the winter period (daily mean: 8.0 per 10,000) than in the summer period (daily mean: 1.1 per 10,000). Pollen counts (table 5), in particular *Poaceae*, were much higher in the summer season; *Betula* counts were especially high in April, which explains the differences between ‘Overall’ counts and the ‘Summer periods’ counts.
Tables 7a and 7b show the distribution of the air pollutants for the whole study period, overall, by region, and by season. All air pollutants except O_3 showed higher concentrations in the four largest cities, and all air pollutants except O_3 and NH_3 show higher levels in the winter periods.
The correlations between the pollutants, influenza incidence, pollen counts, and meteorological conditions, are presented in table 8. All pollutants except O_3 were positively correlated with each other. Highest correlations were found between BS, CO, NO, and NO_2 and between nitrate, sulfate, and ammonium. In general, the correlations between air pollutants were higher for the Netherlands excluding the four largest cities than for the four largest cities.
Table 9 shows the yearly average air pollutants concentrations in the study period, indicating clear downward trends, except for O_3, which remained remarkably constant throughout the years. The reductions in pollutant concentration range from 25-30% for PM10, BS, CO, and NO_2, and are even higher (up to 80%) for NH_3, NO, SO_2, and inorganic aerosol.
All air pollutants showed higher levels in the four largest cities than in the rest of the Netherlands, except for O_3, which shows somewhat lower concentrations in the cities (table 8). The largest differences were found for the components NO, NO_2 and SO_2. Ammonia and inorganic compounds were not measured in the four large cities.

3.2 Model identification

To adjust for the seasonal patterns in mortality, loess-smoothers of the data were used. Based upon the AIC-criterion, the partial autocorrelation function of the residuals, and the time-plot of the predicted values, ‘spans’ of about 75 to 100 days were selected.
To adjust for influenza, combinations of linear terms and loess-smoothers of the previous week average with either the average of the week before the previous or two weeks before the previous were selected based on the AIC-criterion. Spans of 60 to 80% of the data were selected. For cardio-vascular mortality, the previous week average alone was found to be the best predictor.
Based on the AIC-criterion and plots of mortality against temperature, loess-smoothers with lags between 50 and 80% of the data were selected for ambient temperature. Different combinations of four lags (0-3) of the temperature were selected. Linear variables indicating low and high temperatures were not found to be better predictors in our models.
For relative humidity, use of the AIC-criterion led to the selection of three different representations in the model. For COPD and cardio-vascular mortality, a simple linear function was selected, for pneumonia mortality a loess-smoother with a span of 100% of the data, and for total and respiratory mortality a 1-degree (linear) b-spline with 1 knot located at 70%.
A linear term for atmospheric pressure was selected in four models. For pneumonia mortality the AIC-criterion indicated a loess-smoother with a span of 100% of the data as a better predictor.
For each of the three pollen variables included in the models, the AIC-criterion led to selection of mostly lag 2, and sometimes lag 3 values.
Day-of-the-week was added as a factor variable, and finally an indicator variable for holidays completed the confounder models for each mortality cause. Table 10 summarises the final confounder models.

3.3 Associations between mortality and air pollution

3.3.1 Results for the whole period 1992 - 2002

Table 10 shows for the whole study period 1992-2002 the associations between air pollution and daily all causes or cause-specific mortality for the different lags. For the overall period generally positive associations were found between the various air pollutants and all causes and cause-specific daily mortality. All statistically significant RR's were greater than 1.

For *all causes mortality* statistically significant increased RR's were found for all lags of PM10, BS, CO, NO_2, SO_2, inorganic aerosol, nitrate, sulphate, and ammonium. NH_3, NO and O_3 were less consistently associated with total mortality, although statistically significant associations were found, mainly for lag1 and lag0-6. Lag0-6 (weekly average) showed the most strongly associations (based on t-values not shown in table) with mortality, except for O_3 and NH_3, which showed the strongest associations for lag0 or lag1. The results show that a relevant increase in the 24-hour average concentration of 100 $\mu g/m^3$ of PM10 (cf. table 2) is associated (lag1) with an estimated increase in daily mortality of 3.0% (CI: 2.0; 4.0). For lag0-6 and an increase in the 1-week average concentration of 80 $\mu g/m^3$ this estimate equals 4.5% (CI: 3.4; 5.6). An increase in the 8-hour average O_3 concentration of 150 $\mu g/m^3$ is associated with an estimated increase in mortality of 3.4% (CI: 1.9; 4.6). An increase in the 1-week average of 120 $\mu g/m^3$ is associated with an estimated 2.7% (CI: 1.2; 4.2) increase in mortality.

The results for *respiratory mortality* were comparable with all cause mortality, but the relative risks were, as expected, larger than for total mortality. Again, the strongest associations were found for lag0-6, except for NH_3, which showed a somewhat stronger association for lag1, and for inorganic compounds, which show the strongest associations for lag0. Interestingly, O_3 shows the strongest association with lag0-6, which is different from what was found in the analyses of total mortality, where lag1 showed the strongest association. Here, relevant increases in PM10 concentrations are found to be associated with estimated increases in respiratory mortality of 11.2% (CI: 8.0; 14.4) for lag1 and 16.0% (CI: 12.4; 19.8) for lag0-6. For O_3 these respective estimates are 2.1% (CI: -2.8; 7.4%) for lag1 and 24.5% (CI: 18.8; 30.5) for lag0-6.

Cardio-vascular mortality was less consistently associated with air pollution than total and respiratory mortality, however, the RR's for PM10, BS, NO_2 and SO_2 for all lags were statistically significantly increased, the strongest associations for lag0-6. Also, lag0-6 showed the strongest associations for CO and NO, while NH_3, O_3, and inorganic aerosol the strongest association were found for lag1 or lag2. Here, relevant increases in PM10 concentrations are associated with estimated increases in cardio-vascular mortality of 1.8% (CI: 0.3; 3.2) for lag1 and 3.0% (CI: 1.3; 4.6) for lag0-6. For O_3 lag1 the estimate equals 3.1% (CI: 0.8; 5.5%). For O_3 lag0-6 we found no association with cardio-vascular mortality was.

Pneumonia mortality was statistically significantly associated with PM10, BS, CO, NO_2 and SO_2 for all lags, and with the other pollutants for a number of lags. For the components PM10, BS, NO_2, SO_2, and O_3 the strongest associations were found with lag0-6. As was the case with respiratory mortality, O_3 showed the strongest association with the lag0-6, which again is different from what was found for total and cardio-vascular mortality. For pneumonia, relevant increases in PM10 concentrations are associated with estimated increases in mortality of 12.0% (CI: 7.1; 17.1) for lag1 and 17.2% (CI: 11.6; 23.1) for lag0-6. For O_3 lag1 and lag0-6 the estimates equal 5.8% (CI -2.0; 14.2%) and 51.5% (CI 41.0-62.9%), respectively.

For *COPD mortality* the RR's for PM10, inorganic aerosol, nitrate, sulphate, and ammonium were statistically significant increased for all lags, and for BS, CO, NO_2 and SO_2 for several lags. Again, PM10, BS, CO, NO, NO_2, SO_2 showed the strongest associations for lag0-6, but lag2 for O_3. No clear pattern of which lag showed the strongest associations was seen among the inorganic compounds.
For COPD, relevant increases in PM10 concentrations is found to be associated with estimated increases in mortality of 10.0% (CI: 5.8; 14.4) for lag1 and 14.7% (CI: 9.9; 19.8) for lag0-6. For O_3 lag1 and lag0-6 the estimated increased COPD mortality equal 5.7% (CI -0.5; 12.2) and 7.6% (CI: 1.0-14.7), respectively.

In comparison with the earlier study of daily variability in air pollution and daily mortality in the period 1986-1994 (Hoek et al., 1997), we found in general larger relative risks in the present study over the period 1992-2002. In the present study we found a RR for total mortality associated with PM10 of 1.030 for a change of 100 μg/m3 compared to a RR of 1.020 reported by Hoek et al., while our RR based on lag0-6 was 1.045 compared to 1.021 by Hoek et al. The same pattern was seen with BS (1.034 versus 1.021 for lag1, and 1.059 versus 1.028 for lag0-6), and also with SO_2, NO_2, and CO. Results for O_3 were comparable between the two analyses. No other components were analysed in both earlier studies. Qualitatively this pattern was also seen in the comparisons with the other causes of death: on average larger estimates in the present analyses for all components except for O_3.

The overall pattern for the strongest associations with respect to the lags is, that for the components PM10, BS, NO_2, CO, and SO_2 the strongest associations were found for lag0-6. For O_3 the results slightly differed: for all cause mortality, cardio-vascular mortality and COPD mortality, the strongest associations were found with the shorter lags, while for respiratory mortality and pneumonia mortality the shorter lags were stronger associated with mortality.

3.3.2 Results for the different periods

Comparing the relative risks for mortality over the three different time-windows (tables 11a–11e) shows that for all causes of death there is fluctuation in the estimates for the effects of air pollution over time, without showing a trend. For total mortality (table 11a), the intermediate period 1995-1998 showed in general the highest estimates, but depending on the pollutant, highest estimates were also found in the first and second period. PM10, BS, NO_2 are less significantly associated with total mortality in the last period compared to the previous periods. For the cause-specific mortalities (table 11b-11e) the fluctuation over time was larger than for

total mortality and overall there was no preference for a time-period, although for COPD mortality (table 11e) there is a tendency for the largest estimates in the last period. Interestingly, almost the same 'lag structure' was found over time as it was for the total period. Again, also over time the strongest associations for PM10, BS, NO_2 and SO_2 were found lag0-6, while for the other pollutants the RR's were less consistent for the various lags.
One of the aims of the present analyses was to assess trends in relative risks over time, because the results of our second analyses of the data (for the period 1992–1998) suggested that relative risks were increasing over time. Therefore we have visualised the numbers from table 11 to make interpretation of fluctuation over time easier. In figures 1a-1d the relative risks are presented for the different pollutants (lag 1 and lag0-6), for the different study periods per cause of mortality. From the figures it becomes clear that the second period gave the highest relative risks for lag 1 while there is no preference for lag0-6. There was no clear indication for a constant increase in relative risks over time and the confidence intervals between the different periods overlap considerably.

3.3.3 Results from regional models

In tables 11a-11e the results of the regional models are shown for total mortality and for cause-specific mortality. Overall, in both areas RR's larger than 1 were found but there is a tendency for more statistically significant results in the 'rural' area. This is probably partly due to the larger number of deaths in the larger rural population. Stratification on cause-specific deaths showed a relatively large number of statistically significant associations for respiratory deaths compared to total deaths in the urban area (table 11b) while this was not the case for the other cause-specific deaths (tables 11c–11e). Except for cardiovascular related deaths the RR's for cause-specific deaths compared to total mortality became larger in both areas. These results are comparable with the results of Hoek et al. (1997) who also found "no remarkable differences in strength of associations between different regions of the country". We don't have a definitive explanation for our results showing associations in the cities that are comparable with associations found in 'rural' areas. One might expect that within cities local sources (such as traffic) could influence the toxicity of the air pollution mixture. This has been shown by Katsouyanni et al. (2001) who found larger RR's for PM10 in cities with higher NO_2 levels. We also found higher NO_2 levels in the four largest cities (40.3 $\mu g/m^3$) than in the rest of the Netherlands (23.6 $\mu g/m^3$), but in our study the RR for the four largest cities were comparable to those for the rest of the Netherlands.

3.3.4 Results from seasonal models

The results of the season specific analyses for the total period are also shown in tables 11a-11e. In general in both seasons statistically significant associations were found between mortality (total and cause-specific mortality) and air pollution, except for O_3 which shows no, or statistically significantly negative, associations in the winter period. This is because in the winter period O_3 concentrations are generally very low and negatively correlated with all other air pollutants. NH_3 also shows almost no associations with mortality in the winter period. Overall, the estimated relative risks for the summer period were all larger than for the winter period for all causes and pollutants, except for associations between cardiovascular mortality and inorganic aerosol.

3.3.5 Results from two-pollutant models

In table 12a-e the results of the two-pollutant models are presented. Due to the high co-linearity between the different air pollutants (cf. table 8) the results have to be interpreted with caution because high correlation between pollutants (correlation coefficients larger than about 0.7 or less than about -0.7) can lead to over- or underestimation of the effect size and to inflated standard errors. However, in spite of this high co-linearity there is a distinct pattern in the results, showing that some pollutants give more robust results than others. PM10, BS, NO_2, SO_2, and O_3 showed the most stable results, i.e. were least influenced by the co-pollutant added to the statistical model. PM10 estimates were influenced by BS as a confounder and vice versa. Also the secondary components showed variability in the two-pollutant analyses, probably due to the high co-linearity resulting in inconsistent results. Overall, it can be concluded that the results for the main air pollutants PM10, BS, NO_2, and O_3 were not confounded by each other, except for PM10 and BS.

4. Conclusions and discussion

The main questions that were addressed in this study were:
1. To quantify the association between daily excess mortality and ambient concentration of particulate matter (PM10 and BS, ammonium, sulphate, nitrate, inorganic aerosol) and gaseous compounds (SO_2, CO, NO, NH_3, NO_2, and O_3) for the Dutch population, based on observed data from 1992–2002;
2. To quantify these associations for specific causes of death, including mortality from cardio-vascular diseases, pneumonia, and chronic obstructive pulmonary diseases;
3. To quantify these associations for areas with different degrees of urbanisation;
4. To quantify these associations for the summer and winter season separately;
5. To evaluate the results of the different time periods.

Ad 1). In general, all air pollutants showed statistically significant associations with total mortality. This finding is in agreement with our previous analyses (Hoek et al., 1997). The weekly averaged lag was most strongly associated (t-value) with mortality, except for O_3 and NH_3 which generally showed the strongest associations at a lag of 1 day. The results from the two-pollutant models indicated that the relative risk estimates for the air pollutants PM10, BS, NO_2, and O_3 were not confounded by other pollutants, except in the model with PM10 and BS as co-pollutants. Results for NH_3, NO, and inorganic aerosol (and its components) were mostly affected by inclusion of other components in the two component models.

Ad 2). All air pollutants showed statistically significant associations with cause-specific mortality. The risk estimates were larger for respiratory mortality than for total mortality. As was expected, the results for cardiovascular mortality were comparable with the results for total mortality. The weekly averaged lag was most strongly associated (t-value) with cause-specific mortality, except for O_3, NO, and NH_3 which, depending on the cause, showed the strongest associations with lags 1 or 2.

Ad 3). In both areas in the Netherlands (‘urban’ and ‘rural’) relative risks of larger than 1 were found, but there was a tendency for more statistically significant results in the ‘rural’ area. The reason to do these analyses was that it was expected that the air pollution mixture would be more toxic in the urban area because of the increased traffic emissions in the four largest cities compared to the rest of the Netherlands. Neither in this analyses, nor in our previous analyses (Hoek et al., 1997) we found larger relative risks in the urban area compared to the rural area. One of the reasons for this finding may be exposure misclassification. Compared to a city background measurement station, we expect that rural background measurement stations are more representative for exposures of rural populations than city background stations are for urban populations. This is because air pollution levels are more homogeneous in rural areas without large air pollution sources than air pollution levels within cities, where local traffic emissions have large effects on local levels. This has been shown in the city of Amsterdam, where PM10 and PM2.5 levels can vary up to 20% between busy and quiet streets, while Black

Smoke levels can even be doubled in busy streets compared to quiet streets (Fischer et al., 2000). This spatial variability may lead to misclassification and less precise and underestimated relative risks. Another possible reason why relative risks do not differ between the selected four largest cities and the rest of the Netherlands is that within the 'rural area' several agglomerations exist with comparable population densities as those of the four largest cities. Although in this analyses the rest of the Netherlands is qualified as 'rural', some areas are 'more rural than others'. Therefore, it is recommended to refine the analyses within specific agglomerations to elucidate the role of traffic in more detail.

Ad 4). In general, in both seasons statistically significant associations were found between mortality and air pollution except for O_3 and NH_3 which did not, or almost not, show associations in the winter period. The estimated relative risks for the summer period were larger than for the winter period. This finding is in agreement with our previous analyses (Hoek et al., 1997) and confirmed by recent results from the US (Peng et al., 2005).

Ad 5). Results over time fluctuated between the different periods. The intermediate period 1995-1998 showed in general the highest estimates for total mortality, but depending on the pollutant, the highest estimates were also found in the first and third period. For the cause-specific mortalities the fluctuation over time was larger than for total mortality, and overall there was no preference for a time-period. We conclude that no trend was present in the three analysed periods. This conclusion however is based on a limited numbers of observation (3) and under the assumption that the data from the last period could be analysed with the model based on earlier data. Further analyses on the existence of trends in relative risk estimates are therefore recommended. In such detailed analyses formal trend analyses can be performed, based on yearly estimated relative risks instead of average relative risks for three periods. As it becomes clear from our analyses that the estimates may fluctuate over time, it becomes of great importance to assess the underlying factors that cause these fluctuations. One of our next analyses will be on the trends in relative risks of Black Smoke, based on relatively old Black Smoke measurements in the Netherlands. Health impact assessments, also in the Netherlands, use relative risks for estimating the number of premature death in a population during a certain period. Variation in relative risks over time will have consequences on the estimated attributable deaths. Knowledge of the factors that cause fluctuation, including trends in confounders (f.i. trends in weather related variables like temperature), will reduce variability of estimates over time and will increase the accuracy and robustness of the estimations. We therefore recommend additional analyses of sources of variation over time.

Relative risks are applied to assess the health impacts of air pollution in the Netherlands. The magnitude and the precision of the relative risks that were found depend on a number of factors, among which the applied statistical method. We applied the method which is commonly used for this type of in environmental epidemiological studies. While finishing this report, a scientific discussion was going on in the field of air pollution epidemiology whether the GAM and LOESS approach was the best way to analyse time series of air pollution and mortality data. This was also discussed by the Health Effect Institute (2003), where it was concluded that “In most studies, parametric smoothing approaches used to obtain correct standard errors of PM effect estimates produced slightly larger standard errors than did GAM. The impact of these larger standard errors on level of statistical significance of the PM effect was minor. Alternative approaches used to model temporal effects in the revised analyses addressed the problems of obtaining incorrect effect estimates and standard errors when using GAMs. At this time, however, no approach can be strongly preferred over another for use in this context”. Within this project we did not have the opportunity to analyse our data with different statistical methods, for instance penalised splines method which is currently preferred. When this technique will be applied in future studies, it could lead to different estimates of the relative risks and the confidence intervals. Consequently, this would result in different outcomes of the health impact assessments.

Furthermore, the observed downward trends in the concentrations of a number of air pollutants over the years may together with the graduate trends in the co-variables temperature (upward) and influenza incidence (downward) may have an effect on the size and precision of the effect estimates. The databases of daily mortality as well as those of air pollution and the co-variables has increased to such a size that it may be possible to develop statistical models in which the observed trends are more accurately addressed. Together with the application of newly developed statistical techniques, this approach leads to more reliable risk estimates and therefore to more accurate health risk assessments of air pollution in the general population.

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Tables

Table 1. Selected air pollution monitoring sites and concentration data used in this study (for explanations of the abbreviations see table 2).

Site type and name	Site id.	PM10	BS	NH3	CO	NO	NO2	SO2	O3	Chlor	Nitr	Sulf	Amm
Rural sites													
Vredepeel	131	x	x	x	-	x	x	x	x	x	x	x	x
Wijnandsrade	133	x	x	-	-	x	x	x	x	-	-	-	-
Biest-Houtakker	230	x	x	-	x	x	x	x	x	-	-	-	-
Huijbergen	235	-	-	x	-	x	x	x	x	x	x	x	x
Philipine	318	x	x	-	-	x	x	x	x	-	-	-	-
Westmaas	437	x	x	-	-	x	x	x	x	-	-	-	-
De Zilk	444	x	x	-	x	x	x	-	-	-	-	-	-
Wieringerwerf	538	x	x	x	-	x	x	x	x	-	-	-	-
Bilthoven	627	-	-	-	x	x	x	x	-	x	x	x	x
Zegveld	633	-	-	x	-	x	x	x	x	-	-	-	-
Eibergen	722	x	x	x	-	x	x	x	x	-	-	-	-
Wageningen	724	x	-	-	-	x	x	x	x	-	-	-	-
Wekerom	738	-	-	x	-	-	-	-	-	-	-	-	-
Witteveen	928	x	x	x	-	x	x	x	x	x	x	x	x
Kollumerwaard	934	-	-	-	x	x	x	x	x	x	x	x	x
Urban sites													
Den Haag Centrum	404	x	-	-	-	x	x	x	x	-	-	-	-
Rotterdam Centrum	418	x	-	-	x	x	x	x	-	-	-	-	-
Dordrecht	441	x	-	-	x	x	x	-	x	-	-	-	-
Amsterdam Noord	520	x	-	-	x	x	x	x	x	-	-	-	-
Utrecht Universiteit	640	-	-	-	x	x	x	-	x	-	-	-	-

Table 2. Air pollutant concentration ranges ($\mu g/m^3$) for which the relative risks in this report are defined.

Pollutant	Abbreviation	Lags 0, 1, 2, and 3 days	Average of lags 0-6
Particulate matter	PM10	100	80
Black Smoke	BS	50	40
Ammonia	NH3	30	20
Carbon monoxide	CO	1500	1200
Nitric oxide	NO	100	80
Nitrogen dioxide	NO2	50	30
Sulfur dioxide	SO2	50	40
Ozone 8 h avg (12.00-20.00)	O3	150	120
Inorganic aerosol (1)	Sum	60	45
Nitrate	Nitr	15	10
Sulfate	Sulf	15	10
Ammonium	Amm	10	5

[1]) sum of chloride, ammonium, nitrate, and sulfate

Table 3. Statistics of daily number of deaths in the Netherlands in 1992-2002 (means and percentiles).

Stratum	Cause of death	days	mean	p5	p10	p25	median	p75	p90	p95	max
Overall											
	All Causes excl. Accidental	4016	362	308	318	335	356	384	413	433	529
	Respiratory Diseases	4016	36	20	23	27	33	41	52	60	103
	Chron Obstructive Pulmonary Dis	4016	18	9	11	13	17	21	25	29	47
	Pneumonia	4016	15	6	8	10	14	18	24	28	46
	Cardio-Vascular Diseases	4016	138	110	115	125	136	149	162	171	217
Study period 1992-1998											
	All Causes excl. Accidental	2555	356	304	313	330	350	377	407	429	529
	Respiratory Diseases	2555	34	19	22	26	32	39	49	59	96
	Chron Obstructive Pulmonary Dis	2555	17	9	11	13	16	20	25	28	42
	Pneumonia	2555	14	6	7	10	13	17	23	26	43
	Cardio-Vascular Diseases	2555	140	112	118	127	138	152	166	175	217
Study period 1999-2002											
	All Causes excl. Accidental	1461	371	320	329	346	367	394	421	437	521
	Respiratory Diseases	1461	38	23	25	30	36	44	54	62	103
	Chron Obstructive Pulmonary Dis	1461	18	10	11	14	17	21	26	29	47
	Pneumonia	1461	17	8	10	12	16	20	25	29	46
	Cardio-Vascular Diseases	1461	133	106	111	121	131	143	155	161	205
Four largest cities											
	All Causes excl. Accidental	4016	57	43	45	50	57	63	70	74	101
	Respiratory Diseases	4016	6	2	2	4	6	7	10	11	21
	Chron Obstructive Pulmonary Dis	4016	3	0	1	1	3	4	5	6	12
	Pneumonia	4016	3	0	1	1	2	4	5	6	12
	Cardio-Vascular Diseases	4016	21	13	14	17	21	24	28	30	41
Netherlands excl four largest cities											
	All Causes excl. Accidental	4016	305	258	266	281	300	324	347	365	439
	Respiratory Diseases	4016	30	16	19	23	28	34	44	51	93
	Chron Obstructive Pulmonary Dis	4016	15	7	9	11	14	18	22	24	41
	Pneumonia	4016	12	5	6	8	11	15	20	23	43
	Cardio-Vascular Diseases	4016	117	92	97	105	115	126	138	145	187
Summer periods (may-september)											
	All Causes excl. Accidental	1683	342	299	308	324	339	357	378	392	453
	Respiratory Diseases	1683	30	18	21	25	29	35	40	44	69
	Chron Obstructive Pulmonary Dis	1683	15	8	10	12	14	18	21	22	38
	Pneumonia	1683	13	6	7	9	12	16	19	22	43
	Cardio-Vascular Diseases	1683	127	104	109	117	126	135	144	150	182
Winter periods (november-march)											
	All Causes excl. Accidental	1662	384	328	337	357	380	407	438	456	529
	Respiratory Diseases	1662	42	24	27	32	39	49	62	71	103
	Chron Obstructive Pulmonary Dis	1662	21	12	13	16	20	24	29	32	47
	Pneumonia	1662	18	7	9	12	17	22	28	32	46
	Cardio-Vascular Diseases	1662	149	121	127	136	147	160	172	182	217

Table 4. Statistics of influenza incidence ($10,000^{-1}$) in the Netherlands in 1992-2002.

Period	n	mean	p90	p95	p98	p99	max
Overall	4018	4.3	11.3	15.9	25.8	31.1	57.0
Study period 1992-1998	2557	4.8	12.6	18.7	27.0	35.0	57.0
Study period 1999-2002	1461	3.5	10.2	13.3	20.2	27.2	32.8
Summer periods (may-september)	1683	1.1	1.9	2.3	2.7	3.3	4.8
Winter periods (november-march)	1664	8.0	18.5	25.7	32.1	40.7	57.0

Table 5. Statistics of pollen counts (m^{-3}) in the Netherlands in 1992-2002.

Period	Species	n	mean	p90	p95	p98	p99	max
Overall								
	Betula (birch)	4018	17.8	9.5	47.5	205.5	373.0	3554.5
	Poaceae (grasses)	4018	13.7	40.5	81.0	148.5	189.0	422.0
	Rumex (dock)	4018	0.8	2.5	4.5	8.5	13.0	34.5
Study period 1992-1998								
	Betula (birch)	2557	17.5	10.5	51.5	193.5	349.5	3554.5
	Poaceae (grasses)	2557	14.7	46.0	88.0	156.5	204.5	385.5
	Rumex (dock)	2557	0.8	2.0	4.5	8.0	10.5	34.5
Study period 1999-2002								
	Betula (birch)	1461	18.4	7.5	37.5	212.5	395.0	3499.0
	Poaceae (grasses)	1461	11.9	34.5	64.0	134.0	169.0	422.0
	Rumex (dock)	1461	0.9	2.5	5.0	11.0	16.0	29.0
Summer periods (may-september)								
	Betula (birch)	1683	2.6	4.5	12.5	29.5	43.5	258.5
	Poaceae (grasses)	1683	32.5	92.0	147.5	200.5	240.0	422.0
	Rumex (dock)	1683	1.9	5.0	8.5	14.0	19.0	34.5
Winter periods (november-march)								
	Betula (birch)	1664	2.1	0.5	1.9	7.0	29.5	658.5
	Poaceae (grasses)	1664	0.0	0.0	0.0	0.5	0.5	4.5
	Rumex (dock)	1664	0.0	0.0	0.0	0.0	0.0	2.0

Table 6. Statistics of meteorological parameters atmospheric pressure (hPa), relative humidity (%), and temperature (^oC) in the Netherlands in 1992-2002.

Stratum	Parameter (24 h average)	n	mean	min	p10	median	p90	max
Overall								
	Atmospheric pressure (hPa)	4018	1015	980	1002	1016	1027	1043
	Relative humidity (%)	4018	83	38	71	85	94	100
	Temperature (C)	4018	10.1	-13.2	1.9	10.1	18.1	26.0
Study period 1992-1998								
	Atmospheric pressure (hPa)	2557	1016	981	1003	1016	1028	1043
	Relative humidity (%)	2557	83	38	70	85	95	100
	Temperature (C)	2557	9.9	-13.2	1.6	9.7	18.1	26
Study period 1999-2002								
	Atmospheric pressure (hPa)	1461	1014	980	1001	1015	1026	1042
	Relative humidity (%)	1461	83	48	72	85	93	99
	Temperature (C)	1461	10.6	-6.4	2.5	10.6	18.1	25.7
Summer periods (may-september)								
	Atmospheric pressure (hPa)	1683	1015	990	1007	1016	1023	1035
	Relative humidity (%)	1683	80	48	68	81	90	97
	Temperature (C)	1683	15.7	5.5	11.5	15.7	20.3	26.0
Winter periods (november-march)								
	Atmospheric pressure (hPa)	1664	1016	980	1000	1016	1031	1043
	Relative humidity (%)	1664	87	44	77	89	96	100
	Temperature (C)	1664	4.6	-13.2	-1.0	5.2	9.4	15.3

Table 7A. Statistics of air pollution in the Netherlands in 1992-2002; yearly means and percentiles of 24 hour averages ($\mu g/m^3$)

Stratum	Pollutant	days	mean	p10	p50	p90	p95	p98	p99	max
Overall										
	Particulate matter (PM10)	4015	37.4	19.5	31.7	62.5	75.8	91.7	109.6	251.7
	Black Smoke	4018	9.7	2.2	6.8	20.7	28.0	37.5	44.5	116.3
	Ammonia	3792	9.5	3.0	8.0	18.1	22.4	27.2	31.3	81.3
	Carbon monoxide	4018	464	273	402	733	883	1069	1214	3133
	Nitric oxide	4018	10.6	1.0	4.1	28.2	45.3	67.2	87.6	224.4
	Nitrogen dioxide	4018	26.7	13.1	24.7	43.3	47.7	54.1	59.1	93.3
	Sulfur dioxide	4018	6.0	1.8	4.4	11.7	15.4	22.8	29.3	60.8
	Ozone 8 h avg (12.00-20.00)	4018	50.7	12.0	49.2	87.0	106.3	130.7	145.0	189.3
	Inorganic aerosol	3769	11.0	4.6	9.1	19.2	24.2	32.3	40.0	96.0
	Nitrate	4018	4.1	1.2	3.4	7.9	9.7	13.0	15.4	33.3
	Sulfate	4018	3.5	1.1	2.7	6.7	8.9	11.9	14.7	48.2
	Ammonium	4018	2.3	0.7	1.7	4.4	5.6	7.5	9.2	22.2
Four largest cities										
	Particulate matter (PM10)	4004	39.4	21.4	33.6	64.8	79.5	97.2	113.3	324.5
	Black Smoke	3986	11.1	2.9	8.2	23.0	29.7	39.1	46.1	116.3
	Carbon monoxide	4018	533	306	460	847	1040	1251	1462	4096
	Nitric oxide	4018	20.4	2.6	9.6	51.4	75.0	111.6	138.6	413.0
	Nitrogen dioxide	4018	40.3	23.2	39.0	58.4	65.0	72.8	77.8	128.4
	Sulfur dioxide	4018	9.8	2.0	8.0	19.7	24.3	32.3	39.3	80.7
	Ozone 8 h avg (12.00-20.00)	4010	42.1	7.0	37.9	80.2	100.4	125.3	139.3	200.6
Netherlands excl 4 largest cities										
	Particulate matter (PM10)	3995	37.6	18.8	31.5	65.3	77.4	93.9	110.7	246.1
	Black Smoke	4018	9.8	2.0	6.8	21.8	29.4	39.0	46.0	117.0
	Carbon monoxide	4017	370	220	325	577	700	857	983	2267
	Nitric oxide	4018	7.8	0.0	2.5	21.4	37.0	58.3	77.0	177.7
	Nitrogen dioxide	4018	23.6	10.0	21.7	40.3	45.0	51.9	55.4	86.6
	Sulfur dioxide	4018	6.2	2.0	4.9	12.0	16.0	22.0	28.2	61.8
	Ozone 8 h avg (12.00-20.00)	4018	53.8	13.0	53.3	89.6	110.2	134.9	149.8	193.8
Summer periods (may-september)										
	Particulate matter (PM10)	1683	35.7	20.2	31.6	57.2	65.4	77.1	86.9	130.1
	Black Smoke	1683	6.4	2.1	5.4	12.3	14.8	17.6	19.3	28.0
	Ammonia	1587	11.4	4.9	10.4	19.6	22.8	26.8	29.7	81.3
	Carbon monoxide	1683	361	246	345	494	559	647	692	1020
	Nitric oxide	1683	4.2	0.9	2.8	8.9	12.5	18.3	23.2	51.7
	Nitrogen dioxide	1683	21.5	11.5	20.2	33.6	38.0	44.2	47.3	55.4
	Sulfur dioxide	1683	4.4	1.6	3.6	8.5	10.4	12.3	14.6	22.1
	Ozone 8 h avg (12.00-20.00)	1683	70.9	40.0	65.2	111.1	129.4	148.3	159.0	189.3
	Inorganic aerosol	1572	9.9	4.5	8.6	17.1	20.2	25.1	27.5	88.4
	Nitrate	1683	3.7	1.2	3.1	7.1	8.6	10.8	12.6	22.0
	Sulfate	1683	3.4	1.3	2.9	6.3	7.7	9.5	10.7	17.0
	Ammonium	1683	2.1	0.7	1.7	4.0	4.7	5.8	6.7	9.7
Winter periods (november-march)										
	Particulate matter (PM10)	1661	39.6	19.0	31.9	71.3	86.9	109.6	121.6	251.7
	Black Smoke	1664	13.1	2.3	9.2	29.1	36.5	46.8	55.4	116.3
	Ammonia	1569	7.4	2.4	5.4	14.9	20.0	27.0	32.6	53.2
	Carbon monoxide	1664	566	316	494	890	1039	1262	1537	3133
	Nitric oxide	1664	17.2	1.1	7.2	46.1	65.7	91.0	124.9	224.4
	Nitrogen dioxide	1664	31.6	16.2	31.1	47.2	52.4	59.4	65.8	93.3
	Sulfur dioxide	1664	7.8	2.2	5.6	15.5	22.0	31.3	40.5	60.8
	Ozone 8 h avg (12.00-20.00)	1664	30.6	6.5	28.1	58.1	63.8	70.0	73.6	87.0
	Inorganic aerosol	1583	12.1	4.8	9.6	20.9	28.4	37.6	48.9	96.0
	Nitrate	1664	4.4	1.2	3.6	8.1	10.3	14.3	18.0	33.3
	Sulfate	1664	3.8	1.1	2.5	7.8	10.9	14.9	18.3	48.2
	Ammonium	1664	2.4	0.6	1.7	4.9	6.6	9.1	11.3	22.2

Table 7B. Statistics of air pollution in the Netherlands in 1992-2002; yearly means and percentiles of one week averages (μg/m^3)

Stratum	Pollutant (ug/m^3)	days	mean	p10	median	p90	p95	p98	p99	max
Overall										
	Particulate matter (PM10)	4003	37.4	23.6	33.7	55.4	65.4	79.6	88.2	129.0
	Black Smoke	4018	9.7	3.8	7.5	18.5	24.8	33.4	38.2	63.7
	Ammonia	3776	9.6	4.0	8.6	16.3	19.3	23.0	25.1	34.6
	Carbon monoxide	4018	464	298	425	679	798	934	1041	1612
	Nitric oxide	4018	10.6	1.9	5.4	26.7	37.2	52.7	64.5	104.8
	Nitrogen dioxide	4018	26.7	16.1	25.6	38.7	42.5	47.0	50.1	71.9
	Sulfur dioxide	4018	6.0	2.4	4.8	11.1	13.8	20.1	25.6	42.2
	Ozone 8 h avg (12.00-20.00)	4018	50.6	17.5	48.6	84.8	98.2	113.0	122.0	139.9
	Inorganic aerosol	4018	10.9	6.0	9.6	17.0	20.6	28.6	32.8	57.4
	Nitrate	4018	4.1	2.0	3.7	6.8	8.3	10.8	12.1	21.6
	Sulfate	4018	3.5	1.6	2.9	6.0	7.4	10.4	12.9	20.2
	Ammonium	4018	2.3	1.0	1.9	3.8	4.8	6.5	7.8	12.1
Four largest cities										
	Particulate matter (PM10)	3980	39.3	25.9	35.5	56.9	67.8	84.4	96.2	143.5
	Black Smoke	3879	11.1	4.7	8.9	19.9	25.6	34.1	39.4	63.7
	Carbon monoxide	4018	533	335	487	790	927	1083	1209	1971
	Nitric oxide	4018	20.4	4.7	12.7	46.0	63.2	84.3	102.9	178.7
	Nitrogen dioxide	4018	40.3	28.8	39.9	52.4	56.9	61.3	63.7	84.9
	Sulfur dioxide	4018	9.8	4.0	8.5	17.0	20.2	27.0	33.2	42.0
	Ozone 8 h avg (12.00-20.00)	3998	42.2	11.7	38.5	77.3	91.3	107.2	115.2	146.5
Netherlands excl 4 largest cities										
	Particulate matter (PM10)	3989	37.5	22.9	33.9	57.1	65.7	78.9	87.1	119.5
	Black Smoke	4018	9.9	3.6	7.6	18.9	25.5	33.8	38.8	63.7
	Carbon monoxide	4011	370	243	338	538	636	765	836	1222
	Nitric oxide	4018	7.8	1.0	3.6	20.3	29.9	43.4	51.3	82.6
	Nitrogen dioxide	4018	23.6	13.8	22.4	35.5	39.3	43.0	46.3	67.1
	Sulfur dioxide	4018	6.2	2.8	5.3	10.2	13.0	18.5	25.0	42.6
	Ozone 8 h avg (12.00-20.00)	4018	53.7	20.0	53.2	87.5	100.6	116.3	123.7	144.3
Summer periods (may-september)										
	Particulate matter (PM10)	1683	35.6	24.1	33.8	50.7	56.0	62.6	66.9	77.3
	Black Smoke	1683	6.4	3.3	5.8	10.3	12.0	13.7	15.0	19.7
	Ammonia	1577	11.4	6.2	10.8	17.4	19.6	23.3	24.8	30.0
	Carbon monoxide	1683	360	279	349	450	489	536	577	689
	Nitric oxide	1683	4.0	1.6	3.3	7.4	9.7	12.5	14.7	21.3
	Nitrogen dioxide	1683	21.4	14.3	21.1	29.3	31.7	34.9	36.8	43.9
	Sulfur dioxide	1683	4.4	2.2	3.8	7.4	8.5	10.2	11.6	14.9
	Ozone 8 h avg (12.00-20.00)	1683	71.6	46.3	69.3	101.3	112.8	123.9	127.1	139.9
	Inorganic aerosol	1683	9.9	5.7	9.1	15.0	17.5	19.3	20.6	26.5
	Nitrate	1683	3.7	2.0	3.5	5.7	6.7	8.0	8.5	12.0
	Sulfate	1683	3.4	1.8	3.1	5.6	6.4	7.4	7.8	9.5
	Ammonium	1683	2.1	1.1	1.9	3.3	4.0	4.4	4.7	6.0
Winter periods (november-march)										
	Particulate matter (PM10)	1649	39.5	22.9	33.9	63.9	77.8	91.6	104.1	129.0
	Black Smoke	1664	13.2	4.5	10.4	26.0	33.0	39.5	45.2	63.7
	Ammonia	1558	7.4	3.3	6.0	12.8	17.7	22.2	24.2	34.6
	Carbon monoxide	1664	566	372	527	815	921	1081	1240	1612
	Nitric oxide	1664	17.4	2.9	12.4	39.1	51.0	65.8	74.1	104.8
	Nitrogen dioxide	1664	31.6	21.5	30.7	42.8	46.2	51.2	54.8	71.9
	Sulfur dioxide	1664	7.8	2.8	6.1	14.2	20.0	26.5	29.7	42.2
	Ozone 8 h avg (12.00-20.00)	1664	30.0	11.0	28.6	51.3	55.9	59.9	61.4	65.5
	Inorganic aerosol	1664	11.9	6.2	10.0	19.6	26.3	34.2	38.7	57.4
	Nitrate	1664	4.3	2.1	3.8	7.3	8.9	11.9	14.2	21.6
	Sulfate	1664	3.8	1.5	2.8	6.9	10.0	13.5	15.4	20.2
	Ammonium	1664	2.4	1.0	1.9	4.5	6.0	8.1	9.3	12.1

Table 8. Spearman correlation coefficients of air pollutants and co-variables in the Netherlands in the period 1992-2002. *(continued on next page)*

A. Overall

Variable		PM10	BS	NH3	CO	NO	NO2	SO2	O3	Sum	Nitr	Sulf	Amm	Flu	Betu	Poac	Rume	P	RH	T
Particulate matter	**PM10**	1	0.77	0.46	0.56	0.46	0.59	0.56	-0.06	0.66	0.68	0.70	0.73	0.07	0.10	0.05	0.07	0.33	-0.10	0.07
Black Smoke	**BS**	0.77	1	0.36	0.82	0.79	0.87	0.62	-0.43	0.52	0.61	0.52	0.62	0.26	-0.08	-0.25	-0.18	0.30	0.12	-0.22
Ammonia	**NH3**	0.46	0.36	1	0.16	0.20	0.23	0.09	0.31	0.26	0.37	0.31	0.36	-0.30	0.23	0.37	0.29	0.30	-0.33	0.41
Carbon monoxide	**CO**	0.56	0.82	0.16	1	0.82	0.87	0.62	-0.52	0.48	0.52	0.41	0.50	0.45	-0.07	-0.42	-0.31	0.19	0.35	-0.45
Nitric oxide	**NO**	0.46	0.79	0.20	0.82	1	0.88	0.57	-0.59	0.34	0.39	0.29	0.38	0.31	-0.15	-0.35	-0.28	0.28	0.31	-0.36
Nitrogen dioxide	**NO2**	0.59	0.87	0.23	0.87	0.88	1	0.70	-0.50	0.42	0.49	0.37	0.47	0.37	-0.07	-0.35	-0.25	0.24	0.21	-0.34
Sulfur dioxide	**SO2**	0.56	0.62	0.09	0.62	0.57	0.70	1	-0.26	0.47	0.44	0.46	0.46	0.33	0.01	-0.16	-0.08	0.12	-0.04	-0.18
Ozone 8 h avg	**O3**	-0.06	-0.43	0.31	-0.52	-0.59	-0.50	-0.26	1	-0.14	-0.12	-0.03	-0.09	-0.50	0.46	0.68	0.56	-0.05	-0.70	0.62
Inorganic aerosol	**Sum**	0.66	0.52	0.26	0.48	0.34	0.42	0.47	-0.14	1	0.86	0.87	0.89	0.14	0.08	-0.05	-0.02	0.14	0.09	-0.01
Nitrate	**Nitr**	0.68	0.61	0.37	0.52	0.39	0.49	0.44	-0.12	0.86	1	0.82	0.93	0.10	0.13	-0.03	-0.01	0.16	0.05	0.00
Sulfate	**Sulf**	0.70	0.52	0.31	0.41	0.29	0.37	0.46	-0.03	0.87	0.82	1	0.94	0.00	0.11	0.13	0.13	0.15	0.00	0.14
Ammonium	**Amm**	0.73	0.62	0.36	0.50	0.38	0.47	0.46	-0.09	0.89	0.93	0.94	1	0.06	0.11	0.05	0.06	0.17	0.04	0.06
Influenza	**Flu**	0.07	0.26	-0.30	0.45	0.31	0.37	0.33	-0.50	0.14	0.10	0.00	0.06	1	-0.12	-0.70	-0.50	0.05	0.31	-0.72
Betula pollen	**Betu**	0.10	-0.08	0.23	-0.07	-0.15	-0.07	0.01	0.46	0.08	0.13	0.11	0.11	-0.12	1	0.30	0.29	-0.02	-0.37	0.16
Poacea pollen	**Poac**	0.05	-0.25	0.37	-0.42	-0.35	-0.35	-0.16	0.68	-0.05	-0.03	0.13	0.05	-0.70	0.30	1	0.79	0.04	-0.48	0.75
Rumex pollen	**Rume**	0.07	-0.18	0.29	-0.31	-0.28	-0.25	-0.08	0.56	-0.02	-0.01	0.13	0.06	-0.50	0.29	0.79	1	0.03	-0.41	0.58
Atmosph pressure	**P**	0.33	0.30	0.30	0.19	0.28	0.24	0.12	-0.05	0.14	0.16	0.15	0.17	0.05	-0.02	0.04	0.03	1	-0.13	-0.09
Relative humidity	**RH**	-0.10	0.12	-0.33	0.35	0.31	0.21	-0.04	-0.70	0.09	0.05	0.00	0.04	0.31	-0.37	-0.48	-0.41	-0.13	1	-0.38
Temperature	**T**	0.07	-0.22	0.41	-0.45	-0.36	-0.34	-0.18	0.62	-0.01	0.00	0.14	0.06	-0.72	0.16	0.75	0.58	-0.09	-0.38	1

B. Netherlands excluding the four largest cities

Variable		PM10	BS	NH3	CO	NO	NO2	SO2	O3	Sum	Nitr	Sulf	Amm	Flu	Betu	Poac	Rume	P	RH	T
Particulate matter	**PM10**	1	0.75	0.48	0.62	0.54	0.62	0.56	-0.06	0.61	0.66	0.67	0.70	0.02	0.09	0.09	0.10	0.35	-0.14	0.09
Black Smoke	**BS**	0.75	1	0.32	0.84	0.82	0.89	0.67	-0.43	0.50	0.59	0.50	0.60	0.27	-0.07	-0.25	-0.17	0.30	0.10	-0.24
Ammonia	**NH3**	0.48	0.32	1	0.23	0.27	0.30	0.21	0.29	0.26	0.37	0.31	0.36	-0.30	0.23	0.37	0.29	0.30	-0.33	0.41
Carbon monoxide	**CO**	0.62	0.84	0.23	1	0.76	0.82	0.61	-0.46	0.56	0.60	0.51	0.60	0.40	-0.05	-0.35	-0.25	0.19	0.28	-0.36
Nitric oxide	**NO**	0.54	0.82	0.27	0.76	1	0.86	0.56	-0.50	0.37	0.42	0.34	0.42	0.26	-0.08	-0.25	-0.19	0.34	0.18	-0.29
Nitrogen dioxide	**NO2**	0.62	0.89	0.30	0.82	0.86	1	0.70	-0.46	0.41	0.51	0.37	0.48	0.32	-0.04	-0.29	-0.20	0.31	0.13	-0.30
Sulfur dioxide	**SO2**	0.56	0.67	0.21	0.61	0.56	0.70	1	-0.21	0.39	0.45	0.40	0.46	0.27	0.01	-0.13	-0.06	0.20	-0.12	-0.18
Ozone 8 h avg	**O3**	-0.06	-0.43	0.29	-0.46	-0.50	-0.46	-0.21	1	-0.15	-0.13	-0.04	-0.10	-0.49	0.44	0.65	0.53	-0.07	-0.67	0.60
Inorganic aerosol	**Sum**	0.61	0.50	0.26	0.56	0.37	0.41	0.39	-0.15	1	0.86	0.87	0.89	0.14	0.08	-0.05	-0.02	0.14	0.09	-0.01
Nitrate	**Nitr**	0.66	0.59	0.37	0.60	0.42	0.51	0.45	-0.13	0.86	1	0.82	0.93	0.10	0.13	-0.03	-0.01	0.16	0.05	0.00
Sulfate	**Sulf**	0.67	0.50	0.31	0.51	0.34	0.37	0.40	-0.04	0.87	0.82	1	0.94	0.00	0.11	0.13	0.13	0.15	0.00	0.14
Ammonium	**Amm**	0.70	0.60	0.36	0.60	0.42	0.48	0.46	-0.10	0.89	0.93	0.94	1	0.06	0.11	0.05	0.06	0.17	0.04	0.06
Influenza	**Flu**	0.02	0.27	-0.30	0.40	0.26	0.32	0.27	-0.49	0.14	0.10	0.00	0.06	1	-0.12	-0.70	-0.50	0.05	0.31	-0.72
Betula pollen	**Betu**	0.09	-0.07	0.23	-0.05	-0.08	-0.04	0.01	0.44	0.08	0.13	0.11	0.11	-0.12	1	0.30	0.29	-0.02	-0.37	0.16
Poacea pollen	**Poac**	0.09	-0.25	0.37	-0.35	-0.25	-0.29	-0.13	0.65	-0.05	-0.03	0.13	0.05	-0.70	0.30	1	0.79	0.04	-0.48	0.75
Rumex pollen	**Rume**	0.10	-0.17	0.29	-0.25	-0.19	-0.20	-0.06	0.53	-0.02	-0.01	0.13	0.06	-0.50	0.29	0.79	1	0.03	-0.41	0.58
Atmosph pressure	**P**	0.35	0.30	0.30	0.19	0.34	0.31	0.20	-0.07	0.14	0.16	0.15	0.17	0.05	-0.02	0.04	0.03	1	-0.13	-0.09
Relative humidity	**RH**	-0.14	0.10	-0.33	0.28	0.18	0.13	-0.12	-0.67	0.09	0.05	0.00	0.04	0.31	-0.37	-0.48	-0.41	-0.13	1	-0.38
Temperature	**T**	0.09	-0.24	0.41	-0.36	-0.29	-0.30	-0.18	0.60	-0.01	0.00	0.14	0.06	-0.72	0.16	0.75	0.58	-0.09	-0.38	1

C. Four largest cities

Variable		PM10	BS	NH3	CO	NO	NO2	SO2	O3	Sum	Nitr	Sulf	Amm	Flu	Betu	Poac	Rume	P	RH	T
Particulate matter	**PM10**	1	0.66	0.35	0.52	0.37	0.51	0.50	-0.12	0.60	0.59	0.60	0.63	0.15	0.08	-0.04	0.02	0.26	-0.08	-0.02
Black Smoke	**BS**	0.66	1	0.35	0.69	0.67	0.74	0.41	-0.43	0.43	0.55	0.44	0.55	0.21	-0.13	-0.26	-0.18	0.27	0.14	-0.22
Ammonia	**NH3**	0.35	0.35	1	0.12	0.09	0.24	0.07	0.32	0.26	0.37	0.31	0.36	-0.30	0.23	0.37	0.29	0.30	-0.33	0.41
Carbon monoxide	**CO**	0.52	0.69	0.12	1	0.83	0.83	0.53	-0.55	0.43	0.46	0.36	0.45	0.47	-0.08	-0.44	-0.33	0.19	0.37	-0.48
Nitric oxide	**NO**	0.37	0.67	0.09	0.83	1	0.84	0.48	-0.69	0.27	0.33	0.19	0.29	0.39	-0.20	-0.46	-0.37	0.22	0.41	-0.46
Nitrogen dioxide	**NO2**	0.51	0.74	0.24	0.83	0.84	1	0.60	-0.48	0.33	0.42	0.26	0.37	0.35	-0.07	-0.35	-0.26	0.18	0.22	-0.33
Sulfur dioxide	**SO2**	0.50	0.41	0.07	0.53	0.48	0.60	1	-0.29	0.42	0.39	0.40	0.40	0.29	-0.03	-0.15	-0.09	0.06	0.05	-0.13
Ozone 8 h avg	**O3**	-0.12	-0.43	0.32	-0.55	-0.69	-0.48	-0.29	1	-0.14	-0.13	-0.03	-0.10	-0.52	0.44	0.68	0.55	-0.01	-0.68	0.62
Inorganic aerosol	**Sum**	0.60	0.43	0.26	0.43	0.27	0.33	0.42	-0.14	1	0.86	0.87	0.89	0.14	0.08	-0.05	-0.02	0.14	0.09	-0.01
Nitrate	**Nitr**	0.59	0.55	0.37	0.46	0.33	0.42	0.39	-0.13	0.86	1	0.82	0.93	0.10	0.13	-0.03	-0.01	0.16	0.05	0.00
Sulfate	**Sulf**	0.60	0.44	0.31	0.36	0.19	0.26	0.40	-0.03	0.87	0.82	1	0.94	0.00	0.11	0.13	0.13	0.15	0.00	0.14
Ammonium	**Amm**	0.63	0.55	0.36	0.45	0.29	0.37	0.40	-0.10	0.89	0.93	0.94	1	0.06	0.11	0.05	0.06	0.17	0.04	0.06
Influenza	**Flu**	0.15	0.21	-0.30	0.47	0.39	0.35	0.29	-0.52	0.14	0.10	0.00	0.06	1	-0.12	-0.70	-0.50	0.05	0.31	-0.72
Betula pollen	**Betu**	0.08	-0.13	0.23	-0.08	-0.20	-0.07	-0.03	0.44	0.08	0.13	0.11	0.11	-0.12	1	0.30	0.29	-0.02	-0.37	0.16
Poacea pollen	**Poac**	-0.04	-0.26	0.37	-0.44	-0.46	-0.35	-0.15	0.68	-0.05	-0.03	0.13	0.05	-0.70	0.30	1	0.79	0.04	-0.48	0.75
Rumex pollen	**Rume**	0.02	-0.18	0.29	-0.33	-0.37	-0.26	-0.09	0.55	-0.02	-0.01	0.13	0.06	-0.50	0.29	0.79	1	0.03	-0.41	0.58
Atmosph pressure	**P**	0.26	0.27	0.30	0.19	0.22	0.18	0.06	-0.01	0.14	0.16	0.15	0.17	0.05	-0.02	0.04	0.03	1	-0.13	-0.09
Relative humidity	**RH**	-0.08	0.14	-0.33	0.37	0.41	0.22	0.05	-0.68	0.09	0.05	0.00	0.04	0.31	-0.37	-0.48	-0.41	-0.13	1	-0.38
Temperature	**T**	-0.02	-0.22	0.41	-0.48	-0.46	-0.33	-0.13	0.62	-0.01	0.00	0.14	0.06	-0.72	0.16	0.75	0.58	-0.09	-0.38	1

Table 8. (Continued) Spearman correlation coefficients of air pollutants and co-variables in the Netherlands in the period 1992-2002.

D. Summer periods

Variable		PM10	BS	NH3	CO	NO	NO2	SO2	O3	Sum	Nitr	Sulf	Amm	Flu	Betu	Poac	Rume	P	RH	T
Particulate matter	PM10	1	0.79	0.53	0.60	0.31	0.62	0.55	0.38	0.62	0.63	0.69	0.71	0.04	0.09	0.19	0.18	0.10	-0.23	0.59
Black Smoke	BS	0.79	1	0.55	0.76	0.63	0.86	0.59	0.21	0.49	0.56	0.53	0.59	0.12	0.05	-0.01	0.03	0.08	-0.16	0.42
Ammonia	NH3	0.53	0.55	1	0.29	0.23	0.41	0.24	0.41	0.26	0.34	0.30	0.35	-0.10	0.02	0.15	0.14	0.21	-0.37	0.52
Carbon monoxide	CO	0.60	0.76	0.29	1	0.66	0.82	0.61	0.06	0.52	0.55	0.52	0.57	0.21	0.11	-0.09	0.01	-0.07	0.12	0.18
Nitric oxide	NO	0.31	0.63	0.23	0.66	1	0.80	0.52	-0.21	0.24	0.30	0.22	0.26	0.12	-0.03	-0.18	-0.14	0.09	0.11	0.01
Nitrogen dioxide	NO2	0.62	0.86	0.41	0.82	0.80	1	0.69	0.08	0.40	0.47	0.42	0.47	0.13	0.11	-0.02	0.03	0.05	-0.10	0.25
Sulfur dioxide	SO2	0.55	0.59	0.24	0.61	0.52	0.69	1	0.20	0.44	0.42	0.50	0.46	0.15	0.14	0.21	0.21	0.03	-0.27	0.29
Ozone 8 h avg	O3	0.38	0.21	0.41	0.06	-0.21	0.08	0.20	1	0.12	0.12	0.23	0.20	-0.07	0.29	0.51	0.46	0.28	-0.75	0.44
Inorganic aerosol	Sum	0.62	0.49	0.26	0.52	0.24	0.40	0.44	0.12	1	0.88	0.89	0.91	0.03	0.07	0.08	0.09	-0.08	0.07	0.35
Nitrate	Nitr	0.63	0.56	0.34	0.55	0.30	0.47	0.42	0.12	0.88	1	0.81	0.92	0.04	0.07	0.06	0.08	-0.06	0.06	0.32
Sulfate	Sulf	0.69	0.53	0.30	0.52	0.22	0.42	0.50	0.23	0.89	0.81	1	0.95	0.04	0.06	0.20	0.18	-0.05	-0.03	0.47
Ammonium	Amm	0.71	0.59	0.30	0.57	0.26	0.47	0.46	0.20	0.91	0.92	0.95	1	0.04	0.06	0.14	0.14	-0.06	0.00	0.44
Influenza	Flu	0.04	0.12	-0.10	0.21	0.12	0.13	0.15	-0.07	0.03	0.04	0.04	0.04	1	0.19	-0.03	0.04	0.02	0.00	-0.25
Betula pollen	Betu	0.09	0.05	0.02	0.11	-0.03	0.11	0.14	0.29	0.07	0.07	0.06	0.06	0.19	1	0.25	0.39	0.04	-0.28	-0.17
Poacea pollen	Poac	0.19	-0.01	0.15	-0.09	-0.18	-0.02	0.21	0.51	0.08	0.06	0.20	0.14	-0.03	0.25	1	0.73	0.17	-0.46	0.33
Rumex pollen	Rume	0.18	0.03	0.14	0.01	-0.14	0.03	0.21	0.46	0.09	0.08	0.18	0.14	0.04	0.39	0.73	1	0.09	-0.41	0.18
Atmosph pressure	P	0.10	0.08	0.21	-0.07	0.09	0.05	0.03	0.28	-0.08	-0.06	-0.05	-0.06	0.02	0.04	0.17	0.09	1	-0.37	0.03
Relative humidity	RH	-0.23	-0.16	-0.37	0.12	0.11	-0.10	-0.27	-0.75	0.07	0.06	-0.03	0.00	0.00	-0.28	-0.46	-0.41	-0.37	1	-0.33
Temperature	T	0.59	0.42	0.52	0.18	0.01	0.25	0.29	0.44	0.35	0.32	0.47	0.44	-0.25	-0.17	0.33	0.18	0.03	-0.33	1

E. Winter periods

Variable		PM10	BS	NH3	CO	NO	NO2	SO2	O3	Sum	Nitr	Sulf	Amm	Flu	Betu	Poac	Rume	P	RH	T
Particulate matter	PM10	1	0.83	0.43	0.70	0.62	0.68	0.62	-0.46	0.70	0.71	0.71	0.75	0.12	0.12	0.08	0.00	0.48	0.00	-0.25
Black Smoke	BS	0.83	1	0.45	0.87	0.84	0.85	0.60	-0.72	0.57	0.67	0.63	0.70	0.03	-0.01	0.04	-0.02	0.44	0.16	-0.40
Ammonia	NH3	0.43	0.45	1	0.45	0.44	0.46	0.12	-0.15	0.32	0.45	0.28	0.38	0.04	0.23	0.13	0.06	0.38	-0.01	-0.03
Carbon monoxide	CO	0.70	0.87	0.45	1	0.90	0.87	0.55	-0.68	0.50	0.57	0.54	0.60	0.10	-0.03	0.03	-0.04	0.40	0.31	-0.44
Nitric oxide	NO	0.62	0.84	0.44	0.90	1	0.90	0.51	-0.77	0.42	0.48	0.46	0.52	0.00	-0.07	0.01	-0.05	0.42	0.32	-0.37
Nitrogen dioxide	NO2	0.68	0.85	0.46	0.87	0.90	1	0.63	-0.68	0.46	0.56	0.49	0.56	0.07	0.00	0.06	-0.03	0.40	0.20	-0.31
Sulfur dioxide	SO2	0.62	0.60	0.12	0.55	0.51	0.63	1	-0.36	0.53	0.47	0.54	0.51	0.22	0.03	0.05	-0.05	0.21	-0.10	-0.15
Ozone 8 h avg	O3	-0.46	-0.72	-0.15	-0.68	-0.77	-0.68	-0.36	1	-0.31	-0.37	-0.41	-0.44	0.07	0.30	0.13	0.06	-0.28	-0.54	0.32
Inorganic aerosol	Sum	0.70	0.57	0.32	0.50	0.42	0.46	0.53	-0.31	1	0.84	0.89	0.89	0.12	0.13	0.05	0.00	0.28	0.08	-0.09
Nitrate	Nitr	0.71	0.67	0.45	0.57	0.48	0.56	0.47	-0.37	0.84	1	0.85	0.94	0.07	0.16	0.11	0.03	0.31	0.08	-0.13
Sulfate	Sulf	0.71	0.63	0.28	0.54	0.46	0.49	0.54	-0.41	0.89	0.85	1	0.93	0.11	0.11	0.05	-0.01	0.29	0.14	-0.15
Ammonium	Amm	0.75	0.70	0.38	0.60	0.52	0.56	0.51	-0.44	0.89	0.94	0.93	1	0.10	0.13	0.09	0.00	0.33	0.14	-0.20
Influenza	Flu	0.12	0.03	0.04	0.10	0.00	0.07	0.22	0.07	0.12	0.07	0.11	0.10	1	0.06	0.04	0.04	0.15	-0.05	-0.16
Betula pollen	Betu	0.12	-0.01	0.23	-0.03	-0.07	0.00	0.03	0.30	0.13	0.16	0.11	0.13	0.06	1	0.25	0.13	0.05	-0.27	0.17
Poacea pollen	Poac	0.08	0.04	0.13	0.03	0.01	0.06	0.05	0.13	0.05	0.11	0.05	0.09	0.04	0.25	1	0.11	0.03	-0.14	0.11
Rumex pollen	Rume	0.00	-0.02	0.06	-0.04	-0.05	-0.03	-0.05	0.06	0.00	0.03	-0.01	0.00	0.04	0.13	0.11	1	0.01	-0.07	0.06
Atmosph pressure	P	0.48	0.44	0.38	0.40	0.42	0.40	0.21	-0.28	0.28	0.31	0.29	0.33	0.15	0.05	0.03	0.01	1	0.00	-0.29
Relative humidity	RH	0.00	0.16	-0.01	0.31	0.32	0.20	-0.10	-0.54	0.08	0.08	0.14	0.14	-0.05	-0.27	-0.14	-0.07	0.00	1	-0.02
Temperature	T	-0.25	-0.40	-0.03	-0.44	-0.37	-0.31	-0.15	0.32	-0.09	-0.13	-0.15	-0.20	-0.16	0.17	0.11	0.06	-0.29	-0.02	1

Table 9. Trends in air pollution concentrations in the Netherlands. Top: yearly means in 1992-2002; bottom: statistics of air pollutants for the two study periods (24 hour average concentrations, $\mu g/m^3$).

Pollutant (ug/m^3)	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Particulate matter PM10	45.7	39.9	38.5	39.7	43.3	41.1	36.0	32.2	31.8	31.0	32.4
Black Smoke	11.5	10.9	11.3	11.1	13.6	10.7	8.3	7.5	7.5	7.0	7.5
Ammonia	7.4	9.0	9.7	9.8	9.6	10.2	7.4	11.2	10.6	10.2	9.0
Carbon monoxide	543	536	528	501	513	467	457	405	365	396	386
Nitric oxide	14.9	14.3	14.3	13.4	13.5	12.6	9.0	4.8	5.2	7.9	6.5
Nitrogen dioxide	30.7	30.2	29.9	28.5	30.6	30.8	27.3	21.7	21.6	21.5	20.7
Sulfur dioxide	10.6	9.7	8.0	6.8	8.0	5.7	4.9	3.5	3.5	3.0	2.9
Ozone 8 h avg (12.00-20.00)	50.5	46.7	51.5	54.0	48.1	48.0	48.0	56.6	50.9	51.5	51.4
Inorganic aerosol	17.9	15.2	12.6	11.6	11.8	10.9	10.1	8.3	8.3	9.2	8.9
Nitrate	5.2	5.0	4.7	4.2	4.3	4.1	3.8	3.5	3.4	3.8	3.6
Sulfate	5.4	5.1	4.2	3.7	4.0	3.2	2.8	2.4	2.4	2.6	2.8
Ammonium	3.3	3.1	2.6	2.3	2.5	2.1	2.0	1.7	1.7	1.9	1.9

Period	Pollutant	days	mean	p10	p50	p90	p95	p98	p99	max
1992-1998										
	Particulate matter (PM10)	2554	40.6	20.6	34.1	69.8	81.9	101.2	116.8	251.7
	Black Smoke	2557	11.1	2.4	7.8	24.2	31.7	40.9	49.0	116.3
	Ammonia	2339	9.2	3.0	7.8	17.0	20.6	25.3	29.2	53.2
	Carbon monoxide	2557	507	305	440	805	955	1124	1323	3134
	Nitric oxide	2557	13.1	1.6	5.4	35.0	51.8	75.7	97.5	224.4
	Nitrogen dioxide	2557	29.7	15.5	28.0	45.6	50.8	57.3	62.8	93.3
	Sulfur dioxide	2557	7.7	2.4	6.1	13.9	19.4	26.9	35.7	60.8
	Ozone 8 h avg (12.00-20.00)	2557	49.6	10.9	47.3	87.5	112.4	133.4	149.1	189.3
	Inorganic aerosol	2308	12.4	5.1	10.1	21.5	27.4	37.4	46.4	96.0
	Nitrate	2557	4.5	1.3	3.6	8.5	10.7	14.2	17.8	33.3
	Sulfate	2557	4.1	1.2	3.1	8.0	10.3	13.8	17.1	48.2
	Ammonium	2557	2.6	0.7	2.0	5.0	6.4	8.4	10.4	22.2
1999-2002										
	Particulate matter (PM10)	1461	31.8	18.2	28.3	50.7	58.4	68.2	79.7	120.2
	Black Smoke	1461	7.4	1.9	5.4	15.1	19.3	26.0	30.2	67.9
	Ammonia	1453	10.2	3.1	8.4	19.7	24.6	29.5	33.8	81.3
	Carbon monoxide	1461	388	242	346	575	693	887	1039	1714
	Nitric oxide	1461	6.1	0.5	2.3	14.7	26.1	45.9	63.1	150.2
	Nitrogen dioxide	1461	21.4	10.9	19.5	34.9	39.7	44.8	48.2	59.5
	Sulfur dioxide	1461	3.2	1.3	2.9	5.5	6.5	7.6	9.0	15.5
	Ozone 8 h avg (12.00-20.00)	1461	52.6	16.4	52.1	86.6	101.4	120.7	132.9	155.0
	Inorganic aerosol	1461	8.7	4.1	7.6	14.6	17.5	20.1	24.2	38.4
	Nitrate	1461	3.6	1.0	3.0	6.9	8.1	10.2	11.1	15.9
	Sulfate	1461	2.5	1.0	2.2	4.6	5.4	6.4	7.0	15.6
	Ammonium	1461	1.8	0.6	1.5	3.3	4.0	4.6	5.5	8.9

Table 10. Associations of daily mortality with air pollution by cause of death (relative risks (RR) and 95% confidence intervals for a change in concentration cf. table 2).

Pollutant	Lag	All causes excluding accidental deaths RR (RR-lo - RR-hi)	Total respiratory diseases RR (RR-lo - RR-hi)	Cardio-vascular diseases RR (RR-lo - RR-hi)	Pneumonia RR (RR-lo - RR-hi)	Chronic obstructive pulmonary diseases RR (RR-lo - RR-hi)
PM10	0	1.022 (1.012 - 1.032) *	1.079 (1.047 - 1.111) *	1.026 (1.011 - 1.041) *	1.080 (1.031 - 1.132) *	1.066 (1.024 - 1.110) *
	1	1.030 (1.020 - 1.040) *	1.112 (1.080 - 1.144) *	1.018 (1.003 - 1.032) *	1.120 (1.071 - 1.171) *	1.100 (1.058 - 1.144) *
	2	1.025 (1.016 - 1.035) *	1.093 (1.062 - 1.125) *	1.016 (1.001 - 1.030) *	1.105 (1.058 - 1.155) *	1.089 (1.048 - 1.131) *
	3	1.027 (1.018 - 1.036) *	1.084 (1.054 - 1.114) *	1.020 (1.005 - 1.034) *	1.097 (1.050 - 1.145) *	1.092 (1.052 - 1.134) *
	0-6	1.045 (1.034 - 1.056) *	1.160 (1.124 - 1.198) *	1.030 (1.013 - 1.046) *	1.172 (1.116 - 1.231) *	1.147 (1.099 - 1.198) *
BS	0	1.020 (1.009 - 1.031) *	1.055 (1.020 - 1.091) *	1.031 (1.014 - 1.048) *	1.086 (1.031 - 1.144) *	1.031 (0.986 - 1.078)
	1	1.034 (1.023 - 1.046) *	1.108 (1.073 - 1.144) *	1.027 (1.010 - 1.044) *	1.128 (1.073 - 1.186) *	1.086 (1.039 - 1.134) *
	2	1.030 (1.019 - 1.040) *	1.097 (1.062 - 1.132) *	1.022 (1.005 - 1.038) *	1.129 (1.074 - 1.186) *	1.079 (1.034 - 1.126) *
	3	1.032 (1.022 - 1.043) *	1.094 (1.060 - 1.128) *	1.030 (1.014 - 1.046) *	1.118 (1.065 - 1.173) *	1.100 (1.055 - 1.146) *
	0-6	1.059 (1.047 - 1.071) *	1.159 (1.120 - 1.199) *	1.054 (1.036 - 1.073) *	1.173 (1.112 - 1.237) *	1.153 (1.101 - 1.208) *
NH3	0	1.017 (1.008 - 1.027) *	1.050 (1.021 - 1.081) *	1.017 (1.002 - 1.032) *	1.111 (1.064 - 1.160) *	0.995 (0.956 - 1.035)
	1	1.015 (1.005 - 1.024) *	1.057 (1.028 - 1.087) *	1.005 (0.990 - 1.019)	1.077 (1.032 - 1.123) *	1.037 (0.998 - 1.077)
	2	1.004 (0.995 - 1.014)	1.026 (0.998 - 1.055)	0.996 (0.982 - 1.011)	1.046 (1.003 - 1.090) *	1.014 (0.977 - 1.054)
	3	1.000 (0.991 - 1.009)	1.016 (0.989 - 1.044)	0.995 (0.981 - 1.009)	1.030 (0.988 - 1.074)	1.023 (0.985 - 1.062)
	0-6	1.008 (1.000 - 1.017)	1.051 (1.025 - 1.078) *	0.995 (0.982 - 1.008)	1.097 (1.056 - 1.140) *	1.014 (0.979 - 1.050)
CO	0	1.024 (1.010 - 1.039) *	1.050 (1.004 - 1.097) *	1.042 (1.018 - 1.065) *	1.130 (1.055 - 1.210) *	1.008 (0.948 - 1.072)
	1	1.042 (1.027 - 1.057) *	1.127 (1.078 - 1.178) *	1.042 (1.019 - 1.066) *	1.182 (1.105 - 1.265) *	1.084 (1.020 - 1.151) *
	2	1.028 (1.013 - 1.043) *	1.096 (1.048 - 1.145) *	1.017 (0.995 - 1.040)	1.108 (1.035 - 1.187) *	1.090 (1.028 - 1.156) *
	3	1.024 (1.009 - 1.038) *	1.068 (1.023 - 1.115) *	1.028 (1.006 - 1.050) *	1.090 (1.020 - 1.166) *	1.090 (1.030 - 1.153) *
	0-6	1.067 (1.049 - 1.086) *	1.162 (1.101 - 1.226) *	1.075 (1.046 - 1.104) *	1.159 (1.067 - 1.259) *	1.191 (1.108 - 1.279) *
NO	0	1.008 (0.997 - 1.020)	1.009 (0.975 - 1.044)	1.018 (1.000 - 1.036) *	1.083 (1.028 - 1.140) *	0.975 (0.930 - 1.022)
	1	1.015 (1.004 - 1.026) *	1.050 (1.015 - 1.085) *	1.016 (0.998 - 1.033)	1.094 (1.039 - 1.152) *	1.012 (0.967 - 1.060)
	2	1.011 (1.000 - 1.022)	1.041 (1.007 - 1.076) *	1.005 (0.987 - 1.022)	1.056 (1.003 - 1.112) *	1.032 (0.986 - 1.079)
	3	1.008 (0.997 - 1.019)	1.028 (0.995 - 1.062)	1.015 (0.998 - 1.032)	1.046 (0.994 - 1.100)	1.043 (0.999 - 1.089)
	0-6	1.030 (1.016 - 1.045) *	1.056 (1.012 - 1.102) *	1.042 (1.020 - 1.065) *	1.068 (1.001 - 1.141) *	1.078 (1.018 - 1.141) *
NO2	0	1.024 (1.014 - 1.033) *	1.051 (1.020 - 1.082) *	1.040 (1.025 - 1.055) *	1.095 (1.047 - 1.146) *	1.005 (0.966 - 1.046)
	1	1.031 (1.022 - 1.041) *	1.096 (1.065 - 1.127) *	1.027 (1.012 - 1.042) *	1.119 (1.072 - 1.168) *	1.064 (1.023 - 1.106) *
	2	1.022 (1.013 - 1.031) *	1.078 (1.047 - 1.109) *	1.021 (1.006 - 1.035) *	1.096 (1.049 - 1.145) *	1.069 (1.030 - 1.109) *
	3	1.021 (1.012 - 1.030) *	1.057 (1.029 - 1.086) *	1.023 (1.009 - 1.037) *	1.053 (1.010 - 1.098) *	1.085 (1.046 - 1.125) *
	0-6	1.043 (1.035 - 1.051) *	1.107 (1.080 - 1.135) *	1.047 (1.034 - 1.060) *	1.109 (1.068 - 1.152) *	1.103 (1.066 - 1.140) *
SO2	0	1.022 (1.002 - 1.043) *	1.119 (1.053 - 1.190) *	1.054 (1.022 - 1.086) *	1.147 (1.043 - 1.261) *	1.066 (0.982 - 1.158)
	1	1.035 (1.014 - 1.056) *	1.178 (1.109 - 1.251) *	1.032 (1.001 - 1.063) *	1.194 (1.088 - 1.311) *	1.115 (1.029 - 1.207) *
	2	1.062 (1.042 - 1.083) *	1.130 (1.066 - 1.198) *	1.069 (1.038 - 1.100) *	1.209 (1.105 - 1.324) *	1.075 (0.995 - 1.161)
	3	1.061 (1.041 - 1.081) *	1.153 (1.089 - 1.219) *	1.056 (1.026 - 1.087) *	1.213 (1.112 - 1.324) *	1.148 (1.065 - 1.238) *
	0-6	1.118 (1.095 - 1.142) *	1.324 (1.243 - 1.411) *	1.117 (1.082 - 1.153) *	1.377 (1.249 - 1.517) *	1.254 (1.152 - 1.366) *
O3 (8h)	0	1.007 (0.994 - 1.020)	1.016 (0.975 - 1.059)	1.026 (1.001 - 1.052) *	1.048 (0.983 - 1.117)	0.986 (0.921 - 1.057)
	1	1.033 (1.019 - 1.046) *	1.021 (0.972 - 1.074)	1.031 (1.008 - 1.055) *	1.058 (0.980 - 1.142)	1.057 (0.995 - 1.122)
	2	1.007 (0.991 - 1.024)	1.112 (1.064 - 1.162) *	0.999 (0.977 - 1.020)	1.157 (1.081 - 1.237) *	1.134 (1.070 - 1.201) *
	3	1.007 (0.993 - 1.020)	1.088 (1.044 - 1.135) *	0.995 (0.975 - 1.016)	1.195 (1.121 - 1.274) *	0.999 (0.945 - 1.055)
	0-6	1.027 (1.012 - 1.042) *	1.245 (1.188 - 1.305) *	0.989 (0.966 - 1.013)	1.515 (1.410 - 1.629) *	1.076 (1.010 - 1.147) *
Sum	0	1.041 (1.025 - 1.057) *	1.160 (1.105 - 1.217) *	1.048 (1.023 - 1.073) *	1.114 (1.031 - 1.203) *	1.162 (1.089 - 1.240) *
	1	1.045 (1.029 - 1.061) *	1.098 (1.046 - 1.153) *	1.034 (1.010 - 1.058) *	1.121 (1.038 - 1.210) *	1.090 (1.022 - 1.162) *
	2	1.039 (1.023 - 1.055) *	1.109 (1.058 - 1.163) *	1.027 (1.004 - 1.051) *	1.111 (1.030 - 1.197) *	1.120 (1.052 - 1.193) *
	3	1.031 (1.016 - 1.046) *	1.080 (1.030 - 1.131) *	1.021 (0.998 - 1.045)	1.030 (0.956 - 1.109)	1.132 (1.064 - 1.205) *
	0-6	1.053 (1.036 - 1.070) *	1.169 (1.110 - 1.230) *	1.027 (1.001 - 1.053) *	1.120 (1.033 - 1.213) *	1.194 (1.116 - 1.278) *
NO3-	0	1.024 (1.015 - 1.034) *	1.096 (1.066 - 1.126) *	1.026 (1.012 - 1.040) *	1.082 (1.036 - 1.130) *	1.086 (1.046 - 1.127) *
	1	1.022 (1.013 - 1.031) *	1.068 (1.039 - 1.098) *	1.017 (1.003 - 1.030) *	1.056 (1.011 - 1.102) *	1.068 (1.029 - 1.108) *
	2	1.020 (1.011 - 1.028) *	1.041 (1.013 - 1.070) *	1.013 (0.999 - 1.026)	1.023 (0.980 - 1.068)	1.053 (1.016 - 1.093) *
	3	1.013 (1.004 - 1.022) *	1.037 (1.009 - 1.066) *	1.011 (0.997 - 1.024)	0.995 (0.953 - 1.039)	1.071 (1.033 - 1.111) *
	0-6	1.024 (1.015 - 1.033) *	1.079 (1.050 - 1.108) *	1.014 (1.001 - 1.028) *	1.053 (1.009 - 1.098) *	1.086 (1.048 - 1.126) *
SO4--	0	1.017 (1.008 - 1.027) *	1.103 (1.072 - 1.136) *	1.012 (0.997 - 1.026)	1.074 (1.025 - 1.124) *	1.111 (1.069 - 1.155) *
	1	1.022 (1.013 - 1.031) *	1.065 (1.035 - 1.097) *	1.016 (1.002 - 1.031) *	1.043 (0.996 - 1.092)	1.078 (1.037 - 1.120) *
	2	1.024 (1.014 - 1.033) *	1.047 (1.018 - 1.078) *	1.014 (1.000 - 1.029) *	1.026 (0.980 - 1.075)	1.070 (1.030 - 1.112) *
	3	1.019 (1.010 - 1.028) *	1.048 (1.018 - 1.078) *	1.011 (0.997 - 1.026)	1.030 (0.984 - 1.078)	1.075 (1.035 - 1.116) *
	0-6	1.029 (1.020 - 1.038) *	1.086 (1.057 - 1.116) *	1.014 (1.000 - 1.028) *	1.068 (1.023 - 1.115) *	1.101 (1.062 - 1.143) *
NH4+	0	1.024 (1.013 - 1.034) *	1.112 (1.078 - 1.148) *	1.020 (1.005 - 1.037) *	1.092 (1.039 - 1.148) *	1.108 (1.062 - 1.157) *
	1	1.025 (1.015 - 1.035) *	1.077 (1.043 - 1.111) *	1.016 (1.000 - 1.032) *	1.058 (1.007 - 1.112) *	1.083 (1.039 - 1.130) *
	2	1.025 (1.015 - 1.036) *	1.053 (1.021 - 1.087) *	1.014 (0.998 - 1.029)	1.035 (0.986 - 1.088)	1.070 (1.027 - 1.116) *
	3	1.019 (1.009 - 1.029) *	1.050 (1.018 - 1.083) *	1.011 (0.996 - 1.027)	1.019 (0.971 - 1.070)	1.083 (1.039 - 1.129) *
	0-6	1.022 (1.015 - 1.029) *	1.066 (1.043 - 1.090) *	1.010 (0.999 - 1.021)	1.053 (1.017 - 1.090) *	1.073 (1.041 - 1.105) *

Table 11A. Associations of daily total mortality (all causes) with air pollution by period, season, and region; relative risks (RR) and 95% confidence intervals for a change in concentration cf. table 2. (continued on next page)

Pollutant	Lag	Overall 1992-2002 RR (RR-lo - RR-hi)	1992-1998 RR (RR-lo - RR-hi)	1992-1994 RR (RR-lo - RR-hi)	1995-1998 RR (RR-lo - RR-hi)	1999-2002 RR (RR-lo - RR-hi)
PM10	0	1.022 (1.012 - 1.032) *	1.025 (1.014 - 1.036) *	1.016 (1.002 - 1.031) *	1.035 (1.020 - 1.051) *	1.009 (0.988 - 1.031)
	1	1.030 (1.020 - 1.040) *	1.034 (1.023 - 1.045) *	1.024 (1.010 - 1.039) *	1.045 (1.030 - 1.060) *	1.011 (0.990 - 1.033)
	2	1.025 (1.016 - 1.035) *	1.028 (1.017 - 1.038) *	1.022 (1.008 - 1.036) *	1.033 (1.019 - 1.049) *	1.015 (0.994 - 1.036)
	3	1.027 (1.018 - 1.036) *	1.028 (1.018 - 1.039) *	1.025 (1.011 - 1.039) *	1.032 (1.017 - 1.047) *	1.021 (1.000 - 1.042)
	0-6	1.045 (1.034 - 1.056) *	1.045 (1.033 - 1.057) *	1.036 (1.019 - 1.052) *	1.055 (1.039 - 1.072) *	1.045 (1.020 - 1.071) *
BS	0	1.020 (1.009 - 1.031) *	1.021 (1.009 - 1.033) *	1.011 (0.995 - 1.027)	1.032 (1.016 - 1.048) *	1.018 (0.995 - 1.041)
	1	1.034 (1.023 - 1.046) *	1.037 (1.025 - 1.049) *	1.027 (1.011 - 1.043) *	1.048 (1.032 - 1.064) *	1.026 (1.003 - 1.049) *
	2	1.030 (1.019 - 1.040) *	1.032 (1.021 - 1.044) *	1.028 (1.012 - 1.044) *	1.038 (1.022 - 1.054) *	1.018 (0.996 - 1.041)
	3	1.032 (1.022 - 1.043) *	1.035 (1.024 - 1.047) *	1.034 (1.018 - 1.049) *	1.037 (1.022 - 1.053) *	1.021 (0.999 - 1.043)
	0-6	1.059 (1.047 - 1.071) *	1.057 (1.044 - 1.070) *	1.045 (1.028 - 1.062) *	1.073 (1.056 - 1.090) *	1.067 (1.041 - 1.093) *
NH3	0	1.017 (1.008 - 1.027) *	1.023 (1.010 - 1.036) *	1.027 (1.007 - 1.047) *	1.021 (1.005 - 1.036) *	1.012 (0.999 - 1.024)
	1	1.015 (1.005 - 1.024) *	1.026 (1.013 - 1.039) *	1.016 (0.996 - 1.035)	1.032 (1.016 - 1.048) *	1.003 (0.991 - 1.016)
	2	1.004 (0.995 - 1.014)	1.009 (0.997 - 1.022)	1.006 (0.987 - 1.026)	1.011 (0.996 - 1.027)	0.999 (0.987 - 1.012)
	3	1.000 (0.991 - 1.009)	0.999 (0.987 - 1.012)	1.017 (0.998 - 1.037)	0.990 (0.975 - 1.005)	1.000 (0.988 - 1.012)
	0-6	1.008 (1.000 - 1.017)	1.010 (0.999 - 1.021)	1.026 (1.009 - 1.043) *	1.001 (0.987 - 1.015)	1.006 (0.995 - 1.018)
CO	0	1.024 (1.010 - 1.039) *	1.024 (1.009 - 1.040) *	1.015 (0.995 - 1.035)	1.039 (1.016 - 1.062) *	1.025 (0.997 - 1.054)
	1	1.042 (1.027 - 1.057) *	1.044 (1.028 - 1.060) *	1.031 (1.011 - 1.051) *	1.065 (1.042 - 1.089) *	1.035 (1.007 - 1.063) *
	2	1.028 (1.013 - 1.043) *	1.029 (1.013 - 1.045) *	1.022 (1.002 - 1.043) *	1.041 (1.018 - 1.064) *	1.024 (0.996 - 1.052)
	3	1.024 (1.009 - 1.038) *	1.025 (1.009 - 1.040) *	1.030 (1.010 - 1.050) *	1.017 (0.995 - 1.040)	1.020 (0.993 - 1.048)
	0-6	1.067 (1.049 - 1.086) *	1.058 (1.039 - 1.078) *	1.053 (1.029 - 1.078) *	1.069 (1.044 - 1.096) *	1.105 (1.071 - 1.140) *
NO	0	1.008 (0.997 - 1.020)	1.006 (0.994 - 1.017)	1.000 (0.985 - 1.016)	1.012 (0.996 - 1.029)	1.024 (0.999 - 1.050)
	1	1.015 (1.004 - 1.026) *	1.015 (1.003 - 1.027) *	1.008 (0.993 - 1.024)	1.023 (1.007 - 1.040) *	1.016 (0.991 - 1.042)
	2	1.011 (1.000 - 1.022)	1.010 (0.998 - 1.022)	1.014 (0.998 - 1.030)	1.005 (0.989 - 1.022)	1.017 (0.992 - 1.043)
	3	1.008 (0.997 - 1.019)	1.007 (0.996 - 1.019)	1.021 (1.005 - 1.036) *	0.993 (0.977 - 1.009)	1.009 (0.985 - 1.034)
	0-6	1.030 (1.016 - 1.045) *	1.021 (1.006 - 1.036) *	1.030 (1.011 - 1.050) *	1.012 (0.992 - 1.031)	1.079 (1.048 - 1.112) *
NO2	0	1.024 (1.014 - 1.033) *	1.024 (1.014 - 1.035) *	1.016 (1.001 - 1.032) *	1.031 (1.017 - 1.045) *	1.021 (1.004 - 1.038) *
	1	1.031 (1.022 - 1.041) *	1.032 (1.021 - 1.043) *	1.024 (1.009 - 1.040) *	1.039 (1.025 - 1.052) *	1.029 (1.012 - 1.046) *
	2	1.022 (1.013 - 1.031) *	1.025 (1.015 - 1.036) *	1.025 (1.010 - 1.040) *	1.025 (1.012 - 1.039) *	1.012 (0.996 - 1.029)
	3	1.021 (1.012 - 1.030) *	1.024 (1.013 - 1.034) *	1.028 (1.013 - 1.043) *	1.021 (1.008 - 1.034) *	1.012 (0.996 - 1.028)
	0-6	1.043 (1.035 - 1.051) *	1.043 (1.034 - 1.053) *	1.043 (1.030 - 1.058) *	1.044 (1.033 - 1.056) *	1.042 (1.027 - 1.056) *
SO2	0	1.022 (1.002 - 1.043) *	1.022 (1.002 - 1.043) *	1.016 (0.989 - 1.044)	1.028 (1.001 - 1.056) *	1.029 (0.946 - 1.120)
	1	1.035 (1.014 - 1.056) *	1.035 (1.015 - 1.057) *	1.026 (0.998 - 1.054)	1.046 (1.018 - 1.074) *	1.013 (0.931 - 1.103)
	2	1.062 (1.042 - 1.083) *	1.063 (1.042 - 1.084) *	1.057 (1.029 - 1.085) *	1.069 (1.042 - 1.098) *	1.055 (0.971 - 1.146)
	3	1.061 (1.041 - 1.081) *	1.059 (1.039 - 1.079) *	1.052 (1.024 - 1.080) *	1.066 (1.039 - 1.094) *	1.104 (1.017 - 1.199) *
	0-6	1.118 (1.095 - 1.142) *	1.114 (1.091 - 1.138) *	1.107 (1.074 - 1.142) *	1.119 (1.090 - 1.150) *	1.247 (1.119 - 1.388) *
O3 (8h)	0	1.007 (0.994 - 1.020)	1.017 (1.003 - 1.032) *	1.011 (0.992 - 1.030)	1.022 (1.005 - 1.040) *	0.985 (0.967 - 1.004)
	1	1.033 (1.019 - 1.046) *	1.049 (1.034 - 1.064) *	1.049 (1.029 - 1.069) *	1.049 (1.031 - 1.067) *	1.001 (0.982 - 1.020)
	2	1.007 (0.991 - 1.024)	1.010 (0.993 - 1.027)	1.000 (0.979 - 1.021)	1.017 (0.998 - 1.037)	1.003 (0.982 - 1.024)
	3	1.007 (0.993 - 1.020)	1.010 (0.996 - 1.025)	0.995 (0.976 - 1.014)	1.021 (1.004 - 1.039) *	0.999 (0.980 - 1.018)
	0-6	1.027 (1.012 - 1.042) *	1.044 (1.028 - 1.061) *	1.033 (1.014 - 1.053) *	1.050 (1.032 - 1.069) *	0.987 (0.967 - 1.007)
Sum	0	1.041 (1.025 - 1.057) *	1.044 (1.027 - 1.061) *	1.034 (1.012 - 1.055) *	1.061 (1.033 - 1.089) *	1.021 (0.983 - 1.062)
	1	1.045 (1.029 - 1.061) *	1.049 (1.032 - 1.066) *	1.050 (1.029 - 1.072) *	1.047 (1.020 - 1.075) *	1.020 (0.981 - 1.060)
	2	1.039 (1.023 - 1.055) *	1.043 (1.026 - 1.060) *	1.041 (1.020 - 1.063) *	1.045 (1.018 - 1.073) *	1.016 (0.978 - 1.056)
	3	1.031 (1.016 - 1.046) *	1.031 (1.015 - 1.048) *	1.030 (1.009 - 1.051) *	1.034 (1.007 - 1.061) *	1.028 (0.990 - 1.068)
	0-6	1.053 (1.036 - 1.070) *	1.050 (1.032 - 1.069) *	1.046 (1.023 - 1.069) *	1.057 (1.029 - 1.087) *	1.068 (1.022 - 1.115) *
NO3-	0	1.024 (1.015 - 1.034) *	1.027 (1.017 - 1.037) *	1.022 (1.008 - 1.035) *	1.033 (1.018 - 1.048) *	1.015 (0.997 - 1.034)
	1	1.022 (1.013 - 1.031) *	1.025 (1.015 - 1.035) *	1.025 (1.012 - 1.039) *	1.024 (1.009 - 1.039) *	1.012 (0.994 - 1.031)
	2	1.020 (1.011 - 1.028) *	1.025 (1.015 - 1.035) *	1.027 (1.014 - 1.041) *	1.023 (1.008 - 1.038) *	1.000 (0.982 - 1.018)
	3	1.013 (1.004 - 1.022) *	1.015 (1.005 - 1.025) *	1.015 (1.002 - 1.029) *	1.016 (1.001 - 1.031) *	1.005 (0.987 - 1.024)
	0-6	1.024 (1.015 - 1.033) *	1.024 (1.015 - 1.034) *	1.025 (1.012 - 1.038) *	1.023 (1.009 - 1.038) *	1.023 (1.004 - 1.042) *
SO4--	0	1.017 (1.008 - 1.027) *	1.017 (1.007 - 1.028) *	1.009 (0.997 - 1.021)	1.035 (1.018 - 1.053) *	1.016 (0.987 - 1.046)
	1	1.022 (1.013 - 1.031) *	1.023 (1.013 - 1.033) *	1.019 (1.007 - 1.032) *	1.030 (1.013 - 1.047) *	1.017 (0.987 - 1.046)
	2	1.024 (1.014 - 1.033) *	1.023 (1.014 - 1.033) *	1.021 (1.009 - 1.033) *	1.029 (1.012 - 1.046) *	1.026 (0.997 - 1.056)
	3	1.019 (1.010 - 1.028) *	1.018 (1.008 - 1.028) *	1.017 (1.005 - 1.029) *	1.020 (1.003 - 1.037) *	1.030 (1.001 - 1.060) *
	0-6	1.029 (1.020 - 1.038) *	1.026 (1.017 - 1.036) *	1.023 (1.011 - 1.035) *	1.033 (1.017 - 1.048) *	1.058 (1.028 - 1.089) *
NH4+	0	1.024 (1.013 - 1.034) *	1.025 (1.014 - 1.036) *	1.014 (1.000 - 1.029) *	1.042 (1.024 - 1.060) *	1.016 (0.990 - 1.043)
	1	1.025 (1.015 - 1.035) *	1.026 (1.015 - 1.038) *	1.023 (1.009 - 1.037) *	1.032 (1.015 - 1.050) *	1.017 (0.991 - 1.043)
	2	1.025 (1.015 - 1.036) *	1.028 (1.017 - 1.039) *	1.026 (1.012 - 1.041) *	1.030 (1.013 - 1.048) *	1.010 (0.984 - 1.036)
	3	1.019 (1.009 - 1.029) *	1.019 (1.008 - 1.030) *	1.018 (1.004 - 1.032) *	1.021 (1.004 - 1.039) *	1.017 (0.991 - 1.044)
	0-6	1.022 (1.015 - 1.029) *	1.020 (1.013 - 1.028) *	1.018 (1.008 - 1.028) *	1.024 (1.012 - 1.037) *	1.030 (1.011 - 1.050) *

Table 11A. (Continued) Associations of daily total mortality (all causes) with air pollution by period, season, and region; relative risks (RR) and 95% confidence intervals for a change in concentration cf. table 2.

Pollutant	Lag	Overall 1992-2002 RR (RR-lo - RR-hi)	Summer (May - Sept) RR (RR-lo - RR-hi)	Winter (Nov - March) RR (RR-lo - RR-hi)	Four Major Cities RR (RR-lo - RR-hi)	Excl. Major Cities RR (RR-lo - RR-hi)
PM10	0	1.022 (1.012 - 1.032) *	1.079 (1.058 - 1.100) *	1.007 (0.995 - 1.020)	1.003 (0.982 - 1.025)	1.021 (1.011 - 1.031) *
	1	1.030 (1.020 - 1.040) *	1.061 (1.040 - 1.083) *	1.023 (1.011 - 1.036) *	1.014 (0.993 - 1.035)	1.029 (1.019 - 1.040) *
	2	1.025 (1.016 - 1.035) *	1.036 (1.016 - 1.058) *	1.028 (1.016 - 1.041) *	1.004 (0.984 - 1.025)	1.026 (1.016 - 1.036) *
	3	1.027 (1.018 - 1.036) *	1.037 (1.016 - 1.057) *	1.028 (1.016 - 1.040) *	1.012 (0.992 - 1.033)	1.026 (1.016 - 1.035) *
	0-6	1.045 (1.034 - 1.056) *	1.093 (1.068 - 1.118) *	1.040 (1.027 - 1.054) *	1.036 (1.011 - 1.061) *	1.044 (1.033 - 1.055) *
BS	0	1.020 (1.009 - 1.031) *	1.147 (1.106 - 1.190) *	1.009 (0.996 - 1.021)	1.004 (0.979 - 1.028)	1.017 (1.006 - 1.028) *
	1	1.034 (1.023 - 1.046) *	1.148 (1.107 - 1.191) *	1.024 (1.012 - 1.036) *	1.033 (1.009 - 1.058) *	1.031 (1.020 - 1.042) *
	2	1.030 (1.019 - 1.040) *	1.107 (1.066 - 1.149) *	1.027 (1.015 - 1.039) *	1.029 (1.005 - 1.053) *	1.028 (1.017 - 1.039) *
	3	1.032 (1.022 - 1.043) *	1.111 (1.071 - 1.153) *	1.028 (1.016 - 1.039) *	1.013 (0.990 - 1.037)	1.032 (1.021 - 1.042) *
	0-6	1.059 (1.047 - 1.071) *	1.257 (1.205 - 1.311) *	1.046 (1.033 - 1.059) *	1.055 (1.028 - 1.083) *	1.057 (1.045 - 1.070) *
NH3	0	1.017 (1.008 - 1.027) *	1.026 (1.011 - 1.041) *	1.011 (0.998 - 1.025)	1.006 (0.984 - 1.029)	1.019 (1.009 - 1.030) *
	1	1.015 (1.005 - 1.024) *	1.023 (1.008 - 1.038) *	1.008 (0.995 - 1.022)	1.017 (0.995 - 1.040)	1.014 (1.004 - 1.024) *
	2	1.004 (0.995 - 1.014)	1.008 (0.993 - 1.024)	1.001 (0.987 - 1.014)	1.007 (0.986 - 1.030)	1.004 (0.994 - 1.014)
	3	1.000 (0.991 - 1.009)	1.018 (1.003 - 1.033) *	0.987 (0.975 - 1.001)	1.002 (0.980 - 1.023)	0.999 (0.990 - 1.009)
	0-6	1.008 (1.000 - 1.017)	1.030 (1.015 - 1.044) *	0.996 (0.984 - 1.008)	1.005 (0.985 - 1.026)	1.009 (1.000 - 1.018)
CO	0	1.024 (1.010 - 1.039) *	1.142 (1.094 - 1.192) *	1.010 (0.994 - 1.027)	1.000 (0.972 - 1.029)	1.041 (1.021 - 1.061) *
	1	1.042 (1.027 - 1.057) *	1.146 (1.098 - 1.196) *	1.028 (1.012 - 1.045) *	1.031 (1.002 - 1.060) *	1.052 (1.032 - 1.072) *
	2	1.028 (1.013 - 1.043) *	1.090 (1.043 - 1.139) *	1.026 (1.009 - 1.043) *	1.012 (0.984 - 1.042)	1.039 (1.019 - 1.059) *
	3	1.024 (1.009 - 1.038) *	1.074 (1.027 - 1.123) *	1.021 (1.005 - 1.037) *	1.003 (0.975 - 1.031)	1.044 (1.025 - 1.063) *
	0-6	1.067 (1.049 - 1.086) *	1.219 (1.158 - 1.283) *	1.055 (1.035 - 1.075) *	1.042 (1.006 - 1.080) *	1.088 (1.064 - 1.112) *
NO	0	1.008 (0.997 - 1.020)	1.113 (1.042 - 1.189) *	1.004 (0.993 - 1.016)	1.000 (0.984 - 1.016)	1.007 (0.993 - 1.021)
	1	1.015 (1.004 - 1.026) *	1.065 (0.995 - 1.139)	1.012 (1.001 - 1.024) *	1.012 (0.996 - 1.028)	1.016 (1.002 - 1.030) *
	2	1.011 (1.000 - 1.022)	1.077 (1.004 - 1.154) *	1.011 (0.999 - 1.023)	1.003 (0.987 - 1.020)	1.015 (1.001 - 1.029) *
	3	1.008 (0.997 - 1.019)	1.011 (0.942 - 1.086)	1.008 (0.996 - 1.019)	0.996 (0.980 - 1.012)	1.011 (0.997 - 1.025)
	0-6	1.030 (1.016 - 1.045) *	1.217 (1.112 - 1.332) *	1.025 (1.011 - 1.040) *	1.013 (0.992 - 1.035)	1.035 (1.017 - 1.053) *
NO2	0	1.024 (1.014 - 1.033) *	1.043 (1.025 - 1.062) *	1.014 (1.002 - 1.026) *	1.003 (0.985 - 1.020)	1.017 (1.007 - 1.026) *
	1	1.031 (1.022 - 1.041) *	1.063 (1.044 - 1.082) *	1.017 (1.005 - 1.029) *	1.033 (1.015 - 1.051) *	1.022 (1.012 - 1.031) *
	2	1.022 (1.013 - 1.031) *	1.038 (1.020 - 1.057) *	1.019 (1.008 - 1.031) *	1.015 (0.998 - 1.032)	1.017 (1.008 - 1.026) *
	3	1.021 (1.012 - 1.030) *	1.039 (1.021 - 1.058) *	1.016 (1.005 - 1.027) *	1.004 (0.988 - 1.022)	1.015 (1.007 - 1.024) *
	0-6	1.043 (1.035 - 1.051) *	1.090 (1.073 - 1.107) *	1.030 (1.020 - 1.041) *	1.028 (1.011 - 1.046) *	1.034 (1.026 - 1.042) *
SO2	0	1.022 (1.002 - 1.043) *	1.112 (1.053 - 1.174) *	1.009 (0.988 - 1.031)	0.992 (0.962 - 1.024)	1.024 (1.004 - 1.044) *
	1	1.035 (1.014 - 1.056) *	1.111 (1.052 - 1.174) *	1.022 (1.001 - 1.044) *	1.016 (0.985 - 1.048)	1.021 (1.001 - 1.042) *
	2	1.062 (1.042 - 1.083) *	1.046 (0.989 - 1.106)	1.064 (1.043 - 1.086) *	1.004 (0.974 - 1.035)	1.045 (1.024 - 1.065) *
	3	1.061 (1.041 - 1.081) *	1.071 (1.014 - 1.130) *	1.060 (1.039 - 1.081) *	1.014 (0.984 - 1.045)	1.045 (1.026 - 1.064) *
	0-6	1.118 (1.095 - 1.142) *	1.258 (1.181 - 1.340) *	1.100 (1.077 - 1.124) *	1.065 (1.025 - 1.106) *	1.111 (1.088 - 1.135) *
O3 (8h)	0	1.007 (0.994 - 1.020)	1.020 (1.003 - 1.037) *	1.000 (0.978 - 1.023)	1.016 (0.985 - 1.047)	1.010 (0.996 - 1.023)
	1	1.033 (1.019 - 1.046) *	1.062 (1.044 - 1.081) *	0.994 (0.971 - 1.016)	1.019 (0.987 - 1.051)	1.031 (1.017 - 1.045) *
	2	1.007 (0.991 - 1.024)	1.036 (1.016 - 1.057) *	0.967 (0.944 - 0.991) *	0.997 (0.961 - 1.034)	1.007 (0.991 - 1.023)
	3	1.007 (0.993 - 1.020)	1.039 (1.021 - 1.057) *	0.964 (0.942 - 0.986) *	1.030 (0.998 - 1.063)	1.000 (0.986 - 1.013)
	0-6	1.027 (1.012 - 1.042) *	1.088 (1.067 - 1.110) *	0.951 (0.928 - 0.974) *	1.061 (1.024 - 1.100) *	1.019 (1.003 - 1.035) *
Sum	0	1.041 (1.025 - 1.057) *	1.070 (1.039 - 1.102) *	1.028 (1.008 - 1.049) *	1.027 (0.990 - 1.065)	1.043 (1.026 - 1.061) *
	1	1.045 (1.029 - 1.061) *	1.048 (1.017 - 1.080) *	1.047 (1.028 - 1.068) *	1.037 (1.001 - 1.075) *	1.046 (1.029 - 1.063) *
	2	1.039 (1.023 - 1.055) *	1.036 (1.006 - 1.068) *	1.044 (1.024 - 1.064) *	1.036 (1.000 - 1.073)	1.039 (1.023 - 1.056) *
	3	1.031 (1.016 - 1.046) *	1.035 (1.003 - 1.068) *	1.037 (1.018 - 1.056) *	1.009 (0.974 - 1.046)	1.035 (1.019 - 1.052) *
	0-6	1.053 (1.036 - 1.070) *	1.074 (1.036 - 1.113) *	1.055 (1.035 - 1.076) *	1.049 (1.010 - 1.090) *	1.053 (1.035 - 1.072) *
NO3-	0	1.024 (1.015 - 1.034) *	1.039 (1.022 - 1.057) *	1.020 (1.007 - 1.032) *	1.009 (0.988 - 1.031)	1.027 (1.017 - 1.037) *
	1	1.022 (1.013 - 1.031) *	1.027 (1.010 - 1.045) *	1.027 (1.015 - 1.040) *	1.021 (1.001 - 1.043) *	1.022 (1.012 - 1.031) *
	2	1.020 (1.011 - 1.028) *	1.018 (1.001 - 1.036) *	1.025 (1.013 - 1.038) *	1.026 (1.005 - 1.047) *	1.018 (1.009 - 1.028) *
	3	1.013 (1.004 - 1.022) *	1.011 (0.994 - 1.028)	1.020 (1.008 - 1.032) *	1.006 (0.986 - 1.027)	1.014 (1.005 - 1.024) *
	0-6	1.024 (1.015 - 1.033) *	1.025 (1.007 - 1.044) *	1.031 (1.019 - 1.042) *	1.028 (1.007 - 1.049) *	1.023 (1.014 - 1.033) *
SO4--	0	1.017 (1.008 - 1.027) *	1.059 (1.037 - 1.081) *	1.008 (0.997 - 1.019)	0.996 (0.974 - 1.019)	1.021 (1.011 - 1.032) *
	1	1.022 (1.013 - 1.031) *	1.037 (1.016 - 1.059) *	1.020 (1.009 - 1.031) *	1.008 (0.987 - 1.031)	1.025 (1.015 - 1.035) *
	2	1.024 (1.014 - 1.033) *	1.025 (1.004 - 1.047) *	1.024 (1.013 - 1.035) *	1.018 (0.997 - 1.041)	1.025 (1.015 - 1.035) *
	3	1.019 (1.010 - 1.028) *	1.031 (1.010 - 1.053) *	1.019 (1.008 - 1.030) *	1.008 (0.987 - 1.030)	1.021 (1.011 - 1.031) *
	0-6	1.029 (1.020 - 1.038) *	1.052 (1.031 - 1.074) *	1.027 (1.016 - 1.037) *	1.026 (1.005 - 1.047) *	1.030 (1.020 - 1.039) *
NH4+	0	1.024 (1.013 - 1.034) *	1.063 (1.041 - 1.086) *	1.013 (1.000 - 1.026)	0.998 (0.975 - 1.023)	1.029 (1.017 - 1.040) *
	1	1.025 (1.015 - 1.035) *	1.042 (1.020 - 1.065) *	1.025 (1.012 - 1.037) *	1.016 (0.992 - 1.040)	1.027 (1.016 - 1.038) *
	2	1.025 (1.015 - 1.036) *	1.027 (1.005 - 1.050) *	1.028 (1.015 - 1.041) *	1.024 (1.001 - 1.049) *	1.026 (1.015 - 1.037) *
	3	1.019 (1.009 - 1.029) *	1.027 (1.005 - 1.049) *	1.021 (1.009 - 1.034) *	1.007 (0.984 - 1.031)	1.021 (1.010 - 1.032) *
	0-6	1.022 (1.015 - 1.029) *	1.036 (1.019 - 1.054) *	1.021 (1.013 - 1.030) *	1.041 (1.007 - 1.077) *	1.044 (1.029 - 1.060) *

Table 11B. Associations of daily total respiratory mortality with air pollution by period, season, and region; relative risks (RR) and 95% confidence intervals for a change in concentration cf. table 2. (continued on next page)

Pollutant	Lag	RR (RR-lo - RR-hi)	1992-1998 RR (RR-lo - RR-hi)	1992-1994 RR (RR-lo - RR-hi)	1995-1998 RR (RR-lo - RR-hi)	1999-2002 RR (RR-lo - RR-hi)
PM10	0	1.079 (1.047 - 1.111) *	1.083 (1.048 - 1.119) *	1.070 (1.023 - 1.119) *	1.095 (1.047 - 1.145) *	1.061 (0.995 - 1.131)
	1	1.112 (1.080 - 1.144) *	1.120 (1.085 - 1.156) *	1.109 (1.062 - 1.159) *	1.130 (1.082 - 1.181) *	1.074 (1.009 - 1.144) *
	2	1.093 (1.062 - 1.125) *	1.091 (1.058 - 1.126) *	1.084 (1.037 - 1.133) *	1.098 (1.051 - 1.147) *	1.100 (1.034 - 1.171) *
	3	1.084 (1.054 - 1.114) *	1.080 (1.047 - 1.114) *	1.076 (1.029 - 1.124) *	1.084 (1.038 - 1.132) *	1.101 (1.035 - 1.171) *
	0-6	1.160 (1.124 - 1.198) *	1.149 (1.110 - 1.190) *	1.144 (1.088 - 1.202) *	1.155 (1.101 - 1.212) *	1.216 (1.130 - 1.308) *
BS	0	1.055 (1.020 - 1.091) *	1.058 (1.021 - 1.097) *	1.043 (0.992 - 1.097)	1.075 (1.026 - 1.125) *	1.042 (0.974 - 1.113)
	1	1.108 (1.073 - 1.144) *	1.118 (1.080 - 1.158) *	1.103 (1.050 - 1.159) *	1.134 (1.084 - 1.186) *	1.071 (1.003 - 1.143) *
	2	1.097 (1.062 - 1.132) *	1.100 (1.063 - 1.139) *	1.091 (1.039 - 1.146) *	1.110 (1.062 - 1.161) *	1.083 (1.015 - 1.156) *
	3	1.094 (1.060 - 1.128) *	1.099 (1.063 - 1.138) *	1.099 (1.047 - 1.154) *	1.102 (1.054 - 1.152) *	1.074 (1.007 - 1.145) *
	0-6	1.159 (1.120 - 1.199) *	1.155 (1.114 - 1.199) *	1.139 (1.080 - 1.200) *	1.178 (1.125 - 1.234) *	1.173 (1.091 - 1.262) *
NH3	0	1.050 (1.021 - 1.081) *	1.050 (1.011 - 1.091) *	1.074 (1.011 - 1.140) *	1.038 (0.991 - 1.087)	1.050 (1.011 - 1.091) *
	1	1.057 (1.028 - 1.087) *	1.067 (1.028 - 1.108) *	1.102 (1.038 - 1.170) *	1.049 (1.002 - 1.098) *	1.047 (1.008 - 1.087) *
	2	1.026 (0.998 - 1.055)	1.047 (1.009 - 1.087) *	1.081 (1.018 - 1.147) *	1.030 (0.984 - 1.078)	1.004 (0.967 - 1.043)
	3	1.016 (0.989 - 1.044)	1.030 (0.993 - 1.069)	1.102 (1.039 - 1.170) *	0.995 (0.951 - 1.042)	1.001 (0.965 - 1.040)
	0-6	1.051 (1.025 - 1.078) *	1.048 (1.013 - 1.083) *	1.109 (1.055 - 1.167) *	1.015 (0.973 - 1.058)	1.054 (1.019 - 1.091) *
CO	0	1.050 (1.004 - 1.097) *	1.045 (0.996 - 1.096)	1.037 (0.974 - 1.104)	1.056 (0.989 - 1.128)	1.069 (0.986 - 1.160)
	1	1.127 (1.078 - 1.178) *	1.136 (1.083 - 1.191) *	1.134 (1.066 - 1.206) *	1.139 (1.067 - 1.217) *	1.096 (1.010 - 1.189) *
	2	1.096 (1.048 - 1.145) *	1.092 (1.041 - 1.145) *	1.094 (1.028 - 1.165) *	1.091 (1.022 - 1.165) *	1.111 (1.025 - 1.204) *
	3	1.068 (1.023 - 1.115) *	1.066 (1.017 - 1.117) *	1.097 (1.032 - 1.167) *	1.032 (0.967 - 1.101)	1.075 (0.993 - 1.164)
	0-6	1.162 (1.101 - 1.226) *	1.139 (1.076 - 1.205) *	1.166 (1.084 - 1.254) *	1.116 (1.039 - 1.200) *	1.258 (1.146 - 1.381) *
NO	0	1.009 (0.975 - 1.044)	1.001 (0.966 - 1.038)	0.995 (0.946 - 1.047)	1.007 (0.962 - 1.055)	1.051 (0.977 - 1.131)
	1	1.050 (1.015 - 1.085) *	1.049 (1.013 - 1.087) *	1.056 (1.004 - 1.109) *	1.045 (0.997 - 1.094)	1.053 (0.978 - 1.132)
	2	1.041 (1.007 - 1.076) *	1.038 (1.001 - 1.075) *	1.052 (1.001 - 1.105) *	1.026 (0.980 - 1.074)	1.058 (0.984 - 1.137)
	3	1.028 (0.995 - 1.062)	1.024 (0.989 - 1.061)	1.056 (1.006 - 1.109) *	0.998 (0.954 - 1.045)	1.046 (0.973 - 1.123)
	0-6	1.056 (1.012 - 1.102) *	1.042 (0.996 - 1.089)	1.080 (1.016 - 1.148) *	1.009 (0.954 - 1.066)	1.136 (1.040 - 1.241) *
NO2	0	1.051 (1.020 - 1.082) *	1.055 (1.020 - 1.090) *	1.039 (0.990 - 1.090)	1.066 (1.024 - 1.110) *	1.042 (0.992 - 1.095)
	1	1.096 (1.065 - 1.127) *	1.106 (1.071 - 1.142) *	1.102 (1.051 - 1.156) *	1.108 (1.065 - 1.152) *	1.069 (1.019 - 1.122) *
	2	1.078 (1.047 - 1.109) *	1.089 (1.054 - 1.124) *	1.088 (1.037 - 1.141) *	1.090 (1.048 - 1.134) *	1.048 (0.999 - 1.100)
	3	1.057 (1.029 - 1.086) *	1.064 (1.031 - 1.098) *	1.082 (1.031 - 1.134) *	1.053 (1.013 - 1.095) *	1.040 (0.992 - 1.091)
	0-6	1.107 (1.080 - 1.135) *	1.107 (1.076 - 1.139) *	1.129 (1.081 - 1.178) *	1.096 (1.059 - 1.133) *	1.112 (1.066 - 1.160) *
SO2	0	1.119 (1.053 - 1.190) *	1.120 (1.053 - 1.192) *	1.143 (1.048 - 1.246) *	1.099 (1.016 - 1.189) *	1.104 (0.864 - 1.412)
	1	1.178 (1.109 - 1.251) *	1.176 (1.107 - 1.249) *	1.204 (1.106 - 1.311) *	1.149 (1.063 - 1.243) *	1.228 (0.962 - 1.567)
	2	1.130 (1.066 - 1.198) *	1.127 (1.062 - 1.195) *	1.143 (1.050 - 1.244) *	1.112 (1.030 - 1.200) *	1.206 (0.946 - 1.537)
	3	1.153 (1.089 - 1.219) *	1.144 (1.080 - 1.211) *	1.179 (1.085 - 1.282) *	1.114 (1.035 - 1.200) *	1.322 (1.043 - 1.677) *
	0-6	1.324 (1.243 - 1.411) *	1.303 (1.222 - 1.388) *	1.368 (1.244 - 1.505) *	1.262 (1.169 - 1.363) *	2.052 (1.498 - 2.809) *
O3 (8h)	0	1.016 (0.975 - 1.059)	1.046 (0.999 - 1.094)	1.051 (0.990 - 1.116)	1.042 (0.988 - 1.100)	0.964 (0.910 - 1.021)
	1	1.021 (0.972 - 1.074)	1.037 (0.984 - 1.094)	1.100 (1.030 - 1.175) *	0.997 (0.939 - 1.059)	0.995 (0.933 - 1.061)
	2	1.112 (1.064 - 1.162) *	1.131 (1.079 - 1.187) *	1.184 (1.113 - 1.259) *	1.095 (1.036 - 1.158) *	1.078 (1.015 - 1.144) *
	3	1.088 (1.044 - 1.135) *	1.097 (1.048 - 1.148) *	1.160 (1.092 - 1.232) *	1.053 (0.998 - 1.111)	1.074 (1.014 - 1.138) *
	0-6	1.245 (1.188 - 1.305) *	1.282 (1.221 - 1.347) *	1.423 (1.339 - 1.513) *	1.198 (1.133 - 1.267) *	1.168 (1.097 - 1.243) *
Sum	0	1.160 (1.105 - 1.217) *	1.166 (1.107 - 1.229) *	1.124 (1.051 - 1.203) *	1.230 (1.135 - 1.333) *	1.131 (1.007 - 1.271) *
	1	1.098 (1.046 - 1.153) *	1.092 (1.036 - 1.152) *	1.076 (1.005 - 1.152) *	1.117 (1.030 - 1.212) *	1.133 (1.008 - 1.274) *
	2	1.109 (1.058 - 1.163) *	1.108 (1.052 - 1.167) *	1.131 (1.057 - 1.209) *	1.077 (0.994 - 1.168)	1.117 (0.994 - 1.255)
	3	1.080 (1.030 - 1.131) *	1.070 (1.017 - 1.127) *	1.084 (1.015 - 1.158) *	1.052 (0.971 - 1.141)	1.130 (1.007 - 1.268) *
	0-6	1.169 (1.110 - 1.230) *	1.145 (1.083 - 1.210) *	1.147 (1.068 - 1.231) *	1.144 (1.051 - 1.244) *	1.335 (1.170 - 1.522) *
NO3-	0	1.096 (1.066 - 1.126) *	1.106 (1.072 - 1.141) *	1.102 (1.056 - 1.149) *	1.110 (1.062 - 1.161) *	1.064 (1.007 - 1.123) *
	1	1.068 (1.039 - 1.098) *	1.070 (1.037 - 1.104) *	1.079 (1.034 - 1.126) *	1.061 (1.015 - 1.110) *	1.060 (1.004 - 1.120) *
	2	1.041 (1.013 - 1.070) *	1.042 (1.010 - 1.075) *	1.043 (0.999 - 1.089)	1.042 (0.996 - 1.089)	1.038 (0.983 - 1.097)
	3	1.037 (1.009 - 1.066) *	1.041 (1.009 - 1.074) *	1.058 (1.013 - 1.104) *	1.026 (0.980 - 1.073)	1.024 (0.970 - 1.081)
	0-6	1.079 (1.050 - 1.108) *	1.073 (1.041 - 1.106) *	1.082 (1.039 - 1.127) *	1.065 (1.020 - 1.113) *	1.099 (1.040 - 1.162) *
SO4--	0	1.103 (1.072 - 1.136) *	1.104 (1.071 - 1.138) *	1.087 (1.046 - 1.128) *	1.142 (1.086 - 1.200) *	1.094 (1.002 - 1.194) *
	1	1.065 (1.035 - 1.097) *	1.062 (1.029 - 1.095) *	1.059 (1.019 - 1.100) *	1.069 (1.017 - 1.125) *	1.104 (1.011 - 1.206) *
	2	1.047 (1.018 - 1.078) *	1.042 (1.011 - 1.075) *	1.038 (0.999 - 1.078)	1.053 (1.001 - 1.107) *	1.098 (1.006 - 1.199) *
	3	1.048 (1.018 - 1.078) *	1.038 (1.007 - 1.071) *	1.043 (1.004 - 1.084) *	1.032 (0.981 - 1.085)	1.136 (1.042 - 1.240) *
	0-6	1.086 (1.057 - 1.116) *	1.072 (1.041 - 1.104) *	1.072 (1.032 - 1.113) *	1.075 (1.027 - 1.125) *	1.245 (1.141 - 1.358) *
NH4+	0	1.112 (1.078 - 1.148) *	1.118 (1.081 - 1.157) *	1.096 (1.050 - 1.145) *	1.153 (1.094 - 1.215) *	1.077 (0.997 - 1.165)
	1	1.077 (1.043 - 1.111) *	1.075 (1.039 - 1.112) *	1.070 (1.024 - 1.118) *	1.083 (1.027 - 1.141) *	1.090 (1.009 - 1.179) *
	2	1.053 (1.021 - 1.087) *	1.050 (1.015 - 1.086) *	1.045 (0.999 - 1.092)	1.059 (1.005 - 1.117) *	1.074 (0.993 - 1.161)
	3	1.050 (1.018 - 1.083) *	1.045 (1.010 - 1.081) *	1.053 (1.008 - 1.101) *	1.035 (0.982 - 1.091)	1.078 (0.997 - 1.164)
	0-6	1.066 (1.043 - 1.090) *	1.057 (1.032 - 1.083) *	1.114 (1.047 - 1.186) *	1.127 (1.047 - 1.212) *	1.270 (1.132 - 1.425) *

Table 11B. (Continued) Associations of daily total respiratory mortality with air pollution by period, season, and region; relative risks (RR) and 95% confidence intervals for a change in concentration cf. table 2.

Pollutant	Lag	RR (RR-lo - RR-hi)	Summer (May - Sept) RR (RR-lo - RR-hi)	Winter (Nov - March) RR (RR-lo - RR-hi)	Four Major Cities RR (RR-lo - RR-hi)	Excl. Major Cities RR (RR-lo - RR-hi)
PM10	0	1.079 (1.047 - 1.111) *	1.204 (1.130 - 1.282) *	1.044 (1.006 - 1.083) *	1.040 (0.976 - 1.110)	1.073 (1.041 - 1.107) *
	1	1.112 (1.080 - 1.144) *	1.233 (1.156 - 1.316) *	1.086 (1.048 - 1.125) *	1.088 (1.023 - 1.158) *	1.101 (1.069 - 1.134) *
	2	1.093 (1.062 - 1.125) *	1.229 (1.152 - 1.310) *	1.071 (1.034 - 1.110) *	1.069 (1.005 - 1.137) *	1.095 (1.063 - 1.128) *
	3	1.084 (1.054 - 1.114) *	1.182 (1.107 - 1.262) *	1.067 (1.031 - 1.105) *	1.060 (0.997 - 1.126)	1.079 (1.049 - 1.111) *
	0-6	1.160 (1.124 - 1.198) *	1.496 (1.388 - 1.613) *	1.109 (1.067 - 1.153) *	1.138 (1.058 - 1.223) *	1.159 (1.121 - 1.198) *
BS	0	1.055 (1.020 - 1.091) *	1.255 (1.114 - 1.413) *	1.040 (1.002 - 1.078) *	1.042 (0.969 - 1.121)	1.047 (1.012 - 1.083) *
	1	1.108 (1.073 - 1.144) *	1.387 (1.229 - 1.566) *	1.090 (1.052 - 1.129) *	1.135 (1.058 - 1.217) *	1.083 (1.049 - 1.119) *
	2	1.097 (1.062 - 1.132) *	1.421 (1.261 - 1.601) *	1.080 (1.042 - 1.118) *	1.135 (1.058 - 1.217) *	1.079 (1.045 - 1.115) *
	3	1.094 (1.060 - 1.128) *	1.322 (1.171 - 1.492) *	1.078 (1.041 - 1.116) *	1.110 (1.036 - 1.188) *	1.085 (1.051 - 1.119) *
	0-6	1.159 (1.120 - 1.199) *	1.976 (1.722 - 2.268) *	1.119 (1.078 - 1.162) *	1.173 (1.084 - 1.268) *	1.145 (1.105 - 1.188) *
NH3	0	1.050 (1.021 - 1.081) *	1.146 (1.093 - 1.201) *	1.015 (0.977 - 1.054)	1.057 (0.988 - 1.130)	1.049 (1.017 - 1.082) *
	1	1.057 (1.028 - 1.087) *	1.147 (1.094 - 1.203) *	1.027 (0.989 - 1.066)	1.054 (0.987 - 1.125)	1.058 (1.026 - 1.091) *
	2	1.026 (0.998 - 1.055)	1.076 (1.026 - 1.128) *	0.999 (0.962 - 1.038)	1.049 (0.983 - 1.120)	1.021 (0.991 - 1.053)
	3	1.016 (0.989 - 1.044)	1.040 (0.992 - 1.091)	0.993 (0.956 - 1.032)	1.103 (1.035 - 1.175) *	1.000 (0.970 - 1.030)
	0-6	1.051 (1.025 - 1.078) *	1.190 (1.137 - 1.244) *	1.003 (0.969 - 1.038)	1.080 (1.017 - 1.147) *	1.045 (1.017 - 1.075) *
CO	0	1.050 (1.004 - 1.097) *	1.221 (1.059 - 1.409) *	1.038 (0.989 - 1.090)	1.089 (1.001 - 1.185) *	1.091 (1.027 - 1.159) *
	1	1.127 (1.078 - 1.178) *	1.347 (1.166 - 1.556) *	1.105 (1.052 - 1.159) *	1.133 (1.041 - 1.234) *	1.162 (1.095 - 1.234) *
	2	1.096 (1.048 - 1.145) *	1.254 (1.084 - 1.451) *	1.077 (1.027 - 1.130) *	1.104 (1.015 - 1.202) *	1.103 (1.039 - 1.171) *
	3	1.068 (1.023 - 1.115) *	1.171 (1.009 - 1.358) *	1.051 (1.003 - 1.102) *	1.099 (1.012 - 1.194) *	1.107 (1.044 - 1.173) *
	0-6	1.162 (1.101 - 1.226) *	1.675 (1.412 - 1.986) *	1.119 (1.056 - 1.185) *	1.160 (1.042 - 1.293) *	1.209 (1.129 - 1.296) *
NO	0	1.009 (0.975 - 1.044)	0.975 (0.775 - 1.227)	1.013 (0.978 - 1.049)	1.022 (0.975 - 1.071)	1.002 (0.960 - 1.046)
	1	1.050 (1.015 - 1.085) *	1.031 (0.817 - 1.302)	1.045 (1.010 - 1.083) *	1.053 (1.004 - 1.103) *	1.045 (1.002 - 1.090) *
	2	1.041 (1.007 - 1.076) *	1.089 (0.857 - 1.385)	1.039 (1.004 - 1.075) *	1.038 (0.991 - 1.088)	1.045 (1.002 - 1.089) *
	3	1.028 (0.995 - 1.062)	0.839 (0.655 - 1.074)	1.026 (0.992 - 1.062)	1.040 (0.994 - 1.089)	1.044 (1.002 - 1.087) *
	0-6	1.056 (1.012 - 1.102) *	0.829 (0.606 - 1.134)	1.053 (1.008 - 1.100) *	1.048 (0.984 - 1.116)	1.070 (1.015 - 1.129) *
NO2	0	1.051 (1.020 - 1.082) *	1.055 (0.996 - 1.119)	1.051 (1.014 - 1.088) *	1.045 (0.989 - 1.103)	1.035 (1.004 - 1.067) *
	1	1.096 (1.065 - 1.127) *	1.138 (1.074 - 1.206) *	1.077 (1.041 - 1.114) *	1.080 (1.025 - 1.139) *	1.073 (1.042 - 1.104) *
	2	1.078 (1.047 - 1.109) *	1.150 (1.086 - 1.218) *	1.051 (1.016 - 1.088) *	1.086 (1.030 - 1.145) *	1.053 (1.023 - 1.084) *
	3	1.057 (1.029 - 1.086) *	1.084 (1.023 - 1.149) *	1.033 (0.999 - 1.069)	1.066 (1.013 - 1.123) *	1.045 (1.016 - 1.074) *
	0-6	1.107 (1.080 - 1.135) *	1.256 (1.192 - 1.322) *	1.064 (1.033 - 1.097) *	1.090 (1.035 - 1.147) *	1.087 (1.060 - 1.115) *
SO2	0	1.119 (1.053 - 1.190) *	1.411 (1.178 - 1.689) *	1.093 (1.025 - 1.165) *	1.102 (1.003 - 1.211) *	1.052 (0.989 - 1.119)
	1	1.178 (1.109 - 1.251) *	1.437 (1.197 - 1.726) *	1.135 (1.066 - 1.208) *	1.184 (1.079 - 1.299) *	1.113 (1.047 - 1.183) *
	2	1.130 (1.066 - 1.198) *	1.247 (1.042 - 1.492) *	1.101 (1.035 - 1.171) *	1.083 (0.987 - 1.189)	1.087 (1.025 - 1.153) *
	3	1.153 (1.089 - 1.219) *	1.108 (0.925 - 1.327)	1.136 (1.070 - 1.205) *	1.109 (1.013 - 1.214) *	1.100 (1.039 - 1.164) *
	0-6	1.324 (1.243 - 1.411) *	2.071 (1.683 - 2.547) *	1.257 (1.179 - 1.341) *	1.259 (1.123 - 1.412) *	1.264 (1.184 - 1.349) *
O3 (8h)	0	1.016 (0.975 - 1.059)	1.093 (1.036 - 1.153) *	0.917 (0.857 - 0.982) *	1.028 (0.934 - 1.131)	1.022 (0.980 - 1.067)
	1	1.021 (0.972 - 1.074)	1.175 (1.106 - 1.249) *	0.869 (0.808 - 0.935) *	1.065 (0.951 - 1.193)	1.008 (0.959 - 1.059)
	2	1.112 (1.064 - 1.162) *	1.258 (1.190 - 1.331) *	0.956 (0.892 - 1.025)	1.074 (0.969 - 1.190)	1.098 (1.050 - 1.148) *
	3	1.088 (1.044 - 1.135) *	1.218 (1.154 - 1.286) *	0.988 (0.923 - 1.057)	1.099 (0.997 - 1.211)	1.072 (1.027 - 1.119) *
	0-6	1.245 (1.188 - 1.305) *	1.623 (1.523 - 1.729) *	0.928 (0.864 - 0.998) *	1.310 (1.171 - 1.464) *	1.209 (1.151 - 1.271) *
Sum	0	1.160 (1.105 - 1.217) *	1.185 (1.076 - 1.305) *	1.144 (1.078 - 1.214) *	1.141 (1.020 - 1.278) *	1.164 (1.105 - 1.227) *
	1	1.098 (1.046 - 1.153) *	1.120 (1.016 - 1.235) *	1.102 (1.038 - 1.170) *	1.061 (0.947 - 1.188)	1.106 (1.049 - 1.166) *
	2	1.109 (1.058 - 1.163) *	1.146 (1.039 - 1.263) *	1.087 (1.025 - 1.154) *	1.043 (0.932 - 1.167)	1.123 (1.066 - 1.183) *
	3	1.080 (1.030 - 1.131) *	1.144 (1.030 - 1.270) *	1.071 (1.012 - 1.134) *	0.948 (0.849 - 1.060)	1.108 (1.053 - 1.166) *
	0-6	1.169 (1.110 - 1.230) *	1.422 (1.263 - 1.601) *	1.126 (1.061 - 1.195) *	1.104 (0.980 - 1.244)	1.182 (1.118 - 1.250) *
NO3-	0	1.096 (1.066 - 1.126) *	1.141 (1.079 - 1.206) *	1.085 (1.045 - 1.125) *	1.110 (1.041 - 1.184) *	1.093 (1.060 - 1.126) *
	1	1.068 (1.039 - 1.098) *	1.094 (1.034 - 1.157) *	1.069 (1.031 - 1.109) *	1.055 (0.989 - 1.126)	1.070 (1.038 - 1.103) *
	2	1.041 (1.013 - 1.070) *	1.046 (0.988 - 1.107)	1.033 (0.996 - 1.072)	1.044 (0.979 - 1.113)	1.041 (1.010 - 1.072) *
	3	1.037 (1.009 - 1.066) *	1.037 (0.980 - 1.098)	1.043 (1.006 - 1.081) *	0.999 (0.937 - 1.065)	1.045 (1.014 - 1.076) *
	0-6	1.079 (1.050 - 1.108) *	1.116 (1.051 - 1.185) *	1.077 (1.041 - 1.115) *	1.065 (1.000 - 1.134)	1.081 (1.050 - 1.114) *
SO4--	0	1.103 (1.072 - 1.136) *	1.244 (1.163 - 1.330) *	1.073 (1.037 - 1.109) *	1.126 (1.054 - 1.203) *	1.099 (1.064 - 1.134) *
	1	1.065 (1.035 - 1.097) *	1.174 (1.097 - 1.256) *	1.044 (1.009 - 1.080) *	1.030 (0.962 - 1.102)	1.073 (1.039 - 1.107) *
	2	1.047 (1.018 - 1.078) *	1.109 (1.036 - 1.188) *	1.034 (1.000 - 1.070)	1.039 (0.972 - 1.111)	1.049 (1.017 - 1.083) *
	3	1.048 (1.018 - 1.078) *	1.143 (1.068 - 1.224) *	1.035 (1.002 - 1.070) *	0.951 (0.889 - 1.018)	1.068 (1.036 - 1.102) *
	0-6	1.086 (1.057 - 1.116) *	1.315 (1.231 - 1.405) *	1.052 (1.020 - 1.085) *	1.045 (0.979 - 1.114)	1.095 (1.062 - 1.128) *
NH4+	0	1.112 (1.078 - 1.148) *	1.234 (1.150 - 1.323) *	1.079 (1.038 - 1.122) *	1.129 (1.049 - 1.214) *	1.109 (1.071 - 1.148) *
	1	1.077 (1.043 - 1.111) *	1.165 (1.085 - 1.251) *	1.057 (1.017 - 1.099) *	1.055 (0.980 - 1.136)	1.081 (1.044 - 1.119) *
	2	1.053 (1.021 - 1.087) *	1.103 (1.027 - 1.185) *	1.036 (0.997 - 1.076)	1.052 (0.978 - 1.131)	1.054 (1.018 - 1.090) *
	3	1.050 (1.018 - 1.083) *	1.113 (1.036 - 1.196) *	1.039 (1.001 - 1.079) *	0.973 (0.904 - 1.046)	1.066 (1.031 - 1.102) *
	0-6	1.066 (1.043 - 1.090) *	1.192 (1.129 - 1.259) *	1.044 (1.017 - 1.071) *	1.086 (0.979 - 1.205)	1.147 (1.093 - 1.204) *

Table 11C. Associations of daily cardio vascular mortality with air pollution by period, season, and region; relative risks (RR) and 95% confidence intervals for a change in concentration cf. table 2. (continued on next page)

Pollutant	Lag	RR (RR-lo - RR-hi)	1992-1998 RR (RR-lo - RR-hi)	1992-1994 RR (RR-lo - RR-hi)	1995-1998 RR (RR-lo - RR-hi)	1999-2002 RR (RR-lo - RR-hi)
PM10	0	1.026 (1.011 - 1.041) *	1.029 (1.012 - 1.045) *	1.022 (1.001 - 1.044) *	1.037 (1.013 - 1.061) *	1.010 (0.977 - 1.046)
	1	1.018 (1.003 - 1.032) *	1.027 (1.011 - 1.043) *	1.014 (0.993 - 1.035)	1.042 (1.018 - 1.066) *	0.969 (0.936 - 1.002)
	2	1.016 (1.001 - 1.030) *	1.022 (1.007 - 1.038) *	1.014 (0.993 - 1.036)	1.032 (1.009 - 1.056) *	0.980 (0.947 - 1.014)
	3	1.020 (1.005 - 1.034) *	1.025 (1.010 - 1.041) *	1.020 (0.998 - 1.041)	1.033 (1.010 - 1.056) *	0.991 (0.958 - 1.025)
	0-6	1.030 (1.013 - 1.046) *	1.037 (1.020 - 1.056) *	1.027 (1.003 - 1.051) *	1.050 (1.025 - 1.077) *	0.984 (0.946 - 1.024)
BS	0	1.031 (1.014 - 1.048) *	1.032 (1.014 - 1.050) *	1.024 (1.000 - 1.049) *	1.042 (1.017 - 1.067) *	1.027 (0.990 - 1.064)
	1	1.027 (1.010 - 1.044) *	1.035 (1.017 - 1.053) *	1.020 (0.996 - 1.044)	1.054 (1.029 - 1.079) *	0.989 (0.954 - 1.026)
	2	1.022 (1.005 - 1.038) *	1.029 (1.011 - 1.047) *	1.016 (0.993 - 1.040)	1.045 (1.020 - 1.070) *	0.988 (0.953 - 1.024)
	3	1.030 (1.014 - 1.046) *	1.035 (1.018 - 1.053) *	1.028 (1.005 - 1.052) *	1.045 (1.021 - 1.069) *	1.008 (0.973 - 1.044)
	0-6	1.054 (1.036 - 1.073) *	1.058 (1.039 - 1.077) *	1.045 (1.019 - 1.071) *	1.077 (1.051 - 1.104) *	1.033 (0.993 - 1.076)
NH3	0	1.017 (1.002 - 1.032) *	1.023 (1.004 - 1.043) *	1.041 (1.011 - 1.072) *	1.013 (0.989 - 1.037)	1.010 (0.990 - 1.030)
	1	1.005 (0.990 - 1.019)	1.020 (1.001 - 1.039) *	1.015 (0.986 - 1.045)	1.023 (0.999 - 1.047)	0.988 (0.968 - 1.008)
	2	0.996 (0.982 - 1.011)	1.005 (0.986 - 1.024)	0.991 (0.962 - 1.021)	1.014 (0.990 - 1.038)	0.987 (0.967 - 1.007)
	3	0.995 (0.981 - 1.009)	0.992 (0.973 - 1.010)	1.006 (0.977 - 1.036)	0.983 (0.960 - 1.007)	0.999 (0.980 - 1.019)
	0-6	0.995 (0.982 - 1.008)	1.004 (0.987 - 1.021)	1.024 (0.999 - 1.050)	0.990 (0.969 - 1.011)	0.985 (0.967 - 1.003)
CO	0	1.042 (1.018 - 1.065) *	1.042 (1.017 - 1.067) *	1.026 (0.996 - 1.057)	1.070 (1.033 - 1.108) *	1.039 (0.994 - 1.087)
	1	1.042 (1.019 - 1.066) *	1.047 (1.023 - 1.073) *	1.019 (0.989 - 1.049)	1.097 (1.060 - 1.135) *	1.019 (0.975 - 1.066)
	2	1.017 (0.995 - 1.040)	1.023 (0.999 - 1.047)	0.997 (0.967 - 1.027)	1.068 (1.032 - 1.106) *	0.991 (0.948 - 1.035)
	3	1.028 (1.006 - 1.050) *	1.033 (1.009 - 1.057) *	1.024 (0.995 - 1.055)	1.048 (1.013 - 1.084) *	1.008 (0.965 - 1.052)
	0-6	1.075 (1.046 - 1.104) *	1.072 (1.043 - 1.103) *	1.047 (1.012 - 1.084) *	1.120 (1.078 - 1.163) *	1.085 (1.032 - 1.141) *
NO	0	1.018 (1.000 - 1.036) *	1.017 (0.998 - 1.035)	1.010 (0.986 - 1.034)	1.026 (1.000 - 1.052) *	1.027 (0.986 - 1.070)
	1	1.016 (0.998 - 1.033)	1.019 (1.000 - 1.037) *	1.000 (0.977 - 1.024)	1.043 (1.017 - 1.070) *	0.996 (0.957 - 1.038)
	2	1.005 (0.987 - 1.022)	1.006 (0.988 - 1.025)	0.996 (0.972 - 1.019)	1.021 (0.996 - 1.047)	0.992 (0.953 - 1.033)
	3	1.015 (0.998 - 1.032)	1.016 (0.998 - 1.034)	1.018 (0.995 - 1.041)	1.015 (0.990 - 1.040)	1.007 (0.968 - 1.048)
	0-6	1.042 (1.020 - 1.065) *	1.037 (1.014 - 1.060) *	1.032 (1.003 - 1.062) *	1.049 (1.018 - 1.080) *	1.074 (1.023 - 1.128) *
NO2	0	1.040 (1.025 - 1.055) *	1.040 (1.024 - 1.057) *	1.039 (1.016 - 1.063) *	1.041 (1.020 - 1.063) *	1.037 (1.010 - 1.065) *
	1	1.027 (1.012 - 1.042) *	1.032 (1.016 - 1.049) *	1.020 (0.997 - 1.043)	1.042 (1.021 - 1.064) *	1.009 (0.983 - 1.036)
	2	1.021 (1.006 - 1.035) *	1.027 (1.011 - 1.043) *	1.010 (0.987 - 1.033)	1.042 (1.021 - 1.063) *	0.998 (0.972 - 1.024)
	3	1.023 (1.009 - 1.037) *	1.026 (1.011 - 1.042) *	1.014 (0.992 - 1.037)	1.037 (1.017 - 1.058) *	1.013 (0.987 - 1.039)
	0-6	1.047 (1.034 - 1.060) *	1.049 (1.035 - 1.064) *	1.040 (1.018 - 1.061) *	1.058 (1.040 - 1.077) *	1.039 (1.015 - 1.062) *
SO2	0	1.054 (1.022 - 1.086) *	1.052 (1.020 - 1.085) *	1.056 (1.014 - 1.100) *	1.047 (1.004 - 1.091) *	1.094 (0.955 - 1.254)
	1	1.032 (1.001 - 1.063) *	1.037 (1.006 - 1.068) *	1.026 (0.986 - 1.068)	1.049 (1.007 - 1.092) *	0.902 (0.787 - 1.033)
	2	1.069 (1.038 - 1.100) *	1.070 (1.039 - 1.101) *	1.063 (1.022 - 1.106) *	1.076 (1.035 - 1.120) *	1.040 (0.910 - 1.189)
	3	1.056 (1.026 - 1.087) *	1.051 (1.022 - 1.082) *	1.033 (0.992 - 1.075)	1.072 (1.031 - 1.115) *	1.154 (1.010 - 1.319) *
	0-6	1.117 (1.082 - 1.153) *	1.113 (1.077 - 1.149) *	1.105 (1.056 - 1.157) *	1.119 (1.074 - 1.166) *	1.258 (1.057 - 1.497) *
O3 (8h)	0	1.026 (1.001 - 1.052) *	1.028 (1.001 - 1.055) *	1.034 (1.001 - 1.068) *	1.023 (0.993 - 1.055)	1.023 (0.989 - 1.057)
	1	1.031 (1.008 - 1.055) *	1.037 (1.012 - 1.062) *	1.054 (1.022 - 1.086) *	1.023 (0.995 - 1.053)	1.019 (0.987 - 1.051)
	2	0.999 (0.977 - 1.020)	0.989 (0.966 - 1.012)	0.992 (0.963 - 1.022)	0.986 (0.959 - 1.013)	1.021 (0.991 - 1.053)
	3	0.995 (0.975 - 1.016)	1.000 (0.978 - 1.022)	0.995 (0.966 - 1.024)	1.003 (0.977 - 1.030)	0.985 (0.956 - 1.015)
	0-6	0.989 (0.966 - 1.013)	1.002 (0.978 - 1.027)	0.994 (0.965 - 1.025)	1.006 (0.978 - 1.034)	0.957 (0.927 - 0.988) *
Sum	0	1.048 (1.023 - 1.073) *	1.054 (1.027 - 1.080) *	1.049 (1.016 - 1.082) *	1.062 (1.020 - 1.107) *	1.008 (0.947 - 1.073)
	1	1.034 (1.010 - 1.058) *	1.048 (1.023 - 1.075) *	1.047 (1.015 - 1.080) *	1.051 (1.009 - 1.094) *	0.937 (0.881 - 0.998) *
	2	1.027 (1.004 - 1.051) *	1.038 (1.013 - 1.064) *	1.032 (1.001 - 1.065) *	1.049 (1.007 - 1.093) *	0.957 (0.899 - 1.018)
	3	1.021 (0.998 - 1.045)	1.026 (1.001 - 1.052) *	1.016 (0.985 - 1.048)	1.045 (1.003 - 1.089) *	0.987 (0.928 - 1.051)
	0-6	1.027 (1.001 - 1.053) *	1.035 (1.008 - 1.063) *	1.022 (0.988 - 1.056)	1.057 (1.013 - 1.104) *	0.961 (0.895 - 1.031)
NO3-	0	1.026 (1.012 - 1.040) *	1.029 (1.014 - 1.045) *	1.025 (1.005 - 1.045) *	1.036 (1.012 - 1.059) *	1.012 (0.982 - 1.042)
	1	1.017 (1.003 - 1.030) *	1.027 (1.011 - 1.042) *	1.024 (1.004 - 1.045) *	1.030 (1.007 - 1.054) *	0.975 (0.947 - 1.005)
	2	1.013 (0.999 - 1.026)	1.024 (1.008 - 1.039) *	1.022 (1.001 - 1.042) *	1.027 (1.004 - 1.050) *	0.969 (0.941 - 0.998) *
	3	1.011 (0.997 - 1.024)	1.015 (1.000 - 1.031) *	1.008 (0.988 - 1.028)	1.025 (1.002 - 1.048) *	0.992 (0.963 - 1.021)
	0-6	1.014 (1.001 - 1.028) *	1.021 (1.006 - 1.036) *	1.017 (0.998 - 1.037)	1.026 (1.004 - 1.049) *	0.985 (0.956 - 1.014)
SO4--	0	1.012 (0.997 - 1.026)	1.011 (0.996 - 1.027)	1.003 (0.985 - 1.022)	1.030 (1.003 - 1.057) *	1.015 (0.968 - 1.064)
	1	1.016 (1.002 - 1.031) *	1.020 (1.005 - 1.036) *	1.016 (0.998 - 1.035)	1.030 (1.004 - 1.057) *	0.963 (0.918 - 1.010)
	2	1.014 (1.000 - 1.029) *	1.017 (1.002 - 1.032) *	1.012 (0.994 - 1.031)	1.027 (1.000 - 1.054) *	0.989 (0.943 - 1.037)
	3	1.011 (0.997 - 1.026)	1.013 (0.998 - 1.028)	1.009 (0.992 - 1.028)	1.021 (0.995 - 1.048)	0.992 (0.946 - 1.039)
	0-6	1.014 (1.000 - 1.028) *	1.016 (1.001 - 1.030) *	1.010 (0.992 - 1.028)	1.028 (1.004 - 1.052) *	0.986 (0.941 - 1.033)
NH4+	0	1.020 (1.005 - 1.037) *	1.021 (1.004 - 1.038) *	1.010 (0.989 - 1.031)	1.040 (1.012 - 1.069) *	1.017 (0.975 - 1.060)
	1	1.016 (1.000 - 1.032) *	1.023 (1.007 - 1.040) *	1.017 (0.996 - 1.038)	1.035 (1.007 - 1.063) *	0.962 (0.922 - 1.003)
	2	1.014 (0.998 - 1.029)	1.020 (1.004 - 1.037) *	1.014 (0.993 - 1.035)	1.032 (1.005 - 1.060) *	0.965 (0.926 - 1.006)
	3	1.011 (0.996 - 1.027)	1.015 (0.998 - 1.031)	1.007 (0.987 - 1.028)	1.028 (1.000 - 1.056) *	0.989 (0.948 - 1.031)
	0-6	1.010 (0.999 - 1.021)	1.013 (1.001 - 1.025) *	1.013 (0.984 - 1.043)	1.047 (1.009 - 1.087) *	0.967 (0.909 - 1.029)

Table 11C. (Continued) Associations of daily cardio vascular mortality with air pollution by period, season, and region; relative risks (RR) and 95% confidence intervals for a change in concentration cf. table 2.

			Summer (May - Sept)	Winter (Nov - March)	Four Major Cities	Excl. Major Cities
Pollutant	**Lag**	**RR (RR-lo - RR-hi)**	**RR (RR-lo - RR-hi)**	**RR (RR-lo - RR-hi)**	**RR (RR-lo - RR-hi)**	**RR (RR-lo - RR-hi)**
PM10	0	1.026 (1.011 - 1.041) *	1.097 (1.064 - 1.131) *	1.000 (0.982 - 1.019)	0.996 (0.963 - 1.030)	1.030 (1.014 - 1.046) *
	1	1.018 (1.003 - 1.032) *	1.030 (0.998 - 1.063)	1.013 (0.994 - 1.032)	0.987 (0.955 - 1.021)	1.022 (1.007 - 1.038) *
	2	1.016 (1.001 - 1.030) *	1.009 (0.977 - 1.042)	1.020 (1.001 - 1.038) *	0.996 (0.964 - 1.029)	1.016 (1.001 - 1.031) *
	3	1.020 (1.005 - 1.034) *	1.022 (0.990 - 1.055)	1.020 (1.002 - 1.038) *	0.990 (0.958 - 1.022)	1.021 (1.006 - 1.036) *
	0-6	1.030 (1.013 - 1.046) *	1.059 (1.021 - 1.098) *	1.025 (1.005 - 1.046) *	1.006 (0.968 - 1.045)	1.031 (1.014 - 1.048) *
BS	0	1.031 (1.014 - 1.048) *	1.215 (1.149 - 1.285) *	1.007 (0.988 - 1.026)	0.994 (0.956 - 1.033)	1.032 (1.014 - 1.049) *
	1	1.027 (1.010 - 1.044) *	1.099 (1.037 - 1.164) *	1.019 (1.001 - 1.038) *	1.021 (0.983 - 1.061)	1.025 (1.008 - 1.042) *
	2	1.022 (1.005 - 1.038) *	1.077 (1.016 - 1.141) *	1.018 (0.999 - 1.036)	1.011 (0.974 - 1.050)	1.020 (1.004 - 1.037) *
	3	1.030 (1.014 - 1.046) *	1.125 (1.061 - 1.192) *	1.023 (1.006 - 1.041) *	0.993 (0.957 - 1.030)	1.034 (1.018 - 1.050) *
	0-6	1.054 (1.036 - 1.073) *	1.240 (1.160 - 1.325) *	1.038 (1.019 - 1.058) *	1.042 (0.999 - 1.086)	1.055 (1.036 - 1.074) *
NH3	0	1.017 (1.002 - 1.032) *	1.023 (0.999 - 1.047)	1.004 (0.984 - 1.025)	0.999 (0.964 - 1.036)	1.020 (1.004 - 1.037) *
	1	1.005 (0.990 - 1.019)	0.990 (0.967 - 1.014)	1.005 (0.984 - 1.026)	1.013 (0.978 - 1.049)	1.003 (0.988 - 1.019)
	2	0.996 (0.982 - 1.011)	0.985 (0.962 - 1.009)	0.999 (0.978 - 1.020)	0.999 (0.965 - 1.035)	0.996 (0.981 - 1.011)
	3	0.995 (0.981 - 1.009)	1.021 (0.997 - 1.046)	0.974 (0.954 - 0.994) *	0.985 (0.951 - 1.020)	0.997 (0.982 - 1.012)
	0-6	0.995 (0.982 - 1.008)	1.001 (0.979 - 1.024)	0.985 (0.967 - 1.003)	0.996 (0.965 - 1.029)	0.995 (0.981 - 1.009)
CO	0	1.042 (1.018 - 1.065) *	1.250 (1.169 - 1.336) *	1.011 (0.986 - 1.037)	0.978 (0.933 - 1.025)	1.071 (1.039 - 1.104) *
	1	1.042 (1.019 - 1.066) *	1.153 (1.077 - 1.235) *	1.029 (1.003 - 1.055) *	1.018 (0.972 - 1.066)	1.041 (1.010 - 1.073) *
	2	1.017 (0.995 - 1.040)	1.047 (0.977 - 1.123)	1.018 (0.993 - 1.043)	0.984 (0.940 - 1.030)	1.029 (0.999 - 1.060)
	3	1.028 (1.006 - 1.050) *	1.048 (0.976 - 1.125)	1.023 (0.999 - 1.048)	0.972 (0.930 - 1.016)	1.053 (1.024 - 1.084) *
	0-6	1.075 (1.046 - 1.104) *	1.250 (1.152 - 1.356) *	1.056 (1.026 - 1.088) *	1.027 (0.970 - 1.087)	1.094 (1.057 - 1.132) *
NO	0	1.018 (1.000 - 1.036) *	1.263 (1.139 - 1.400) *	1.007 (0.988 - 1.025)	0.992 (0.966 - 1.019)	1.015 (0.993 - 1.038)
	1	1.016 (0.998 - 1.033)	1.080 (0.971 - 1.201)	1.012 (0.994 - 1.030)	1.005 (0.979 - 1.031)	1.018 (0.996 - 1.040)
	2	1.005 (0.987 - 1.022)	1.052 (0.943 - 1.174)	1.005 (0.987 - 1.023)	0.989 (0.963 - 1.015)	1.009 (0.987 - 1.031)
	3	1.015 (0.998 - 1.032)	1.040 (0.930 - 1.163)	1.012 (0.995 - 1.029)	0.987 (0.963 - 1.012)	1.018 (0.997 - 1.039)
	0-6	1.042 (1.020 - 1.065) *	1.483 (1.288 - 1.708) *	1.031 (1.008 - 1.054) *	1.013 (0.980 - 1.048)	1.043 (1.015 - 1.071) *
NO2	0	1.040 (1.025 - 1.055) *	1.082 (1.053 - 1.112) *	1.015 (0.997 - 1.034)	1.007 (0.978 - 1.036)	1.036 (1.020 - 1.052) *
	1	1.027 (1.012 - 1.042) *	1.039 (1.011 - 1.069) *	1.017 (0.999 - 1.036)	1.033 (1.005 - 1.063) *	1.021 (1.006 - 1.036) *
	2	1.021 (1.006 - 1.035) *	1.031 (1.002 - 1.060) *	1.017 (0.999 - 1.036)	1.002 (0.975 - 1.031)	1.014 (1.000 - 1.029)
	3	1.023 (1.009 - 1.037) *	1.043 (1.014 - 1.073) *	1.017 (1.000 - 1.035)	0.989 (0.963 - 1.017)	1.018 (1.004 - 1.032) *
	0-6	1.047 (1.034 - 1.060) *	1.092 (1.065 - 1.120) *	1.033 (1.016 - 1.049) *	1.032 (1.005 - 1.061) *	1.036 (1.023 - 1.049) *
SO2	0	1.054 (1.022 - 1.086) *	1.232 (1.132 - 1.341) *	1.023 (0.990 - 1.056)	1.011 (0.963 - 1.062)	1.065 (1.032 - 1.098) *
	1	1.032 (1.001 - 1.063) *	1.055 (0.969 - 1.149)	1.029 (0.997 - 1.062)	1.000 (0.952 - 1.050)	1.017 (0.987 - 1.049)
	2	1.069 (1.038 - 1.100) *	1.091 (1.002 - 1.188) *	1.070 (1.037 - 1.103) *	0.978 (0.932 - 1.027)	1.051 (1.021 - 1.082) *
	3	1.056 (1.026 - 1.087) *	1.160 (1.065 - 1.263) *	1.046 (1.015 - 1.078) *	0.982 (0.936 - 1.030)	1.045 (1.016 - 1.076) *
	0-6	1.117 (1.082 - 1.153) *	1.320 (1.197 - 1.455) *	1.094 (1.059 - 1.131) *	1.031 (0.970 - 1.096)	1.110 (1.074 - 1.147) *
O3 (8h)	0	1.026 (1.001 - 1.052) *	1.052 (1.022 - 1.083) *	1.000 (0.963 - 1.039)	1.008 (0.950 - 1.069)	1.020 (0.995 - 1.046)
	1	1.031 (1.008 - 1.055) *	1.064 (1.035 - 1.094) *	0.996 (0.961 - 1.033)	0.987 (0.935 - 1.042)	1.032 (1.008 - 1.056) *
	2	0.999 (0.977 - 1.020)	1.016 (0.989 - 1.045)	0.980 (0.946 - 1.015)	1.041 (0.988 - 1.096)	0.999 (0.978 - 1.022)
	3	0.995 (0.975 - 1.016)	1.030 (1.003 - 1.058) *	0.955 (0.923 - 0.989) *	1.022 (0.972 - 1.074)	0.993 (0.973 - 1.014)
	0-6	0.989 (0.966 - 1.013)	1.039 (1.007 - 1.072) *	0.946 (0.911 - 0.982) *	1.027 (0.969 - 1.089)	0.988 (0.964 - 1.012)
Sum	0	1.048 (1.023 - 1.073) *	1.062 (1.014 - 1.112) *	1.040 (1.009 - 1.071) *	1.011 (0.954 - 1.072)	1.055 (1.028 - 1.082) *
	1	1.034 (1.010 - 1.058) *	1.010 (0.964 - 1.058)	1.044 (1.014 - 1.074) *	1.027 (0.970 - 1.087)	1.035 (1.009 - 1.062) *
	2	1.027 (1.004 - 1.051) *	1.003 (0.957 - 1.051)	1.045 (1.015 - 1.075) *	0.994 (0.939 - 1.052)	1.033 (1.008 - 1.060) *
	3	1.021 (0.998 - 1.045)	1.019 (0.969 - 1.071)	1.033 (1.004 - 1.062) *	0.980 (0.926 - 1.037)	1.029 (1.004 - 1.055) *
	0-6	1.027 (1.001 - 1.053) *	1.022 (0.965 - 1.082)	1.035 (1.005 - 1.066) *	0.988 (0.930 - 1.051)	1.034 (1.006 - 1.062) *
NO3-	0	1.026 (1.012 - 1.040) *	1.041 (1.014 - 1.069) *	1.024 (1.005 - 1.044) *	0.988 (0.956 - 1.022)	1.033 (1.018 - 1.048) *
	1	1.017 (1.003 - 1.030) *	1.007 (0.980 - 1.035)	1.025 (1.007 - 1.045) *	1.011 (0.978 - 1.045)	1.018 (1.003 - 1.033) *
	2	1.013 (0.999 - 1.026)	1.001 (0.974 - 1.028)	1.020 (1.002 - 1.040) *	0.989 (0.956 - 1.022)	1.017 (1.002 - 1.032) *
	3	1.011 (0.997 - 1.024)	1.008 (0.981 - 1.036)	1.019 (1.001 - 1.038) *	0.991 (0.959 - 1.025)	1.014 (0.999 - 1.029)
	0-6	1.014 (1.001 - 1.028) *	1.012 (0.983 - 1.041)	1.021 (1.004 - 1.039) *	1.003 (0.971 - 1.036)	1.017 (1.002 - 1.031) *
SO4--	0	1.012 (0.997 - 1.026)	1.056 (1.022 - 1.091) *	1.005 (0.988 - 1.022)	0.973 (0.939 - 1.008)	1.019 (1.003 - 1.035) *
	1	1.016 (1.002 - 1.031) *	1.013 (0.980 - 1.048)	1.019 (1.003 - 1.036) *	0.996 (0.962 - 1.031)	1.020 (1.004 - 1.036) *
	2	1.014 (1.000 - 1.029) *	0.993 (0.961 - 1.027)	1.020 (1.003 - 1.037) *	0.981 (0.948 - 1.015)	1.021 (1.005 - 1.036) *
	3	1.011 (0.997 - 1.026)	1.010 (0.977 - 1.043)	1.016 (1.000 - 1.033)	0.990 (0.956 - 1.024)	1.015 (1.000 - 1.031)
	0-6	1.014 (1.000 - 1.028) *	1.010 (0.978 - 1.043)	1.018 (1.002 - 1.033) *	0.994 (0.962 - 1.028)	1.017 (1.003 - 1.032) *
NH4+	0	1.020 (1.005 - 1.037) *	1.065 (1.030 - 1.102) *	1.011 (0.991 - 1.031)	0.970 (0.933 - 1.008)	1.030 (1.013 - 1.047) *
	1	1.016 (1.000 - 1.032) *	1.014 (0.979 - 1.049)	1.020 (1.001 - 1.040) *	0.999 (0.961 - 1.037)	1.019 (1.002 - 1.036) *
	2	1.014 (0.998 - 1.029)	0.997 (0.963 - 1.032)	1.020 (1.001 - 1.039) *	0.977 (0.941 - 1.015)	1.020 (1.003 - 1.037) *
	3	1.011 (0.996 - 1.027)	1.012 (0.978 - 1.047)	1.018 (0.999 - 1.037)	0.986 (0.950 - 1.024)	1.016 (0.999 - 1.033)
	0-6	1.010 (0.999 - 1.021)	1.012 (0.985 - 1.039)	1.012 (0.999 - 1.025)	0.988 (0.937 - 1.042)	1.025 (1.001 - 1.050) *

Table 11D. Associations of daily mortality from pneumonia with air pollution by period, season, and region; relative risks (RR) and 95% confidence intervals for a change in concentration cf. table 2. (continued on next page)

			1992-1998	1992-1994	1995-1998	1999-2002
Pollutant	**Lag**	**RR (RR-lo - RR-hi)**	**RR (RR-lo - RR-hi)**	**RR (RR-lo - RR-hi)**	**RR (RR-lo - RR-hi)**	**RR (RR-lo - RR-hi)**
PM10	0	1.080 (1.031 - 1.132) *	1.109 (1.054 - 1.167) *	1.099 (1.022 - 1.180) *	1.117 (1.044 - 1.196) *	0.970 (0.880 - 1.069)
	1	1.120 (1.071 - 1.171) *	1.135 (1.080 - 1.192) *	1.122 (1.045 - 1.204) *	1.145 (1.071 - 1.224) *	1.062 (0.965 - 1.168)
	2	1.105 (1.058 - 1.155) *	1.106 (1.053 - 1.162) *	1.108 (1.032 - 1.190) *	1.104 (1.033 - 1.180) *	1.101 (1.002 - 1.210) *
	3	1.097 (1.050 - 1.145) *	1.089 (1.037 - 1.143) *	1.127 (1.050 - 1.209) *	1.057 (0.989 - 1.130)	1.128 (1.027 - 1.239) *
	0-6	1.172 (1.116 - 1.231) *	1.167 (1.104 - 1.232) *	1.189 (1.098 - 1.288) *	1.149 (1.069 - 1.236) *	1.196 (1.070 - 1.337) *
BS	0	1.086 (1.031 - 1.144) *	1.107 (1.047 - 1.171) *	1.089 (1.004 - 1.181) *	1.125 (1.049 - 1.207) *	1.013 (0.914 - 1.122)
	1	1.128 (1.073 - 1.186) *	1.153 (1.092 - 1.217) *	1.121 (1.035 - 1.213) *	1.184 (1.106 - 1.268) *	1.044 (0.945 - 1.154)
	2	1.129 (1.074 - 1.186) *	1.137 (1.077 - 1.200) *	1.125 (1.039 - 1.218) *	1.151 (1.075 - 1.232) *	1.101 (0.997 - 1.216)
	3	1.118 (1.065 - 1.173) *	1.120 (1.062 - 1.181) *	1.160 (1.073 - 1.254) *	1.091 (1.020 - 1.167) *	1.114 (1.011 - 1.228) *
	0-6	1.173 (1.112 - 1.237) *	1.168 (1.104 - 1.237) *	1.183 (1.088 - 1.287) *	1.165 (1.086 - 1.249) *	1.194 (1.068 - 1.336) *
NH3	0	1.111 (1.064 - 1.160) *	1.150 (1.086 - 1.219) *	1.232 (1.124 - 1.351) *	1.111 (1.036 - 1.192) *	1.073 (1.014 - 1.136) *
	1	1.077 (1.032 - 1.123) *	1.130 (1.067 - 1.197) *	1.232 (1.124 - 1.350) *	1.082 (1.010 - 1.160) *	1.025 (0.969 - 1.085)
	2	1.046 (1.003 - 1.090) *	1.086 (1.026 - 1.150) *	1.174 (1.071 - 1.288) *	1.045 (0.975 - 1.121)	1.007 (0.952 - 1.066)
	3	1.030 (0.988 - 1.074)	1.053 (0.995 - 1.115)	1.182 (1.077 - 1.296) *	0.997 (0.930 - 1.068)	1.008 (0.953 - 1.067)
	0-6	1.097 (1.056 - 1.140) *	1.106 (1.051 - 1.164) *	1.207 (1.116 - 1.305) *	1.056 (0.991 - 1.125)	1.088 (1.033 - 1.145) *
CO	0	1.130 (1.055 - 1.210) *	1.144 (1.062 - 1.233) *	1.116 (1.010 - 1.233) *	1.183 (1.070 - 1.307) *	1.086 (0.960 - 1.229)
	1	1.182 (1.105 - 1.265) *	1.211 (1.125 - 1.304) *	1.178 (1.068 - 1.300) *	1.258 (1.139 - 1.389) *	1.091 (0.964 - 1.234)
	2	1.108 (1.035 - 1.187) *	1.106 (1.026 - 1.192) *	1.098 (0.993 - 1.214)	1.124 (1.017 - 1.241) *	1.116 (0.988 - 1.262)
	3	1.090 (1.020 - 1.166) *	1.079 (1.002 - 1.162) *	1.161 (1.053 - 1.281) *	1.004 (0.909 - 1.108)	1.129 (1.001 - 1.273) *
	0-6	1.159 (1.067 - 1.259) *	1.124 (1.029 - 1.228) *	1.178 (1.049 - 1.323) *	1.092 (0.978 - 1.220)	1.304 (1.132 - 1.502) *
NO	0	1.083 (1.028 - 1.140) *	1.077 (1.019 - 1.138) *	1.059 (0.977 - 1.147)	1.096 (1.022 - 1.175) *	1.112 (0.995 - 1.243)
	1	1.094 (1.039 - 1.152) *	1.097 (1.038 - 1.158) *	1.069 (0.987 - 1.158)	1.124 (1.049 - 1.204) *	1.083 (0.969 - 1.211)
	2	1.056 (1.003 - 1.112) *	1.052 (0.996 - 1.111)	1.038 (0.958 - 1.125)	1.068 (0.996 - 1.145)	1.078 (0.965 - 1.204)
	3	1.046 (0.994 - 1.100)	1.035 (0.980 - 1.093)	1.110 (1.027 - 1.200) *	0.983 (0.917 - 1.055)	1.102 (0.988 - 1.229)
	0-6	1.068 (1.001 - 1.141) *	1.037 (0.968 - 1.112)	1.089 (0.988 - 1.200)	1.012 (0.930 - 1.101)	1.229 (1.074 - 1.406) *
NO2	0	1.095 (1.047 - 1.146) *	1.128 (1.072 - 1.187) *	1.109 (1.027 - 1.198) *	1.140 (1.072 - 1.212) *	1.012 (0.939 - 1.090)
	1	1.119 (1.072 - 1.168) *	1.153 (1.097 - 1.211) *	1.135 (1.052 - 1.224) *	1.164 (1.097 - 1.236) *	1.037 (0.964 - 1.116)
	2	1.096 (1.049 - 1.145) *	1.105 (1.051 - 1.162) *	1.109 (1.027 - 1.197) *	1.105 (1.040 - 1.173) *	1.073 (0.997 - 1.154)
	3	1.053 (1.010 - 1.098) *	1.057 (1.007 - 1.110) *	1.111 (1.030 - 1.199) *	1.028 (0.969 - 1.091)	1.043 (0.971 - 1.121)
	0-6	1.109 (1.068 - 1.152) *	1.107 (1.060 - 1.157) *	1.142 (1.066 - 1.222) *	1.094 (1.040 - 1.152) *	1.117 (1.048 - 1.191) *
SO2	0	1.147 (1.043 - 1.261) *	1.173 (1.067 - 1.291) *	1.223 (1.067 - 1.403) *	1.134 (1.006 - 1.278) *	0.730 (0.501 - 1.063)
	1	1.194 (1.088 - 1.311) *	1.202 (1.094 - 1.321) *	1.227 (1.071 - 1.406) *	1.182 (1.050 - 1.331) *	1.045 (0.721 - 1.515)
	2	1.209 (1.105 - 1.324) *	1.195 (1.090 - 1.309) *	1.163 (1.016 - 1.332) *	1.217 (1.086 - 1.365) *	1.505 (1.046 - 2.167) *
	3	1.213 (1.112 - 1.324) *	1.211 (1.108 - 1.323) *	1.285 (1.126 - 1.468) *	1.158 (1.035 - 1.296) *	1.252 (0.874 - 1.795)
	0-6	1.377 (1.249 - 1.517) *	1.359 (1.233 - 1.498) *	1.426 (1.227 - 1.657) *	1.322 (1.177 - 1.485) *	1.869 (1.158 - 3.016) *
O3 (8h)	0	1.048 (0.983 - 1.117)	1.108 (1.033 - 1.188) *	1.200 (1.094 - 1.316) *	1.050 (0.968 - 1.140)	0.948 (0.868 - 1.034)
	1	1.058 (0.980 - 1.142)	1.104 (1.018 - 1.198) *	1.257 (1.137 - 1.391) *	1.015 (0.926 - 1.113)	0.986 (0.894 - 1.087)
	2	1.157 (1.081 - 1.237) *	1.223 (1.137 - 1.315) *	1.409 (1.282 - 1.548) *	1.114 (1.024 - 1.211) *	1.046 (0.956 - 1.145)
	3	1.195 (1.121 - 1.274) *	1.242 (1.158 - 1.332) *	1.334 (1.217 - 1.463) *	1.180 (1.088 - 1.280) *	1.117 (1.024 - 1.219) *
	0-6	1.515 (1.410 - 1.629) *	1.615 (1.498 - 1.742) *	1.934 (1.762 - 2.122) *	1.440 (1.322 - 1.568) *	1.316 (1.197 - 1.447) *
Sum	0	1.114 (1.031 - 1.203) *	1.145 (1.053 - 1.245) *	1.101 (0.984 - 1.231)	1.201 (1.062 - 1.359) *	0.976 (0.816 - 1.167)
	1	1.121 (1.038 - 1.210) *	1.120 (1.030 - 1.217) *	1.149 (1.029 - 1.282) *	1.084 (0.958 - 1.227)	1.125 (0.942 - 1.343)
	2	1.111 (1.030 - 1.197) *	1.119 (1.030 - 1.215) *	1.210 (1.087 - 1.348) *	1.011 (0.893 - 1.144)	1.070 (0.896 - 1.277)
	3	1.030 (0.956 - 1.109)	1.021 (0.941 - 1.109)	1.100 (0.988 - 1.224)	0.928 (0.819 - 1.051)	1.070 (0.898 - 1.275)
	0-6	1.120 (1.033 - 1.213) *	1.113 (1.020 - 1.215) *	1.111 (0.990 - 1.248)	1.118 (0.983 - 1.272)	1.155 (0.945 - 1.412)
NO3-	0	1.082 (1.036 - 1.130) *	1.109 (1.056 - 1.165) *	1.103 (1.029 - 1.182) *	1.115 (1.042 - 1.194) *	1.004 (0.924 - 1.092)
	1	1.056 (1.011 - 1.102) *	1.058 (1.007 - 1.111) *	1.084 (1.012 - 1.162) *	1.034 (0.965 - 1.107)	1.051 (0.967 - 1.141)
	2	1.023 (0.980 - 1.068)	1.020 (0.970 - 1.071)	1.047 (0.977 - 1.123)	0.996 (0.929 - 1.067)	1.032 (0.950 - 1.122)
	3	0.995 (0.953 - 1.039)	0.996 (0.948 - 1.047)	1.059 (0.988 - 1.135)	0.941 (0.877 - 1.009)	0.993 (0.914 - 1.078)
	0-6	1.053 (1.009 - 1.098) *	1.054 (1.004 - 1.106) *	1.073 (1.003 - 1.147) *	1.038 (0.971 - 1.111)	1.049 (0.964 - 1.141)
SO4--	0	1.074 (1.025 - 1.124) *	1.085 (1.034 - 1.139) *	1.061 (0.997 - 1.129)	1.130 (1.047 - 1.220) *	0.976 (0.853 - 1.117)
	1	1.043 (0.996 - 1.092)	1.039 (0.989 - 1.091)	1.023 (0.960 - 1.089)	1.069 (0.990 - 1.154)	1.080 (0.944 - 1.235)
	2	1.026 (0.980 - 1.075)	1.024 (0.975 - 1.075)	1.025 (0.962 - 1.091)	1.026 (0.950 - 1.108)	1.049 (0.918 - 1.200)
	3	1.030 (0.984 - 1.078)	1.023 (0.975 - 1.074)	1.055 (0.992 - 1.122)	0.977 (0.904 - 1.056)	1.080 (0.946 - 1.234)
	0-6	1.068 (1.023 - 1.115) *	1.062 (1.014 - 1.112) *	1.055 (0.993 - 1.121)	1.077 (1.005 - 1.153) *	1.122 (0.982 - 1.282)
NH4+	0	1.092 (1.039 - 1.148) *	1.113 (1.054 - 1.174) *	1.084 (1.009 - 1.164) *	1.154 (1.065 - 1.250) *	0.989 (0.878 - 1.114)
	1	1.058 (1.007 - 1.112) *	1.054 (0.998 - 1.113)	1.049 (0.976 - 1.127)	1.063 (0.981 - 1.153)	1.080 (0.959 - 1.215)
	2	1.035 (0.986 - 1.088)	1.032 (0.977 - 1.089)	1.047 (0.974 - 1.124)	1.016 (0.938 - 1.102)	1.054 (0.937 - 1.187)
	3	1.019 (0.971 - 1.070)	1.014 (0.961 - 1.070)	1.067 (0.995 - 1.146)	0.952 (0.877 - 1.033)	1.045 (0.930 - 1.175)
	0-6	1.053 (1.017 - 1.090) *	1.049 (1.010 - 1.090) *	1.100 (0.995 - 1.217)	1.108 (0.992 - 1.238)	1.162 (0.975 - 1.385)

Table 11D. (Continued) Associations of daily mortality from pneumonia with air pollution by period, season, and region; relative risks (RR) and 95% confidence intervals for a change in concentration cf. table 2.

			Summer (May - Sept)	Winter (Nov - March)	Four Major Cities	Excl. Major Cities
Pollutant	Lag	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)
PM10	0	1.080 (1.031 - 1.132) *	1.212 (1.101 - 1.334) *	1.044 (0.986 - 1.106)	1.084 (0.985 - 1.192)	1.071 (1.019 - 1.124) *
	1	1.120 (1.071 - 1.171) *	1.280 (1.161 - 1.412) *	1.098 (1.038 - 1.160) *	1.107 (1.009 - 1.214) *	1.093 (1.043 - 1.145) *
	2	1.105 (1.058 - 1.155) *	1.260 (1.143 - 1.389) *	1.104 (1.045 - 1.167) *	1.092 (0.996 - 1.197)	1.104 (1.054 - 1.156) *
	3	1.097 (1.050 - 1.145) *	1.288 (1.166 - 1.422) *	1.084 (1.027 - 1.145) *	1.065 (0.972 - 1.166)	1.087 (1.039 - 1.137) *
	0-6	1.172 (1.116 - 1.231) *	1.741 (1.553 - 1.951) *	1.101 (1.036 - 1.169) *	1.160 (1.041 - 1.291) *	1.178 (1.119 - 1.241) *
BS	0	1.086 (1.031 - 1.144) *	1.255 (1.046 - 1.504) *	1.071 (1.012 - 1.133) *	1.087 (0.975 - 1.211)	1.070 (1.014 - 1.129) *
	1	1.128 (1.073 - 1.186) *	1.409 (1.172 - 1.694) *	1.115 (1.055 - 1.178) *	1.194 (1.077 - 1.324) *	1.094 (1.039 - 1.151) *
	2	1.129 (1.074 - 1.186) *	1.483 (1.237 - 1.777) *	1.122 (1.063 - 1.185) *	1.157 (1.043 - 1.283) *	1.109 (1.054 - 1.166) *
	3	1.118 (1.065 - 1.173) *	1.401 (1.166 - 1.685) *	1.111 (1.053 - 1.173) *	1.134 (1.025 - 1.256) *	1.115 (1.062 - 1.171) *
	0-6	1.173 (1.112 - 1.237) *	2.353 (1.909 - 2.900) *	1.127 (1.063 - 1.194) *	1.199 (1.069 - 1.346) *	1.167 (1.103 - 1.235) *
NH3	0	1.111 (1.064 - 1.160) *	1.186 (1.105 - 1.272) *	1.090 (1.029 - 1.154) *	1.153 (1.047 - 1.270) *	1.102 (1.051 - 1.156) *
	1	1.077 (1.032 - 1.123) *	1.155 (1.076 - 1.241) *	1.055 (0.996 - 1.117)	1.076 (0.978 - 1.184)	1.077 (1.028 - 1.128) *
	2	1.046 (1.003 - 1.090) *	1.086 (1.012 - 1.165) *	1.026 (0.968 - 1.087)	1.013 (0.921 - 1.115)	1.053 (1.005 - 1.102) *
	3	1.030 (0.988 - 1.074)	1.076 (1.002 - 1.155) *	1.005 (0.948 - 1.065)	1.074 (0.978 - 1.179)	1.021 (0.975 - 1.069)
	0-6	1.097 (1.056 - 1.140) *	1.331 (1.244 - 1.424) *	1.021 (0.969 - 1.076)	1.114 (1.020 - 1.216) *	1.094 (1.048 - 1.141) *
CO	0	1.130 (1.055 - 1.210) *	1.145 (0.918 - 1.428)	1.133 (1.052 - 1.221) *	1.146 (1.010 - 1.299) *	1.184 (1.077 - 1.302) *
	1	1.182 (1.105 - 1.265) *	1.311 (1.049 - 1.638) *	1.177 (1.093 - 1.268) *	1.191 (1.051 - 1.349) *	1.214 (1.106 - 1.333) *
	2	1.108 (1.035 - 1.187) *	1.123 (0.896 - 1.407)	1.116 (1.036 - 1.202) *	1.129 (0.996 - 1.281)	1.125 (1.024 - 1.237) *
	3	1.090 (1.020 - 1.166) *	1.072 (0.853 - 1.349)	1.100 (1.023 - 1.184) *	1.099 (0.970 - 1.244)	1.128 (1.030 - 1.236) *
	0-6	1.159 (1.067 - 1.259) *	1.522 (1.170 - 1.981) *	1.138 (1.042 - 1.244) *	1.149 (0.979 - 1.347)	1.218 (1.094 - 1.357) *
NO	0	1.083 (1.028 - 1.140) *	0.949 (0.661 - 1.362)	1.087 (1.031 - 1.147) *	1.061 (0.990 - 1.137)	1.081 (1.011 - 1.156) *
	1	1.094 (1.039 - 1.152) *	0.880 (0.608 - 1.273)	1.096 (1.040 - 1.156) *	1.075 (1.003 - 1.152) *	1.096 (1.027 - 1.171) *
	2	1.056 (1.003 - 1.112) *	0.836 (0.571 - 1.224)	1.064 (1.009 - 1.122) *	1.061 (0.991 - 1.137)	1.064 (0.996 - 1.136)
	3	1.046 (0.994 - 1.100)	0.635 (0.429 - 0.940) *	1.059 (1.005 - 1.116) *	1.051 (0.982 - 1.125)	1.058 (0.992 - 1.129)
	0-6	1.068 (1.001 - 1.141) *	0.508 (0.309 - 0.837) *	1.079 (1.009 - 1.154) *	1.061 (0.966 - 1.166)	1.089 (1.002 - 1.183) *
NO2	0	1.095 (1.047 - 1.146) *	1.058 (0.969 - 1.157)	1.109 (1.051 - 1.171) *	1.062 (0.980 - 1.150)	1.070 (1.021 - 1.121) *
	1	1.119 (1.072 - 1.168) *	1.156 (1.057 - 1.263) *	1.110 (1.054 - 1.169) *	1.051 (0.972 - 1.136)	1.089 (1.043 - 1.138) *
	2	1.096 (1.049 - 1.145) *	1.173 (1.074 - 1.281) *	1.077 (1.021 - 1.135) *	1.074 (0.993 - 1.162)	1.069 (1.023 - 1.118) *
	3	1.053 (1.010 - 1.098) *	1.090 (0.997 - 1.192)	1.033 (0.981 - 1.088)	1.031 (0.955 - 1.114)	1.053 (1.009 - 1.099) *
	0-6	1.109 (1.068 - 1.152) *	1.316 (1.216 - 1.424) *	1.061 (1.013 - 1.111) *	1.025 (0.950 - 1.106)	1.108 (1.066 - 1.152) *
SO2	0	1.147 (1.043 - 1.261) *	1.485 (1.122 - 1.965) *	1.100 (0.996 - 1.214)	1.126 (0.978 - 1.297)	1.098 (0.997 - 1.210)
	1	1.194 (1.088 - 1.311) *	1.389 (1.043 - 1.850) *	1.151 (1.044 - 1.268) *	1.125 (0.979 - 1.293)	1.116 (1.014 - 1.229) *
	2	1.209 (1.105 - 1.324) *	1.251 (0.945 - 1.655)	1.184 (1.077 - 1.301) *	1.107 (0.963 - 1.272)	1.141 (1.041 - 1.251) *
	3	1.213 (1.112 - 1.324) *	1.221 (0.922 - 1.617)	1.195 (1.091 - 1.310) *	1.134 (0.990 - 1.300)	1.129 (1.034 - 1.233) *
	0-6	1.377 (1.249 - 1.517) *	2.418 (1.747 - 3.347) *	1.295 (1.174 - 1.429) *	1.145 (0.965 - 1.359)	1.371 (1.240 - 1.515) *
O3 (8h)	0	1.048 (0.983 - 1.117)	1.156 (1.065 - 1.253) *	0.897 (0.809 - 0.995) *	1.113 (0.967 - 1.280)	1.048 (0.981 - 1.120)
	1	1.058 (0.980 - 1.142)	1.271 (1.159 - 1.394) *	0.836 (0.749 - 0.934) *	1.061 (0.898 - 1.254)	1.062 (0.983 - 1.147)
	2	1.157 (1.081 - 1.237) *	1.353 (1.244 - 1.472) *	0.924 (0.831 - 1.028)	1.118 (0.962 - 1.300)	1.124 (1.049 - 1.205) *
	3	1.195 (1.121 - 1.274) *	1.377 (1.270 - 1.493) *	1.043 (0.940 - 1.157)	1.362 (1.182 - 1.570) *	1.128 (1.055 - 1.206) *
	0-6	1.515 (1.410 - 1.629) *	2.138 (1.944 - 2.351) *	1.022 (0.916 - 1.140)	1.728 (1.465 - 2.038) *	1.415 (1.310 - 1.529) *
Sum	0	1.114 (1.031 - 1.203) *	1.250 (1.077 - 1.451) *	1.103 (1.002 - 1.214) *	1.033 (0.869 - 1.229)	1.132 (1.039 - 1.232) *
	1	1.121 (1.038 - 1.210) *	1.191 (1.026 - 1.383) *	1.149 (1.045 - 1.263) *	0.995 (0.837 - 1.183)	1.149 (1.056 - 1.250) *
	2	1.111 (1.030 - 1.197) *	1.186 (1.021 - 1.377) *	1.095 (0.997 - 1.203)	1.022 (0.863 - 1.211)	1.130 (1.040 - 1.227) *
	3	1.030 (0.956 - 1.109)	1.119 (0.952 - 1.314)	1.026 (0.937 - 1.124)	0.915 (0.773 - 1.081)	1.056 (0.973 - 1.147)
	0-6	1.120 (1.033 - 1.213) *	1.564 (1.304 - 1.876) *	1.056 (0.961 - 1.160)	1.016 (0.849 - 1.217)	1.143 (1.046 - 1.249) *
NO3-	0	1.082 (1.036 - 1.130) *	1.118 (1.026 - 1.218) *	1.093 (1.032 - 1.158) *	1.045 (0.948 - 1.152)	1.090 (1.039 - 1.143) *
	1	1.056 (1.011 - 1.102) *	1.114 (1.021 - 1.214) *	1.076 (1.017 - 1.140) *	1.021 (0.926 - 1.125)	1.063 (1.014 - 1.115) *
	2	1.023 (0.980 - 1.068)	1.053 (0.966 - 1.149)	1.031 (0.973 - 1.092)	0.989 (0.898 - 1.090)	1.030 (0.982 - 1.080)
	3	0.995 (0.953 - 1.039)	1.014 (0.929 - 1.107)	0.996 (0.941 - 1.055)	0.933 (0.846 - 1.028)	1.009 (0.962 - 1.058)
	0-6	1.053 (1.009 - 1.098) *	1.145 (1.044 - 1.256) *	1.045 (0.990 - 1.103)	0.985 (0.895 - 1.084)	1.067 (1.019 - 1.119) *
SO4--	0	1.074 (1.025 - 1.124) *	1.228 (1.108 - 1.362) *	1.043 (0.987 - 1.101)	1.073 (0.970 - 1.188)	1.073 (1.020 - 1.130) *
	1	1.043 (0.996 - 1.092)	1.241 (1.120 - 1.376) *	1.016 (0.963 - 1.073)	1.013 (0.914 - 1.122)	1.049 (0.997 - 1.104)
	2	1.026 (0.980 - 1.075)	1.170 (1.055 - 1.297) *	1.005 (0.952 - 1.061)	1.004 (0.907 - 1.111)	1.031 (0.980 - 1.085)
	3	1.030 (0.984 - 1.078)	1.148 (1.035 - 1.274) *	1.016 (0.963 - 1.071)	0.970 (0.876 - 1.074)	1.043 (0.992 - 1.097)
	0-6	1.068 (1.023 - 1.115) *	1.436 (1.299 - 1.588) *	1.016 (0.967 - 1.067)	1.035 (0.940 - 1.139)	1.075 (1.025 - 1.128) *
NH4+	0	1.092 (1.039 - 1.148) *	1.216 (1.092 - 1.355) *	1.070 (1.007 - 1.138) *	1.069 (0.957 - 1.195)	1.097 (1.038 - 1.159) *
	1	1.058 (1.007 - 1.112) *	1.221 (1.096 - 1.361) *	1.045 (0.983 - 1.111)	1.034 (0.925 - 1.155)	1.063 (1.006 - 1.123) *
	2	1.035 (0.986 - 1.088)	1.158 (1.038 - 1.292) *	1.020 (0.960 - 1.084)	1.012 (0.906 - 1.130)	1.040 (0.985 - 1.099)
	3	1.019 (0.971 - 1.070)	1.108 (0.992 - 1.237)	1.009 (0.950 - 1.071)	0.959 (0.859 - 1.071)	1.033 (0.978 - 1.090)
	0-6	1.053 (1.017 - 1.090) *	1.271 (1.169 - 1.381) *	1.020 (0.980 - 1.063)	1.033 (0.884 - 1.206)	1.126 (1.043 - 1.216) *

Table 11E. Associations of daily mortality from chronic obstructive pulmonary diseases with air pollution by period, season, and region; relative risks (RR) and 95% confidence intervals for a change in concentration cf. table 2. (cont'd next page)

			1992-1998	1992-1994	1995-1998	1999-2002
Pollutant	Lag	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)
PM10	0	1.066 (1.024 - 1.110) *	1.052 (1.007 - 1.099) *	1.057 (0.996 - 1.121)	1.047 (0.984 - 1.113)	1.139 (1.043 - 1.244) *
	1	1.100 (1.058 - 1.144) *	1.100 (1.054 - 1.148) *	1.105 (1.043 - 1.171) *	1.095 (1.031 - 1.163) *	1.098 (1.006 - 1.198) *
	2	1.089 (1.048 - 1.131) *	1.086 (1.041 - 1.132) *	1.077 (1.016 - 1.142) *	1.095 (1.031 - 1.162) *	1.100 (1.009 - 1.200) *
	3	1.092 (1.052 - 1.134) *	1.085 (1.041 - 1.131) *	1.066 (1.006 - 1.130) *	1.106 (1.043 - 1.174) *	1.123 (1.030 - 1.224) *
	0-6	1.147 (1.099 - 1.198) *	1.130 (1.078 - 1.184) *	1.123 (1.052 - 1.200) *	1.137 (1.065 - 1.214) *	1.233 (1.113 - 1.366) *
BS	0	1.031 (0.986 - 1.078)	1.017 (0.969 - 1.067)	1.014 (0.948 - 1.083)	1.022 (0.959 - 1.088)	1.092 (0.997 - 1.197)
	1	1.086 (1.039 - 1.134) *	1.078 (1.029 - 1.131) *	1.082 (1.014 - 1.155) *	1.076 (1.011 - 1.144) *	1.119 (1.022 - 1.225) *
	2	1.079 (1.034 - 1.126) *	1.076 (1.028 - 1.127) *	1.072 (1.005 - 1.144) *	1.082 (1.018 - 1.151) *	1.092 (0.998 - 1.194)
	3	1.100 (1.055 - 1.146) *	1.101 (1.053 - 1.152) *	1.077 (1.010 - 1.148) *	1.130 (1.064 - 1.200) *	1.092 (1.000 - 1.192)
	0-6	1.153 (1.101 - 1.208) *	1.141 (1.087 - 1.199) *	1.108 (1.034 - 1.188) *	1.184 (1.112 - 1.261) *	1.204 (1.089 - 1.331) *
NH3	0	0.995 (0.956 - 1.035)	0.971 (0.921 - 1.023)	1.008 (0.928 - 1.095)	0.951 (0.891 - 1.014)	1.022 (0.969 - 1.078)
	1	1.037 (0.998 - 1.077)	1.013 (0.962 - 1.067)	1.050 (0.967 - 1.140)	0.993 (0.932 - 1.058)	1.064 (1.010 - 1.121) *
	2	1.014 (0.977 - 1.054)	1.017 (0.966 - 1.070)	1.040 (0.958 - 1.130)	1.005 (0.944 - 1.070)	1.013 (0.961 - 1.067)
	3	1.023 (0.985 - 1.062)	1.024 (0.973 - 1.077)	1.081 (0.996 - 1.173)	0.995 (0.934 - 1.059)	1.023 (0.971 - 1.078)
	0-6	1.014 (0.979 - 1.050)	1.008 (0.963 - 1.055)	1.054 (0.983 - 1.130)	0.982 (0.928 - 1.040)	1.022 (0.974 - 1.071)
CO	0	1.008 (0.948 - 1.072)	0.984 (0.921 - 1.051)	1.001 (0.920 - 1.089)	0.962 (0.877 - 1.054)	1.111 (0.991 - 1.245)
	1	1.084 (1.020 - 1.151) *	1.070 (1.003 - 1.142) *	1.100 (1.013 - 1.194) *	1.030 (0.941 - 1.128)	1.141 (1.019 - 1.277) *
	2	1.090 (1.028 - 1.156) *	1.082 (1.015 - 1.153) *	1.085 (1.000 - 1.177)	1.081 (0.989 - 1.181)	1.124 (1.006 - 1.255) *
	3	1.090 (1.030 - 1.153) *	1.084 (1.019 - 1.153) *	1.076 (0.993 - 1.167)	1.099 (1.007 - 1.200) *	1.111 (0.997 - 1.238)
	0-6	1.191 (1.108 - 1.279) *	1.159 (1.074 - 1.251) *	1.149 (1.043 - 1.265) *	1.184 (1.073 - 1.307) *	1.327 (1.168 - 1.508) *
NO	0	0.975 (0.930 - 1.022)	0.959 (0.913 - 1.008)	0.970 (0.907 - 1.038)	0.950 (0.889 - 1.014)	1.061 (0.958 - 1.175)
	1	1.012 (0.967 - 1.060)	1.002 (0.954 - 1.052)	1.031 (0.965 - 1.101)	0.974 (0.913 - 1.039)	1.066 (0.964 - 1.179)
	2	1.032 (0.986 - 1.079)	1.023 (0.975 - 1.073)	1.050 (0.984 - 1.121)	0.997 (0.935 - 1.063)	1.075 (0.973 - 1.188)
	3	1.043 (0.999 - 1.089)	1.035 (0.988 - 1.084)	1.034 (0.969 - 1.103)	1.038 (0.976 - 1.105)	1.076 (0.976 - 1.187)
	0-6	1.078 (1.018 - 1.141) *	1.057 (0.996 - 1.123)	1.057 (0.975 - 1.145)	1.064 (0.986 - 1.148)	1.179 (1.044 - 1.331) *
NO2	0	1.005 (0.966 - 1.046)	0.985 (0.942 - 1.030)	0.983 (0.921 - 1.048)	0.986 (0.934 - 1.042)	1.070 (1.000 - 1.146)
	1	1.064 (1.023 - 1.106) *	1.054 (1.009 - 1.101) *	1.079 (1.013 - 1.150) *	1.035 (0.980 - 1.093)	1.093 (1.022 - 1.170) *
	2	1.069 (1.030 - 1.109) *	1.080 (1.035 - 1.127) *	1.088 (1.022 - 1.159) *	1.074 (1.019 - 1.133) *	1.034 (0.968 - 1.105)
	3	1.085 (1.046 - 1.125) *	1.091 (1.046 - 1.137) *	1.090 (1.024 - 1.160) *	1.092 (1.037 - 1.151) *	1.067 (0.999 - 1.138)
	0-6	1.103 (1.066 - 1.140) *	1.095 (1.054 - 1.137) *	1.111 (1.049 - 1.177) *	1.085 (1.037 - 1.136) *	1.123 (1.059 - 1.190) *
SO2	0	1.066 (0.982 - 1.158)	1.049 (0.965 - 1.140)	1.051 (0.937 - 1.179)	1.046 (0.939 - 1.166)	1.535 (1.088 - 2.165) *
	1	1.115 (1.029 - 1.207) *	1.103 (1.018 - 1.195) *	1.119 (1.000 - 1.253)	1.087 (0.979 - 1.208)	1.374 (0.978 - 1.932)
	2	1.075 (0.995 - 1.161)	1.076 (0.995 - 1.164)	1.113 (0.995 - 1.244)	1.044 (0.942 - 1.157)	1.036 (0.739 - 1.451)
	3	1.148 (1.065 - 1.238) *	1.128 (1.045 - 1.218) *	1.142 (1.022 - 1.275) *	1.117 (1.010 - 1.235) *	1.542 (1.104 - 2.153) *
	0-6	1.254 (1.152 - 1.366) *	1.226 (1.126 - 1.336) *	1.276 (1.123 - 1.449) *	1.193 (1.074 - 1.325) *	2.190 (1.410 - 3.402) *
O3 (8h)	0	0.986 (0.921 - 1.057)	0.996 (0.925 - 1.071)	0.986 (0.900 - 1.079)	1.003 (0.923 - 1.090)	0.971 (0.888 - 1.062)
	1	1.057 (0.995 - 1.122)	1.067 (1.000 - 1.138)	1.137 (1.046 - 1.235) *	1.018 (0.944 - 1.099)	1.039 (0.957 - 1.128)
	2	1.134 (1.070 - 1.201) *	1.141 (1.071 - 1.215) *	1.181 (1.088 - 1.282) *	1.111 (1.032 - 1.197) *	1.123 (1.036 - 1.217) *
	3	0.999 (0.945 - 1.055)	1.007 (0.948 - 1.070)	1.090 (1.005 - 1.182) *	0.953 (0.886 - 1.024)	0.985 (0.911 - 1.066)
	0-6	1.076 (1.010 - 1.147) *	1.100 (1.028 - 1.176) *	1.233 (1.135 - 1.341) *	1.022 (0.947 - 1.103)	1.031 (0.947 - 1.123)
Sum	0	1.162 (1.089 - 1.240) *	1.151 (1.073 - 1.233) *	1.121 (1.026 - 1.224) *	1.201 (1.076 - 1.340) *	1.234 (1.049 - 1.453) *
	1	1.090 (1.022 - 1.162) *	1.078 (1.006 - 1.156) *	1.038 (0.949 - 1.135)	1.145 (1.027 - 1.277) *	1.156 (0.983 - 1.360)
	2	1.120 (1.052 - 1.193) *	1.113 (1.039 - 1.192) *	1.093 (1.001 - 1.194) *	1.145 (1.027 - 1.277) *	1.160 (0.988 - 1.361)
	3	1.132 (1.064 - 1.205) *	1.113 (1.040 - 1.191) *	1.099 (1.009 - 1.198) *	1.137 (1.020 - 1.268) *	1.238 (1.055 - 1.453) *
	0-6	1.194 (1.116 - 1.278) *	1.157 (1.076 - 1.245) *	1.173 (1.069 - 1.287) *	1.136 (1.013 - 1.274) *	1.451 (1.210 - 1.741) *
NO3-	0	1.086 (1.046 - 1.127) *	1.086 (1.042 - 1.132) *	1.097 (1.037 - 1.160) *	1.074 (1.010 - 1.142) *	1.084 (1.004 - 1.171) *
	1	1.068 (1.029 - 1.108) *	1.070 (1.027 - 1.116) *	1.071 (1.012 - 1.132) *	1.070 (1.008 - 1.137) *	1.058 (0.980 - 1.142)
	2	1.053 (1.016 - 1.093) *	1.059 (1.017 - 1.104) *	1.042 (0.985 - 1.103)	1.080 (1.017 - 1.147) *	1.032 (0.957 - 1.114)
	3	1.071 (1.033 - 1.111) *	1.069 (1.026 - 1.115) *	1.061 (1.003 - 1.122) *	1.080 (1.017 - 1.148) *	1.077 (0.998 - 1.161)
	0-6	1.086 (1.048 - 1.126) *	1.076 (1.034 - 1.120) *	1.082 (1.025 - 1.141) *	1.070 (1.009 - 1.136) *	1.127 (1.043 - 1.217) *
SO4--	0	1.111 (1.069 - 1.155) *	1.106 (1.062 - 1.152) *	1.097 (1.044 - 1.152) *	1.127 (1.053 - 1.207) *	1.173 (1.037 - 1.326) *
	1	1.078 (1.037 - 1.120) *	1.073 (1.030 - 1.117) *	1.074 (1.022 - 1.128) *	1.072 (1.001 - 1.148) *	1.134 (1.004 - 1.282) *
	2	1.070 (1.030 - 1.112) *	1.063 (1.021 - 1.107) *	1.056 (1.005 - 1.110) *	1.078 (1.007 - 1.155) *	1.142 (1.012 - 1.289) *
	3	1.075 (1.035 - 1.116) *	1.062 (1.020 - 1.105) *	1.055 (1.004 - 1.109) *	1.076 (1.004 - 1.152) *	1.200 (1.064 - 1.354) *
	0-6	1.101 (1.062 - 1.143) *	1.083 (1.042 - 1.126) *	1.092 (1.040 - 1.147) *	1.070 (1.005 - 1.138) *	1.309 (1.160 - 1.477) *
NH4+	0	1.108 (1.062 - 1.157) *	1.105 (1.056 - 1.157) *	1.097 (1.036 - 1.162) *	1.120 (1.043 - 1.204) *	1.127 (1.010 - 1.257) *
	1	1.083 (1.039 - 1.130) *	1.080 (1.033 - 1.130) *	1.074 (1.014 - 1.138) *	1.092 (1.016 - 1.173) *	1.099 (0.986 - 1.226)
	2	1.070 (1.027 - 1.116) *	1.067 (1.020 - 1.116) *	1.048 (0.989 - 1.110)	1.099 (1.023 - 1.180) *	1.086 (0.976 - 1.210)
	3	1.083 (1.039 - 1.129) *	1.073 (1.026 - 1.123) *	1.060 (1.001 - 1.122) *	1.097 (1.021 - 1.178) *	1.137 (1.022 - 1.266) *
	0-6	1.073 (1.041 - 1.105) *	1.060 (1.027 - 1.095) *	1.124 (1.035 - 1.220) *	1.127 (1.020 - 1.244) *	1.333 (1.137 - 1.564) *

Table 11E. (Continued) Associations of daily mortality from chronic obstructive pulmonary diseases with air pollution by period, season, and region; relative risks (RR) and 95% confidence intervals for a change in concentration cf. table 2.

Pollutant	Lag	RR (RR-lo - RR-hi)	Summer (May - Sept) RR (RR-lo - RR-hi)	Winter (Nov - March) RR (RR-lo - RR-hi)	Four Major Cities RR (RR-lo - RR-hi)	Excl. Major Cities RR (RR-lo - RR-hi)
PM10	0	1.066 (1.024 - 1.110) *	1.182 (1.084 - 1.288) *	1.037 (0.987 - 1.089)	1.046 (0.955 - 1.145)	1.069 (1.025 - 1.114) *
	1	1.100 (1.058 - 1.144) *	1.230 (1.128 - 1.341) *	1.063 (1.012 - 1.116) *	1.089 (0.998 - 1.189)	1.105 (1.062 - 1.151) *
	2	1.089 (1.048 - 1.131) *	1.248 (1.142 - 1.365) *	1.043 (0.994 - 1.094)	1.016 (0.930 - 1.110)	1.099 (1.057 - 1.143) *
	3	1.092 (1.052 - 1.134) *	1.128 (1.033 - 1.233) *	1.073 (1.025 - 1.124) *	1.043 (0.956 - 1.137)	1.094 (1.052 - 1.137) *
	0-6	1.147 (1.099 - 1.198) *	1.336 (1.206 - 1.479) *	1.108 (1.052 - 1.167) *	1.100 (0.993 - 1.220)	1.144 (1.094 - 1.197) *
BS	0	1.031 (0.986 - 1.078)	1.119 (0.950 - 1.318)	1.027 (0.978 - 1.079)	1.055 (0.952 - 1.170)	1.027 (0.982 - 1.075)
	1	1.086 (1.039 - 1.134) *	1.402 (1.195 - 1.646) *	1.063 (1.012 - 1.115) *	1.099 (0.993 - 1.216)	1.075 (1.029 - 1.124) *
	2	1.079 (1.034 - 1.126) *	1.467 (1.246 - 1.727) *	1.048 (0.999 - 1.099)	1.079 (0.977 - 1.191)	1.073 (1.028 - 1.119) *
	3	1.100 (1.055 - 1.146) *	1.287 (1.093 - 1.515) *	1.077 (1.029 - 1.127) *	1.087 (0.988 - 1.197)	1.087 (1.043 - 1.133) *
	0-6	1.153 (1.101 - 1.208) *	1.580 (1.310 - 1.904) *	1.123 (1.068 - 1.181) *	1.147 (1.026 - 1.282) *	1.139 (1.085 - 1.195) *
NH3	0	0.995 (0.956 - 1.035)	1.081 (1.012 - 1.155) *	0.967 (0.916 - 1.020)	1.004 (0.909 - 1.108)	0.993 (0.951 - 1.037)
	1	1.016 (0.969 - 1.065)	1.090 (1.014 - 1.171) *	0.982 (0.922 - 1.045)	1.014 (0.902 - 1.141)	1.017 (0.966 - 1.070)
	2	1.018 (0.972 - 1.067)	1.099 (1.023 - 1.181) *	0.977 (0.918 - 1.040)	1.050 (0.935 - 1.179)	1.013 (0.963 - 1.065)
	3	1.026 (0.980 - 1.075)	1.089 (1.013 - 1.171) *	0.983 (0.924 - 1.045)	1.140 (1.017 - 1.277) *	1.006 (0.957 - 1.058)
	0-6	1.012 (0.973 - 1.052)	1.059 (1.001 - 1.120) *	0.987 (0.938 - 1.040)	1.026 (0.930 - 1.131)	1.009 (0.967 - 1.053)
CO	0	1.008 (0.948 - 1.072)	1.072 (0.883 - 1.301)	1.004 (0.939 - 1.074)	1.076 (0.951 - 1.217)	1.034 (0.952 - 1.124)
	1	1.084 (1.020 - 1.151) *	1.307 (1.077 - 1.585) *	1.055 (0.987 - 1.127)	1.070 (0.947 - 1.210)	1.115 (1.028 - 1.210) *
	2	1.090 (1.028 - 1.156) *	1.334 (1.096 - 1.624) *	1.049 (0.983 - 1.120)	1.029 (0.912 - 1.161)	1.121 (1.036 - 1.213) *
	3	1.090 (1.030 - 1.153) *	1.257 (1.030 - 1.535) *	1.055 (0.992 - 1.123)	1.070 (0.953 - 1.201)	1.156 (1.071 - 1.247) *
	0-6	1.191 (1.108 - 1.279) *	1.526 (1.212 - 1.921) *	1.142 (1.057 - 1.234) *	1.123 (0.964 - 1.309)	1.255 (1.145 - 1.376) *
NO	0	0.975 (0.930 - 1.022)	0.770 (0.565 - 1.050)	0.983 (0.936 - 1.032)	1.008 (0.940 - 1.080)	0.968 (0.912 - 1.027)
	1	1.012 (0.967 - 1.060)	0.973 (0.712 - 1.330)	1.009 (0.962 - 1.058)	1.028 (0.961 - 1.100)	1.010 (0.954 - 1.070)
	2	1.032 (0.986 - 1.079)	1.245 (0.907 - 1.709)	1.022 (0.976 - 1.071)	0.990 (0.925 - 1.059)	1.050 (0.993 - 1.111)
	3	1.043 (0.999 - 1.089)	1.087 (0.786 - 1.502)	1.028 (0.983 - 1.075)	1.022 (0.959 - 1.090)	1.071 (1.015 - 1.131) *
	0-6	1.078 (1.018 - 1.141) *	0.890 (0.586 - 1.350)	1.067 (1.006 - 1.132) *	1.019 (0.931 - 1.115)	1.113 (1.036 - 1.195) *
NO2	0	1.005 (0.966 - 1.046)	0.987 (0.912 - 1.068)	1.006 (0.959 - 1.056)	1.038 (0.960 - 1.122)	1.002 (0.963 - 1.044)
	1	1.064 (1.023 - 1.106) *	1.121 (1.037 - 1.212) *	1.034 (0.986 - 1.084)	1.098 (1.016 - 1.185) *	1.053 (1.012 - 1.095) *
	2	1.069 (1.030 - 1.109) *	1.155 (1.068 - 1.248) *	1.031 (0.984 - 1.080)	1.074 (0.997 - 1.158)	1.051 (1.012 - 1.091) *
	3	1.085 (1.046 - 1.125) *	1.105 (1.021 - 1.195) *	1.062 (1.016 - 1.110) *	1.085 (1.008 - 1.167) *	1.067 (1.029 - 1.107) *
	0-6	1.103 (1.066 - 1.140) *	1.166 (1.087 - 1.251) *	1.070 (1.027 - 1.115) *	1.120 (1.041 - 1.206) *	1.077 (1.041 - 1.114) *
SO2	0	1.066 (0.982 - 1.158)	1.209 (0.949 - 1.541)	1.059 (0.972 - 1.154)	1.095 (0.959 - 1.251)	0.994 (0.913 - 1.081)
	1	1.115 (1.029 - 1.207) *	1.538 (1.214 - 1.947) *	1.062 (0.977 - 1.155)	1.184 (1.039 - 1.350) *	1.087 (1.003 - 1.178) *
	2	1.075 (0.995 - 1.161)	1.353 (1.064 - 1.721) *	1.034 (0.952 - 1.122)	1.013 (0.889 - 1.154)	1.056 (0.977 - 1.141)
	3	1.148 (1.065 - 1.238) *	1.120 (0.879 - 1.426)	1.128 (1.043 - 1.221) *	1.097 (0.965 - 1.247)	1.119 (1.038 - 1.206) *
	0-6	1.254 (1.152 - 1.366) *	1.794 (1.363 - 2.363) *	1.200 (1.100 - 1.308) *	1.305 (1.111 - 1.534) *	1.186 (1.087 - 1.293) *
O3 (8h)	0	0.986 (0.921 - 1.057)	1.046 (0.963 - 1.137)	0.931 (0.842 - 1.029)	1.060 (0.898 - 1.251)	0.986 (0.921 - 1.055)
	1	1.057 (0.995 - 1.122)	1.195 (1.109 - 1.288) *	0.902 (0.820 - 0.992) *	1.254 (1.084 - 1.451) *	1.010 (0.950 - 1.073)
	2	1.134 (1.070 - 1.201) *	1.308 (1.214 - 1.410) *	0.977 (0.891 - 1.072)	1.110 (0.963 - 1.280)	1.141 (1.076 - 1.210) *
	3	0.999 (0.945 - 1.055)	1.134 (1.052 - 1.222) *	0.883 (0.807 - 0.966) *	0.923 (0.804 - 1.059)	1.009 (0.953 - 1.068)
	0-6	1.076 (1.010 - 1.147) *	1.348 (1.236 - 1.470) *	0.841 (0.763 - 0.928) *	1.138 (0.970 - 1.336)	1.073 (1.004 - 1.147) *
Sum	0	1.162 (1.089 - 1.240) *	1.099 (0.963 - 1.254)	1.147 (1.059 - 1.242) *	1.140 (0.972 - 1.337)	1.166 (1.087 - 1.251) *
	1	1.090 (1.022 - 1.162) *	1.089 (0.953 - 1.243)	1.063 (0.981 - 1.151)	1.044 (0.892 - 1.223)	1.099 (1.025 - 1.178) *
	2	1.120 (1.052 - 1.193) *	1.108 (0.971 - 1.264)	1.098 (1.016 - 1.187) *	1.020 (0.872 - 1.193)	1.141 (1.066 - 1.222) *
	3	1.132 (1.064 - 1.205) *	1.179 (1.024 - 1.356) *	1.121 (1.040 - 1.209) *	0.958 (0.819 - 1.120)	1.169 (1.093 - 1.251) *
	0-6	1.194 (1.116 - 1.278) *	1.345 (1.146 - 1.579) *	1.160 (1.072 - 1.256) *	1.114 (0.942 - 1.318)	1.211 (1.124 - 1.303) *
NO3-	0	1.086 (1.046 - 1.127) *	1.124 (1.043 - 1.212) *	1.059 (1.008 - 1.114) *	1.124 (1.025 - 1.232) *	1.078 (1.035 - 1.123) *
	1	1.068 (1.029 - 1.108) *	1.095 (1.015 - 1.181) *	1.041 (0.991 - 1.094)	1.044 (0.952 - 1.143)	1.073 (1.030 - 1.116) *
	2	1.053 (1.016 - 1.093) *	1.052 (0.974 - 1.136)	1.031 (0.982 - 1.083)	1.075 (0.983 - 1.176)	1.050 (1.009 - 1.092) *
	3	1.071 (1.033 - 1.111) *	1.065 (0.987 - 1.150)	1.078 (1.027 - 1.131) *	1.038 (0.948 - 1.136)	1.078 (1.036 - 1.121) *
	0-6	1.086 (1.048 - 1.126) *	1.098 (1.013 - 1.190) *	1.084 (1.035 - 1.134) *	1.097 (1.004 - 1.199) *	1.085 (1.043 - 1.128) *
SO4--	0	1.111 (1.069 - 1.155) *	1.256 (1.148 - 1.376) *	1.080 (1.033 - 1.129) *	1.122 (1.022 - 1.232) *	1.109 (1.063 - 1.156) *
	1	1.078 (1.037 - 1.120) *	1.179 (1.075 - 1.292) *	1.050 (1.004 - 1.098) *	1.005 (0.914 - 1.106)	1.093 (1.048 - 1.139) *
	2	1.070 (1.030 - 1.112) *	1.095 (0.998 - 1.201)	1.060 (1.014 - 1.107) *	1.035 (0.943 - 1.137)	1.078 (1.034 - 1.123) *
	3	1.075 (1.035 - 1.116) *	1.150 (1.050 - 1.261) *	1.063 (1.018 - 1.110) *	0.929 (0.843 - 1.023)	1.105 (1.061 - 1.151) *
	0-6	1.101 (1.062 - 1.143) *	1.246 (1.139 - 1.364) *	1.078 (1.035 - 1.123) *	1.026 (0.937 - 1.124)	1.117 (1.073 - 1.162) *
NH4+	0	1.108 (1.062 - 1.157) *	1.233 (1.122 - 1.355) *	1.067 (1.013 - 1.124) *	1.123 (1.012 - 1.246) *	1.106 (1.056 - 1.158) *
	1	1.083 (1.039 - 1.130) *	1.171 (1.064 - 1.289) *	1.044 (0.991 - 1.099)	1.019 (0.918 - 1.131)	1.096 (1.047 - 1.147) *
	2	1.070 (1.027 - 1.116) *	1.093 (0.991 - 1.205)	1.048 (0.996 - 1.102)	1.049 (0.947 - 1.162)	1.075 (1.027 - 1.124) *
	3	1.083 (1.039 - 1.129) *	1.136 (1.032 - 1.251) *	1.071 (1.019 - 1.125) *	0.966 (0.871 - 1.071)	1.107 (1.059 - 1.158) *
	0-6	1.073 (1.041 - 1.105) *	1.153 (1.071 - 1.242) *	1.054 (1.019 - 1.091) *	1.072 (0.925 - 1.242)	1.167 (1.094 - 1.244) *

Table 12A. Associations of daily total mortality (all causes) with air pollution from two-pollutant models; relative risks (RR) and 95% confidence intervals for a change in concentration cf. table 2.

Pollutant #1	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)
	1-pollutant model	**#1**	**Pollutant #2: BS**	**#1**	**Pollutant #2: NH3**
PM10	1.045 (1.034 - 1.056) *	0.994 (0.973 - 1.014)	1.066 (1.043 - 1.091) *	1.053 (1.040 - 1.066) *	0.989 (0.979 - 0.998) *
BS	1.059 (1.047 - 1.071) *	-		1.071 (1.057 - 1.085) *	0.987 (0.978 - 0.996) *
	1-pollutant model	**#1**	**Pollutant #2: CO**	**#1**	**Pollutant #2: NO**
PM10	1.045 (1.034 - 1.056) *	1.033 (1.017 - 1.049) *	1.026 (1.000 - 1.052)	1.048 (1.035 - 1.061) *	0.994 (0.977 - 1.011)
BS	1.059 (1.047 - 1.071) *	1.074 (1.050 - 1.098) *	0.977 (0.944 - 1.010)	1.096 (1.076 - 1.116) *	0.948 (0.927 - 0.970) *
NH3	1.008 (1.000 - 1.017)	0.993 (0.984 - 1.002)	1.071 (1.050 - 1.092) *	0.983 (0.974 - 0.992) *	1.051 (1.041 - 1.060) *
CO	1.067 (1.049 - 1.086) *	-		1.185 (1.142 - 1.230) *	0.909 (0.882 - 0.936) *
	1-pollutant model	**#1**	**Pollutant #2: NO2**	**#1**	**Pollutant #2: SO2**
PM10	1.045 (1.034 - 1.056) *	1.017 (1.003 - 1.031) *	1.033 (1.022 - 1.044) *	1.020 (1.006 - 1.034) *	1.091 (1.062 - 1.121) *
BS	1.059 (1.047 - 1.071) *	1.029 (1.012 - 1.046) *	1.027 (1.015 - 1.039) *	1.033 (1.018 - 1.049) *	1.073 (1.043 - 1.104) *
NH3	1.008 (1.000 - 1.017)	0.983 (0.974 - 0.992) *	1.051 (1.041 - 1.060) *	1.009 (1.001 - 1.018) *	1.009 (1.006 - 1.013) *
CO	1.067 (1.049 - 1.086) *	0.984 (0.956 - 1.013)	1.050 (1.036 - 1.064) *	1.034 (1.013 - 1.054) *	1.096 (1.069 - 1.123) *
NO	1.030 (1.016 - 1.045) *	0.966 (0.948 - 0.984)	1.058 (1.047 - 1.070) *	1.010 (0.995 - 1.025)	1.113 (1.088 - 1.139) *
NO2	1.043 (1.035 - 1.051) *	-		1.028 (1.019 - 1.038) *	1.075 (1.049 - 1.101) *
	1-pollutant model	**#1**	**Pollutant #2: O3**	**#1**	**Pollutant #2: Sum**
PM10	1.045 (1.034 - 1.056) *	1.048 (1.038 - 1.059) *	1.032 (1.021 - 1.043) *	1.072 (1.051 - 1.094) *	0.957 (0.928 - 0.987) *
BS	1.059 (1.047 - 1.071) *	1.065 (1.053 - 1.078) *	1.036 (1.024 - 1.047) *	1.068 (1.052 - 1.085) *	0.984 (0.963 - 1.006)
NH3	1.008 (1.000 - 1.017)	0.997 (0.988 - 1.006)	1.155 (1.094 - 1.219) *	0.995 (0.985 - 1.005)	1.123 (1.067 - 1.181) *
CO	1.067 (1.049 - 1.086) *	1.078 (1.059 - 1.097) *	1.035 (1.024 - 1.046) *	1.053 (1.030 - 1.076) *	1.020 (0.999 - 1.041)
NO	1.030 (1.016 - 1.045) *	1.038 (1.023 - 1.053) *	1.031 (1.020 - 1.043) *	1.011 (0.996 - 1.027)	1.046 (1.028 - 1.065) *
NO2	1.043 (1.035 - 1.051) *	1.049 (1.040 - 1.058) *	1.038 (1.027 - 1.050) *	1.041 (1.032 - 1.051) *	1.005 (0.986 - 1.024)
SO2	1.118 (1.095 - 1.142) *	1.125 (1.102 - 1.150) *	1.031 (1.020 - 1.042) *	1.106 (1.079 - 1.134) *	1.016 (0.997 - 1.036)
O3 (8h)	1.033 (1.019 - 1.046) *	-		1.030 (1.019 - 1.041) *	1.058 (1.041 - 1.075) *
Sum	1.053 (1.036 - 1.070) *	-		-	
	1-pollutant model	**#1**	**Pollutant #2: Nitrate**	**#1**	**Pollutant #2: Sulfate**
PM10	1.045 (1.034 - 1.056) *	1.064 (1.047 - 1.082) *	0.983 (0.969 - 0.996) *	1.057 (1.037 - 1.077) *	0.989 (0.973 - 1.005)
BS	1.059 (1.047 - 1.071) *	1.067 (1.052 - 1.082) *	0.992 (0.981 - 1.003)	1.066 (1.050 - 1.083) *	0.993 (0.981 - 1.005)
NH3	1.008 (1.000 - 1.017)	1.000 (0.991 - 1.009)	1.030 (1.020 - 1.041) *	0.997 (0.988 - 1.007)	1.044 (1.026 - 1.063) *
CO	1.067 (1.049 - 1.086) *	1.059 (1.036 - 1.082) *	1.006 (0.995 - 1.017)	1.051 (1.029 - 1.074) *	1.013 (1.002 - 1.024) *
NO	1.030 (1.016 - 1.045) *	1.015 (1.000 - 1.031) *	1.020 (1.010 - 1.029) *	1.011 (0.995 - 1.027)	1.026 (1.016 - 1.036) *
NO2	1.043 (1.035 - 1.051) *	1.049 (1.038 - 1.059) *	0.992 (0.981 - 1.003)	1.039 (1.029 - 1.048) *	1.009 (0.999 - 1.019)
SO2	1.118 (1.095 - 1.142) *	1.109 (1.083 - 1.135) *	1.007 (0.998 - 1.017)	1.105 (1.078 - 1.134) *	1.009 (0.999 - 1.020)
O3 (8h)	1.033 (1.019 - 1.046) *	1.030 (1.019 - 1.041) *	1.027 (1.018 - 1.036) *	1.030 (1.019 - 1.041) *	1.031 (1.022 - 1.041) *
Sum	1.053 (1.036 - 1.070) *	1.067 (1.021 - 1.115) *	0.992 (0.970 - 1.016)	1.021 (0.975 - 1.069)	1.018 (0.993 - 1.044)
Nitrate	1.024 (1.015 - 1.033) *			1.007 (0.994 - 1.021)	1.023 (1.009 - 1.037) *
	1-pollutant model	**#1**	**Pollutant #2: Amm**		
PM10	1.045 (1.034 - 1.056) *	1.085 (1.062 - 1.108) *	0.973 (0.959 - 0.987) *		
BS	1.059 (1.047 - 1.071) *	1.076 (1.059 - 1.094) *	0.988 (0.978 - 0.998) *		
NH3	1.008 (1.000 - 1.017)	0.996 (0.986 - 1.006)	1.022 (1.014 - 1.031) *		
CO	1.067 (1.049 - 1.086) *	1.057 (1.033 - 1.081) *	1.006 (0.997 - 1.015)		
NO	1.030 (1.016 - 1.045) *	1.011 (0.995 - 1.027)	1.019 (1.011 - 1.027) *		
NO2	1.043 (1.035 - 1.051) *	1.044 (1.034 - 1.054) *	0.999 (0.991 - 1.008)		
SO2	1.118 (1.095 - 1.142) *	1.109 (1.081 - 1.136) *	1.006 (0.997 - 1.014)		
O3 (8h)	1.033 (1.019 - 1.046) *	1.030 (1.019 - 1.041) *	1.024 (1.017 - 1.031) *		
Sum	1.053 (1.036 - 1.070) *	1.107 (1.019 - 1.203) *	0.978 (0.943 - 1.014)		
Nitrate	1.024 (1.015 - 1.033) *	1.002 (0.982 - 1.023)	1.020 (1.003 - 1.037) *		
Sulfate	1.029 (1.020 - 1.038) *	1.028 (1.002 - 1.055) *	1.001 (0.981 - 1.022)		
Ammonium	1.022 (1.015 - 1.029) *	-			

Table 12B. Associations of daily total respiratory mortality with air pollution from two-pollutant models; relative risks (RR) and 95% confidence intervals for a change in concentration cf. table 2.

Pollutant #1	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)
	1-pollutant model	**#1**	**Pollutant #2: BS**	**#1**	**Pollutant #2: NH3**
PM10	1.160 (1.124 - 1.198) *	1.179 (1.105 - 1.257) *	0.980 (0.915 - 1.051)	1.169 (1.125 - 1.216) *	0.991 (0.962 - 1.021)
BS	1.159 (1.120 - 1.199) *	-		1.163 (1.117 - 1.211) *	1.001 (0.974 - 1.030)
	1-pollutant model	**#1**	**Pollutant #2: CO**	**#1**	**Pollutant #2: NO**
PM10	1.160 (1.124 - 1.198) *	1.195 (1.141 - 1.252) *	0.937 (0.866 - 1.013)	1.203 (1.158 - 1.250) *	0.918 (0.873 - 0.966) *
BS	1.159 (1.120 - 1.199) *	1.240 (1.161 - 1.323) *	0.892 (0.806 - 0.987) *	1.286 (1.219 - 1.357) *	0.849 (0.795 - 0.906) *
NH3	1.051 (1.025 - 1.078) *	1.022 (0.994 - 1.052)	1.126 (1.058 - 1.198) *	1.003 (0.975 - 1.032)	1.092 (1.062 - 1.124) *
CO	1.162 (1.101 - 1.226) *	-		1.588 (1.417 - 1.780) *	0.754 (0.689 - 0.825) *
	1-pollutant model	**#1**	**Pollutant #2: NO2**	**#1**	**Pollutant #2: SO2**
PM10	1.160 (1.124 - 1.198) *	1.123 (1.076 - 1.171) *	1.040 (1.006 - 1.075) *	1.110 (1.065 - 1.156) *	1.165 (1.073 - 1.265) *
BS	1.159 (1.120 - 1.199) *	1.093 (1.040 - 1.148) *	1.056 (1.019 - 1.094) *	1.088 (1.039 - 1.139) *	1.197 (1.099 - 1.303) *
NH3	1.051 (1.025 - 1.078) *	1.003 (0.975 - 1.032)	1.092 (1.062 - 1.124) *	1.052 (1.026 - 1.079) *	1.007 (0.993 - 1.021)
CO	1.162 (1.101 - 1.226) *	0.934 (0.855 - 1.021)	1.138 (1.092 - 1.185) *	1.071 (1.008 - 1.137) *	1.276 (1.187 - 1.371) *
NO	1.056 (1.012 - 1.102) *	0.890 (0.842 - 0.942)	1.161 (1.124 - 1.200) *	1.008 (0.964 - 1.055)	1.320 (1.234 - 1.411) *
NO2	1.107 (1.080 - 1.135) *	-		1.066 (1.036 - 1.096) *	1.216 (1.131 - 1.308) *
	1-pollutant model	**#1**	**Pollutant #2: O3**	**#1**	**Pollutant #2: Sum**
PM10	1.160 (1.124 - 1.198) *	1.165 (1.128 - 1.202) *	1.039 (0.998 - 1.081)	1.329 (1.250 - 1.413) *	0.789 (0.715 - 0.870) *
BS	1.159 (1.120 - 1.199) *	1.167 (1.127 - 1.209) *	1.046 (1.004 - 1.090) *	1.156 (1.104 - 1.211) *	1.004 (0.937 - 1.075)
NH3	1.051 (1.025 - 1.078) *	1.020 (0.991 - 1.050)	1.469 (1.241 - 1.739) *	1.017 (0.986 - 1.049)	1.334 (1.138 - 1.565) *
CO	1.162 (1.101 - 1.226) *	1.170 (1.108 - 1.235) *	1.035 (0.993 - 1.077)	1.078 (1.007 - 1.154) *	1.115 (1.045 - 1.190) *
NO	1.056 (1.012 - 1.102) *	1.060 (1.015 - 1.107) *	1.025 (0.983 - 1.068)	0.989 (0.944 - 1.036)	1.176 (1.112 - 1.244) *
NO2	1.107 (1.080 - 1.135) *	1.115 (1.087 - 1.144) *	1.053 (1.011 - 1.097) *	1.088 (1.057 - 1.121) *	1.058 (0.996 - 1.124)
SO2	1.324 (1.243 - 1.411) *	1.339 (1.255 - 1.428) *	1.042 (1.000 - 1.085) *	1.265 (1.176 - 1.362) *	1.073 (1.011 - 1.138) *
O3 (8h)	1.021 (0.972 - 1.074)	-		1.029 (0.989 - 1.071)	1.173 (1.115 - 1.234) *
Sum	1.169 (1.110 - 1.230) *	-		-	
	1-pollutant model	**#1**	**Pollutant #2: Nitrate**	**#1**	**Pollutant #2: Sulfate**
PM10	1.160 (1.124 - 1.198) *	1.249 (1.188 - 1.314) *	0.930 (0.891 - 0.971) *	1.265 (1.193 - 1.341) *	0.917 (0.871 - 0.964) *
BS	1.159 (1.120 - 1.199) *	1.156 (1.107 - 1.207) *	1.003 (0.969 - 1.037)	1.161 (1.106 - 1.218) *	0.998 (0.960 - 1.038)
NH3	1.051 (1.025 - 1.078) *	1.028 (1.001 - 1.056) *	1.086 (1.052 - 1.122) *	1.023 (0.994 - 1.053)	1.118 (1.059 - 1.180) *
CO	1.162 (1.101 - 1.226) *	1.092 (1.021 - 1.168) *	1.049 (1.014 - 1.085) *	1.089 (1.019 - 1.165) *	1.057 (1.021 - 1.094) *
NO	1.056 (1.012 - 1.102) *	0.999 (0.955 - 1.046)	1.079 (1.048 - 1.111) *	0.994 (0.948 - 1.042)	1.088 (1.055 - 1.122) *
NO2	1.107 (1.080 - 1.135) *	1.100 (1.066 - 1.135) *	1.010 (0.976 - 1.045)	1.088 (1.059 - 1.119) *	1.038 (1.007 - 1.071) *
SO2	1.324 (1.243 - 1.411) *	1.274 (1.188 - 1.366) *	1.035 (1.005 - 1.067) *	1.272 (1.180 - 1.370) *	1.035 (1.002 - 1.069) *
O3 (8h)	1.021 (0.972 - 1.074)	1.031 (0.991 - 1.073)	1.081 (1.052 - 1.111) *	1.027 (0.987 - 1.069)	1.088 (1.058 - 1.118) *
Sum	1.169 (1.110 - 1.230) *	1.161 (1.013 - 1.330) *	1.004 (0.934 - 1.079)	1.135 (0.983 - 1.311)	1.017 (0.941 - 1.099)
Nitrate	1.079 (1.050 - 1.108) *			1.039 (0.997 - 1.083)	1.053 (1.009 - 1.098) *
	1-pollutant model	**#1**	**Pollutant #2: Amm**		
PM10	1.160 (1.124 - 1.198) *	1.390 (1.302 - 1.483) *	0.872 (0.834 - 0.913) *		
BS	1.159 (1.120 - 1.199) *	1.180 (1.123 - 1.240) *	0.986 (0.955 - 1.018)		
NH3	1.051 (1.025 - 1.078) *	1.009 (0.978 - 1.041)	1.064 (1.037 - 1.091) *		
CO	1.162 (1.101 - 1.226) *	1.088 (1.014 - 1.168) *	1.041 (1.011 - 1.072) *		
NO	1.056 (1.012 - 1.102) *	0.989 (0.943 - 1.038)	1.069 (1.043 - 1.096) *		
NO2	1.107 (1.080 - 1.135) *	1.095 (1.062 - 1.128) *	1.016 (0.989 - 1.044)		
SO2	1.324 (1.243 - 1.411) *	1.276 (1.185 - 1.374) *	1.025 (0.999 - 1.052)		
O3 (8h)	1.021 (0.972 - 1.074)	1.029 (0.989 - 1.071)	1.068 (1.044 - 1.092) *		
Sum	1.169 (1.110 - 1.230) *	1.510 (1.161 - 1.963) *	0.893 (0.796 - 1.000)		
Nitrate	1.079 (1.050 - 1.108) *	1.038 (0.974 - 1.106)	1.036 (0.983 - 1.091)		
Sulfate	1.086 (1.057 - 1.116) *	1.061 (0.978 - 1.150)	1.020 (0.956 - 1.089)		
Ammonium	1.066 (1.043 - 1.090) *	-			

Table 12C. Associations of daily cardio vascular mortality with air pollution from two-pollutant models; relative risks (RR) and 95% confidence intervals for a change in concentration cf. table 2.

Pollutant #1	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)
	1-pollutant model	**#1**	**Pollutant #2: BS**	**#1**	**Pollutant #2: NH3**
PM10	1.030 (1.013 - 1.046) *	0.936 (0.906 - 0.967) *	1.128 (1.089 - 1.169) *	1.043 (1.023 - 1.064) *	0.980 (0.965 - 0.995) *
BS	1.054 (1.036 - 1.073) *	-		1.078 (1.056 - 1.100) *	0.973 (0.959 - 0.987) *
	1-pollutant model	**#1**	**Pollutant #2: CO**	**#1**	**Pollutant #2: NO**
PM10	1.030 (1.013 - 1.046) *	0.990 (0.967 - 1.014)	1.088 (1.046 - 1.132) *	1.016 (0.997 - 1.036)	1.031 (1.004 - 1.058) *
BS	1.054 (1.036 - 1.073) *	1.037 (1.003 - 1.072) *	1.028 (0.976 - 1.082)	1.065 (1.036 - 1.095) *	0.984 (0.951 - 1.019)
NH3	0.995 (0.982 - 1.008)	0.976 (0.962 - 0.990) *	1.094 (1.061 - 1.128) *	0.964 (0.950 - 0.978) *	1.064 (1.049 - 1.079) *
CO	1.075 (1.046 - 1.104) *	-		1.153 (1.088 - 1.222) *	0.939 (0.896 - 0.983) *
	1-pollutant model	**#1**	**Pollutant #2: NO2**	**#1**	**Pollutant #2: SO2**
PM10	1.030 (1.013 - 1.046) *	0.981 (0.960 - 1.002)	1.058 (1.041 - 1.076) *	0.994 (0.974 - 1.015)	1.127 (1.080 - 1.175) *
BS	1.054 (1.036 - 1.073) *	1.008 (0.983 - 1.033)	1.043 (1.024 - 1.062) *	1.024 (1.000 - 1.048)	1.086 (1.039 - 1.134) *
NH3	0.995 (0.982 - 1.008)	0.964 (0.950 - 0.978) *	1.064 (1.049 - 1.079) *	0.996 (0.983 - 1.009)	1.007 (1.001 - 1.014) *
CO	1.075 (1.046 - 1.104) *	0.988 (0.945 - 1.033)	1.052 (1.031 - 1.074) *	1.042 (1.010 - 1.074) *	1.090 (1.050 - 1.131) *
NO	1.042 (1.020 - 1.065) *	0.980 (0.953 - 1.008)	1.056 (1.039 - 1.074) *	1.021 (0.998 - 1.045)	1.105 (1.068 - 1.144) *
NO2	1.047 (1.034 - 1.060) *	-		1.033 (1.019 - 1.048) *	1.067 (1.028 - 1.107) *
	1-pollutant model	**#1**	**Pollutant #2: O3**	**#1**	**Pollutant #2: Sum**
PM10	1.030 (1.013 - 1.046) *	1.033 (1.016 - 1.049) *	1.028 (1.010 - 1.047) *	1.064 (1.033 - 1.096) *	0.945 (0.902 - 0.991) *
BS	1.054 (1.036 - 1.073) *	1.060 (1.042 - 1.079) *	1.035 (1.016 - 1.054) *	1.089 (1.064 - 1.114) *	0.944 (0.912 - 0.976) *
NH3	0.995 (0.982 - 1.008)	0.988 (0.974 - 1.003)	1.092 (1.004 - 1.187) *	0.985 (0.970 - 1.001)	1.095 (1.012 - 1.184) *
CO	1.075 (1.046 - 1.104) *	1.085 (1.056 - 1.115) *	1.036 (1.017 - 1.055) *	1.098 (1.062 - 1.137) *	0.969 (0.939 - 1.001)
NO	1.042 (1.020 - 1.065) *	1.050 (1.027 - 1.073) *	1.033 (1.014 - 1.052) *	1.041 (1.016 - 1.065) *	1.004 (0.977 - 1.032)
NO2	1.047 (1.034 - 1.060) *	1.053 (1.040 - 1.067) *	1.041 (1.022 - 1.060) *	1.060 (1.045 - 1.076) *	0.962 (0.934 - 0.990) *
SO2	1.117 (1.082 - 1.153) *	1.124 (1.088 - 1.160) *	1.032 (1.013 - 1.050) *	1.128 (1.087 - 1.171) *	0.984 (0.956 - 1.013)
O3 (8h)	1.031 (1.008 - 1.055) *	-		1.027 (1.009 - 1.046) *	1.031 (1.005 - 1.057) *
Sum	1.027 (1.001 - 1.053) *	-		-	
	1-pollutant model	**#1**	**Pollutant #2: Nitrate**	**#1**	**Pollutant #2: Sulfate**
PM10	1.030 (1.013 - 1.046) *	1.044 (1.019 - 1.071) *	0.986 (0.966 - 1.007)	1.053 (1.023 - 1.084) *	0.978 (0.955 - 1.003)
BS	1.054 (1.036 - 1.073) *	1.075 (1.052 - 1.098) *	0.980 (0.964 - 0.997) *	1.090 (1.064 - 1.117) *	0.967 (0.949 - 0.986) *
NH3	0.995 (0.982 - 1.008)	0.991 (0.977 - 1.004)	1.017 (1.001 - 1.034) *	0.990 (0.975 - 1.004)	1.024 (0.997 - 1.051)
CO	1.075 (1.046 - 1.104) *	1.094 (1.058 - 1.131) *	0.987 (0.970 - 1.003)	1.095 (1.059 - 1.132) *	0.985 (0.969 - 1.002)
NO	1.042 (1.020 - 1.065) *	1.039 (1.015 - 1.063) *	1.004 (0.990 - 1.019)	1.041 (1.017 - 1.067) *	1.001 (0.986 - 1.017)
NO2	1.047 (1.034 - 1.060) *	1.067 (1.051 - 1.084) *	0.972 (0.956 - 0.988) *	1.054 (1.039 - 1.068) *	0.987 (0.972 - 1.002)
SO2	1.117 (1.082 - 1.153) *	1.122 (1.083 - 1.163) *	0.996 (0.981 - 1.011)	1.130 (1.088 - 1.174) *	0.990 (0.975 - 1.006)
O3 (8h)	1.031 (1.008 - 1.055) *	1.028 (1.009 - 1.046) *	1.017 (1.003 - 1.030) *	1.027 (1.009 - 1.046) *	1.016 (1.002 - 1.030) *
Sum	1.027 (1.001 - 1.053) *	1.005 (0.939 - 1.075)	1.012 (0.976 - 1.049)	1.024 (0.954 - 1.100)	1.001 (0.963 - 1.040)
Nitrate	1.014 (1.001 - 1.028) *			1.011 (0.990 - 1.032)	1.005 (0.984 - 1.026)
	1-pollutant model	**#1**	**Pollutant #2: Amm**		
PM10	1.030 (1.013 - 1.046) *	1.083 (1.049 - 1.118) *	0.963 (0.942 - 0.984) *		
BS	1.054 (1.036 - 1.073) *	1.103 (1.076 - 1.131) *	0.966 (0.951 - 0.981) *		
NH3	0.995 (0.982 - 1.008)	0.999 (0.983 - 1.014)	1.008 (0.995 - 1.021)		
CO	1.075 (1.046 - 1.104) *	1.111 (1.072 - 1.151) *	0.980 (0.966 - 0.995) *		
NO	1.042 (1.020 - 1.065) *	1.044 (1.019 - 1.070) *	0.999 (0.986 - 1.011)		
NO2	1.047 (1.034 - 1.060) *	1.065 (1.049 - 1.081) *	0.978 (0.965 - 0.991) *		
SO2	1.117 (1.082 - 1.153) *	1.134 (1.092 - 1.177) *	0.990 (0.978 - 1.003)		
O3 (8h)	1.031 (1.008 - 1.055) *	1.027 (1.009 - 1.046) *	1.012 (1.001 - 1.023) *		
Sum	1.027 (1.001 - 1.053) *	1.159 (1.021 - 1.315) *	0.947 (0.896 - 1.002)		
Nitrate	1.014 (1.001 - 1.028) *	1.024 (0.992 - 1.057)	0.991 (0.966 - 1.017)		
Sulfate	1.014 (1.000 - 1.028) *	1.020 (0.981 - 1.061)	0.995 (0.963 - 1.027)		
Ammonium	1.010 (0.999 - 1.021)	-			

Table 12D. Associations of daily mortality from pneumonia with air pollution from two-pollutant models; relative risks (RR) and 95% confidence intervals for a change in concentration cf. table 2.

Pollutant #1	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)
	1-pollutant model	**#1**	**Pollutant #2: BS**	**#1**	**Pollutant #2: NH3**
PM10	1.172 (1.116 - 1.231) *	1.177 (1.065 - 1.301) *	0.994 (0.893 - 1.107)	1.142 (1.076 - 1.213) *	1.045 (0.999 - 1.093)
BS	1.173 (1.112 - 1.237) *	-		1.135 (1.067 - 1.208) *	1.055 (1.011 - 1.102) *
	1-pollutant model	**#1**	**Pollutant #2: CO**	**#1**	**Pollutant #2: NO**
PM10	1.172 (1.116 - 1.231) *	1.222 (1.138 - 1.313) *	0.911 (0.808 - 1.027)	1.211 (1.142 - 1.285) *	0.925 (0.855 - 1.000)
BS	1.173 (1.112 - 1.237) *	1.306 (1.181 - 1.444) *	0.834 (0.713 - 0.975) *	1.303 (1.200 - 1.415) *	0.847 (0.765 - 0.938) *
NH3	1.097 (1.056 - 1.140) *	1.087 (1.041 - 1.135) *	1.045 (0.950 - 1.150)	1.066 (1.022 - 1.113) *	1.058 (1.013 - 1.104) *
CO	1.159 (1.067 - 1.259) *	-		1.466 (1.109 - 1.937) *	0.809 (0.752 - 0.870) *
	1-pollutant model	**#1**	**Pollutant #2: NO2**	**#1**	**Pollutant #2: SO2**
PM10	1.172 (1.116 - 1.231) *	1.135 (1.064 - 1.212) *	1.038 (0.987 - 1.091)	1.107 (1.039 - 1.180) *	1.215 (1.072 - 1.378) *
BS	1.173 (1.112 - 1.237) *	1.116 (1.033 - 1.205) *	1.047 (0.991 - 1.106)	1.085 (1.010 - 1.165) *	1.250 (1.096 - 1.425) *
NH3	1.097 (1.056 - 1.140) *	1.066 (1.022 - 1.113) *	1.058 (1.013 - 1.104) *	1.100 (1.058 - 1.143) *	1.018 (0.997 - 1.040)
CO	1.159 (1.067 - 1.259) *	0.909 (0.664 - 1.244)	1.152 (1.100 - 1.206) *	1.052 (0.807 - 1.373)	1.339 (1.201 - 1.494) *
NO	1.068 (1.001 - 1.141) *	0.901 (0.826 - 0.984)	1.157 (1.100 - 1.217) *	1.015 (0.947 - 1.088)	1.368 (1.234 - 1.517) *
NO2	1.109 (1.068 - 1.152) *	-		1.060 (1.015 - 1.106) *	1.276 (1.142 - 1.425) *
	1-pollutant model	**#1**	**Pollutant #2: O3**	**#1**	**Pollutant #2: Sum**
PM10	1.172 (1.116 - 1.231) *	1.180 (1.123 - 1.240) *	1.072 (1.009 - 1.140) *	1.589 (1.444 - 1.749) *	0.585 (0.500 - 0.684) *
BS	1.173 (1.112 - 1.237) *	1.190 (1.127 - 1.256) *	1.083 (1.018 - 1.153) *	1.257 (1.170 - 1.351) *	0.879 (0.789 - 0.981) *
NH3	1.097 (1.056 - 1.140) *	1.084 (1.038 - 1.133) *	1.171 (0.901 - 1.521)	1.101 (1.051 - 1.154) *	0.967 (0.755 - 1.240)
CO	1.159 (1.067 - 1.259) *	1.176 (0.903 - 1.531)	1.067 (1.002 - 1.136) *	1.133 (0.852 - 1.506)	1.035 (0.942 - 1.136)
NO	1.068 (1.001 - 1.141) *	1.079 (1.008 - 1.154) *	1.058 (0.993 - 1.127)	1.028 (0.957 - 1.105)	1.102 (1.009 - 1.204) *
NO2	1.109 (1.068 - 1.152) *	1.123 (1.080 - 1.168) *	1.089 (1.023 - 1.160) *	1.115 (1.066 - 1.166) *	0.982 (0.893 - 1.080)
SO2	1.377 (1.249 - 1.517) *	1.406 (1.274 - 1.551) *	1.078 (1.013 - 1.147) *	1.380 (1.234 - 1.544) *	0.996 (0.908 - 1.093)
O3 (8h)	1.058 (0.980 - 1.142)	-		1.056 (0.993 - 1.123)	1.128 (1.041 - 1.222) *
Sum	1.120 (1.033 - 1.213) *	-		-	
	1-pollutant model	**#1**	**Pollutant #2: Nitrate**	**#1**	**Pollutant #2: Sulfate**
PM10	1.172 (1.116 - 1.231) *	1.390 (1.286 - 1.502) *	0.845 (0.790 - 0.903) *	1.404 (1.282 - 1.538) *	0.832 (0.768 - 0.901) *
BS	1.173 (1.112 - 1.237) *	1.240 (1.160 - 1.326) *	0.944 (0.895 - 0.996) *	1.240 (1.150 - 1.336) *	0.944 (0.888 - 1.004)
NH3	1.097 (1.056 - 1.140) *	1.080 (1.036 - 1.126) *	1.064 (1.012 - 1.118) *	1.085 (1.038 - 1.134) *	1.048 (0.964 - 1.140)
CO	1.159 (1.067 - 1.259) *	1.150 (0.857 - 1.545)	1.006 (0.957 - 1.058)	1.123 (0.853 - 1.479)	1.028 (0.979 - 1.080)
NO	1.068 (1.001 - 1.141) *	1.037 (0.966 - 1.113)	1.042 (0.996 - 1.091)	1.026 (0.954 - 1.104)	1.059 (1.010 - 1.112) *
NO2	1.109 (1.068 - 1.152) *	1.138 (1.086 - 1.193) *	0.961 (0.911 - 1.014)	1.103 (1.058 - 1.151) *	1.013 (0.965 - 1.063)
SO2	1.377 (1.249 - 1.517) *	1.379 (1.240 - 1.535) *	0.998 (0.953 - 1.046)	1.374 (1.225 - 1.542) *	1.002 (0.951 - 1.054)
O3 (8h)	1.058 (0.980 - 1.142)	1.057 (0.994 - 1.124)	1.058 (1.014 - 1.103) *	1.055 (0.992 - 1.122)	1.071 (1.026 - 1.119) *
Sum	1.120 (1.033 - 1.213) *	1.161 (0.939 - 1.435)	0.980 (0.876 - 1.097)	1.012 (0.808 - 1.268)	1.061 (0.940 - 1.198)
Nitrate	1.053 (1.009 - 1.098) *			1.011 (0.948 - 1.078)	1.058 (0.991 - 1.131)
	1-pollutant model	**#1**	**Pollutant #2: Amm**		
PM10	1.172 (1.116 - 1.231) *	1.608 (1.453 - 1.779) *	0.786 (0.732 - 0.844) *		
BS	1.173 (1.112 - 1.237) *	1.267 (1.174 - 1.367) *	0.941 (0.896 - 0.990) *		
NH3	1.097 (1.056 - 1.140) *	1.087 (1.037 - 1.140) *	1.033 (0.992 - 1.075)		
CO	1.159 (1.067 - 1.259) *	1.127 (0.847 - 1.499)	1.018 (0.978 - 1.059)		
NO	1.068 (1.001 - 1.141) *	1.022 (0.949 - 1.100)	1.047 (1.007 - 1.089) *		
NO2	1.109 (1.068 - 1.152) *	1.115 (1.065 - 1.167) *	0.993 (0.952 - 1.035)		
SO2	1.377 (1.249 - 1.517) *	1.374 (1.227 - 1.539) *	1.001 (0.962 - 1.043)		
O3 (8h)	1.058 (0.980 - 1.142)	1.057 (0.994 - 1.124)	1.057 (1.021 - 1.094) *		
Sum	1.120 (1.033 - 1.213) *	0.859 (0.564 - 1.308)	1.124 (0.937 - 1.349)		
Nitrate	1.053 (1.009 - 1.098) *	0.971 (0.880 - 1.072)	1.077 (0.994 - 1.167)		
Sulfate	1.068 (1.023 - 1.115) *	1.033 (0.909 - 1.175)	1.028 (0.927 - 1.140)		
Ammonium	1.053 (1.017 - 1.090) *	-			

Table 12E. Associations of daily mortality from chronic obstructive pulmonary diseases with air pollution from two-pollutant models; relative risks (RR) and 95% confidence intervals for a change in concentration cf. table 2.

Pollutant #1	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)	RR (RR-lo - RR-hi)
	1-pollutant model	**#1**	**Pollutant #2: BS**	**#1**	**Pollutant #2: NH3**
PM10	1.066 (1.024 - 1.110) *	1.130 (1.036 - 1.234) *	1.019 (0.927 - 1.120)	1.186 (1.125 - 1.250) *	0.949 (0.911 - 0.989) *
BS	1.153 (1.101 - 1.208) *	-		1.191 (1.128 - 1.258) *	0.958 (0.922 - 0.996) *
	1-pollutant model	**#1**	**Pollutant #2: CO**	**#1**	**Pollutant #2: NO**
PM10	1.066 (1.024 - 1.110) *	1.139 (1.070 - 1.212) *	1.017 (0.916 - 1.128)	1.170 (1.112 - 1.232) *	0.955 (0.891 - 1.022)
BS	1.153 (1.101 - 1.208) *	1.163 (1.065 - 1.270) *	0.985 (0.860 - 1.129)	1.245 (1.158 - 1.338) *	0.887 (0.811 - 0.969) *
NH3	1.014 (0.979 - 1.050)	0.969 (0.932 - 1.007)	1.223 (1.126 - 1.328) *	0.958 (0.921 - 0.996) *	1.117 (1.076 - 1.161) *
CO	1.191 (1.108 - 1.279) *	-		1.617 (1.385 - 1.888) *	0.759 (0.671 - 0.858) *
	1-pollutant model	**#1**	**Pollutant #2: NO2**	**#1**	**Pollutant #2: SO2**
PM10	1.066 (1.024 - 1.110) *	1.110 (1.049 - 1.175) *	1.040 (0.995 - 1.088)	1.120 (1.059 - 1.184) *	1.086 (0.972 - 1.213)
BS	1.153 (1.101 - 1.208) *	1.099 (1.027 - 1.175) *	1.047 (0.998 - 1.099)	1.116 (1.048 - 1.187) *	1.097 (0.977 - 1.231)
NH3	1.014 (0.979 - 1.050)	0.958 (0.921 - 0.996) *	1.117 (1.076 - 1.161) *	1.015 (0.980 - 1.051)	1.014 (0.997 - 1.031)
CO	1.191 (1.108 - 1.279) *	1.037 (0.921 - 1.168)	1.086 (1.028 - 1.148) *	1.125 (1.037 - 1.221) *	1.174 (1.066 - 1.294) *
NO	1.078 (1.018 - 1.141) *	0.936 (0.867 - 1.009)	1.133 (1.084 - 1.185) *	1.038 (0.977 - 1.102)	1.234 (1.128 - 1.351) *
NO2	1.103 (1.066 - 1.140) *	-		1.073 (1.033 - 1.115) *	1.142 (1.035 - 1.259) *
	1-pollutant model	**#1**	**Pollutant #2: O3**	**#1**	**Pollutant #2: Sum**
PM10	1.066 (1.024 - 1.110) *	1.153 (1.104 - 1.203) *	1.060 (1.010 - 1.112) *	1.172 (1.081 - 1.271) *	0.964 (0.848 - 1.095)
BS	1.153 (1.101 - 1.208) *	1.165 (1.112 - 1.221) *	1.068 (1.018 - 1.121) *	1.112 (1.045 - 1.183) *	1.070 (0.977 - 1.173)
NH3	1.014 (0.979 - 1.050)	0.971 (0.933 - 1.009)	1.736 (1.383 - 2.179) *	0.959 (0.919 - 1.000)	1.638 (1.322 - 2.029) *
CO	1.191 (1.108 - 1.279) *	1.211 (1.125 - 1.302) *	1.068 (1.017 - 1.121) *	1.096 (1.001 - 1.200) *	1.128 (1.035 - 1.230) *
NO	1.078 (1.018 - 1.141) *	1.091 (1.029 - 1.157) *	1.058 (1.007 - 1.112) *	1.005 (0.944 - 1.069)	1.191 (1.105 - 1.283) *
NO2	1.103 (1.066 - 1.140) *	1.114 (1.076 - 1.152) *	1.075 (1.023 - 1.128) *	1.069 (1.028 - 1.112) *	1.107 (1.022 - 1.199) *
SO2	1.254 (1.152 - 1.366) *	1.266 (1.162 - 1.379) *	1.056 (1.006 - 1.108) *	1.158 (1.050 - 1.278) *	1.132 (1.047 - 1.225) *
O3 (8h)	1.057 (0.995 - 1.122)	-		1.059 (1.010 - 1.111) *	1.204 (1.125 - 1.289) *
Sum	1.194 (1.116 - 1.278) *	-		-	
	1-pollutant model	**#1**	**Pollutant #2: Nitrate**	**#1**	**Pollutant #2: Sulfate**
PM10	1.066 (1.024 - 1.110) *	1.170 (1.094 - 1.252) *	0.981 (0.926 - 1.038)	1.155 (1.068 - 1.249) *	0.993 (0.929 - 1.062)
BS	1.153 (1.101 - 1.208) *	1.129 (1.065 - 1.196) *	1.023 (0.977 - 1.070)	1.113 (1.043 - 1.188) *	1.037 (0.984 - 1.092)
NH3	1.014 (0.979 - 1.050)	0.986 (0.950 - 1.023)	1.108 (1.060 - 1.158) *	0.975 (0.938 - 1.015)	1.169 (1.087 - 1.257) *
CO	1.191 (1.108 - 1.279) *	1.121 (1.025 - 1.226) *	1.048 (1.002 - 1.096) *	1.102 (1.007 - 1.205) *	1.068 (1.020 - 1.118) *
NO	1.078 (1.018 - 1.141) *	1.020 (0.959 - 1.085)	1.081 (1.040 - 1.124) *	1.005 (0.943 - 1.071)	1.100 (1.055 - 1.146) *
NO2	1.103 (1.066 - 1.140) *	1.080 (1.036 - 1.126) *	1.032 (0.986 - 1.080)	1.072 (1.033 - 1.113) *	1.062 (1.020 - 1.107) *
SO2	1.254 (1.152 - 1.366) *	1.181 (1.075 - 1.297) *	1.056 (1.015 - 1.099) *	1.160 (1.049 - 1.283) *	1.070 (1.024 - 1.117) *
O3 (8h)	1.057 (0.995 - 1.122)	1.059 (1.010 - 1.111) *	1.092 (1.053 - 1.132) *	1.058 (1.008 - 1.110) *	1.106 (1.066 - 1.147) *
Sum	1.194 (1.116 - 1.278) *	1.245 (1.037 - 1.494) *	0.977 (0.887 - 1.077)	1.109 (0.914 - 1.346)	1.044 (0.940 - 1.159)
Nitrate	1.086 (1.048 - 1.126) *			1.030 (0.974 - 1.090)	1.075 (1.016 - 1.138) *
	1-pollutant model	**#1**	**Pollutant #2: Amm**		
PM10	1.066 (1.024 - 1.110) *	1.242 (1.139 - 1.353) *	0.942 (0.887 - 1.000) *		
BS	1.153 (1.101 - 1.208) *	1.141 (1.068 - 1.219) *	1.008 (0.967 - 1.052)		
NH3	1.014 (0.979 - 1.050)	0.962 (0.922 - 1.003)	1.083 (1.046 - 1.121) *		
CO	1.191 (1.108 - 1.279) *	1.117 (1.017 - 1.228) *	1.040 (1.000 - 1.081)		
NO	1.078 (1.018 - 1.141) *	1.009 (0.946 - 1.075)	1.070 (1.035 - 1.107) *		
NO2	1.103 (1.066 - 1.140) *	1.078 (1.035 - 1.122) *	1.032 (0.995 - 1.069)		
SO2	1.254 (1.152 - 1.366) *	1.175 (1.064 - 1.298) *	1.045 (1.010 - 1.082) *		
O3 (8h)	1.057 (0.995 - 1.122)	1.059 (1.009 - 1.110) *	1.077 (1.045 - 1.109) *		
Sum	1.194 (1.116 - 1.278) *	1.905 (1.348 - 2.690) *	0.812 (0.699 - 0.945) *		
Nitrate	1.086 (1.048 - 1.126) *	1.041 (0.956 - 1.134)	1.040 (0.970 - 1.116)		
Sulfate	1.101 (1.062 - 1.143) *	1.127 (1.012 - 1.256) *	0.980 (0.899 - 1.070)		
Ammonium	1.073 (1.041 - 1.105) *	-			

Figures

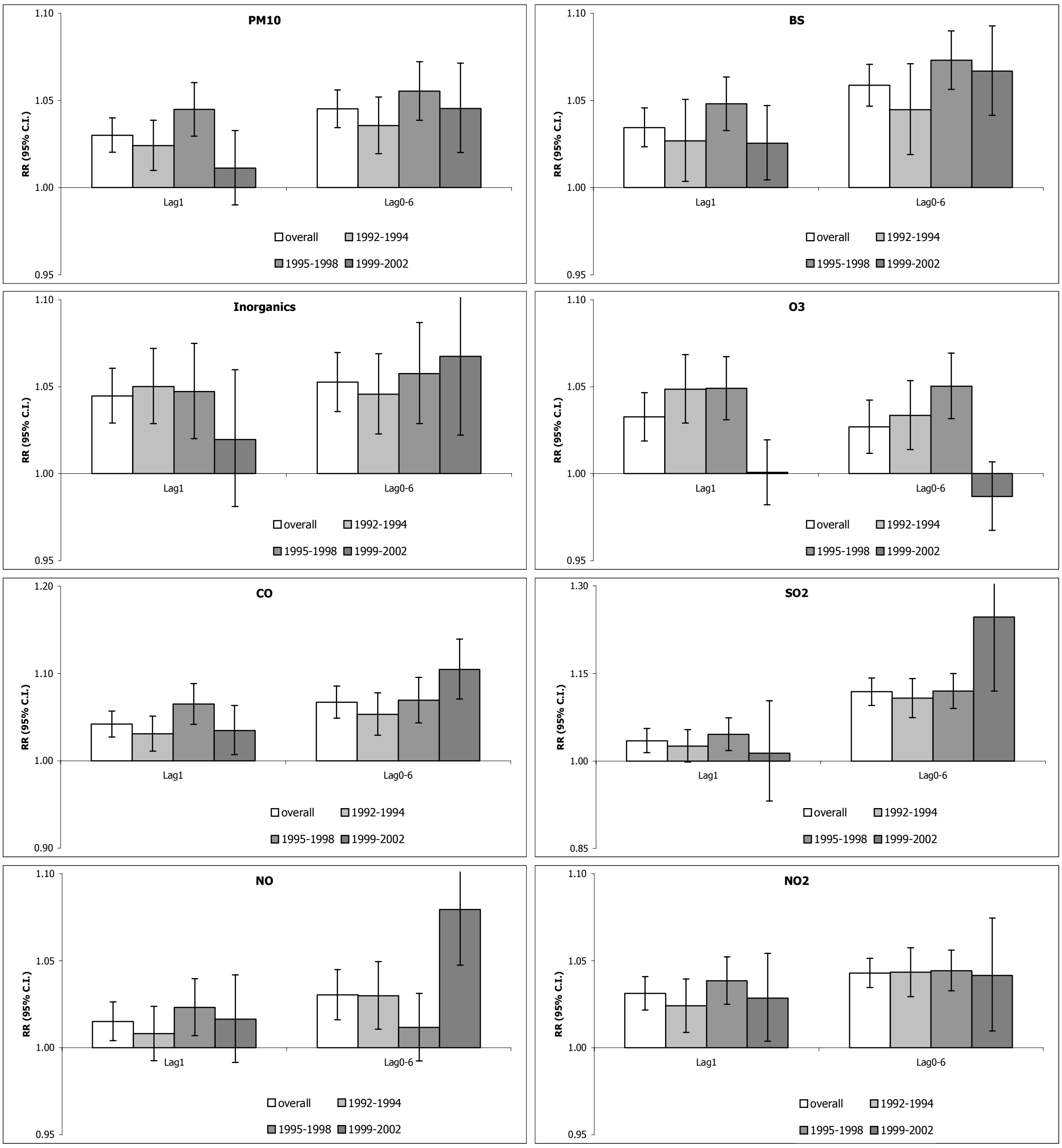

Figure 1A. Trends in the associations between total mortality and air pollution concentration over the study periods. Shown are the relative risks for lag1 and lag0-6 associated with a change in concentration cf. table 2 (error bars represent 95% confidence intervals).

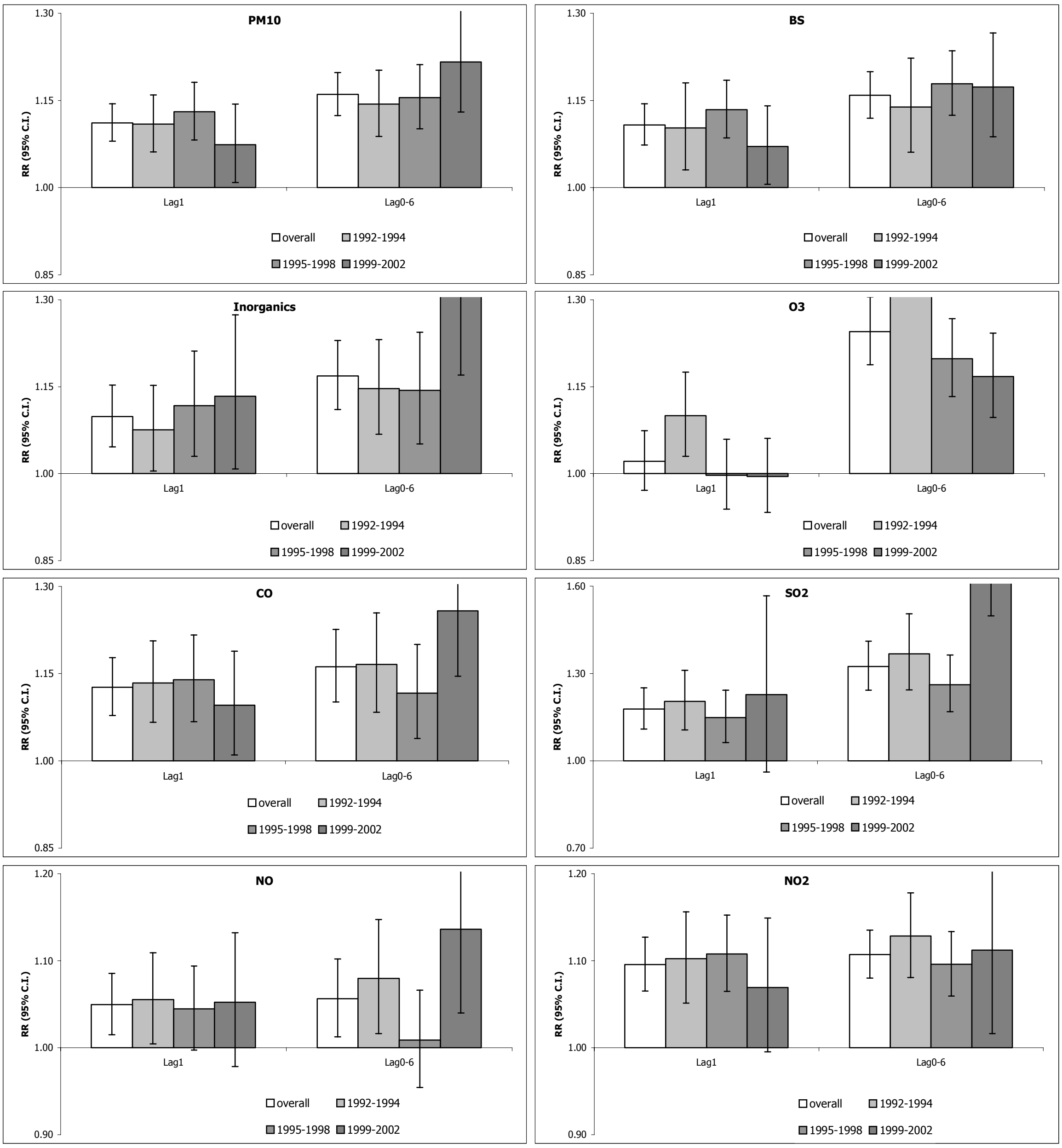

Figure 1B. Trends in the associations between mortality from respiratory diseases and air pollution concentration over the study periods. Shown are the relative risks for lag1 and lag0-6 associated with a change in concentration cf. table 2 (error bars represent 95% confidence intervals).

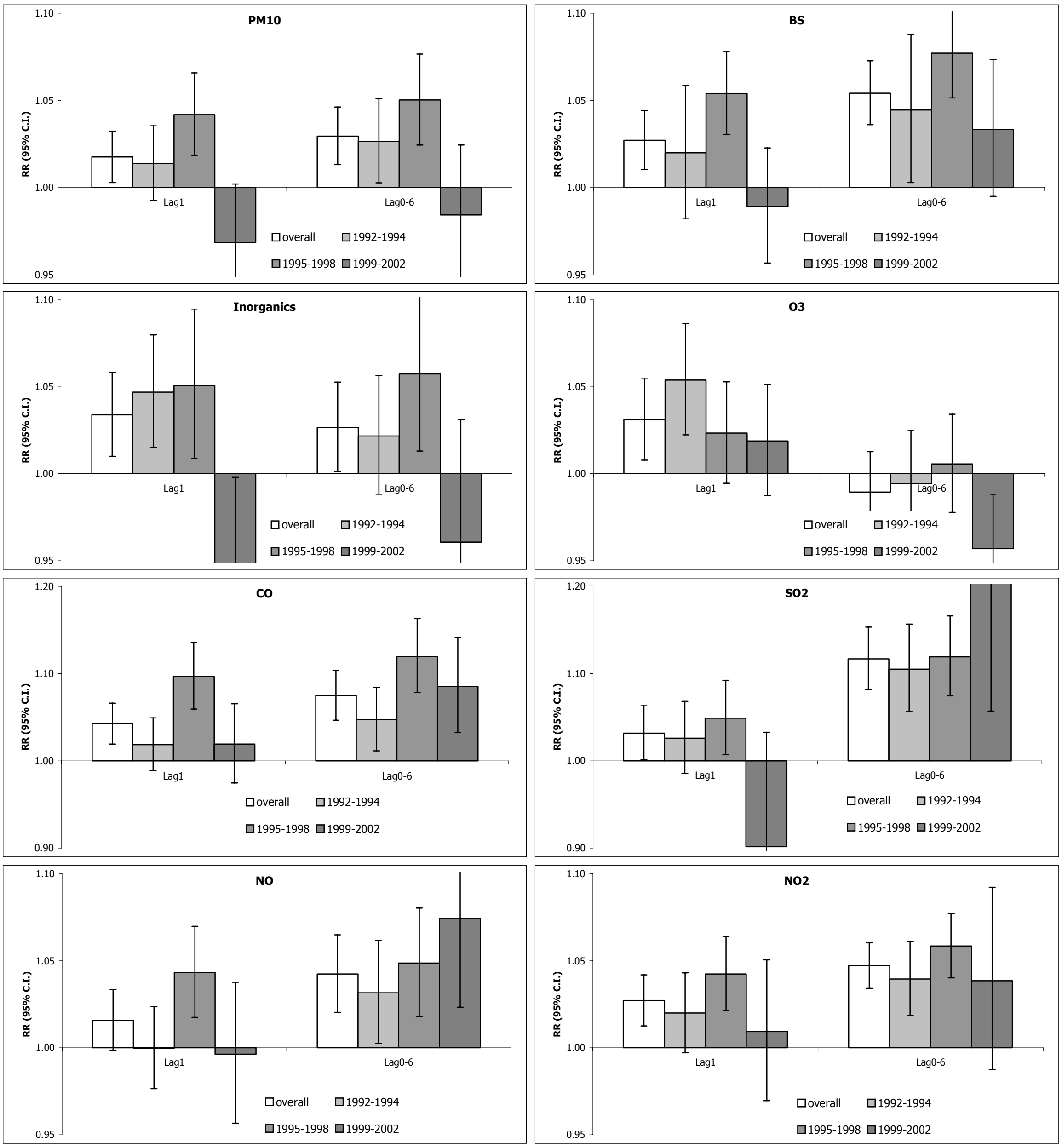

Figure 1C. Trends in the associations between mortality from cardio vascular diseases and air pollution concentration over the study periods. Shown are the relative risks for lag1 and lag0-6 associated with a change in concentration cf. table 2 (error bars represent 95% confidence intervals).

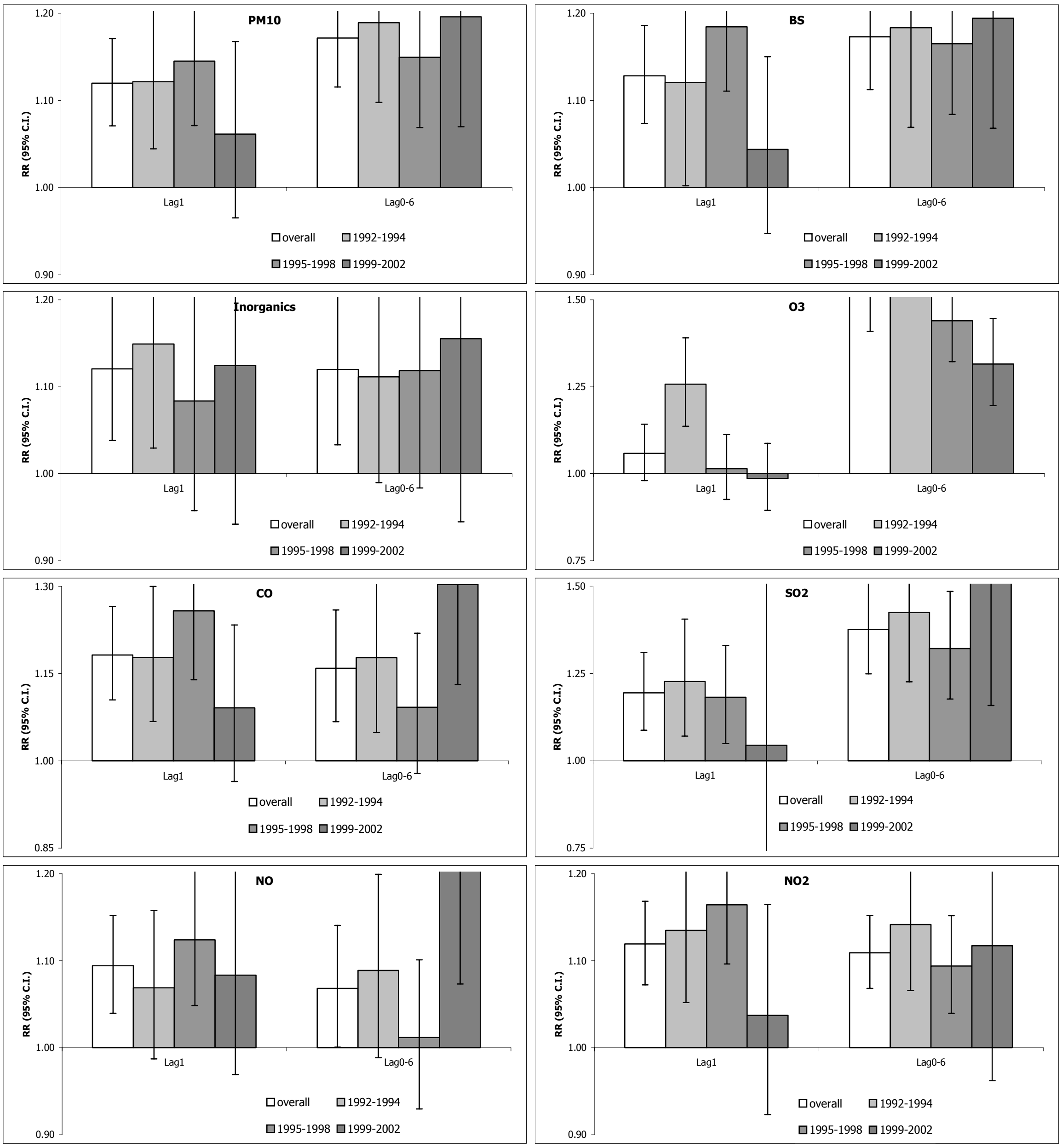

Figure 1D. Trends in the associations between mortality from pneumonia and air pollution concentration over the study periods. Shown are the relative risks for lag1 and lag0-6 associated with a change in concentration cf. table 2 (error bars represent 95% confidence intervals).

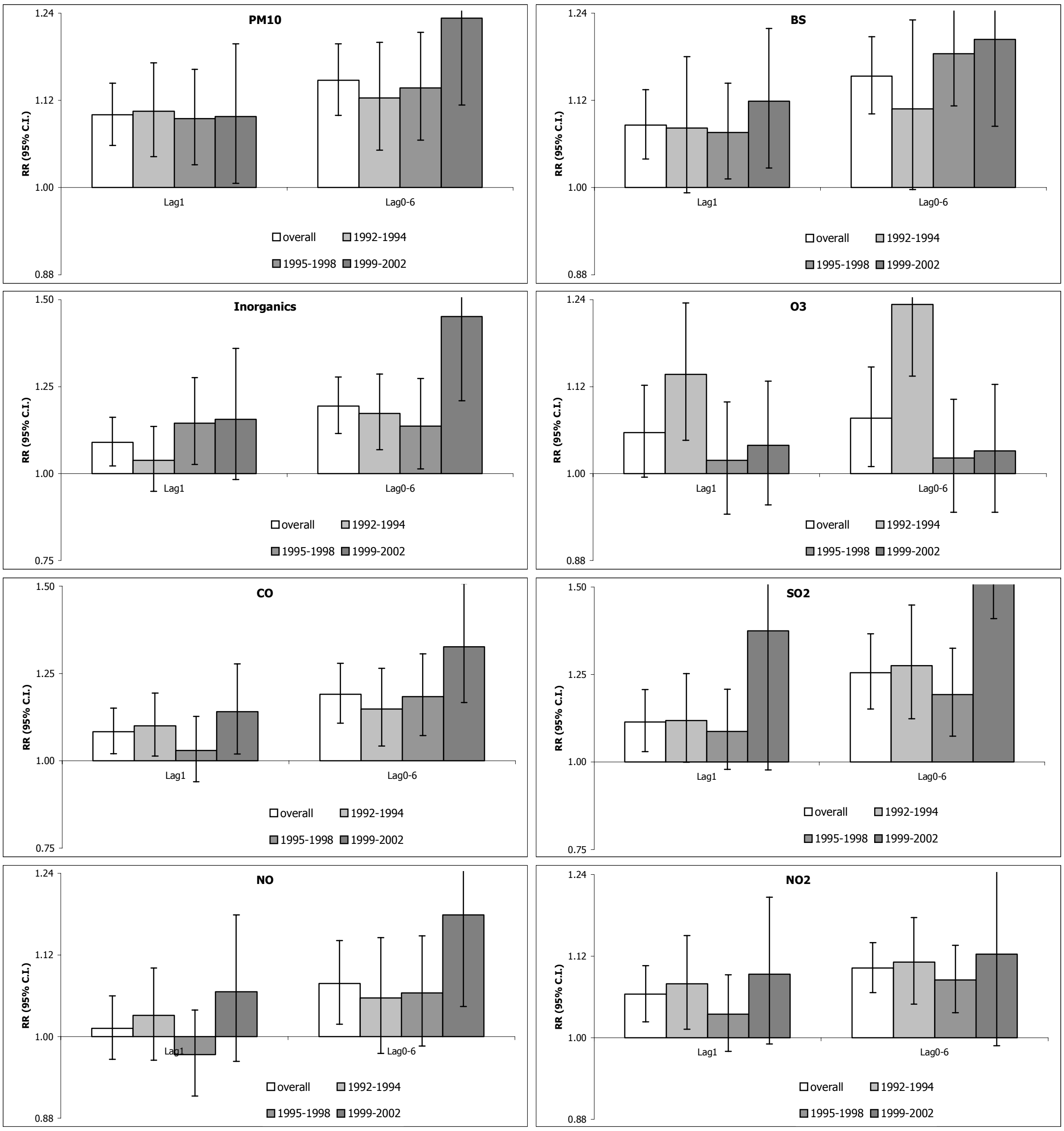

Figure 1E. Trends in the associations between mortality from chronic obstructive pulmonary diseases and air pollution concentration over the study periods. Shown are the relative risks for lag1 and lag0-6 associated with a change in concentration cf. table 2 (error bars represent 95% confidence intervals).

Appendix 1 Selected confounder model parameters

Mortality	Trend	Influenza	Temperature	Relative Humidity	Atmos-pheric pressure	Pollen*
Total	lo(daynr, 0.019)	lo(infl0,0.8) +infl2	lo(temp, 0.6) +lo(templ2, 0.6)	bs(rhl2, knots=70, degree=1)	P	poacl2, betul2, rumel2
Respiratory	lo(daynr, 0.019)	Infl0 +lo(infl1,0.9)	lo(templ1, 0.8) +lo(templ3, 0.8)	bs(rhl1, knots=70, degree=1)	P	poacl2, betul2, rumel2
Cardio-vascular	lo(daynr, 0.025)	lo(infl0,0.7)	lo(templ1, 0.5) +lo(templ2, 0.5)	rh	P	poacl2, betul3, rumel3
Pneumonia	lo(daynr, 0.025)	lo(infl0,0.9) +lo(infl2,0.9)	lo(templ1, 0.8) +lo(templ3, 0.8)	lo(rhl1, 1)	lo(P, 1)	poacl2, betul3, rumel2
COPD	lo(daynr, 0.025)	infl0 +lo(infl1,0.6)	lo(temp, 0.8) +lo(templ2, 0.8)	rh	P	poacl3, betul2, rumel3

* all pollen factorial, divided into 4 categories at percentile cut points (p25, p50 and p75).

Appendix 2 S-plus code of programs used for the data analyses (The Netherlands, total period)

S-plus function definition code for GAM fitting:

```
f.plotluvo2<-
function(span, kop, model, stap, fplot)
{
som<-summary(model)
nobs<-round(som$df[1]+som$df[2])
aic<-round(stap[[7]],2)
par(mfrow=c(3,1))
acf(residuals(model,type="deviance"),type="partial")
title(paste("\n ", kop, ", LUVO, N = ", nobs, ",  AIC = ", aic, ", span = ", span))
mtext(paste(model$call[2]),side=3, line=4, outer=F, at=5)
pre<-preplot(model)
plot(pre[[fplot]], se=T)
title(paste("\n ", kop, ", LUVO, N = ", nobs, ",  AIC = ", aic, ", span = ", span))
plot(pre[[fplot+1]], se=T)
title(paste("\n ", kop, ", LUVO, N = ", nobs, ",  AIC = ", aic, ", span = ", span))
stamp(paste("C. Ameling", date()))
}
f.luvomod<-
function(luvol, luvonm, luvol2, luvonm2, tspan, flu, tmp, rht, pt, poac, betu, rume, fplot, span, outcome, kop)
{
cat("\n span = ", span, "\n")
eval(parse(text=paste("gammodel<-gam(",as.character(outcome),"~", luvol, "+lo(DAGNR,",
as.character(tspan), ")+", flu , "+", tmp, "+", rht, "+", pt, "+", poac, "+", betu, "+", rume, "+ factor(WEEKDAG)
+ FEEST,family=quasi(link=log, variance='mu'), na.action=na.omit)")))
eval(parse(text=paste("stap<-step.gam(gammodel,scope=list(~1))")))
sum<-summary.glm(gammodel, correlation=F)
print(sum)
mat<-sum$coef
#phi<-sum$deviance/sum$df[2]
lijst<-c(outcome, luvonm, mat[2,1], mat[2,2], mat[2,3], round(sum$df[1]+sum$df[2]), round(stap[[24]][[7]],2))
assign("airpollca", rbind(get("airpollca", where=1),lijst), where=1, immediate=1)
f.plotluvo2(span, kop, gammodel,stap[[24]], fplot)
}
```

Appendix 2 (cont'd) S-plus code of programs used for the data analyses (The Netherlands, total period)

S-plus batch job code for GAM fitting:

```
options(object.size=150000000)
gam.control()
print(f.luvomod)
attach(mnp2004)
unix('rm mnp2004allnl*.wmf')
wmf.graph('mnp2004allnl###.wmf')
airpollca<-NULL
f.luvomod(luvol=' BS ',luvonm=' bs ',tspan= 0.019 ,flu=' lo(GRIEP0, 0.8)+GRIEP2 ',tmp=' lo(TEMP, 0.6)+lo(TEMPL2, 0.6) ',rht=' bs(RHL2, knots=70, degree=1) ',pt=' P ',poac=' cut(POACL2, breaks=c(-1,21,77,135,10000)) ',betu=' cut(BETUL2, breaks=c(-1,17,68,600,10000)) ',rume=' cut(RUMEL2, breaks=c(-1,5,10000)) ',fplot= 1 ,span=' nvt ',outcome=' TOTAALNL ',kop=' TOTAL MORTALITY ')
…
f.luvomod(luvol=' BS ',luvonm=' bs ',tspan= 0.019 ,flu=' GRIEP0+lo(GRIEP1, 0.9) ',tmp=' lo(TEMPL1, 0.8)+lo(TEMPL3, 0.8) ',rht=' bs(RHL1, knots=70, degree=1) ',pt=' P ',poac=' cut(POACL2, breaks=c(-1,21,77,135,10000)) ',betu=' cut(BETUL2, breaks=c(-1,17,68,600,10000)) ',rume=' cut(RUMEL2, breaks=c(-1,5,10000)) ',fplot= 1 ,span=' nvt ',outcome=' RESPIRNL ',kop=' RESPIRATORY MORTALITY ')
…
f.luvomod(luvol=' BS ',luvonm=' bs ',tspan= 0.025 ,flu=' lo(GRIEP0, 0.7) ',tmp=' lo(TEMPL1, 0.5)+lo(TEMPL2, 0.5) ',rht=' RH ',pt=' P ',poac=' cut(POACL2, breaks=c(-1,21,77,135,10000)) ',betu=' cut(BETUL3, breaks=c(-1,17,68,600,10000)) ',rume=' cut(RUMEL3, breaks=c(-1,5,10000)) ',fplot= 1 ,span=' nvt ',outcome=' CARDIONL ',kop=' CARDIOVASCULARY MORTALITY ')
…
f.luvomod(luvol=' BS ',luvonm=' bs ',tspan= 0.025 ,flu=' lo(GRIEP0, 0.9)+lo(GRIEP2, 0.9) ',tmp=' lo(TEMPL1, 0.8)+lo(TEMPL3, 0.8) ',rht=' lo(RHL1, 1) ',pt=' lo(P, 1) ',poac=' cut(POACL2, breaks=c(-1,21,77,135,10000)) ',betu=' cut(BETUL3, breaks=c(-1,17,68,600,10000)) ',rume=' cut(RUMEL2, breaks=c(-1,5,10000)) ',fplot= 1 ,span=' nvt ',outcome=' PNEUMONL ',kop=' PNEUMONIA MORTALITY ')
…
f.luvomod(luvol=' BS ',luvonm=' bs ',tspan= 0.025 ,flu=' GRIEP0+lo(GRIEP1, 0.6) ',tmp=' lo(TEMP, 0.8)+lo(TEMPL2, 0.8) ',rht=' RH ',pt=' P ',poac=' cut(POACL3, breaks=c(-1,21,77,135,10000)) ',betu=' cut(BETUL2, breaks=c(-1,17,68,600,10000)) ',rume=' cut(RUMEL3, breaks=c(-1,5,10000)) ',fplot= 1 ,span=' nvt ',outcome=' COBSTRNL ',kop=' COPD MORTALITY ')
…
get('airpollca', where=1)
print(airpollca)
write(t(airpollca), file='../mnp2004allnl.dat', ncol=7)
dev.off()
```

(for reasons of clearity only the code for black smoke, lag 0 is given; at "…" analogous code for the other components and for the various lags is omitted)