Epidemiological time series studies of $PM_{2.5}$ and daily mortality and hospital admissions – a systematic review and meta-analysis

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Methods

Search String

The following search string was used (with minor amendments for the specific databases) to identify potential studies published in peer reviewed journals and indexed in PubMed, EMBASE or Web of Science (which includes the Science Citation Index):

(air pollution OR pollution OR smog OR particle*OR particulate*) AND (timeseries OR time series OR time-series OR daily OR case-crossover) AND (mortality OR death* OR dying OR hospital admission* OR admission* OR emergency room OR visit* OR attendance* OR 'a&e' OR 'a and e' OR accident and emergency OR general pract* OR physician* OR consultation* OR emergency department*)

Study Selection criteria

The selection criteria used were that the study provided: 1) estimates for $PM_{2.5}$; 2) at least one year of daily data relating to a general population; 3) a reasonable attempt to control for important confounding factors such as season, long-term temporal trends and meteorological conditions and 4) sufficient information for the calculation of a regression estimate and standard error for comparison in the quantitative analysis. No limitation was placed upon language. We also cross-checked our search results against publications selected for other reviews.

Lag selection protocol

The short-term relationships between air pollution and health effects are characterised by the time lag (in days) between exposure and health events and investigators vary in which lags they study and report. This means that the use of any particular lag would result in the exclusion of many other studies. In the absence of a standard method of reporting the lag, we therefore adopted the following approach for selecting lag results for inclusion in the database. If only one lagged estimate for a given pollutant/outcome pair was presented (either because only one was analysed or only one was reported in the paper), this estimate was recorded in the Access database for the outcome–pollutant pair. If more than one lag measure was presented, we selected one for meta-analysis according to the following algorithm: 1) the lag that the author focused on or stated a priori; 2) the lag that was the most statistically significant (positive or negative) and 3) the lag with the largest effect estimate (positive or negative). For options 2) and 3) results for single lags were selected ahead of results for cumulative/distributed lags.

Estimate selection protocol

Furthermore, numerous multi-city studies have incorporated the same cities more than once. Inclusion of results from a single-city more than once in a meta-analysis was not appropriate as the study populations will be correlated and the over-representation of a single-city may bias the summary estimate. Hence, we selected estimates from single-city studies only if they did not appear in multi-city studies. If a city was the subject of a single-city study on more than one occasion we took the result for the most recent publication. Where results from more than one multi-city study within a WHO Region were available we selected, in order of priority, the multi-city study: 1) with the most cities/greatest geographical coverage; 2) the most recently published; and 3) the longest study period.

Table S1 List of countries by WHO Region and mortality strata
(Source: *The World Health Report 2002)*

Mortality strata
A. Very low child, very low adult
B. Low child, low adult
C. Low child, high adult
D. High child, high adult
E. High child, very high adult

African Region	Eastern Mediterranean Region	European Region	Region of the Americas	South-East Asian Region	Western Pacific Region
AFR D • Algeria • Angola • Benin • Burkina Faso • Cameroon • Cape Verde • Chad • Equatorial Guinea • Gabon • Gambia • Ghana • Guinea	**EMR B** • Bahrain • Cyprus • Iran, Islamic Republic of • Jordan • Kuwait • Lebanon • Libyan Arab Jamahiriya • Oman • Qatar • Saudi Arabia • Syrian Arab	**EUR A** • Andorra • Austria • Belgium • Croatia • Czech Republic • Denmark • Finland • France • Germany • Greece • Iceland • Ireland • Israel	**AMR A** • Canada • Cuba • United States of America **AMR B** • Antigua and Barbuda • Argentina • Bahamas • Barbados • Belize	**SEAR B** • Indonesia • Sri Lanka • Thailand • Timor-Leste **SEAR D** • Bangladesh • Bhutan • Democratic People's Republic of Korea	**WPR A** • Australia • Brunei Darussalam • Japan • New Zealand • Singapore **WPR B** • Cambodia • China • Cook Islands • Fiji

• Guinea-Bissau • Liberia • Madagascar • Mali • Mauritania • Mauritius • Niger • Nigeria • Sao Tome and Principe • Senegal • Seychelles • Sierra Leone • Togo **AFR E** • Botswana • Burundi • Central African Republic • Congo • Côte d'Ivoire • Democratic Republic of Congo • Eritrea • Ethiopia • Kenya • Lesotho • Malawi • Mozambique	Republic • Tunisia • United Arab Emirates **EMR D** • Afghanistan • Djibouti • Egypt • Iraq • Morocco • Pakistan • Somalia • Sudan • Yemen	• Italy • Luxembourg • Malta • Monaco • Netherlands • Norway • Portugal • San Marino • Slovenia • Spain • Sweden • Switzerland • United Kingdom **EUR B** • Albania • Armenia • Azerbaijan • Bosnia and Herzegovina • Bulgaria • Georgia • Kyrgyzstan • Poland • Romania • Slovakia • Tajikistan • The former Yugoslav Republic of	• Brazil • Chile • Colombia • Costa Rica • Dominica • Dominican Republic • El Salvador • Grenada • Guyana • Honduras • Jamaica • Mexico • Panama • Paraguay • Saint Kitts and Nevis • Saint Lucia • Saint Vincent and the Grenadines • Suriname • Trinidad and Tobago • Uruguay • Venezuela, Bolivarian Republic of **AMR D** • Bolivia	• India • Maldives • Myanmar • Nepal	• Kiribati • Lao People's Democratic Republic • Malaysia • Marshall Islands • Micronesia, Federated States of • Mongolia • Nauru • Niue • Palau • Papua New Guinea • Philippines • Republic of Korea • Samoa • Solomon Islands • Tonga • Tuvalu • Vanuatu • Viet Nam

• Namibia • Rwanda • South Africa • Swaziland • Uganda • United Republic of Tanzania • Zambia • Zimbabwe		Macedonia • Turkey • Turkmenistan • Uzbekistan • Yugoslavia **EUR C** • Belarus • Estonia • Hungary • Kazakhstan • Latvia • Lithuania • Republic of Moldova • Russian Federation • Ukraine	• Ecuador • Guatemala • Haiti • Nicaragua • Peru		

Source: http://www.who.int/choice/demography/regions/en/ (accessed 27th March 2014)

Table S2 List of time series studies of $PM_{2.5}$ and mortality and hospital admissions

Goldberg, M.S., Burnett, R.T., Bailar, J.C., Brook, J., Bonvalot, Y., Tamblyn, R., Singh, R., & Valois, M.F. 2001. The association between daily mortality and ambient air particle pollution in Montreal, Quebec 1. Nonaccidental mortality. *Environmental Research*, 86, (1) 12-25
Ref ID: 19

Burnett, R.T., Smith-Doiron, M., Stieb, D., Raizenne, M.E., Brook, J.R., Dales, R.E., Leech, J.A., Cakmak, S., & Krewski, D. 2001. Association between ozone and hospitalization for acute respiratory diseases in children less than 2 years of age. *American Journal of Epidemiology*, 153, (5) 444-452
Ref ID: 57

Anderson, H.R., Bremner, S.A., Atkinson, R.W., Harrison, R.M., & Walters, S. 2001. Particulate matter and daily mortality and hospital admissions in the west midlands conurbation of the United Kingdom: associations with fine and coarse particles, black smoke and sulphate. *Occupational and Environmental Medicine*, 58, (8) 504-510
Ref ID: 69

Chen, Y., Yang, Q.Y., Krewski, D., Burnett, R.T., Shi, Y.L., & McGrail, K.M. 2005. The effect of coarse ambient particulate matter on first, second, and overall hospital admissions for respiratory disease among the elderly. *Inhalation Toxicology*, 17, (12) 649-655 available from: ISI:000231082600002
Ref ID: 73

Ostro, B., Roth, L., Malig, B., & Marty, M. 2009. The Effects of Fine Particle Components on Respiratory Hospital Admissions in Children. *Environmental Health Perspectives*, 117, (3) 475-480 available from: ISI:000263933600038
Ref ID: 95

Chimonas, M.A.R. & Gessner, B.D. 2007. Airborne particulate matter from primarily geologic, non-industrial sources at levels below National Ambient Air Quality Standards is associated with outpatient visits for asthma and quick-relief medication prescriptions among children less than 20 years old enrolled in Medicaid in Anchorage, Alaska. *Environmental Research*, 103, (3) 397-404 available from: ISI:000244903200014
Ref ID: 100

Lin, M., Chen, Y., Burnett, R.T., Villeneuve, P.J., & Krewski, D. 2002. The influence of ambient coarse particulate matter on asthma hospitalization in children: Case-crossover and time series analyses. *Environmental Health Perspectives*, 110, (6) 575-581
Ref ID: 103

Zanobetti, A. & Schwartz, J. 2006. Air pollution and emergency admissions in Boston, MA. *Journal of Epidemiology and Community Health*, 60, (10) 890-895 available from: ISI:000240495000015
Ref ID: 105

Lee, S.L., Wong, W.H.S., & Lau, Y.L. 2006. Association between air pollution and asthma admission among children in Hong Kong. *Clinical and Experimental Allergy*, 36, (9) 1138-1146 available from: ISI:000240311900005
Ref ID: 126

Simpson, R., Williams, G., Petroeschevsky, A., Best, T., Morgan, G., Denison, L., Hinwood, A., Neville, G., & Neller, A. 2005. The short-term effects of air pollution on daily mortality in four Australian cities. *Australian and New Zealand Journal of Public Health*, 29, (3) 205-212 available

from: ISI:000229854700003
Ref ID: 133

Burnett, R.T., Brook, J., Dann, T., Delocla, C., Philips, O., Cakmak, S., Vincent, R., Goldberg, M.S., & Krewski, D. 2000. Association between particulate- and gas-phase components of urban air pollution and daily mortality in eight Canadian cities. *Inhalation Toxicology*, 12, 15-39
Ref ID: 135

Moolgavkar, S.H. 2000. Air pollution and hospital admissions for chronic obstructive pulmonary disease in three metropolitan areas in the United States. *Inhalation Toxicology*, 12, 75-90
Ref ID: 136

Ostro, B.D., Broadwin, R., & Lipsett, M.J. 2000. Coarse and fine particles and daily mortality in the Coachella Valley, California: a follow-up study. *Journal of Exposure Analysis and Environmental Epidemiology*, 10, (5) 412-419
Ref ID: 144

Kan, H., Jia, J., & Chen, B.H. 2004. The association of daily diabetes mortality and outdoor air pollution in Shanghai, China. *Journal of Environmental Health*, 67, (3) 21-25 available from: ISI:000224044900004
Ref ID: 150

Ito, K., Christensen, W.F., Eatough, D.J., Henry, R.C., Kim, E., Laden, F., Lall, R., Larson, T.V., Neas, L., Hopke, P.K., & Thurston, G.D. 2006. PM source apportionment and health effects: 2. An investigation of intermethod variability in associations between source-apportioned fine particle mass and daily mortality in Washington, DC. *Journal of Exposure Science and Environmental Epidemiology*, 16, (4) 300-310 available from: ISI:000239389600002
Ref ID: 159

Moolgavkar, S.H. 2003. Air pollution and daily mortality in two U. S. counties: Season-specific analyses and exposure-response relationships. *Inhalation Toxicology*, 15, (9) 877-907 available from: ISI:000184470900002
Ref ID: 162

Moolgavkar, S.H. 2000. Air pollution and daily mortality in three US counties. *Environmental Health Perspectives*, 108, (8) 777-784
Ref ID: 163

Klemm, R.J. & Mason, R.M. 2000. Aerosol Research and Inhalation Epidemiological Study (ARIES): Air quality and daily mortality statistical modeling - Interim results. *Journal of the Air & Waste Management Association*, 50, (8) 1433-1439
Ref ID: 176

Chock, D.P. & Winkler, S.L. 2000. A study of the association between daily mortality and ambient air pollutant concentrations in Pittsburgh, Pennsylvania. *Journal of the Air & Waste Management Association*, 50, (8) 1481-1500
Ref ID: 177

Lipfert, F.W., Morris, S.C., & Wyzga, R.E. 2000. Daily mortality in the Philadelphia metropolitan area and size- classified particulate matter. *Journal of the Air & Waste Management Association*, 50, (8) 1501-1513
Ref ID: 178

Loomis, D.P., Castillejos, M., Gold, D.R., McDonnell, W., & Borja-Aburto, V.H. 1999. Air pollution and infant mortality in Mexico City. *Epidemiology*, 10, (2) 118-123
Ref ID: 210

Peters, A., Skorkovsky, J., Kotesovec, F., Brynda, J., Spix, C., Wichmann, H.E., & Heinrich, J. 2000. Associations between mortality and air pollution in Central Europe. *Environmental Health Perspectives*, 108, (4) 283-287
Ref ID: 212

Borja-Aburto, V.H., Castillejos, M., Gold, D.R., Bierzwinski, S., & Loomis, D. 1998. Mortality and ambient fine particles in southwest Mexico City, 1993-1995. *Environmental Health Perspectives*, 106, (12) 849-855
Ref ID: 214

Burnett, R.T., Cakmak, S., Raizenne, M.E., Stieb, D., Vincent, R., Krewski, D., Brook, J.R., Philips, O., & Ozkaynak, H. 1998. The association between ambient carbon monoxide levels and daily mortality in Toronto, Canada. *Journal of the Air & Waste Management Association*, 48, (8) 689-700
Ref ID: 224

Slaughter, J.C., Kim, E., Sheppard, L., Sullivan, J.H., Larson, T.V., & Claiborn, C. 2005. Association between particulate matter and emergency room visits, hospital admissions and mortality in Spokane, Washington. *Journal of Exposure Analysis and Environmental Epidemiology*, 15, (2) 153-159 available from: ISI:000227541800005
Ref ID: 230

Halonen, J.I., Lanki, T., Yli-Tuomi, T., Tiittanen, P., Kulmala, M., & Pekkanen, J. 2009. Particulate Air Pollution and Acute Cardiorespiratory Hospital Admissions and Mortality Among the Elderly. *Epidemiology*, 20, (1) 143-153 available from: ISI:000261930800023
Ref ID: 238

Schreuder, A.B., Larson, T.V., Sheppard, L., & Claiborn, C.S. 2006. Ambient woodsmoke and associated respiratory emergency department visits in Spokane, Washington. *International Journal of Occupational and Environmental Health*, 12, (2) 147-153 available from: ISI:000237477200008
Ref ID: 239

Cancado, J.E., Saldiva, P.H.N., Pereira, L.A.A., Lara, L.B.L.S., Artaxo, P., Martinelli, L.A., Arbex, M.A., Zanobetti, A., & Braga, A.L.F. 2006. The impact of sugar cane-burning emissions on the respiratory system of children and the elderly. *Environmental Health Perspectives*, 114, (5) 725-729 available from: ISI:000237308500040
Ref ID: 248

Schwartz, J., Dockery, D.W., & Neas, L.M. 1996. Is daily mortality associated specifically with fine particles? *Journal of the Air & Waste Management Association*, 46, (10) 927-939
Ref ID: 250

Ostro, B.D. 1995. Fine particulate air pollution and mortality in two Southern California counties. *Environmental Research*, 70, (2) 98-104
Ref ID: 271

Perez, L., Tobias, A., Querol, X., Kunzli, N., Pey, J., Alastuey, A., Viana, M., Valero, N., Gonzalez-Cabre, M., & Sunyer, J. 2008. Coarse Particles From Saharan Dust and Daily Mortality.

Epidemiology, 19, (6) 800-807 available from: ISI:000260191700009
Ref ID: 283

Dockery, D.W., Schwartz, J., & Spengler, J.D. 1992. Air pollution and daily mortality: associations with particulates and acid aerosols. *Environmental Research*, 59, (2) 362-373
Ref ID: 312

Lisabeth, L.D., Escobar, J.D., Dvonch, J.T., Sanchez, B.N., Majersik, J.J., Brown, D.L., Smith, M.A., & Morgenstern, L.B. 2008. Ambient air pollution and risk for ischemic stroke and transient ischemic attack. *Annals of Neurology*, 64, (1) 53-59 available from: ISI:000258199900009
Ref ID: 333

Burnett, R.T., Smith-Doiron, M., Stieb, D., Cakmak, S., & Brook, J.R. 1999. Effects of particulate and gaseous air pollution on cardiorespiratory hospitalizations. *Archives of Environmental Health*, 54, (2) 130-139
Ref ID: 368

Sheppard, L., Levy, D., Norris, G., Larson, T.V., & Koenig, J.Q. 1999. Effects of ambient air pollution on nonelderly asthma hospital admissions in Seattle, Washington, 1987-1994. *Epidemiology*, Vol 10, (1) 23-30
Ref ID: 374

Ostro, B., Broadwin, R., Green, S., Feng, W.Y., & Lipsett, M. 2006. Fine particulate air pollution and mortality in nine California counties: Results from CALFINE. *Environmental Health Perspectives*, 114, (1) 29-33 available from: ISI:000234396800034
Ref ID: 379

Hinwood, A.L., De Klerk, N., Rodriguez, C., Jacoby, P., Runnion, T., Rye, P., Landau, L., Murray, F., Feldwick, M., & Spickett, J. 2006. The relationship between changes in daily air pollution and hospitalizations in Perth, Australia 1992-1998: A case-crossover study. *International Journal of Environmental Health Research*, 16, (1) 27-46 available from: ISI:000234228900004
Ref ID: 388

Ueda, K., Nitta, H., & Ono, M. 2009. Effects of fine particulate matter on daily mortality for specific heart diseases in Japan. *Circulation Journal*, 73, (7) 1248-1254 available from: ISI:000267584400016
Ref ID: 390

Peng, R.D., Chang, H.H., Bell, M.L., McDermott, A., Zeger, S.L., Samet, J.M., & Dominici, F. 2008. Coarse particulate matter air pollution and hospital admissions for cardiovascular and respiratory diseases among medicare patients. *Jama-Journal of the American Medical Association*, 299, (18) 2172-2179 available from: ISI:000255790000024
Ref ID: 391

Koop, G. & Tole, L. 2004. Measuring the health effects of air pollution: to what extent can we really say that people are dying from bad air? *Journal of Environmental Economics and Management*, 47, (1) 30-54 available from: ISI:000187570600003
Ref ID: 396

Burnett, R.T., Cakmak, S., Brook, J.R., & Krewski, D. 1997. The role of particulate size and chemistry in the association between summertime ambient air pollution and hospitalization for cardiorespiratory diseases. *Environmental Health Perspectives*, 105, (6) 614-620
Ref ID: 399

Delfino, R.J., Murphy-Moulton, A.M., Burnett, R.T., Brook, J.R., & Becklake, M.R. 1997. Effects of air pollution on emergency room visits for respiratory illnesses in Montreal, Quebec. *American Journal of Respiratory & Critical Care Medicine*, 155, (2) 568-576
Ref ID: 408

Cakmak, S., Dales, R.E., & Blanco, C. 2009. Components of particulate air pollution and mortality in Chile. *International Journal of Occupational and Environmental Health*, 15, (2) 152-158 available from: ISI:000266257200006
Ref ID: 412

Thurston, G.D., Ito, K., Hayes, C.G., Bates, D.V., & Lippmann, M. 1994. Respiratory hospital admissions and summertime haze air pollution in Toronto, Ontario: Consideration of the role of acid aerosols. *Environmental Research*, 65, (2) 271-290
Ref ID: 441

Jalaludin, B., Morgan, G., Lincoln, D., Sheppeard, V., Simpson, R., & Corbett, S. 2006. Associations between ambient air pollution and daily emergency department attendances for cardiovascular disease in the elderly (65 + years), Sydney, Australia. *Journal Of Exposure Science & Environmental Epidemiology*, 16, (3) 225-237
Ref ID: 449

Bell, M.L., Levy, J.K., & Lin, Z. 2008. The effect of sandstorms and air pollution on cause-specific hospital admissions in Taipei, Taiwan. *Occupational and Environmental Medicine*, 65, (2) 104-111 available from: ISI:000252601700005
Ref ID: 458

Neuberger, M., Rabczenko, D., & Moshammer, H. 2007. Extended effects of air pollution on cardiopulmonary mortality in Vienna. *Atmospheric Environment*, 41, (38) 8549-8556 available from: ISI:000252101300012
Ref ID: 475

Brook, J.R., Burnett, R.T., Dann, T.F., Cakmak, S., Goldberg, M.S., Fan, X.H., & Wheeler, A.J. 2007. Further interpretation of the acute effect of nitrogen dioxide observed in Canadian time series studies. *Journal of Exposure Science and Environmental Epidemiology*, 17, S36-S44 available from: ISI:000251751900006
Ref ID: 485

Atkinson, R.W., Fuller, G.W., Anderson, H.R., Harrison, R.M., & Armstrong, B. 2010. Urban ambient particle metrics and health: a time series analysis. *Epidemiology*, 21, (4) 501-511
Ref ID: 517

Belleudi, V., Faustini, A., Stafoggia, M., Cattani, G., Marconi, A., Perucci, C.A., & Forastiere, F. 2010. Impact of fine and ultrafine particles on emergency hospital admissions for cardiac and respiratory diseases. *Epidemiology*, 21, (3) 414-423
Ref ID: 520

Sanhueza, P., Vargas, C., & Jimenez, J. 1999. Daily mortality in Santiago and its relationship with air pollution. *Revista Medica de Chile*, 127, (NO- 2) 235-242
Ref ID: 530

Ko, F.W.S., Tam, W., Wong, T.W., Lai, C.K.W., Wong, G.W.K., Leung, T.F., Ng, S.S.S., & Hui, D.S.C. 2007. Effects of air pollution on asthma hospitalization rates in different age groups in Hong Kong. *Clinical and Experimental Allergy*, 37, (9) 1312-1319 available from:

ISI:000249253100008
Ref ID: 567

Jimenez, E., Linares, C., Rodriguez, L.F., Bleda, M.J., & Diaz, J. 2009. Short-term impact of particulate matter (PM2.5) on daily mortality among the over-75 age group in Madrid (Spain). *Science of the Total Environment*, 407, (21) 5486-5492
Ref ID: 576

Jimenez, E., Linares, C., Martinez, D., & Diaz, J. 2010. Role of Saharan dust in the relationship between particulate matter and short-term daily mortality among the elderly in Madrid (Spain). *Science of the Total Environment*, 408, (23) 5729-5736
Ref ID: 577

Linares, C. & Diaz, J. 2010. Short-term effect of concentrations of fine particulate matter on hospital admissions due to cardiovascular and respiratory causes among the over-75 age group in Madrid, Spain. *Public Health*, 124, (1) 28-36
Ref ID: 590

Peng, R.D., Bell, M.L., Geyh, A.S., McDermott, A., Zeger, S.L., Samet, J.M., & Dominici, F. 2009. Emergency admissions for cardiovascular and respiratory diseases and the chemical composition of fine particle air pollution. *Environmental Health Perspectives*, 117, (6) 957-963
Ref ID: 618

Peters, A., Breitner, S., Cyrys, J., Stolzel, M., Pitz, M., Wolke, G., Heinrich, J., Kreyling, W., Kuchenhoff, H., & Wichmann, H. E. 2009, *The influence of improved air quality on mortality risks in Erfurt, Germany*.
Ref ID: 621

Ueda, K., Nitta, H., Ono, M., & Takeuchi, A. 2009. Estimating mortality effects of fine particulate matter in Japan: a comparison of time series and case-crossover analyses. *Journal of the Air & Waste Management Association*, 59, (10) 1212-1218
Ref ID: 669

Zanobetti, A. & Schwartz, J. 2009. The effect of fine and coarse particulate air pollution on mortality: a national analysis. *Environmental Health Perspectives*, 117, (6) 898-903
Ref ID: 684

Jayaraman, G. & Nidhi 2008. Air pollution and associated respiratory morbidity in Delhi. *Health Care Management Science*, 11, (2) 132-138 available from:
http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=18581819&site=ehost-live
Ref ID: 739

Fairley, D. 1999. Daily mortality and air pollution in Santa Clara County, California: 1989-1996. *Environmental Health Perspectives*, 107, (8) 637-641
Ref ID: 889

Huang, W., Tan, J., Kan, H., Zhao, N., Song, W., Song, G., Chen, G., Jiang, L., Jiang, C., Chen, R., & Chen, B. 2009. Visibility, air quality and daily mortality in Shanghai, China. *The Science Of The Total Environment*, 407, (10) 3295-3300 available from:
http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=19275954&site=ehost-live
Ref ID: 923

Castillejos, M., BorjaAburto, V.H., Dockery, D.W., Gold, D.R., & Loomis, D. 2000. Airborne coarse particles and mortality. *Inhalation Toxicology*, 12, 61-72
Ref ID: 1075

Mar, T.F., Norris, G.A., Koenig, J.Q., & Larson, T.V. 2000. Associations between air pollution and mortality in Phoenix, 1995- 1997. *Environmental Health Perspectives*, 108, 347-353
Ref ID: 1120

Cifuentes, L., Vega, J., Kopfer, K., & Lava, L.B. 2000. Effect of the fine fraction of particulate matter versus the coarse mass and other pollutants on daily mortality in Santiago, Chile. *Journal of the Air & Waste Management Association*, 50, (8) 1287-1298
Ref ID: 1152

Lippmann, M., Ito, K., Nadas, A., & Burnett, R. T. 2000, *Association of particulate matter components with daily mortality and morbidity in urban populations*, Health Effects Institute, 95.
Ref ID: 1181

Samet, J. M., Zeger, S. L., Dominici, F., Curriero, F., Coursac, I., Dockery, D. W., Schwartz, J., & Zanobetti, A. 2000, *The national morbidity, mortality and air pollution study part II:morbidity, mortality and air pollution in the United States*, Health Effects Institute, 94, Part II.
Ref ID: 1182

Moolgavkar, S.H. 2000. Air pollution and hospital admissions for diseases of the circulatory system in three US metropolitan areas. *Journal of the Air & Waste Management Association*, 50, (7) 1199-1206
Ref ID: 1196

Wichmann, H. E., Spix, C., Tuch, T., Wolke, G., Peters, A., Heinrich, J., Kreyling, W. G., & Heyder, J. 2000, *Daily Mortality and Fine and Ultrafile Particles in Erfurt, Germany Part I: Role of Particle Number and Particle Mass*, Health Effects Institute, 98.
Ref ID: 1205

Goldberg, M.S., Burnett, R.T., Bailar, J.C., Brook, J., Bonvalot, Y., Tamblyn, R., Singh, R., Valois, M.F., & Vincent, R. 2001. The association between daily mortality and ambient air particle pollution in Montreal, Quebec 2. Cause-specific mortality. *Environmental Research*, 86, (1) 26-36
Ref ID: 1347

Schwartz, J., Laden, F., & Zanobetti, A. 2002. The concentration-response relation between PM(2.5) and daily deaths. *Environmental Health Perspectives.*, 110, (10) 1025-1029
Ref ID: 1481

2003, *Revised analyses of time series studies of air pollution and health*, Health Effects Institute, Special report.
Ref ID: 1494

Venners, S.A., Wang, B.Y., Peng, Z.G., Xu, Y., Wang, L.H., & Xu, X.P. 2003. Particulate matter, sulfur dioxide, and daily mortality in Chongqing, China. *Environmental Health Perspectives*, 111, (4) 562-567 available from: ISI:000182144300048
Ref ID: 1497

Chen, Y., Yang, Q.Y., Krewski, D., Shi, Y., Burnett, R.T., & McGrail, K. 2004. Influence of relatively low level of particulate air pollution on hospitalization for COPD in elderly people. *Inhalation Toxicology*, 16, (1) 21-25 available from: ISI:000188240300002
Ref ID: 1506

Villeneuve, P.J., Burnett, R.T., Shi, Y.L., Krewski, D., Goldberg, M.S., Hertzman, C., Chen, Y., & Brook, J. 2003. A time series study of air pollution, socioeconomic status, and mortality in Vancouver, Canada. *Journal of Exposure Analysis and Environmental Epidemiology*, 13, (6) 427-435 available from: ISI:000186454100002
Ref ID: 1587

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Table S3 Meta-analysis results for cause-specific mortality by WHO region and overall

WHO Region	All[a] (SC/MC)	Selected[b] (SC/MC	RE (95% CI)[c]	I^2 (%)[d]
Ischaemic Heart Disease				
AMR A	1/2	1/1	1.27 (0.60, 1.94)	90
EUR A	2/0	2/0	5.90 (3.88, 7.95)	
WPR A	0/1	0/1	5.40 (0.20, 10.87)	
Summary[e]	-	2/2	3.36 (0.68, 6.10)	
Stroke				
AMR A	0/3	0/1	1.78 (0.96, 2.61)	50
EUR A	2/0	2/0	5.44 (1.52, 9.52)	
WPR A	1/0	1/0	1.30 (0.20, 2.41)	
Summary[e]	-	2/1	1.85 (0.74, 2.97)	
COPD (excl. Asthma)				
AMR A	2/1	1/1	1.81 (-0.57, 4.23)	72
EUR A	1/0	1/0	9.00 (5.11, 13.03)	
Summary[e]	-	2/1	2.86 (-0.12, 5.93)	

Notes: a - Numbers of single-city(SC)/multi-city (MC) estimates available from all studies and b-Numbers of single-city(SC)/multi-city (MC) estimates selected for meta-analysis (see estimate selection protocol in Methods section); c - Random effects summary estimate (95% confidence interval) per 10 μg/m^3; d -I^2 statistic for heterogeneity; e - Estimate numbers for 'Summary' refers to the number of pooled (from single-city estimates) and multi-city estimates used to calculate the overall summary estimate across WHO Region

Table S4 Meta-analysis results for ages 65+ yrs. for cardiovascular admissions by WHO region and overall

WHO Region	All[a] (SC/MC)	Selected[b] (SC/MC	RE (95% CI)[c]	I^2 (%)[d]
Cardiovascular				
AMR A	0/3	0/1	0.71 (0.45, 0.97)	
EUR A	2/1	2/1	1.91 (0.92, 2.91)	85
WPR A	2/1	0/1	3.46 (1.59, 5.36)	
Summary[e]	-	1/3	1.78 (0.48, 3.10)	
Cardiac				
AMR A	1/1	0/1	1.89 (1.34, 2.44)	72
EUR A	1/1	1/1	3.69 (0.31, 7.19)	
WPR A	1/1	0/1	5.08 (2.65, 7.56)	
Summary[e]	-	1/3	3.05 (1.64, 4.48)	
Ischaemic Heart Disease				
AMR A	3/2	1/1	0.47 (0.06, 0.89)	
EUR A	3/1	3/1	2.79 (-0.38, 6.07)	86
WPR A	1/1	0/1	7.26 (3.46, 11.21)	
Summary[e]	-	2/3	2.52 (0.53, 4.55)	
Stroke				
AMR A	2/1	1/1	0.81 (0.31, 1.31)	
EUR A	2/0	2/0	-1.58 (-3.59, 0.47)	79
WPR A	1/0	1/0	-3.06 (-6.31, 0.31)	
Summary[e]	-	3/1	-0.45 (-2.21, 1.33)	
Heart Failure				
AMR A	3/2	2/1	2.78 (-0.33, 5.98)	65
EUR A	1/0	1/0	3.58 (0.16, 7.11)	
WPR A	0/1	0/1	9.75 (4.81, 14.93)	
Summary[e]	-	2/2	4.39 (1.35, 7.53)	
Dysrhythmias				
AMR A	1/1	0/1	0.57 (-0.01, 1.15)	
EUR A	1/0	1/0	1.33 (-1.66, 4.40)	0
Summary[e]	-	1/1	0.60 (0.03, 1.17)	

Notes: a - Numbers of single-city(SC)/multi-city (MC) estimates available from all studies and b-Numbers of single-city(SC)/multi-city (MC) estimates selected for meta-analysis (see estimate selection protocol in Methods section); c - Random effects summary estimate (95% confidence interval) per 10 $\mu g/m^3$; d -I^2 statistic for heterogeneity; e - Estimate numbers for 'Summary' refers to the number of pooled (from single-city estimates) and multi-city estimates used to calculate the overall summary estimate across WHO Region

Table S5 Meta-analysis results for ages 65+ years & 0-14 years for respiratory admissions by WHO region and overall

WHO Region	All[a] (SC/MC)	Selected[b] (SC/MC	RE (95% CI)[c]	I^2 (%)[d]
Respiratory, 65+ years				
AMR A	2/4	1/1	0.90 (0.39, 1.1)	80
EUR A	4/1	4/1	0.99 (-0.90, 2.92)	
WPR A	1/0	1/0	1.23 (-1.30, 3.82)	
Summary[e]	-	3/2	0.91 (0.43, 1.40)	
COPD (incl. asthma), 65+ years				
AMR A	1/1	1/1	7.48 (-6.91, 24.10)	4
EUR A	2/0	2/0	-0.49 (-3.80, 2.93)	
Summary[e]	-	2/1	1.85 (-2.07, 5.93)	
COPD (excl. asthma), 65+ years				
AMR A	3/0	2/0	1.90 (0.37, 3.46)	32
EUR A	2/0	2/0	3.93 (1.06, 6.89)	
Summary[e]	-	2/0	2.36 (1.0, 3.73)	
Lower Respiratory Infection, 65+ years				
AMR A	3/0	2/0	3.88 (1.62, 6.20)	0
EUR A	2/0	2/0	4.05 (0.97, 7.22)	
Summary[e]	-	2/0	3.94 (2.11, 5.80)	
Respiratory, 0-14 years				
AMR A	0/1	0/1	2.74 (1.14, 4.36)	76
AMR B	2/0	2/0	10.84 (-2.54, 26.05)	
EUR A	2/1	2/1	0.32 (-1.18, 1.84)	
WPR A	0/1	0/1	6.44 (2.65, 10.37)	
Summary[e]	-	2/3	2.45 (0.12, 4.85)	
Asthma, 0-14 years				
AMR A	4/1	3/1	-1.67 (-9.88, 7.28)	33
EUR A	2/0	2/0	12.27 (-10.64, 41.06)	
WPR A	1/1	1/1	5.08 (2.28, 7.95)	
WPR B	2/0	1/0	2.40 (1.30, 3.51)	
Summary[e]	-	4/2[c]	2.29 (-0.09, 4.73)	

Notes: a - Numbers of single-city(SC)/multi-city (MC) estimates available from all studies and b-Numbers of single-city(SC)/multi-city (MC) estimates selected for meta-analysis (see estimate selection protocol in Methods section); c - Random effects summary estimate (95% confidence interval) per 10 μg/m^3; d -I^2 statistic for heterogeneity; e - Estimate numbers for 'Summary' refers to the number of pooled (from single-city estimates) and multi-city estimates used to calculate the overall summary estimate across WHO Region

Figure S1

Ref Man id	Country	City	Lag	Author	Year	Study Period	ES (95% CI)
Amr A,Multi-city							
2120	Canada	12 Canadian Cities	lag 1	Burnett	2004	1981-1999	0.60 (-0.03, 1.23)
684	USA	112 US cities	lag 0-1	Zanobetti	2009	1999-2005	0.98 (0.75, 1.20)
Amr A,Single city							
271	USA	2 Californian Counties	lag 0	Ostro	1995	1980-1986	0.11 (-0.28, 0.50)
176	USA	2 Georgian Counties	lag 1	Klemm	2000	1998-1999	2.51 (-0.70, 5.72)
144	USA	Coachella Valley	lag 4	Ostro	2000	1989-1998	4.36 (0.00, 8.72)
312	USA	Tennessee eastern	lag 1	Dockery	1992	1985-1986	2.28 (-1.37, 5.93)
1181	USA	Wayne County	lag 3	Lippmann	2000	1992-1994	1.22 (-0.25, 2.70)
Amr B,Single city							
412	Chile	Santiago	lag 0-1	Cakmak	2009	1998-2006	2.12 (1.63, 2.62)
1075	Mexico	Mexico City	lag 1-5	Castillejos	2000	1993-1995	1.47 (-0.01, 2.95)
Eur A,Multi-city							
2037	France	9 French cities	lag 0-1	Blanchard	2008	2000-2004	1.59 (0.80, 2.38)
Eur A,Single city							
475	Austria	Vienna	lag 0-14	Neuberger	2007	2002-2004	2.57 (1.09, 4.04)
212	Czech Republic	Czech Republic (coal basin)	lag 1	Peters	2000	1993-1994	0.57 (-0.20, 1.35)
2051	Czech Republic	Prague	lag 1	Branis	2010	2006-2006	0.40 (-0.80, 1.60)
621	Germany	Erfurt	lag 3	Peters	2009	1991-2002	-0.66 (-1.82, 0.50)
283	Spain	Barcelona	lag 1	Perez	2008	2003-2004	3.92 (2.27, 5.57)
2064	Spain	Las Palmas de Gran Canaria	lag 0-1	López-Villarrubia	2010	2001-2004	-0.91 (-4.08, 2.25)
2064	Spain	Santa Cruz de Tenerife	lag 0-1	López-Villarrubia	2010	2001-2004	-0.68 (-4.00, 2.63)
517	UK	London	lag 1	Atkinson	2010	2000-2005	0.52 (-0.76, 1.80)
69	UK	West Midlands	lag 0-1	Anderson	2001	1994-1996	0.34 (-0.85, 1.53)
Wpr A,Multi-city							
133	Australia	3 Australian Cities		Simpson	2005	1996-1999	0.90 (-0.70, 2.49)
Wpr B,Single city							
1497	China	Chongqing	lag 3	Venners	2003	1995-1995	-0.40 (-1.07, 0.27)
923	China	Shanghai	lag 0	Huang	2009	2004-2005	0.30 (0.06, 0.54)
1958	South Korea	Seoul	distribute	Cho	2008	2001-2001	0.30 (0.29, 0.32)

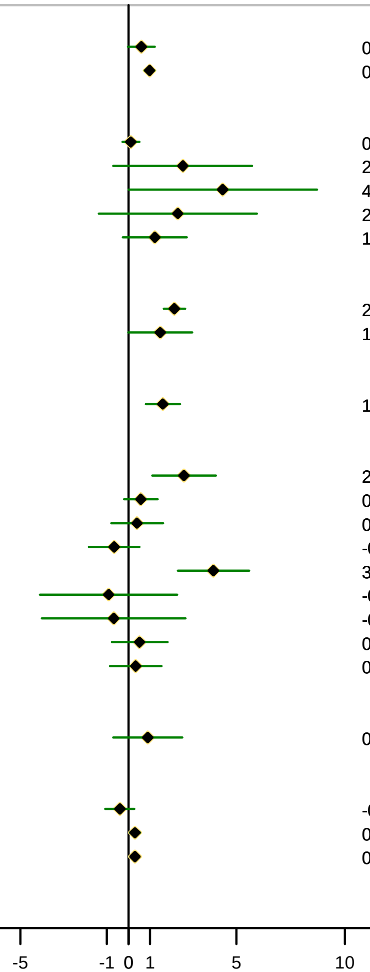

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Figure S2

Ref Man id	Country	City	Lag	Author	Year	Study Period	ES (95% CI)
Amr A,Multi-city							
684	USA	112 US cities	lag 0-1	Zanobetti	2009	1999-2005	0.85 (0.46, 1.23)
Amr A,Single city							
1347	Canada	Montreal	lag 1	Goldberg	2001	1984-1993	1.33 (-0.46, 3.13)
271	USA	2 Californian Counties	lag 0	Ostro	1995	1980-1986	0.28 (-0.28, 0.83)
144	USA	Coachella Valley	lag 4	Ostro	2000	1989-1998	3.28 (-2.24, 8.81)
1607	USA	Guilford	lag 1	Holloman	2004	1999-2001	-7.30 (-17.80, 3.20)
1607	USA	Wake	lag 2	Holloman	2004	1999-2001	6.10 (-3.10, 15.30)
1181	USA	Wayne County	lag 1	Lippmann	2000	1992-1994	1.25 (-0.93, 3.43)
Amr B,Single city							
412	Chile	Santiago	lag 0-1	Cakmak	2009	1998-2006	0.00 (0.00, 0.00)
1075	Mexico	Mexico City	lag 1-5	Castillejos	2000	1993-1995	1.54 (-1.26, 4.33)
Eur A,Multi-city							
2037	France	9 French cities	lag 0-1	Blanchard	2008	2000-2004	2.57 (1.09, 4.04)
Eur A,Single city							
475	Austria	Vienna	lag 0-14	Neuberger	2007	2002-2004	3.73 (1.88, 5.58)
2051	Czech Republic	Prague	lag 1	Branis	2010	2006-2006	0.90 (-0.90, 2.70)
2112	Spain	Barcelona	lag 1	Perez	2009	2003-2005	6.81 (1.69, 11.94)
2065	Spain	Madrid	lag 6	Maté	2010	2003-2005	2.50 (0.73, 4.27)
517	UK	London	lag 1	Atkinson	2010	2000-2005	0.50 (-1.67, 2.68)
69	UK	West Midlands	lag 0-1	Anderson	2001	1994-1996	0.51 (-1.20, 2.21)
Wpr B,Single city							
923	China	Shanghai	lag 0	Huang	2009	2004-2005	0.39 (0.12, 0.66)
1958	South Korea	Seoul	distribute	Cho	2008	2001-2001	0.65 (0.62, 0.69)

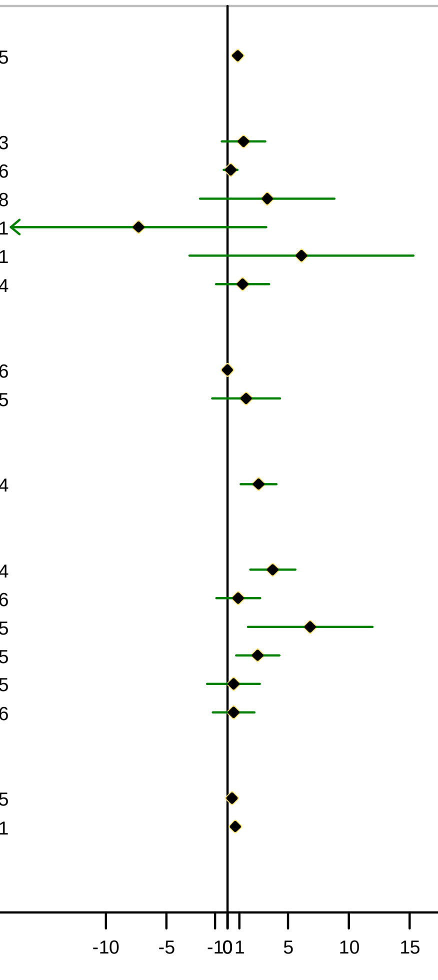


Figure S3

Ref Man id	Country	City	Lag	Author	Year	Study Period	ES (95% CI)
Amr A,Multi-city							
684	USA	112 US cities	lag 0-1	Zanobetti	2009	1999-2005	1.67 (1.03, 2.30)
Amr A,Single city							
271	USA	2 Californian Counties	lag 0	Ostro	1995	1980-1986	0.82 (-0.28, 1.92)
144	USA	Coachella Valley	lag 4	Ostro	2000	1989-1998	-5.70 (-22.05, 10.65)
1494	USA	Santa Clara County	lag 0	Samet	2003	1990-1996	4.46 (-4.16, 13.08)
1181	USA	Wayne County	lag 0	Lippmann	2000	1992-1994	0.90 (-4.35, 6.16)
Amr B,Single city							
412	Chile	Santiago	lag 0-1	Cakmak	2009	1998-2006	0.01 (0.01, 0.01)
1075	Mexico	Mexico City	lag 1-5	Castillejos	2000	1993-1995	3.54 (-1.07, 8.14)
Eur A,Single city							
475	Austria	Vienna	lag 0-14	Neuberger	2007	2002-2004	6.20 (1.88, 10.52)
2051	Czech Republic	Prague	lag 1	Branis	2010	2006-2006	2.96 (-1.11, 7.02)
2112	Spain	Barcelona	lag 2	Perez	2009	2003-2005	15.57 (6.72, 24.42)
2064	Spain	Las Palmas de Gran Canaria	lag 0-1	López-Villarrubia	2010	2001-2004	-4.31 (-14.85, 6.23)
2064	Spain	Santa Cruz de Tenerife	lag 0-1	López-Villarrubia	2010	2001-2004	2.27 (-7.99, 12.54)
517	UK	London	lag 2	Atkinson	2010	2000-2005	4.40 (1.06, 7.73)
69	UK	West Midlands	lag 0-1	Anderson	2001	1994-1996	-0.06 (-3.14, 3.02)
Wpr B,Single city							
923	China	Shanghai	lag 0	Huang	2009	2004-2005	0.71 (0.05, 1.36)
1958	South Korea	Seoul	distribute	Cho	2008	2001-2001	2.17 (2.11, 2.24)

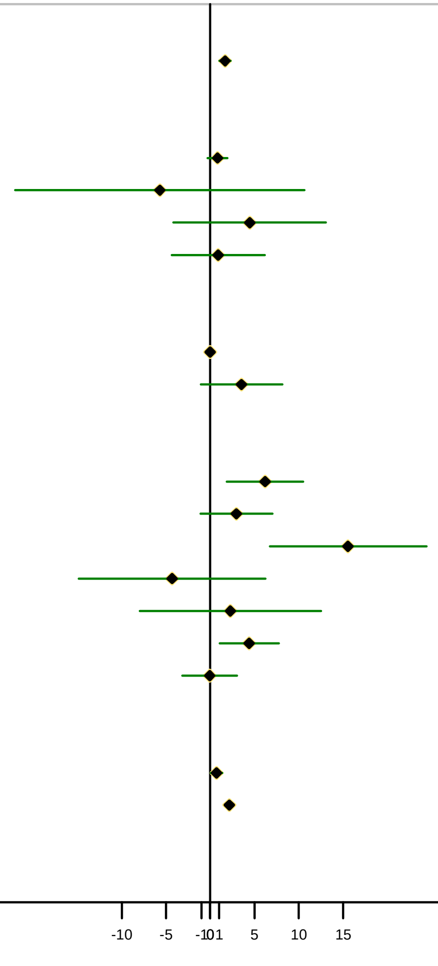
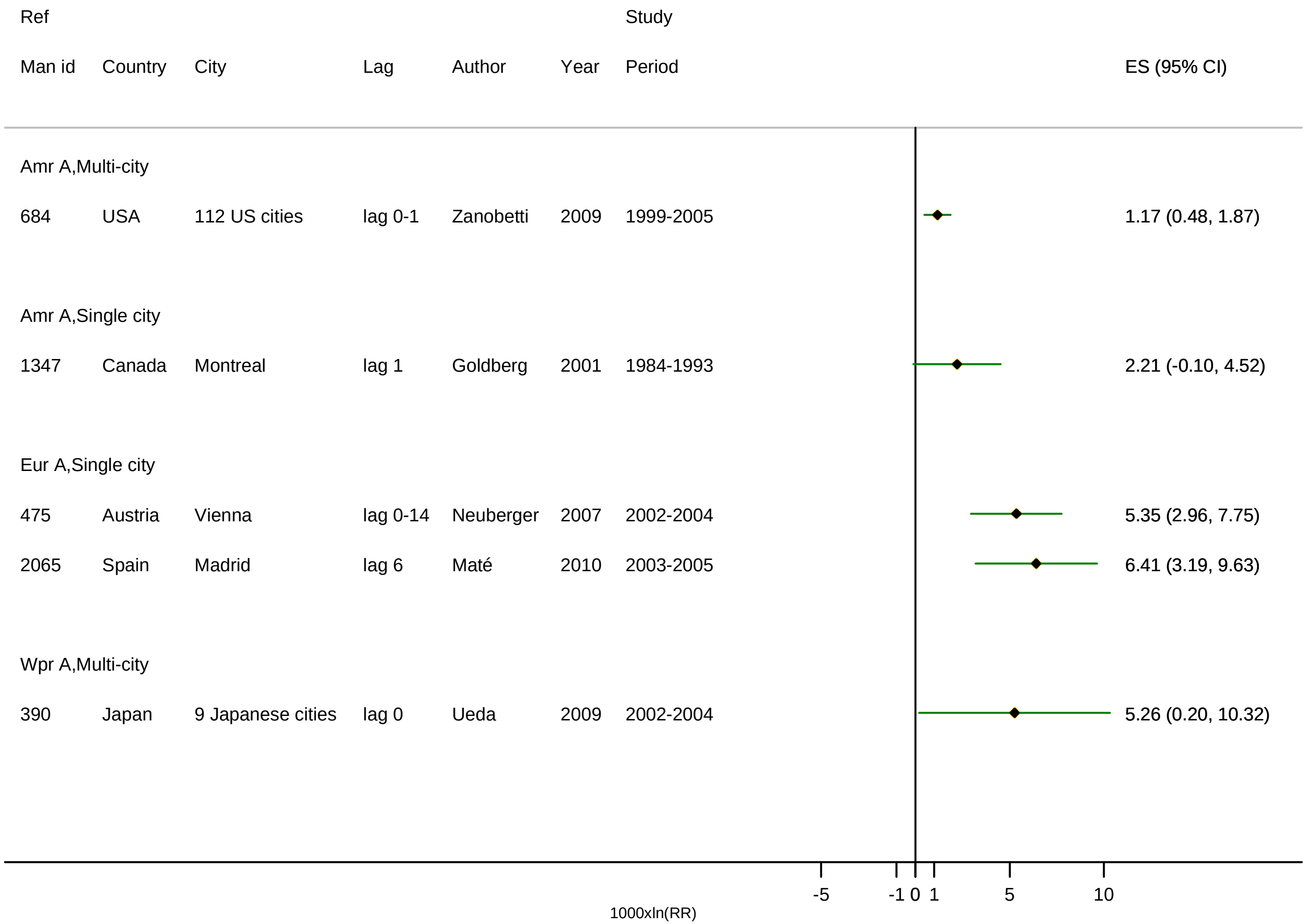


Figure S4



Ref
Study
Man id
Country
City
Lag
Author
Year
Period
ES (95% CI)
Amr A,Multi-city
684 USA 112 US cities lag 0-1 Zanobetti 2009 1999-2005 1.17 (0.48, 1.87)
Amr A,Single city
1347 Canada Montreal lag 1 Goldberg 2001 1984-1993 2.21 (-0.10, 4.52)
Eur A,Single city
475 Austria Vienna lag 0-14 Neuberger 2007 2002-2004 5.35 (2.96, 7.75)
2065 Spain Madrid lag 6 Maté 2010 2003-2005 6.41 (3.19, 9.63)
Wpr A,Multi-city
390 Japan 9 Japanese cities lag 0 Ueda 2009 2002-2004 5.26 (0.20, 10.32)
-5
-1
0
1
5
10
1000xln(RR)

Figure S5

Ref Man id	Country	City	Lag	Author	Year	Study Period	ES (95% CI)
Amr A,Multi-city							
684	USA	112 US cities	lag 0-1	Zanobetti	2009	1999-2005	1.76 (0.96, 2.57)
Eur A,Single city							
475	Austria	Vienna	lag 0-14	Neuberger	2007	2002-2004	4.78 (0.70, 8.87)
2112	Spain	Barcelona	lag 1	Perez	2009	2003-2005	8.48 (-1.66, 18.62)
Wpr A,Single city							
2077	Japan	Tokyo	lag 0	Yorifuji	2011	2003-2008	1.29 (0.20, 2.38)

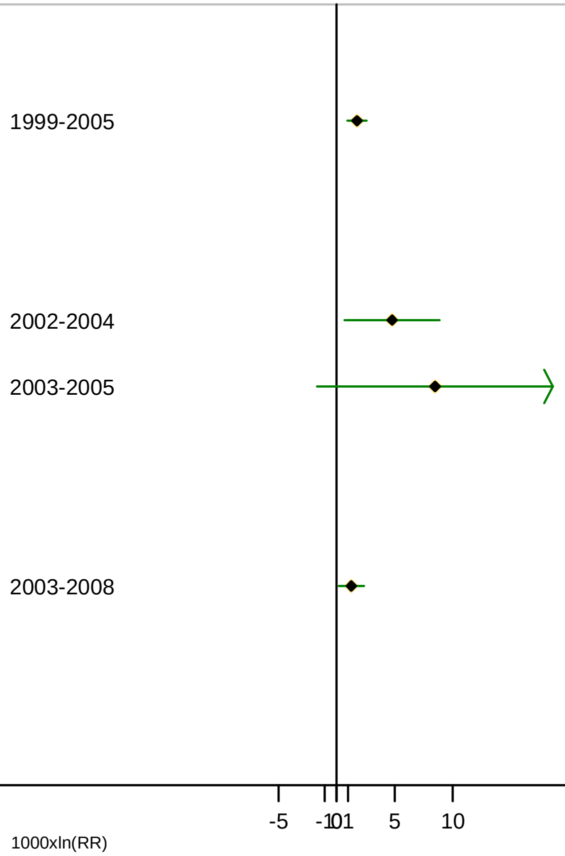


Figure S6

Ref Man id	Country	City	Lag	Author	Year	Study Period	ES (95% CI)
Amr A,Multi-city							
250	USA	6 Eastern US Counties	lag 0-1	Schwartz	1996	1979-1988	3.25 (1.00, 5.50)
Amr A,Single city							
1494	USA	Los Angeles	lag 3	Samet	2003	1987-1995	0.80 (-0.03, 1.63)
Eur A,Single city							
475	Austria	Vienna	lag 0-14	Neuberger	2007	2002-2004	8.62 (1.88, 15.35)

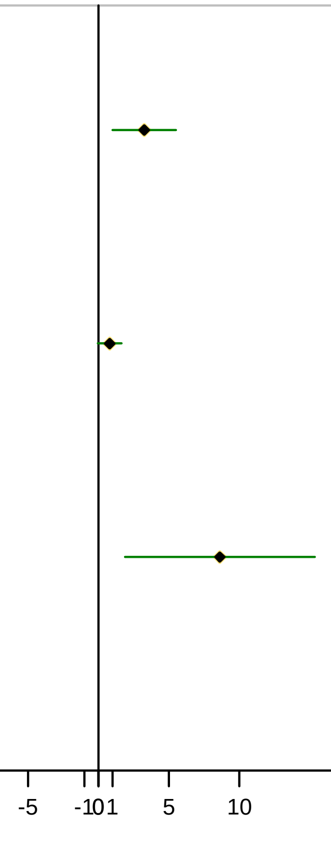


Figure S7

Ref Man id	Country	City	Lag	Author	Year	Study Period	ES (95% CI)
Amr A,Single city							
239	USA	Spokane	lag 1	Schreuder	2006	1995-2002	0.00 (-2.89, 2.89)
Eur A,Multi-city							
1968	France	6 French Cities	lag 0-1	Host	2008	2000-2003	0.90 (0.10, 1.69)
Eur A,Single city							
2051	Czech Republic	Prague	lag 2	Branis	2010	2006-2006	1.59 (0.50, 2.68)
2063	Spain	Madrid	lag 0	Linares	2010	2003-2005	7.70 (2.96, 12.44)
517	UK	London	lag 2	Atkinson	2010	2000-2005	-0.90 (-2.24, 0.43)
69	UK	West Midlands	lag 0-1	Anderson	2001	1994-1996	-0.28 (-1.49, 0.92)
Wpr A,Single city							
388	Australia	Perth	lag 1	Hinwood	2006	1992-1998	1.03 (-0.30, 2.36)

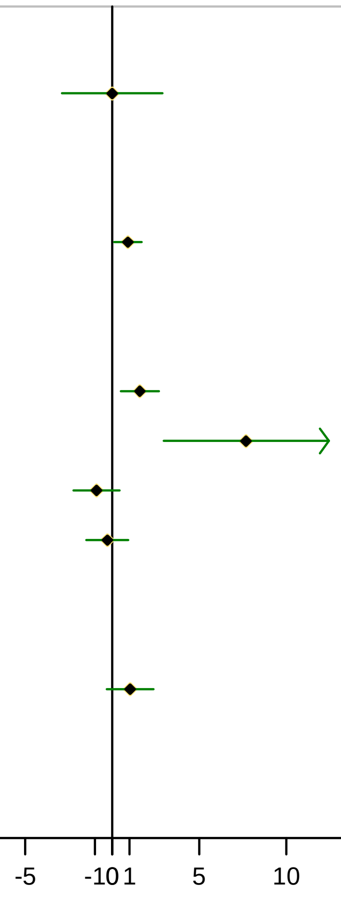


Figure S8

Ref Man id	Country	City	Lag	Author	Year	Study Period	ES (95% CI)
Amr A,Multi-city							
391	USA	202 US Counties	lag 0	Peng	2008	1999-2005	0.71 (0.45, 0.97)
Eur A,Multi-city							
1968	France	6 French Cities	lag 0-1	Host	2008	2000-2003	1.88 (0.90, 2.87)
Eur A,Single city							
238	Finland	Helsinki	lag 2	Halonen	2009	1998-2004	-0.82 (-2.01, 0.36)
590	Spain	Madrid	lag 0	Linares	2010	2003-2005	6.02 (3.54, 8.49)
Wpr A,Multi-city							
1647	Australia&New Zealand	7 Australia/New Zealand	lag 0-1	Barnett	2006	1998-2001	3.40 (1.57, 5.22)

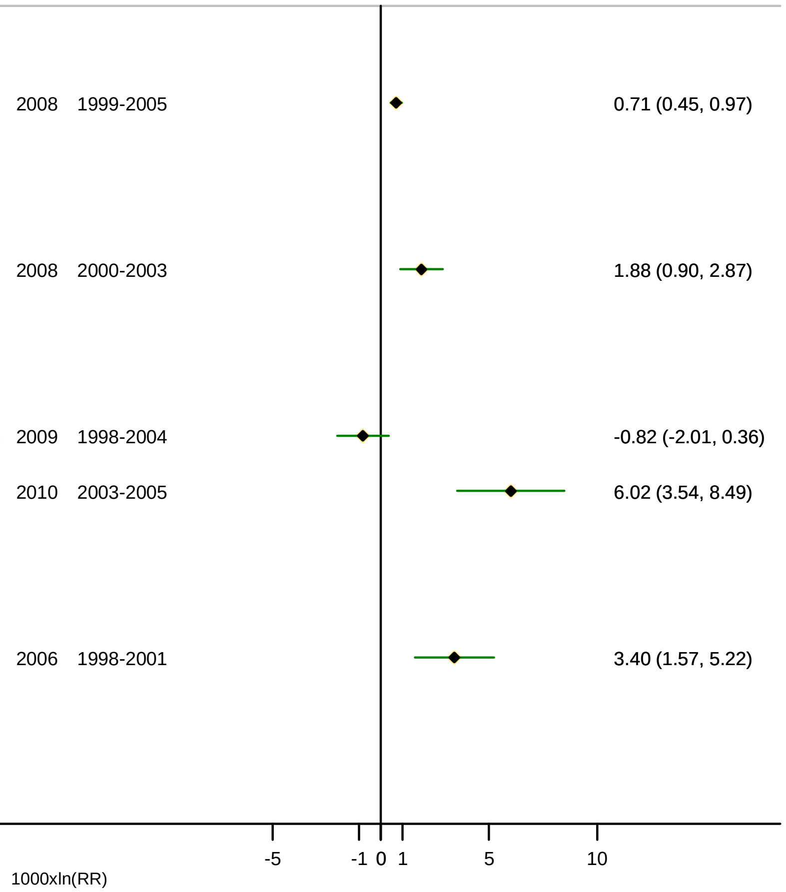


Figure S9

Ref Man id	Country	City	Lag	Author	Year	Study Period	ES (95% CI)
Amr A,Multi-city							
2078	USA	26 US communities	lag 0-1	Zanobetti	2009	2000-2003	1.87 (1.33, 2.41)
Eur A,Multi-city							
1968	France	6 French Cities	lag 0-1	Host	2008	2000-2003	2.37 (1.19, 3.55)
Eur A,Single city							
1950	Denmark	Copenhagen	lag 0-3	Andersen	2008	2001-2004	5.91 (1.99, 9.83)
Wpr A,Multi-city							
1647	Australia&New Zealand	7 Australia/New Zealand	lag 0-1	Barnett	2006	1998-2001	4.95 (2.62, 7.29)

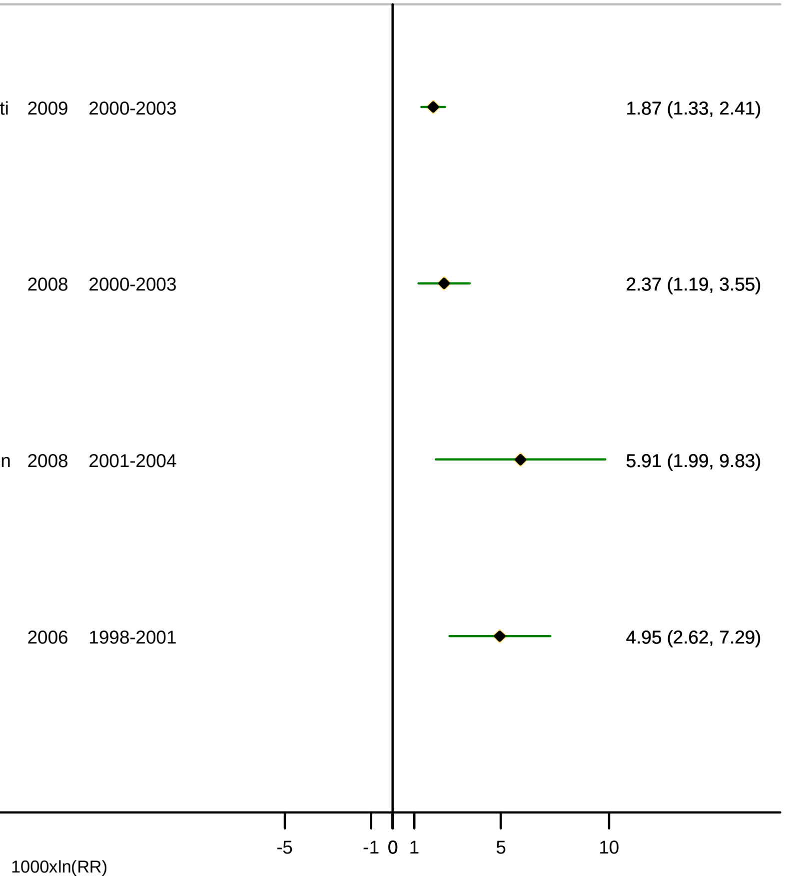


Figure S10

Ref Man id	Country	City	Lag	Author	Year	Study Period	ES (95% CI)
Amr A,Multi-city							
1654	USA	204 US Counties	lag 2	Dominici	2006	1999-2002	0.44 (0.02, 0.86)
1494	USA	Wayne County	lag 2	Samet	2003	1992-1994	1.43 (-0.82, 3.69)
Eur A,Multi-city							
1968	France	6 French Cities	lag 0-1	Host	2008	2000-2003	4.40 (2.27, 6.53)
Eur A,Single city							
238	Finland	Helsinki	lag 0-4	Halonen	2009	1998-2004	1.29 (-1.52, 4.09)
520	Italy	Rome	lag 0	Belleudi	2010	2001-2005	3.12 (-0.02, 6.25)
69	UK	West Midlands	lag 0-1	Anderson	2001	1994-1996	-0.17 (-2.60, 2.26)
Wpr A,Multi-city							
1647	Australia&New Zealand	7 Australia/New Zealand	lag 0-1	Barnett	2006	1998-2001	7.01 (3.40, 10.62)

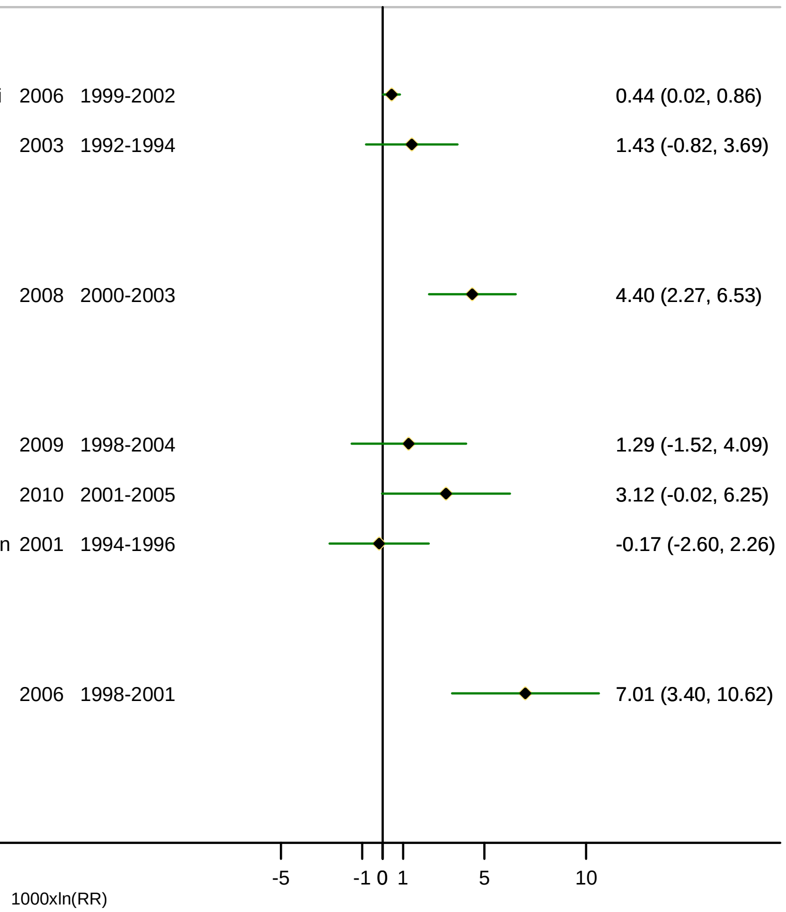


Figure S11

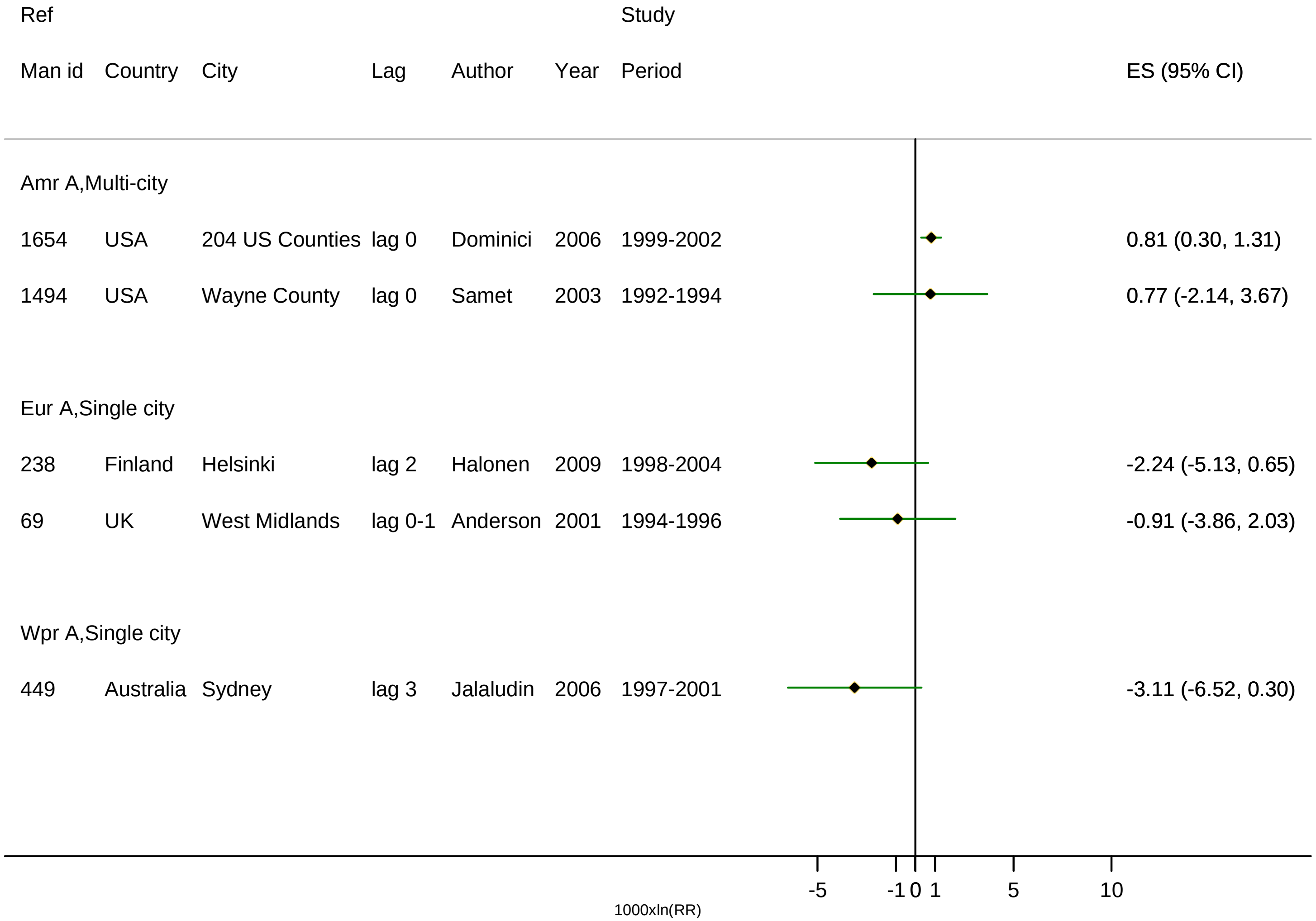

Ref
Study
Man id
Country
City
Lag
Author
Year
Period
ES (95% CI)
Amr A,Multi-city
1654 USA 204 US Counties lag 0 Dominici 2006 1999-2002 0.81 (0.30, 1.31)
1494 USA Wayne County lag 0 Samet 2003 1992-1994 0.77 (-2.14, 3.67)
Eur A,Single city
238 Finland Helsinki lag 2 Halonen 2009 1998-2004 -2.24 (-5.13, 0.65)
69 UK West Midlands lag 0-1 Anderson 2001 1994-1996 -0.91 (-3.86, 2.03)
Wpr A,Single city
449 Australia Sydney lag 3 Jalaludin 2006 1997-2001 -3.11 (-6.52, 0.30)
-5
-1
0
1
5
10
1000xln(RR)

Figure S12

Ref Man id	Country	City	Lag	Author	Year	Study Period	ES (95% CI)
Amr A,Multi-city							
1654	USA	204 US Counties	lag 0	Dominici	2006	1999-2002	1.27 (0.78, 1.77)
1494	USA	Wayne County	lag 1	Samet	2003	1987-1992	3.07 (0.55, 5.60)
Amr A,Single city							
1997	USA	Utah Wasatch Front	lag 0-13	Pope III	2008	2002-2006	17.90 (3.92, 31.87)
Eur A,Single city							
520	Italy	Rome	lag 0	Belleudi	2010	2001-2005	3.51 (0.16, 6.87)
Wpr A,Multi-city							
1647	Australia&New Zealand	7 Australia/New Zealand	lag 0-1	Barnett	2006	1998-2001	9.31 (4.69, 13.92)

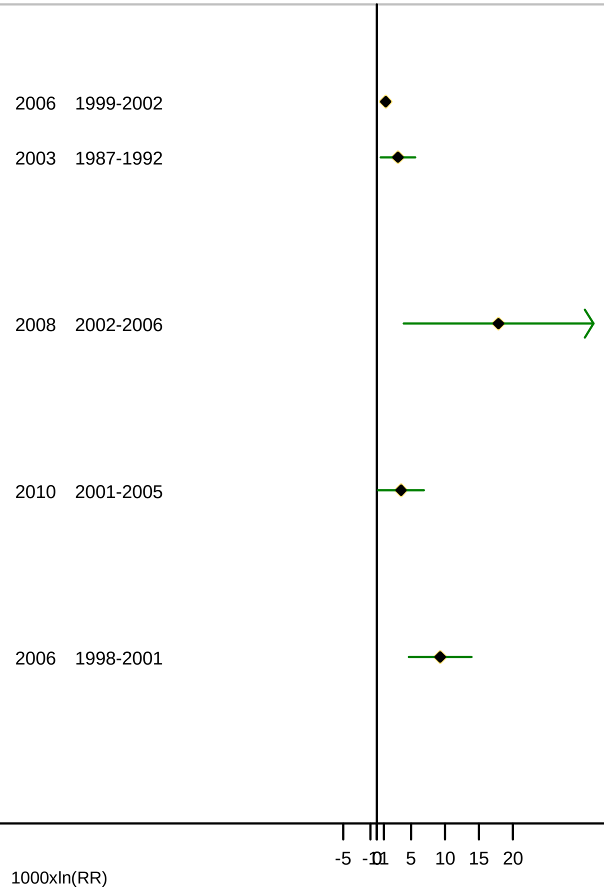


Figure S13

Ref Man id	Country	City	Lag	Author	Year	Study Period	ES (95% CI)
Amr A,Multi-city							
1654	USA	204 US Counties	lag 0	Dominici	2006	1999-2002	0.57 (-0.01, 1.15)
Eur A,Single city							
238	Finland	Helsinki	lag 0	Halonen	2009	1998-2004	1.32 (-1.67, 4.30)

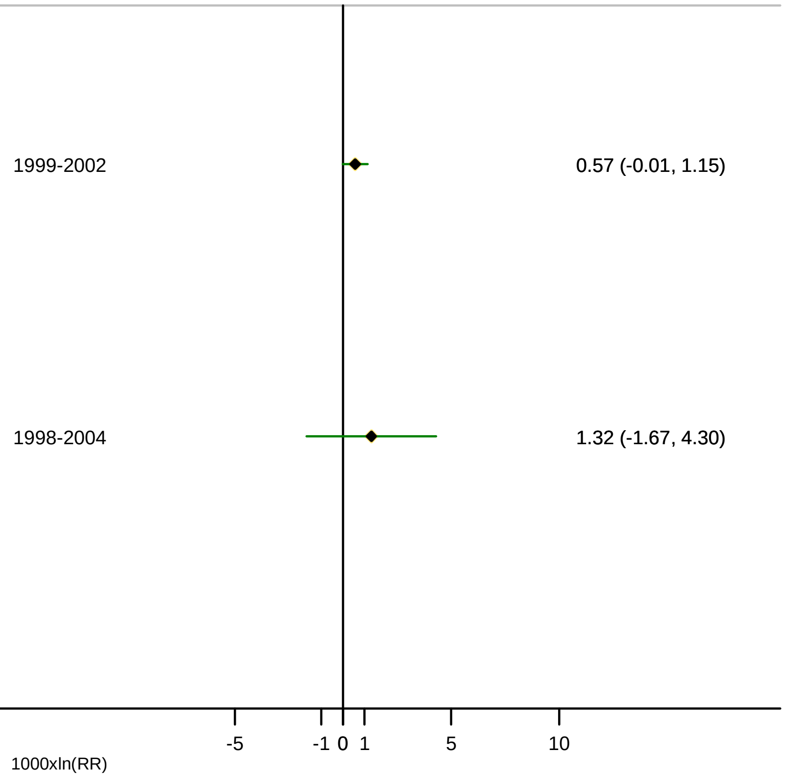


Figure S14

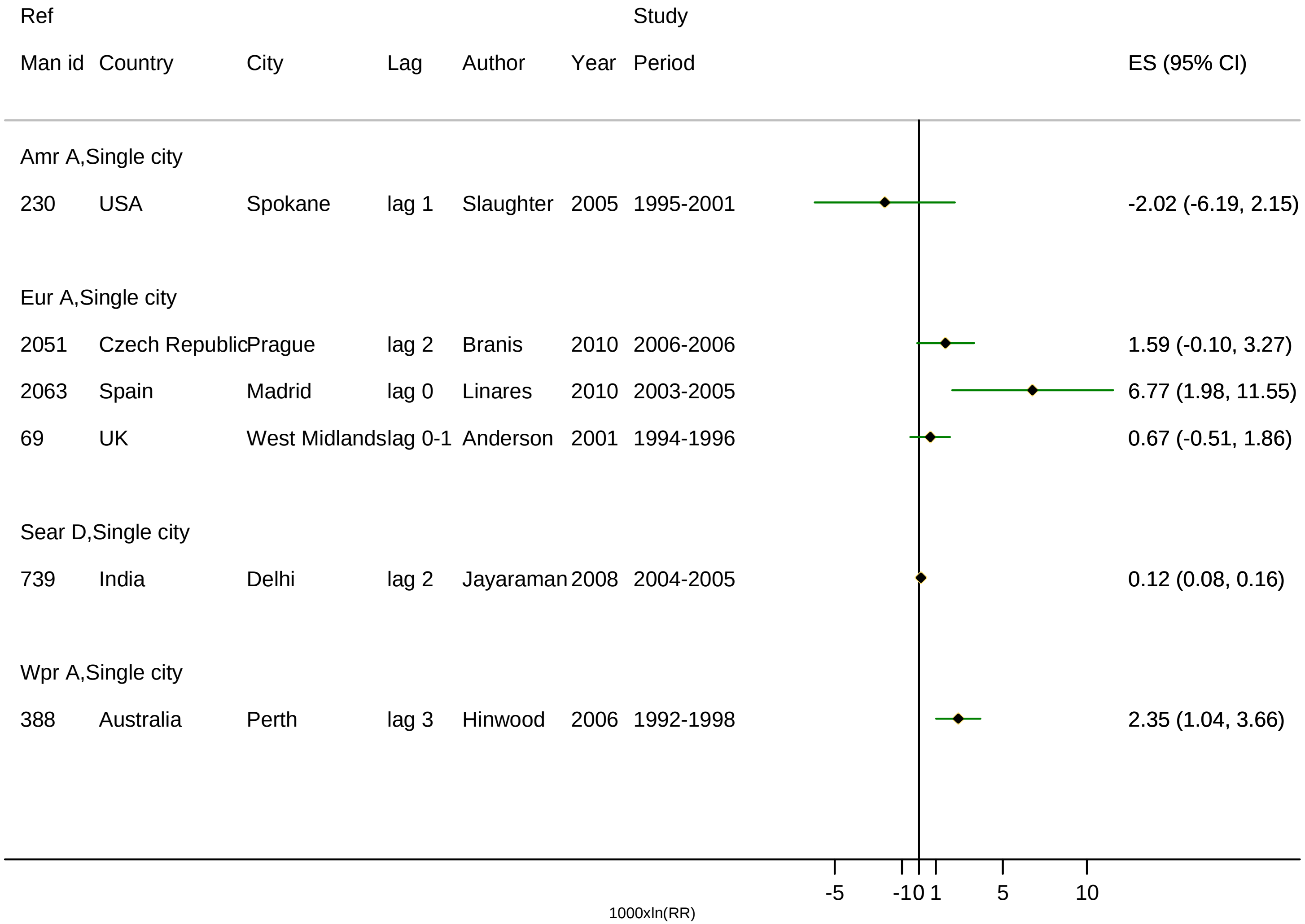

Ref
Man id Country City Lag Author Year Study Period ES (95% CI)
Amr A,Single city
230 USA Spokane lag 1 Slaughter 2005 1995-2001 -2.02 (-6.19, 2.15)
Eur A,Single city
2051 Czech Republic Prague lag 2 Branis 2010 2006-2006 1.59 (-0.10, 3.27)
2063 Spain Madrid lag 0 Linares 2010 2003-2005 6.77 (1.98, 11.55)
69 UK West Midlands lag 0-1 Anderson 2001 1994-1996 0.67 (-0.51, 1.86)
Sear D,Single city
739 India Delhi lag 2 Jayaraman 2008 2004-2005 0.12 (0.08, 0.16)
Wpr A,Single city
388 Australia Perth lag 3 Hinwood 2006 1992-1998 2.35 (1.04, 3.66)
-5
-1
0
1
5
10
1000xln(RR)

Figure S15

Ref Man id	Country	City	Lag	Author	Year	Study Period	ES (95% CI)
Amr A,Multi-city							
1654	USA	204 US Counties	lag 2	Dominici	2006	1999-2002	0.92 (0.41, 1.42)
Amr A,Single city							
1656	Canada	Vancouver	lag 0-4	Fung	2006	1995-1999	-1.76 (-7.10, 3.59)
Eur A,Multi-city							
1968	France	6 French Cities	lag 0-1	Host	2008	2000-2003	0.50 (-2.02, 3.02)
Eur A,Single city							
238	Finland	Helsinki	lag 0-4	Halonen	2009	1998-2004	4.03 (1.35, 6.71)
590	Spain	Madrid	lag 3	Linares	2010	2003-2005	4.78 (1.88, 7.69)
517	UK	London	lag 1	Atkinson	2010	2000-2005	-0.97 (-2.89, 0.95)
69	UK	West Midlands	lag 0-1	Anderson	2001	1994-1996	-0.74 (-2.72, 1.24)
Wpr A,Single city							
388	Australia	Perth	lag 3	Hinwood	2006	1992-1998	1.22 (-1.31, 3.75)

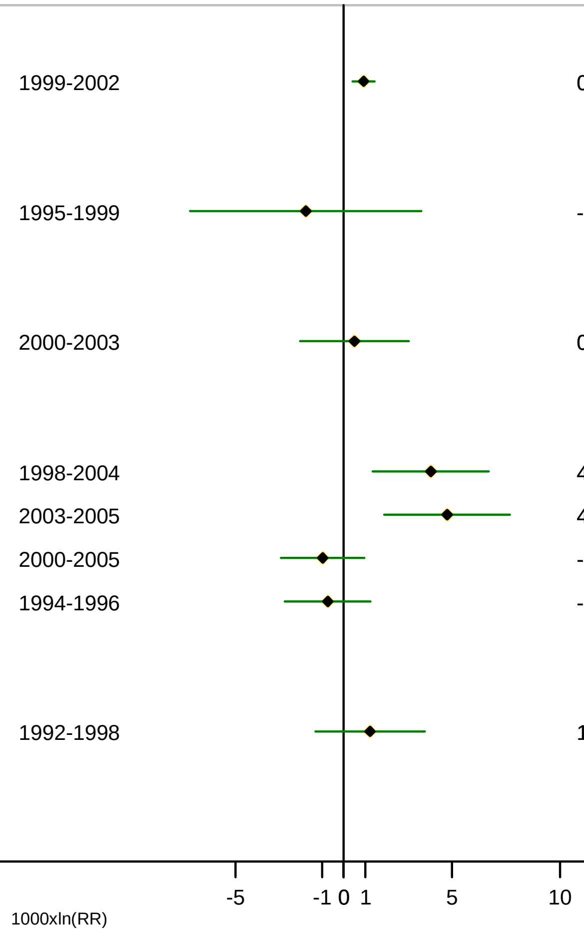


Figure S16

Ref Man id	Country	City	Lag	Author	Year	Study Period	ES (95% CI)
Amr A,Multi-city							
1654	USA	204 US Counties	lag 0	Dominici	2006	1999-2002	0.91 (0.18, 1.63)
Amr A,Single city							
1506	Canada	Vancouver	lag 0	Chen	2004	1995-1999	15.74 (4.46, 27.03)
Eur A,Single city							
520	Italy	Rome	lag 0	Belleudi	2010	2001-2005	1.20 (-1.76, 4.16)
69	UK	West Midlands	lag 0-1	Anderson	2001	1994-1996	-2.25 (-5.33, 0.83)

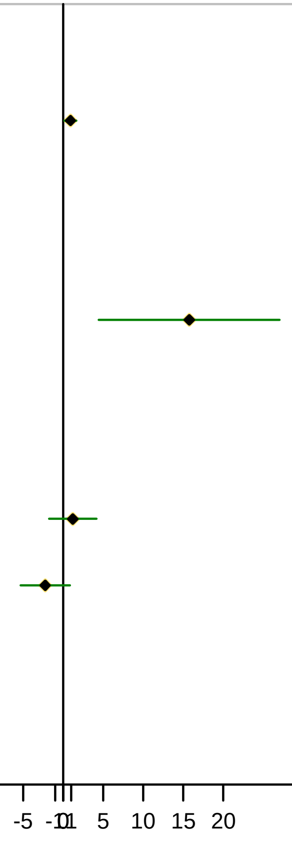


Figure S17

Ref Man id	Country	City	Lag	Author	Year	Study Period	ES (95% CI)
Amr A,Single city							
136	USA	Los Angeles County	lag 2	Moolgavkar	2000	1987-1995	2.00 (0.37, 3.63)
1494	USA	Wayne County	lag 3	Samet	2003	1992-1994	1.17 (-2.86, 5.20)
Eur A,Single city							
1950	Denmark	Copenhagen	lag 0-4	Andersen	2008	2001-2004	0.00 (-10.26, 10.26)
238	Finland	Helsinki	lag 1	Halonen	2009	1998-2004	4.17 (1.25, 7.09)

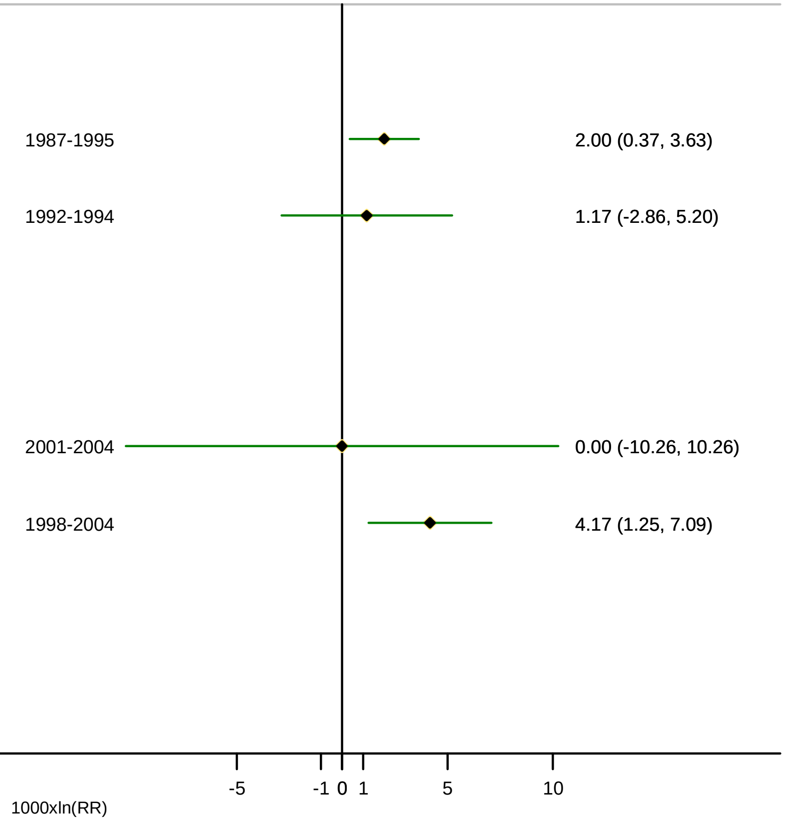


Figure S18

Ref Man id	Country	City	Lag	Author	Year	Study Period	ES (95% CI)
Amr A,Single city							
105	USA	Boston	lag 0	Zanobetti	2006	1995-1999	3.66 (0.66, 6.67)
1494	USA	Wayne County	lag 1	Samet	2003	1992-1994	3.98 (0.74, 7.22)
Eur A,Single city							
238	Finland	Helsinki	lag 0-4	Halonen	2009	1998-2004	4.92 (0.96, 8.88)
520	Italy	Rome	lag 2	Belleudi	2010	2001-2005	2.68 (-1.91, 7.28)

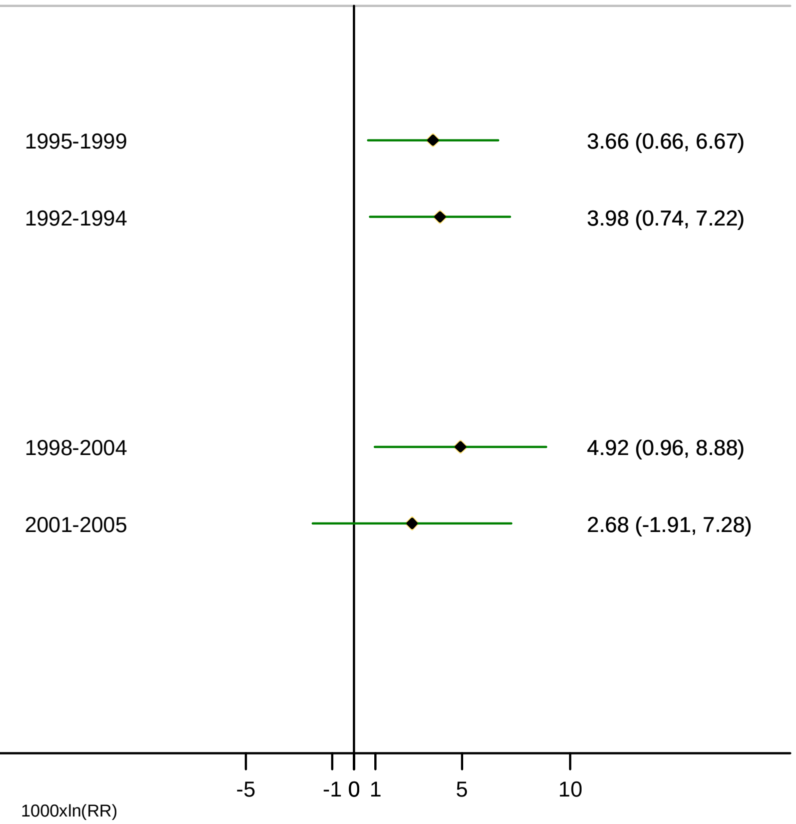


Figure S19

Ref Man id	Country	City	Lag	Author	Year	Study Period	ES (95% CI)
Amr A,Multi-city							
95	USA	6 California Counties	lag 3	Ostro	2009	2000-2003	2.70 (1.13, 4.27)
Amr B,Single city							
2059	Brazil	Alta Foresta	lag 4	Ignotti	2010	2000-2004	5.35 (0.56, 10.15)
248	Brazil	Piracicaba	lag 0-2	Cancado	2006	1997-1998	19.01 (4.13, 33.90)
Eur A,Multi-city							
1968	France	6 French Cities	lag 0-1	Host	2008	2000-2003	0.40 (-1.21, 2.01)
Eur A,Single city							
517	UK	London	lag 1	Atkinson	2010	2000-2005	-2.64 (-5.16, -0.11)
69	UK	West Midlands	lag 0-1	Anderson	2001	1994-1996	1.89 (-0.06, 3.83)
Wpr A,Multi-city							
2039	Australia&New Zealand	7 Australia/New Zealand	lag 0-1	Barnett	2005	1998-2001	6.24 (2.62, 9.86)

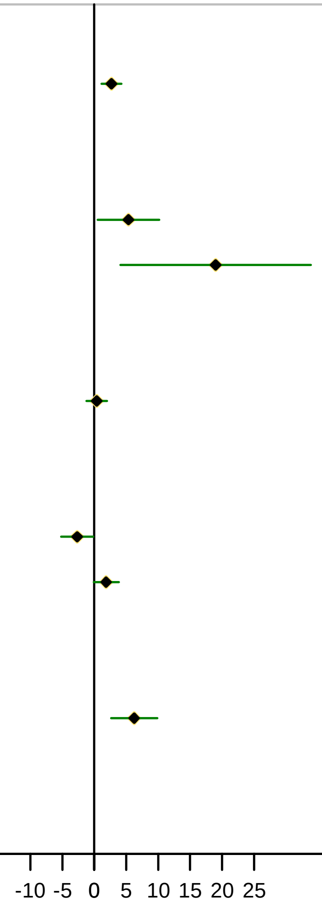
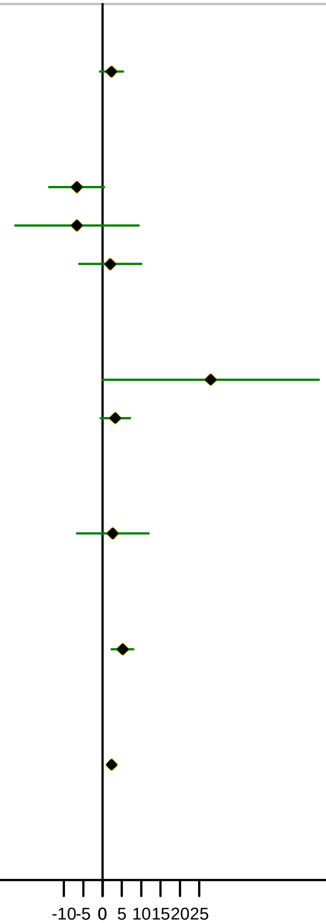


Figure S20

Ref Man id	Country	City	Lag	Author	Year	Study Period	ES (95% CI)
Amr A,Multi-city							
95	USA	6 California Counties	lag 3	Ostro	2009	2000-2003	2.30 (-0.64, 5.24)
Amr A,Single city							
103	Canada	Toronto	lag 6	Lin	2002	1980-1994	-6.65 (-13.75, 0.44)
100	USA	Anchorage	lag 0	Chimonas	2007	1999-2003	-6.61 (-22.56, 9.34)
1683	USA	Washington DC	lag 0	Babin	2007	2001-2004	2.00 (-6.02, 10.01)
Eur A,Single city							
1950	Denmark	Copenhagen	lag 0-5	Andersen	2008	2001-2004	27.95 (0.00, 55.90)
69	UK	West Midlands	lag 0-1	Anderson	2001	1994-1996	3.29 (-0.51, 7.09)
Wpr A,Multi-city							
2039	Australia&New Zealand	7 Australia/New Zealand	lag 0-1	Barnett	2005	1998-2001	2.62 (-6.66, 11.90)
Wpr A,Single city							
388	Australia	Perth	lag 2	Hinwood	2006	1992-1998	5.17 (2.35, 7.99)
Wpr B,Single city							
567	China	Hong Kong	lag 0-5	Ko	2007	2000-2005	2.37 (1.29, 3.45)



1000xln(RR)