Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
MAINLAND CHINA							
Chang G, Pan X, Xie X, et al. 2003. Time-series analysis on the relationship between air pollution and daily mortality in Beijing [in Chinese]. Wei Sheng Yan Jiu 32:565–568.	Time series	Beijing	1998–2000	Residents in 8 districts	TSP, PM_{10}, SO_2, NO_x, CO	Daily cause-specific mortality (RespD, CVD, CBVD, CHD, COPD)	Airborne levels of CO, SO_2, NO_x, and PM_{10} each correlated significantly with mortality, especially from RespD, CVD, CBVD, CHD, and COPD. TSP levels were associated with RespD.
Chang GQ, Wang LG, Pan XC. 2003. Study on the associations between ambient air pollutant and hospital outpatient visitor emergency room visit in Beijing [in Chinese]. Chin J School Doctor 17:295–297.	Time series	Beijing	1998–2000	Children	TSP, PM_{10}, SO_2, NO_x, CO	Daily unscheduled hospital outpatient and ER visits for colds, pneumonia, and bronchitis	When CO, SO_2, NO_x, or PM_{10} increased by 100 $\mu g/m^3$, visits for colds, bronchitis, and pneumonia also increased by 1–8%.
Chen XL, Tao XG, Hong CJ. 1993. Effects of ambient SO_2 pollution on pulmonary function of women and children [in Chinese]. Chin J Environ Health 10:152–154.	Cross section	Shanghai	1983–1986	Women (50–59 yr), children (10–12 yr)	PM, SO_2	Lung function	Increase of 60 $\mu g/m^3$ of SO_2 was assoicated with 99.48 mL decrease of children's FVC, 70.15 mL decrease of children's FEV_1, and 6.53 mL decrease of women's FVC.
Chen Z, Chen C, Dong S et al. 1995. Epidemiological studies on risk for adverse pregnancy outcomes in women neighboring a petrochemical works [in Chinese]. Zhonghua Yu Fang Yi Xue Za Zhi 29:209–212.	Case control	Guangzhou	1985–1992	7695 newborns (325 adverse outcomes and 390 controls)	Petrochemical air pollution	Pregnancy outcomes (congenital malformation, stillbirth, low birth weight, preterm birth)	Adverse pregnancy outcomes were significantly higher among women living near a petrochemical plant.
Cui Y, Zhang ZF, Froines J, et al. 2003. Air pollution and case fatality of SARS in the People's Republic of China: an ecologic study. Environ Health 2:15.	Ecologic	Guangdong, Shanxi, Hebei, Beijing, Tianjin	2002–2003	5327 probable SARS cases	Ambient air pollution	SARS fatality	Case fatality rate increased with the increment of air pollution index (API). The SARS patients from regions with high APIs were twice as likely to die from SARS compared to those from regions with low APIs.
Dai H, Song W, Gao X, et al. 2004. Study on relationship between ambient PM_{10}, $PM_{2.5}$ pollution and daily mortality in a district in Shanghai [in Chinese]. Wei Sheng Yan Jiu 33:293–297.	Time series	Shanghai	2002–2003	1.24 million residents in a district of Shanghai	PM_{10}, $PM_{2.5}$	Daily mortality for all causes, cardiovascular causes, and respiratory causes	Each increase of 10 $\mu g/m^3$ in PM_{10} and $PM_{2.5}$ was associated with 0.53% and 0.85% increase of daily mortality, respectively.
Dong JW, Xu XP, Chen YD, et al. 1995. Relationship between air pollution and daily mortality in urban district of Beijing [in Chinese]. J Hyg Res 24:212–214.	Time series	Beijing	1990–1991	1.4 million residents	TSP, SO_2	Daily mortality	Increased mortality was associated with increased SO_2 and TSP levels, especially for people ≥ 65 yr. The effects of TSP on cardiovascular mortality and SO_2 on respiratory mortality were greater, particularly for people ≥ 65 yr.

* Last updated June 2006.

Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
MAINLAND CHINA (*Continued*)							
Dong JW, Xu XP, Dockery DW, et al. 1996. Association of air pollution with unscheduled outpatient visits in Beijing Longfu Hospital, 1991 [in Chinese]. Zhonghua Liu Xing Bing Xue Za Zhi 17:13–16.	Time series	Beijing	1991	All unscheduled patient visits	TSP, SO_2	Unscheduled outpatient and surgery visits	Airborne TSP level was significantly related to the number of unscheduled nonsurgical outpatient visits, but not related to the number of unscheduled surgical visits. SO_2 was significantly associated with pediatric visits only.
Environmental Health Monitoring Department of the Nanning Anti-Epidemic Station. 1986. Relationship between air pollution and children's prevalence of carrying *Streptococcus hemolyticus*alpha, beta on the nasal mucosa [in Chinese]. Zhonghua Yu Fang Yi Xue Za Zhi 20:157–159.	Cross section	Nanning	1982–1983	Children (8–11 yr)	SPM, SO_2, NO_x	Children's prevalence of carrying *Streptococcus hemolyticus* alpha, beta on nasal mucosa	The rate of carrying *Streptococcus hemolyticus* in the nasal mucosa among children in heavily polluted area with higher SO_2, NO_2, SPM levels was higher than that in control area.
Gao J, Xu XP, Chen YD, et al. 1993. Relationship between air pollution and mortality in Dongcheng and Xicheng Districts, Beijing [in Chinese]. Zhonghua Yu Fang Yi Xue Za Zhi 27:340–343.	Time series	Beijing	1989	All deaths	TSP, SO_2	Total mortality, RespD mortality	Logarithmic levels of airborne SO_2 were significantly associated with daily number of deaths (especially from bronchitis, COPD, and cor pulmonale).
Han C, Jing JX, Sun GX, et al. 1997. Study of environmental pollution and damage of cytogenetic materials in urban residents [in Chinese]. Zhonghua Liu Xing Bing Xue Za Zhi 18:83–85.	Cross section	Datong	–	35,561 subjects in polluted area, 35,110 in non-polluted areas.	TSP, B*a*P	Cytogenetic damage	The micronuclei and aberration nucleus rates as well as the cpm values of cultured lymphocytes among residents strongly correlated with B*a*P, TSP, nitrate, and nitrite in air and drinking water.
Han CZ, Guo Y, Jing JX, et al. 1995. A study on the relationship between malignant tumor mortality and environmental pollution in Beicun countryside of Datong City [in Chinese]. Zhonghua Liu Xing Bing Xue Za Zhi 16:101–104.	Ecologic	Datong	1985–1989	103 subjects, 30 controls	TSP, B*a*P	Tumor mortality, serum copper, and zinc levels	Greater levels of nitrate and nitrite in drinking water and airborne levels of B*a*P were associated with significantly higher levels of serum copper and zinc and significantly higher incidence of malignant tumor mortality compared with a control group.
He QC, Lioy PJ, Wilson WE, et al. 1993. Effects of air pollution on children's pulmonary function in urban and suburban areas of Wuhan, People's Republic of China. Arch Environ Health 48:382–391.	Cross section	Wuhan	1981–1988	604 children (7–13 yr)	TSP, SO_2, NO_x, CO	Lung function (FVC, FEV_1), clinical exam of upper respiratory tract (nasal mucosa, concha, nasal passages, pharynx, tonsils)	Higher airborne TSP, SO_2, and NO_x values were associated with significantly slower growth of respiratory function and respiratory irritation in children but were not associated with FEV_1.

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Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
MAINLAND CHINA (*Continued*)							
Hu W, Wei F, Zhang J, et al. 2001. Study on relation between air pollution and children's respiratory illness prevalence using two-step regression [in Chinese]. China Environ Sci. 216:485–489.	Cross section	Wuhan, Changqing, Lanzhou, Guangzhou	–	7977 children	SPM, SO_2, NO_2	Prevalence of children's respiratory illness	PM was associated with the prevalence of most respiratory symptoms. SO_2 was associated with children's wheeze in cold. NO_x was associated with children's wheeze without cold.
Jin LB, Qin Y, Xu Z et al. 1999. Association between air pollution and mortality in Benxi [in Chinese]. Chin J Public Health 15:211–212.	Ecologic	Benxi	1993–1994	667,553 people	TSP, SO_2	All-cause mortality, COPD, CVD, CBVD	Annual daily mean TSP concentrations varied from medium to high in three districts of Benxi, a major center for the iron and steel industry. With each 100 $\mu g/m^3$ increase in TSP, mortality from all causes, COPD, CVD, and CBVD were estimated to increase by 8% to 24%.
Jin Y, Cheng Y, Wang H, et al. 2002. Effect of coal-burning air pollution on children immune function [in Chinese]. Wei Sheng Yan Jiu 31:379–381.	Cross section	Taiyuan	1994–1998	257 children (10–12 yr)	TSP, SO_2	T lymphocyte subpopulations classes ($CD3^+$, $CD4^+$, and $CD8^+$), saliva lysozyme contents and immunoglobulin content	Air pollution from the burning of coal was associated with the nonspecific immunity and cell immunity in children. The effect on cell immunity was not significant.
Jing LB, Qin Y, Xu Z, et al. 2000. Relationship between air pollution and acute and chronic respiratory disease in Benxi, China [in Chinese]. Chin J Environ Health 17:268–270.	Cross section	Benxi	1994–1995	3461 subjects in 1994, 3625 in1995	TSP, SO_2	Respiratory symptoms	Each increase of 100 $\mu g/m^3$ TSP was associated with increases of the prevalence of phlegm, shortness of breath, wheezing, and chronic respiratory diseases by 30–60%. SO_2 revealed more significant influence on phlegm and wheezing, but no significant effect on other symptoms or diseases.
Kan H, Chen B. 2003. A case-crossover analysis of air pollution and daily mortality in Shanghai. J Occup Health 45:119–124.	Case crossover	Shanghai	2000–2001	64,862 deaths	PM_{10}, SO_2, NO_2	Mortality (total, COPD, and CVD)	Conditional logistic regression identified increases in relative risk of death from COPD and CVD.
Kan H, Chen B. 2003. Air pollution and daily mortality in Shanghai: a time-series study. Arch Environ Health 58:360–367.	Time series	Shanghai	2000–2001	Residents	PM_{10}, SO_2, NO_2	Daily mortality for all-nonaccidental-cause, CVD, and COPD	Each 10 $\mu g/m^3$ increase in PM_{10}, SO_2, and NO_2 corresponded to a significant increase in relative risk of mortality from all causes of 0.3%, 1.4%, and 1.5%, respectively.

* Last updated June 2006.

Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
MAINLAND CHINA (*Continued*)							
Kan H, Chen B. 2004. Particulate air pollution in urban areas of Shanghai, China: health-based economic assessment. Sci Total Environ 322:71–79.	Health impact	Shanghai	2001	Residents	PM_{10}	Economic cost of health impacts	In 2001, total economic cost of health impacts due to particulate air pollution in urban areas of Shanghai was approximately 625.40 million US dollars, accounting for 1.03% of gross domestic product of the city.
Kan H, Jia J, Chen B. 2003. Acute stroke mortality and air pollution: new evidence from Shanghai, China. J Occup Health 45:321–323.	Time series	Zhabei District of Shanghai	2001–2002	2426 stroke deaths	PM_{10}, SO_2, NO_2	Daily stroke mortality	Each 10 μg/m^3 increase in PM_{10}, SO_2, and NO_2 corresponded to 0.8%, 1.7%, and 2.9% increase in relative risk of stroke mortality, respectively.
Kan H, Jia J, Chen B. 2004. The association of daily diabetes mortality and outdoor air pollution in Shanghai, China. J Environ Health 67:21–26.	Time series	Shanghai	2001–2002	Residents in a district of Shanghai	PM_{10}, SO_2, NO_2	Daily diabetes mortality	Each 10 μg/m^3 increase in PM_{10}, SO_2, and NO_2 corresponded to an increase of relative risk of diabetes mortality of 0.6%, 1.1%, and 1.3%, respectively, in Shanghai.
Kan HD, Chen BH, Chen CG, et al. 2004. An evaluation of public health impact of ambient air pollution under various energy scenarios in Shanghai, China. Atmos Environ 38:95–102.							
Kan HD, Chen BH, Chen CG, et al. 2004. An evaluation of public health impact of ambient air pollution under various energy scenarios in Shanghai, China. Atmos Environ 38:95–102.	Health impact	Shanghai	2010, 2020	Shanghai residents	Air pollution in various energy scenarios	Premature death, chronic bronchitis, respiratory hospital admission, cardiovascular hospital admission, outpatient visit (internal medicine, pediatrics), acute bronchitis, and asthma attack	Compared with best-case scenario, implementation of various energy scenarios could prevent 608 to 5144 and 1189 to 10,462 PM_{10}-related avoidable deaths in 2010 and 2020, respectively. Substantial decrease of morbidity would occur as well.
Kan HD, Chen BH. 2002. Impact of long-term exposure to air particulate matter on life expectancy and survival rate of Shanghai residents. Biomed Environ Sci 15:209-214.	Health impact	Shanhai	1999	Residents	TSP (converted into PM_{10} and $PM_{2.5}$)	Life expectancy and survival rate	Long-term air particulate matter exposure caused a 1.34–1.69 year reduction of life expectancy and a decrease of survival rate for Shanghai residents.

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Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
MAINLAND CHINA (*Continued*)							
Kasamatsu J, Shima M, Yamazaki S, et al. 2006. Effects of winter air pollution on pulmonary function of school children in Shenyang, China. Int J Hyg Environ Health 209:435–444.	Panel	Shenyang	2001–2002	244 schoolchildren	PM_7, $PM_{2.1}$ TSP	Pulmonary function, PEF, FEV_1, FVC, FEF_{75}	Significant decrease in pulmonary function values when airborne particulate concentrations were elevated. FVC, FEV1, and PEF were also significantly associated with PM concentrations. Increased PM levels due to coal heating in the winter may result in subacute health effects in children's pulmonary function. PM7 and PM2.1 have more adverse effects on pulmonary function than TSP.
Li H, Jin S, Shi S, et al. 1994. The trend of mortality of lung cancer and its association with air pollution [in Chinese]. Zhonghua Liu Xing Bing Xue Za Zhi 15:38–41.	Ecologic	Shandong Province	1985–1989	All deaths	TSP, SO_2, NO_x, BaP	Lung cancer mortality	Compared with 1970–1974, deaths from lung cancer were higher in 1985–1989. Correlational analyses attributed rate of lung cancer to air pollution.
Li J, Guttikunda SK, Carmichael GR, et al. 2004. Quantifying the human health benefits of curbing air pollution in Shanghai. J Environ Manage 70:49–62.	Health impact	Shanghai	1995–2020	Residents	PM_{10} emission estimation in various coal-use policy scenarios	Human health benefiit	The benefit-to-cost ratio is in the range of 1–5 for the power-sector initiative and 2–15 for the industrial-sector initiative. Considerable net health benefit would result from supporting investment in air pollution control in developing cities like Shanghai.
Li SX. 1984. Air pollution and lung cancer [in Chinese]. Zhonghua Zhong Liu Za Zhi 6:173–176.	Ecologic	Shanxi	1979–1980	169,767 residents (>30 yr)	TSP, SO_2, NO_x, BaP	Lung cancer	The air pollution levels in the area with high incidence rate of lung cancer were much higher than controls areas with low incidence rate.
Ma HB, Hong CJ. 1991. Multifactor analysis of particulate pollution in air of on pulmonary function of children [in Chinese]. Chin J Public Health 10:75–77.	Cross section	Industrial city	–	504 children	TSP	Lung function	The decrease in FEF_{25-75} and FEF_{75-85} were observed in children living in polluted areas. Long-term exposure to particulate pollution was associated with children's lung function.
Ma HB, Hong CJ. 1992. The impact of air particulate matter on chronic respiratory illness in Shanhai residents [in Chinese]. Chin J Public Health 11:229–232.	Cross section	Shanghai	–	3021 residents	TSP	Chronic respiratory illness	A 100 μg/m^3 increase in TSP levels was associated with odds ratios of 1.1–1.6% for incidence of respiratory symptoms and diseases.

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Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
MAINLAND CHINA (*Continued*)							
Qian Z, Chapman RS, Hu W, et al. 2004. Using air pollution based community clusters to explore air pollution health effects in children. Environ Int 30:611–620.	Cohort	Guangzhou, Wuhan, Lanchou, Chongqing	1993–1996	7058 schoolchildren (5–16 yr)	$PM_{2.5}$, $PM_{10-2.5}$, (TSP-PM_{10}), SO_2, NO_x	Respiratory symptoms (cough, phlegm, cough with phlegm, and wheeze), asthma, bronchitis	The relationship of exposure to the pollutant mixture with prevalence rates of cough with phlegm and wheeze were observed. Odds ratios for cough, phlegm, bronchitis, and asthma in a higher exposure district cluster were higher than in the lowest exposure district cluster.
Qian Z, Chapman RS, Tian Q, et al. 2000. Effects of air pollution on children's respiratory health in three Chinese cities. Arch Environ Health 55:126–133.	Cross section	Lanzhou, Wuhan, Guangzhou	1985–1988	2789 elementary-school students (5–14 yr)	TSP, SO_2, NO_x	Wheeze, asthma, bronchitis, hospitalization due to RespD, cough, phlegm, pneumonia	In all 3 urban districts, TSP levels were significantly associated with the adjusted odds ratios for cough, phlegm, hospitalization, and pneumonia. Parental smoking was associated with cough and phlegm, and coal use in the home was associated only with cough.
Tao X, Hong CJ, Yu S, et al. 1992. Priority among air pollution factors for preventing chronic obstructive pulmonary disease in Shanghai. Sci Total Environ 127:57–67.	Cross section	Shanghai	1978–1987	All deaths	IP, SO_2, indoor coal use	Mortality and morbidity (COPD, lung function, nonspecific immunologic function)	Of ambient SO_2, inhalable particles, and indoor use of coal, COPD mortality and morbidity as well as nonspecific immunologic compromise correlated most strongly with indoor use of coal.
Venners SA, Wang B, Peng Z, et al. 2003. Particulate matter, sulfur dioxide, and daily mortality in Chongqing, China. Environ Health Perspect 111:562–567.	Time series	Chongqing	1995	576,000 residents	$PM_{2.5}$, SO_2	Daily mortality (RespD, CVD, cancers, other)	When SO_2 increased by 100 μg/m^3, relative risks of mortality (lags 2 and 3), RespD mortality (lag 2), and CVD mortality (lag 3) also increased. The association of $PM_{2.5}$ and daily mortality was negative and nonsignificant. Rates of mortality due to cancer and other causes did not change. Estimated RespD and CVD mortality correlated with SO_2 even after controlling for $PM_{2.5}$.
Wan Y, Yang H, Masui T. 2005. Air pollution-induced health impacts on the national economy of China: demonstration of a computable general equilibrium approach. Rev Environ Health 20:119–140.	Health impact	China	2000	Chinese citizens	PM_{10}	Economic loss	Different approaches were used to estimate the economic loss resulting from premature death and other diseases associated with air pollution. The human capital approach method estimated that the economic burden of disease was equivalent to 1.26% of China's GDP, whereas the computable general equilibrium model estimate was 0.38% of China's GDP.

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Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
MAINLAND CHINA (*Continued*)							
Wan Y, Yang HW, Masui T. 2005. Health and economic impacts of air pollution in China: A comparison of the general equilibrium approach and human capital approach. Biomed Environ Sci. 18:427–441.	Health impact	China	2000	Chinese citizens	PM_{10}	Economic loss	The economic loss resulting from premature death and disease attributed to air pollution equals 0.38% of China's GDP, based on estimates of a computable general equlibrium model. The human capital approach found the economic burden of disease to be a 1.26% loss to China's GDP. Major implication of study is that air pollution can slow down China's economic growth by decreasing health and vitality of the people.
Wang B, Peng Z, Zhang X. et al. 1999. Particulate matter, sulfur dioxide, and pulmonary function in never-smoking adults in Chongqing, China. Int J Occup Environ Health 5:14–19.	Cross section	Chongqing	1989	1075 adults (35–60 yr)	$PM_{2.5}$, SO_2	Lung function	Mean urban SO_2 (213 μg/m^3) was double the suburban SO_2 (103 μg/m^3). Urban and suburban $PM_{2.5}$ were high (143 and 139 μg/m^3, respectively). After removal of 104 subjects with confounding occupation exposures, the estimated difference between urban and suburban FEV_1, and FEV_1/FVC% were significant for men and women.
Wang H, Mullahy J. 2006. Willingness to pay for reducing fatal risk by improving air quality: A contingent valuation study in Chongqing, China. Sci Total Environ 367:50–57.	Health impact	Chongqing	1998	500 residents (15–80 yr)	Ambient air pollution	Willingness to pay to reduce fatal risk to air pollution	Among study subjects, their willingness to pay to save one statistical life was $34,458, while their mean annual income was $490. Unlike a developed country, clean air may still be considered a "luxury good" in China based on the estimation.
Wang J, Chen B. 1989. The effects of indoor and outdoor air pollution on pupil's immune function [in Chinese]. Chin J Environ Health 6:1–3.	Cross section	Shanghai	–	School boys (11–13 yr)	Ambient air pollution, indoor fuel use	Immune index	The immune function of students living in a slightly polluted area with use of coal gas as home fuel was best, compared with those living in more polluted areas with use of coal as home fuel.
Wang J, Lan LS, Hu JM, et al. 1992. Study of the effects of air pollution on human health in Beijing [in Chinese]. Zhonghua Liu Xing Bing Xue Za Zhi 13:89–92.	Cross section	Beijing	1989–1990	1500 adults, 1500 children	Ambient pollution	Health status, respiratory symptoms	The effects of air pollution on human health in cities were more severe than in suburban and rural areas. Respiratory complaints correlated with the level of pollution.

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Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
MAINLAND CHINA (*Continued*)							
Wang LH, Xu X, Zhou L, et al. 1994 Relationship between air pollution and changes in children's peak expiratory flow (PEF) [in Chinese]. Chin J Environ Health 11:243–246.	Panel	Beijing	1993	60 children (9–11 yr)	SO_2, NO_2	Lung function	Ambient NO_2 and coal burning at home were significantly associated with a decrease of children's PEF. Personal exposure to SO_2 was also associated with the decrease of children's PEF.
Wang X, Ding H, Ryan L, et al. 1997. Association between air pollution and low birth weight: A community-based study. Environ Health Perspect 105:514–520.	Cohort	Beijing	1988–1991	74,671 first-parity live births	TSP, SO_2	Birth weight	Maternal exposure to airborne SO_2 and TSP during the third trimester of pregnancy was significantly related to reduced infant birth weight.
Wang XP, Mauzerall DL. 2006. Evaluating impacts of air pollution in China on public health: Implications for future air pollution and energy policies. Atmos Environ 40:1706–1721.	Health impact	Zaozhuang	2000, 2020	281 million residents	PM in different energy technology scenarios	Health impact (morbidity, mortality, year-of-life lost)	Despite some significant uncertainties, the study demonstrated that substantial benefits to public health could be achieved through the use of additional pollution controls, particularly from the use of advanced coal gasification technology.
Wei F, Hu W, Teng J, et al. 2000. Relation analysis of air pollution and children's respiratory system disease prevalence [in Chinese]. China Environ Sci 20:220–224.	Cross section	Guangzhou, Wuhan, Lanchou, Chongqing	1993–1997	7977 schoolchildren (11–12 yr)	TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_x	Respiratory symptoms	$PM_{2.5}$ and PM_{10} were significantly associated with children's respiratory morbidity. PM, SO_2, and NO_x had a synergistic effect on childhood asthma, and PM and NO_x had a significant effect on cough without having a cold.
Wei F, Hu W, Wu G, et al. 2001. Analysis of relation between air pollution and children's lung function indexes [in Chinese]. China Environ Sci 215: 385–389.	Cohort	Guangzhou, Wuhan, Lanchou, Chongqing	1993–1996	Children	TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_x	Lung function	Significant associations between $PM_{2.5}$, PM_{10}, and TSP and FEV_1, adjusted mean of FEV_1/FVC, and abnormal rate of FEV_1/FVC (≤ 80%) in children were found, whereas no association was found between SO_2, NO_x, and children's lung function.
Xiao HP, Xiu Q, Xu ZY. 1990. Effects of air pollution on human respiratory disease in Shengyang [in Chinese]. Chinese J Public Health 65:195–198.	Cross section	Shengyang	1985	2615 adults (40–69 yr)	TSP, SO_2	Prevalence and mortality of RespD, hospital admissions	Ambient air pollution was associated with the increase of morbidity, hospital admission, mortality of respiratory diseases among people > 40 yr.
Xiao HP, Xu ZY. 1985. Air pollution and lung cancer in Liaoning Province, People's Republic of China. NCI Monogr 69:53–58.	Ecologic	Liaoning Province	1976–1978	Residents in 10 Liaoning cities	TSP, industrial pollution (including Cu, Zn)	Lung cancer mortality	Neighborhood air pollution indices correlated significantly with mortality rates in one city, and lung cancer rates were higher near point sources of industrial pollution. Little correlation was found between TSP levels and lung cancer in 10 cities.

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Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
MAINLAND CHINA (*Continued*)							
Xu X, Ding H, Wang X. 1995. Acute effects of total suspended particles and sulfur dioxides on preterm delivery: A community-based cohort study. Arch Environ Health 50:407–415.	Cohort	Beijing	1988	25,370 deliveries	TSP, SO_2	Preterm delivery (at < 37 weeks)	Preterm delivery showed a significant dose-dependent association with levels of SO_2 and TSP (mean SO_2, 102 μg/m^3; mean TSP, 375 μg/m^3).
Xu X, Dockery DW, Christiani DC, et al. 1995. Association of air pollution with hospital outpatient visits in Beijing. Arch Environ Health 50:214–220.	Time series	Beijing	1990	–	TSP, SO_2	Hospital outpatient visits	The number of daily nonsurgical outpatient visits was significantly associated with SO_2 and TSP levels, especially in summer. This was true even though the mean SO_2 concentration in summer was only 17 μg/m^3.
Xu X, Gao J, Dockery DW, et al. 1994. Air pollution and daily mortality in residential areas of Beijing, China. Arch Environ Health 49:216–222.	Time series	Beijing	1994	1.5 million residents in 2 areas	TSP, SO_2	Daily mortality (all causes, CVD, cardiopulmonary disease, cancer)	SO_2 was significantly associated with total mortality (at levels below World Health Organization recommendations) and with COPD, CHD, cardiopulmonary, and CVD mortality. TSP was significantly associated only with COPD mortality. SO_2 and TSP were significant predictors of total mortality in summer, but in winter only SO_2 was a significant predictor.
Xu X, Li B, Huang H. 1995. Air pollution and unscheduled hospital outpatient and emergency room visits. Environ Health Perspect 103:286–289.	Time series	Beijing	1990	–	TSP, SO_2	Daily hospital outpatient and emergency visits	Results suggested an exposure–response relation between TSP and SO_2 and hospital outpatient visits both at high air pollution levels and at levels well below World Health Organization air quality standards.
Xu X, Wang L. 1993. Association of indoor and outdoor particulate level with chronic respiratory illness. Am Rev Respir Dis 148:1516–1522.	Cross section	Beijing	1982	1576 never-smokers (40–69 yr)	Airborne particles	Respiratory illness	Particulate levels were highest to lowest in the industrial, residential, and suburban areas, respectively. Subjects residing in the industrial and residential areas had an excess risk of respiratory symptoms and showed an increased prevalence of symptoms with increased outdoor particulate levels.

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Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
MAINLAND CHINA (*Continued*)							
Xu X. 1998 Synergistic effects of air pollution and personal smoking on adult pulmonary function. Arch Environ Health 53:44–45.	Cross section	Beijing	1986	3287 adults (40–69 yr)	TSP, SO_2	Lung function	Long-term exposure to high level of particulate and SO_2 in Beijing was associated with significantly reduced pulmonary function in both never-smokers and smokers. The association was significantly greater among smokers than among never-smokers, indicating a synergistic effect of air pollution and personal smoking on adult pulmonary function
Xu XP, Dockery DW, Wang L. 1991. Effects of air pollution on adult pulmonary function. Arch Environ Health 46:198–206.	Cohort	Beijing	1986	1440 adults (40–69 yr)	TSP, SO_2	Lung function	Outdoor SO_2 had an inverse linear relation to lung capacity with or without coal stove heating.
Xu Z, Yu D, Jing L, et al. 2000. Air pollution and daily mortality in Shenyang, China. Arch Environ Health 55:115–120.	Time series	Shenyang	1992	3.1 million residents	TSP, SO_2	Daily mortality (all causes, CVD, cardiopulmonary disease, COPD, cancer)	High mean TSP (430 μg/m^3) and SO_2 (197 μg/m^3) levels were each positively associated with total daily mortality. TSP was also significantly associated with CVD mortality. SO_2 was positively associated with COPD mortality.
Xu ZY, Blot WJ, Xiao HP, et al. 1989. Smoking, air pollution, and the high rates of lung cancer in Shenyang, China. J Natl Cancer Inst 81:1800 1806.	Case control	Shenyang	1985–1987	1349 patients, 1345 controls	Industrial air pollution	Lung cancer	After adjustment for smoking (the principal cause of lung cancer in this cohort), increased lung cancer risk was significantly associated with several measures of exposure to air pollutants.
Xu ZY, Brown L, Pan GW, et al. 1996. Lifestyle, environmental pollution and lung cancer in cities of Liaoning in northeastern China. Lung Cancer 14(Suppl 1):S149–S160.	Case control	Shenyang	1985–1988	1249 lung cancer patients, 1345 controls	Industrial air pollution	Lung cancer mortality	Risk was increased for all occupations in which there was exposure to dusts, with the highest risk seen among coke oven workers and fire-resistant brick makers. Significant dose–response patterns were observed among cumulative total dust, cumulative total BaP, and lung cancer.

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Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
MAINLAND CHINA (*Continued*)							
Xu ZY, Liu Y, Yu D, et al. 1996. Effect of air pollution mortalities in Shenyang city [in Chinese]. Chin J Public Health 15:61–64.	Ecologic	Shenyang	1992	438,600 people	TSP, SO_2	All-cause mortality, COPD, CBVD, CVD, cancer, tuberculosis	Annual daily TSP means in 3 neighborhoods of low, medium, or high pollution were 361, 477, and 518 μg/m^3, respectively. The means for SO_2 were 64, 128, and 235 μg/m^3, respectively. The three neighborhoods differed in rates of mortality from all causes, COPD, CBVD, CVD, cancer, and tuberculosis.
Xu ZY, Yu G, Zhang S, et al. 1996. Relationship between air pollution and morbidity of chronic diseases in Shenyang City [in Chinese]. Chin J Public Health 15:123–125.	Cross section	Shenyang	1992	3706 residents	Ambient air pollution	Chronic bronchitis, wheezing, COPD, and other respiratory and cardiovascular diseases	Living in areas with heavy air pollution was significantly associated with the incidence of COPD and cardiovascular diseases.
Yang ZF, Xu LY. 2004. Valuing health effects from the industrial air pollution in rural Tianjin, China [in Chinese]. J Environ Sci (China) 16:157–160.	Health impact	Tianjin City	2000	277 residents, 274 workers	TSP, SO_2	Willingness-to-pay for respiratory illness prevention	The willingness-to-pay of Tianjin residents and workers to avoid health effects from township-village industrial air pollution could be equivalent to 65 million US dollars per year.
Zhang J, Hu W, Wei F, et al. 2002. Children's respiratory morbidity prevalence in relation to air pollution in four Chinese cities. Environ Health Perspect 110:961–967.	Cohort	Guangzhou, Wuhan, Lanchou, Chongqing	1993–1996	7557 elementary-school students	TSP, $PM_{2.5}$, $PM_{10–2.5}$, PM_{10}, SO_2, NO_x	Wheeze, asthma, bronchitis, hospitalization due to respiratory diseases, persistent cough, persistent phlegm	Standardized questionnaires revealed positive associations between respiratory morbidity and all outdoor PM levels, especially $PM_{10–2.5}$. A weaker but still positive association was found with NO_x and SO_2.
Zhang J, Qian Z, Kong L, et al. 1999. Effects of air pollution on respiratory health of adults in three Chinese cities. Arch Environ Health 54:373–381.	Cross section	Lanzhou, Wuhan, Guangzhou	1985–1988	4108 adults	TSP, SO_2, NO_x	Respiratory morbidity (cough, phlegm, wheeze, persistent cough and phlegm, asthma, bronchitis)	Standardized questionnaires revealed increased rates of cough, phlegm, persistent cough and phlegm, and wheeze associated with increasing TSP levels. Findings in adults were compared to their children. Tobacco smoking was a confounder.
Zhang J, Song H, Tong S, et al. 2000. Ambient sulfate concentration and chronic disease mortality in Beijing. Sci Total Environ 262:63–71.	Cohort	Beijing	1980–1992	Residents in 8 districts	TSP, SO_2, NO_x, CO, BaP, SO_4^{2-}	Cause-specific mortality (total, RespD, CBVD and CVD, malignant tumor)	Both current SO_4^{2-} level and the level 12 yr before death were significantly correlated with total mortality and mortality due to CVD, malignant tumor, and lung cancer. SO_4^{2-} levels did not correlate with mortality from RespD or CBVD.

* Last updated June 2006.

Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
MAINLAND CHINA (*Continued*)							
Zhang K, Fei SZ, Chen Z, et al. 1990. Relation between air pollution and laryngeal cancer in Liaoning [in Chinese]. Zhonghua Er Bi Yan Hou Ke Za Zhi 25:240–242.	Ecologic	Liaoning Province	1985	Residents of 12 cities	PM, SO_2, B*a*P	Laryngeal cancer	Ambient PM, SO_2, and B*a*P were associated with the incidence of laryngeal cancer, particularly in winter.
Zhao X, Niu J, Wang Y, et al. 1998. Genotoxicity and chronic health effects of automobile exhaust: a study on the traffic policemen in the city of Lanzhou. Mutat Res 415:185–190.	Cross section	Lanzhou	1996	87 traffic policemen, 57 household register policemen	Traffic emissions	Rhinitis, pharyngitis, trachoma, syndrome of neurasthenia, joint pain, micronuclei and sister-chromatid exchanges	Significant differences were observed between the traffic emission–exposed group and the control group with respect to the morbidity of rhinitis, pharyngitis, trachoma, syndrome of neurasthenia, and joint pain. The exposed group also had significant increased rate of micronuclei and sister-chromatid exchanges.
Zhou W, Yaun D, Ye S, et al. 2001. Health effects of occupational exposure to vehicle emissions in Shanghai. Int J Occup Environ Health 7:23–30.	Cross section	Shanghai	1998	745 bus and taxi drivers, 532 controls	Traffic emissions	Respiratory symptoms	The prevalence of some respiratory symptoms and chronic respiratory diseases was significantly higher in the exposed group compared with controls. Pulmonary function and serum lead levels did not significantly correlate with exposure.
Zhou YR, Zeng Q, Xu F. 1997 Relationships between air pollution and trend of admission case in Chongqing [in Chinese]. J Mod Prev Med 24:43–45.	Time series	Chongqing	1991–1992	Residents of 6 districts	TSP, SO_2, NO_x	Hospital admission for respiratory diseases, COPD, cancer, and injury	Ambient air pollution, especially TSP and SO_2, was associated with the COPD hospital admission.
Zhu Z, Tau ZQ, Ti ZK, et al. 1987. The effect of air pollution on lymphocyte transformation rate in children [in Chinese]. Hua Xi Yi Ke Da Xue Xue Bao 18:157–159.	Cross section	Industrial city	1983	289 children (8–13 yr)	PM, SO_2	Lymphocyte transformation rate	There was a significant difference of lymphocyte transformation rate between two groups of children living in an area with air pollution and a control area.

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Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
HONG KONG							
Hedley AJ, Wong CM, Thach TQ, et al. 2002. Cardiorespiratory and all-cause mortality after restrictions on sulphur content of fuel in Hong Kong: An intervention study. Lancet 360:1646–1652.	Time series	Hong Kong	1985–1995	~75% Hong Kong residents (15–64 yr, >65 yr, and all ages)	PM_{10}, SO_2, NO_2, O_3	Monthly mortality (all, RespD, CVD)	A one-weekend restriction to < 0.5% sulfur content in fuel oil for power plants and motor vehicles in Hong Kong led to an immediate fall in SO_2 levels. In the following year, seasonal mortality was substantially reduced for total deaths, RespD, and CVD causes, resulting in a gain in life expectancy. By 3–5 years later, the pattern had returned to expected.
Ong SG, Liu J, Wong CM, et al. 1991. Studies on the respiratory health of primary school children in urban communities of Hong Kong. Sci Total Environ 106:121–135.	Cross section	Hong Kong	1989	3846 schoolchildren	Industrial pollution	Respiratory morbidity (sore throat, evening cough, cough for longer than 3 months, morning phlegm, wheezing)	In a district with high levels of exhaust emissions from factories, primary-school children had significantly higher levels of sore throat, cough, morning phlegm, and wheezing compared with a control group. The study was intended to provide a baseline for evaluating the impact of low sulfur regulations to be introduced subsequently.
Peters J, Hedley AJ, Wong CM, et al. 1996. Effects of an ambient air pollution intervention and environmental tobacco smoke on children's respiratory health in Hong Kong. Int J Epidemiol 25:821–828.	Cross section	Hong Kong	1989–1991	3521 children	TSP, RSP, SO_2, NO_2	Respiratory symptoms	After regulation, ambient SO_2 levels in a polluted district of Hong Kong decreased by up to 80% and sulfate in respiratory particles decreased by 38%. Reports of cough, sore throat, phlegm, and wheezing among children declined. Tobacco smoke in the home increased the risk for RespD before and after the regulation.
Tam AYC, Wong CM, Lam TH, et al. 1994. Bronchial responsiveness in children exposed to atmospheric pollution in Hong Kong. Chest 106:1056–1060.	Cross section	Hong Kong	1989–1990	423 children	TSP, RSP, SO_2, NO_2	Bronchial responsiveness (FEV_1, FVC)	Bronchial hyperreactivity after histamine challenge was more common among children living in a more polluted district even when results were controlled for wheeze, asthma, home tobacco smoke, and socioeconomic factors.
Tseng RYM, Li CK, Spinks JA. 1992. Particulate air pollution and hospitalization for asthma. Ann Allergy 68:425–432.	Time series	Hong Kong	1983–1989	Hospital patients	TSP, RSP, SO_2, NO_2, NO_x, O_3	Hospital discharges for asthma	Quarterly mean TSP and hospital discharge rates were strongly correlated for children 1–4 yr, were inversely correlated for children 5–14 yr, and were uncorrelated for adults. No correlation was found for SO_2, O_3, RSP, NO_2, or NO_x.

* Last updated June 2006.

Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
HONG KONG (*Continued*)							
Tseng RYM, Li CK. 1990. Low level atmospheric sulfur dioxide pollution and childhood asthma. Ann Allergy 65:379–383.	Time series	Hong Kong	1983–1987	13,620 childhood hospitalizations	TSP, RSP, SO_2, NO_2, NO, O_3	Asthma episodes	Hospitalizations of children for asthma compared with levels of SO_2, NO_2, NO, O_3, TSP, and RSP identified an inverse correlation of SO_2 with hospitalization.
Wong CM, Atkinson RW, Anderson HR, et al. 2002. A tale of two cities: Effects of air pollution on hospital admissions in Hong Kong and London compared. Environ Health Perspect 110:67–77.	Time series	Hong Kong, London	1995–1997 (Hong Kong), 1992–1994 (London)	-	PM_{10}, SO_2, NO_2, O_3	Hospital admissions for asthma (15–64 yr), RespD (60 yr only), cardiac disease (all ages), IHD (all ages)	For respiratory hospital admissions, both cities showed positive associations with PM_{10}, NO_2, SO_2, and O_3 with slightly different lags. For cardiac admissions, both cities showed positive associations with PM_{10}, NO_2, and SO_2. Associations between NO_2 and O_3 were negative in London but positive in Hong Kong.
Wong CM, Hu ZG, Lam TH, et al. 1999. Effects of ambient air pollution and environmental tobacco smoke on respiratory health of non-smoking women in Hong Kong. Int J Epidemiol 28:859–864.	Cohort	Hong Kong	1989–1991	3405 nonsmoking women (mean age 36.5 yr)	Ambient air pollution	Respiratory symptoms (sore throat, morning cough, evening cough, phlegm in the morning, phlegm day or night, and phlegm for 3 months)	Assessments before and 1 and 2 yr after governmental restricted sulfur content in fuel oil showed that air pollution and tobacco smoke had adverse effects.
Wong CM, Lam TH, Peters J, et al. 1998. Comparison between two districts of the effects of an air pollution intervention on bronchial responsiveness in primary school children in Hong Kong. J Epidemiol Community Health 52:571–578.	Cohort	Hong Kong	1990–1991	Schoolchildren (9–12 yr)	Ambient air pollution before and after intervention	Bronchial reactivity and hyperreactivity	At 1 and 2 yr after the government restricted sulfur content in fuels to 0.5%, children were challenged with histamine. Those in a highly polluted district and those in a less polluted district showed significant differences in bronchial hyperreactivity but not in bronchial reactivity 1 yr later. Children in the more polluted area showed a further significant decrease in hyperreactivity and reactivity in the second year.
Wong CM, Ma S, Hedley AJ, et al. 1999. Does ozone have any effect on daily hospital admissions for circulatory diseases? J Epidemiol Community Health 53:580–581.	Time series	Hong Kong	1994–1995	629,196 population (65 yr or older)	PM_{10}, SO_2, NO_2, O_3	Hospital admissions for RespD and CVD	Levels of NO_2, SO_2, O_3 and PM_{10} were significantly associated with hospital admissions for RespD, CVD, COPD, and heart failure. NO_2, O_3, and PM_{10} were significantly associated with admissions for asthma, pneumonia, and influenza. Significant positive interactions were found between NO_2, O_3, and PM_{10} and between O_3 and winter months. Patients ≥ 65 yr were at greater risk.

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Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
HONG KONG (*Continued*)							
Wong CM, Ma S, Hedley AJ, et al. 2001. Effect of air pollution on daily mortality in Hong Kong. Environ Health Perspect 109:335–340.	Time series	Hong Kong	1995–1997	All residents	PM_{10}, SO_2, NO_2, O_3	Daily mortality (nonaccidental, CVD, RespD)	Ambient concentrations of NO_2, SO_2, and O_3 were associated with mortality from all nonaccidental causes, CVD, and RespD during the cool season, but not the warm season. PM_{10} was associated with RespD mortality only.
Wong GWK, Ko FWS, Lau TS, et al. 2001. Temporal relationship between air pollution and hospital admissions for asthmatic children in Hong Kong. Clin Exp Allergy 31:565–569.	Time series	Hong Kong	1993–1994	1217 children (<15 yr)	PM_{10}, SO_2, NO_2	Hospital admissions for asthma	Daily admissions for asthma increased significantly with increases in ambient NO_2, SO_2, and inhalable particles
Wong TW, Lau TS, Yu TS, et al. 1999. Air pollution and hospital admissions for respiratory and cardiovascular diseases in Hong Kong. Occup Environ Med 56:679–683.	Time series	Hong Kong	1994–1995	–	PM_{10}, SO_2, NO_2, O_3	Hospital admissions for CVD or CBVD	Daily hospital admissions for all causes of circulatory disease were associated with increased ozone with the strongest effect on patients with arrhythmias and heart failure.
Wong TW, Tam WS, Yu TS, et al. 2002. Associations between daily mortalities from respiratory and cardiovascular diseases and air pollution in Hong Kong, China. Occup Environ Med 59:30–35.	Time series	Hong Kong	1995–1998	Hong Kong residents	PM_{10}, SO_2, NO_2, O_3	Daily mortality (RespD; CVD and CBVD)	Levels of NO_2, SO_2, O_3, and PM_{10} were significantly associated with mortality from RespD and from IHD. In multipollutant analyses, PM_{10} was not associated with RespD or CVD mortality.
Yu IT, Wong TW, Liu HJ. 2004. Impact of air pollution on cardiopulmonary fitness in schoolchildren. J Occup Environ Med 46:946–952.	Cross section	Hong Kong (Kwun Tong and Shatin district)	–	821 primary-school children (8–13 yr)	RSP, SO_2, NO_2	Respiratory symptoms, asthma, bronchitis, lung function, maximal oxygen uptake	Children in the high pollution district had significantly lower maximum oxygen uptake than those in the low pollution district. Habitual physical exercise was associated with a higher maximal oxygen uptake in the low pollution district but not in the high pollution district.
Yu TSI, Wong TW, Wang XR, et al. 2001. Adverse effects of low-level air pollution on the respiratory health of schoolchildren in Hong Kong. J Occup Environ Med 43:310–316.	Cross section	Hong Kong	1994–1995	1294 children (8–12 yr)	RSP, SO_2, NO_2	Respiratory symptoms, spirometry	Children living in a more polluted district had higher odds ratios for frequent cough, frequent sputum, chronic sputum, and doctor-diagnosed asthma. They had poorer measured lung function.

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Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
TAIPEI,CHINA							
Chan CC, Chuang KJ, Chien LC, et al. 2006. Urban air pollution and emergency admissions for cerebrovascular diseases in Taipei, Taiwan. Eur Heart J 27:1238–1244.	Time series	Taipei,China	1997–2002	All residents	PM_{10}, $PM_{2.5}$, NO_2, SO_2, CO, O_3	Emergency admissions for cerebrovascular diseases	Emergency admissions for cerebrovascular diseases among adults were positively associated with increasing urban air pollution concentrations of O_3 lagged 0 day and CO lagged 2 days in Taipei.
Chan CC, Chuang KJ, Su TC, Lin LY. 2005. Association between nitrogen dioxide and heart rate variability in a susceptible population. Eur J Cardiovasc Prev Rehabil 12:580–586.	Panel	Taipei,China	2001–2002	83 cardiology clinic patients	NO_2, PM_{10}, CO, SO_2, O_3	Heart rate variability	Increasing NO_2 exposure was found to be associated with decreasing standard deviation of all normal-to-normal intervals and low frequency in suceptible populations.
Chang CC, Lee IM, Tsai SS, Yang CY. 2006. Correlation of Asian dust storm events with daily clinic visits for allergic rhinitis in Taipei, Taiwan. J Toxicol Environ Health A 69:229–235.	Time series (episode)	Taipei	1997–2001	All residents	Asian dust storms	Daily clinic visit for allergic rhinitis	Effects of dust storms on clinic visits for allergic rhinitis were prominent 2 days after event, but were not statistically significant.
Chang CC, Tsai SS, Ho SC, et al. 2005. Air pollution and hospital admissions for cardiovascular disease in Taipei, Taiwan. Environ Res 98:114–119.	Case crossover	Taipei	1997–2001	Hospital admissions of 47 hospitals	PM_{10}, NO_2, CO, O_3	Hospital admission for CVD	Significant associations were found between hospital admission for CVD and exposure to PM_{10}, NO_2, CO, and O_3 on warm days (>20°C). On cool days, PM_{10}, NO_2, and O_3 were significantly associated with admission for CVD.
Chang JH, Hsia YU, Chen WL. 2002. Effect of air pollution on daily clinic treatments for respiratory cardiovascular diseases in central Taiwan, 1997–1999 [in Chinese]. Taiwan Occupational Medicine Journal. 9:111–120.	Time series	Central Taipei,China	1997–1999	Residents	PM_{10}, SO_2, NO_2, O_3	Hospital admission for RespD and CVD	The increase of O_3, NO_2, PM_{10}, and SO_2 levels were significantly associated with the increase of respiratory admissions, but not with cardiovascular disease admissions.
Chen CH, Xirasagar S, Lin HC. 2006. Seasonality in adult asthma admissions, air pollutant levels, and climate: A population-based study. J Asthma 43:287–292.	Time series	Taipei,China	1998–2001	99,591 asthma hospitalizations	PM_{10}, SO_2, CO, NO_2, O_3	Asthma, chronic bronchitis	Adult asthma hospitalization was highest in spring and was significantly correlated with air pollution and climate.
Chen PC, Lai YM, Chan CC, et al. 1999. Short-term effect of ozone on the pulmonary function of children in primary school. Environ Health Perspect 107:921–925.	Panel	Sanchung, Taihsi, Linyuan	1995–1996	941 primary-school children	PM_{10}, SO_2, NO_2, CO, O_3	Lung function	Using data from a questionnaire, peak O_3 was significantly negatively associated with FVC and FEV_1. Lung function decreased 1 mL/ppb at peak hourly O_3 exposure.

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Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
TAIPEI,CHINA (*Continued*)							
Chen PC, Lai YM, Wang JD, et al. 1998. Adverse effect of air pollution on respiratory health of primary school children in Taiwan. Environ Health Perspect 106:331–335.	Cross section	6 communities	–	4860 primary-school children	PM_{10}, SO_2, NO_x, NO_2, NO, CO, O_3, THC, NMHC	Respiratory symptoms or disease (morning cough, day or night cough, chronic cough, shortness of breath, nasal symptoms, sinusitis, wheezing or asthma, allergic rhinitis, bronchitis, pneumonia)	Urban children had significantly more respiratory symptoms (cough, shortness of breath, nasal symptoms) and diseases (sinusitis, wheezing or asthma, allergic rhinitis, bronchitis) compared with rural children. The authors considered their findings to be suggestive but did not confirm a causal relation.
Chen YS, Sheen PC, Chen ER, et al. 2004. Effects of Asian dust storm events on daily mortality in Taipei, Taiwan. Environ Res 95:151–155.	Time series (episode)	Taipei	1995–2000	2.6 million residents	PM_{10}, SO_2, NO_2, CO, O_3	Daily mortality for all-cause, RespD, and CVD	The analysis results suggested a likely casual relationship between dust storm and mortality for all-cause, CVD, and RespD.
Chen YS, Yang CY. 2005. Effects of Asian dust storm events on daily hospital admissions for cardiovascular disease in Taipei, Taiwan. J Toxicol Environ Health A 68:1457–1464.	Time series (episode)	Taipei	1996–2001	2.6 million residents	Asian dust storms (PM_{10}, NO_2, SO_2, CO, O_3)	Daily hospital admissions for cerebrovascular diseases	The effects of dust storms on cerebrovascular diseases were prominent 1 day after the event although the effects were not statistically significant.
Chuang KJ, Chan CC, Chen NT, et al. 2005. Effects of particle size fractions on reducing heart rate variability in cardiac and hypertensive patients. Environ Health Perspect 113:1693–1697.	Panel	Taipei,China	2002–2003	10 chronic heart disease patients and 16 hypertensive patients	$PM_{2.5–10}$, $PM_{1.0–2.5}$, $PM_{0.3–1.0}$	Heart rate variability	Heart rate variability in susceptible populations was associated with $PM_{0.3–1.0}$, but was not associated with $PM_{1.0–2.5}$ or $PM_{2.5–10}$.
Guo YL, Lin YC, Sung FC, et al. 1999. Climate, traffic-related air pollutants, and asthma prevalence in middle-school children in Taiwan. Environ Health Perspect 107:1001–1006.	Cross section	Taipei,China	1995	331,686 nonsmoking children	PM_{10}, SO_2, NO_x, CO, O_3	Asthma prevalence	A nationwide survey of asthma linked to local air pollution revealed that nonsummer temperature, winter humidity, and traffic-related air pollution (especially CO and NO_x) were positively associated with asthma prevalence.
Hsieh KH, Shen JJ. 1988. Prevalence of childhood asthma in Taipei, Taiwan, and other Asian Pacific countries. J Asthma 25:73–82.	Cross section	Taipei	1974, 1985	23,678 children in 1974, 147,373 children in 1985 (7–15 yr)	PM, SO_2, NO_2	Asthma	The prevalence of childhood asthma increased from 1.3% in 1974 to 5.07% in1985, while the air pollution levels of PM and SO_2 decreased gradually over the study period.
Hwang BF, Jaakkola JJK, Lee YL, et al. 2006. Relation between air pollution and allergic rhinitis in Taiwanese schoolchildren. Respir Res 7:23.	Cross section	Taipei,China	2001	32,143 schoolchildren	PM_{10}, SO_2, NO_x, CO, O_3	Allergic rhinitis	Persistent exposure to NO_x, CO, and SO_2 may increase the prevalence of allergic rhinitis in children.

* Last updated June 2006.

Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
TAIPEI,CHINA (*Continued*)							
Hwang BF, Lee YL, Lin YC, et al. 2005. Traffic related air pollution as a determinant of asthma among Taiwanese school children. Thorax 60:467 473.	Cross section	22 municipalities	2001	32,672 schoolchildren (6–15 yr)	PM_{10}, SO_2, NO_x, CO, O_3	Asthma	Children's asthma was positively associated with O_3, CO, and NO_x, but was weakly or not associated with SO_2 and PM_{10}. The results suggested that long term exposure to traffic-related pollutants, such as NO_x, CO, and O_3 increases the risk of childhood asthma.
Hwang JS, Chan CC. 2002. Effects of air pollution on daily clinic visits for lower respiratory tract illness. Am J Epidemiol 155:1–10.	Time series	50 townships and city districts	1998	–	PM_{10}, SO_2, NO_2, CO, O_3	Daily clinic visits for lower respiratory tract illness	The number of daily clinic visits was associated with current day levels of NO_2, CO, SO_2, and PM_{10}. People > 65 yr were most susceptible. Estimated pollution effects decreased as exposure lag increased.
Hwang JS, Chen YJ, Wang JD, et al. 2000. Subject-domain approach to the study of air pollution effects on schoolchildren's illness absence. Am J Epidemiol 152:67–74.	Cohort	6 communities	1994–1995	4697 schoolchildren	NO_2, NO_x	Illness-related school absence	Subject-domain models showed a significant association between absences due to illness and acute NO_2–NO_x exposures at levels below World Health Organization guidelines. Time-domain models showed no such association.
Knöbel HH, Chen CJ, Liang KY. 1995. Sudden infant death syndrome in relation to weather and optimetrically measured air pollution in Taiwan. Pediatrics 96:1106–1110.	Time series	Taipei,China	1981–1991	Infants (1 wk–1 yr)	PM_{10}, SO_2, CO, PSI, visibility	Daily mortality from sudden infant death syndrome or suffocation	Mortality from sudden infant death syndrome was 3.3 times greater in the lowest category of visibility on day of death than in the highest category; rate ratio was 3.4 for the average visibility during 9 days before death. Adjusting for covariates increased rate ratios to 3.8 and 5.1, respectively.
Ko YC, Lee CH, Chen MJ, et al. 1997. Risk factors for primary lung cancer among non-smoking women in Taiwan. Int J Epidemiol 26:24–31.	Case control	Kaohsiung	1992–1993	117 women with lung cancer, 117 matched controls	Industrial air pollution, cooking fumes	Morbidity: lung cancer	Risk of lung cancer for nonsmoking women was associated with certain cooking practices, especially preparing meals in kitchens not equipped with fume extractor at age 20–40 yr.
Kuo HW, Lai JS, Lee MC, et al. 2002. Respiratory effects of air pollutants among asthmatics in central Taiwan. Arch Environ Health 57:194–200.	Cross section	8 junior high schools in central Taipei,China	–	12,926 junior-high-school students (13–16 yr)	PM_{10}, SO_2, NO_2,	Morbidity: asthma prevalence, hospital admissions (for respiratory illness), pulmonary function	Asthma prevalence significantly correlated with NO_2 and O_3 concentrations. Levels of NO_2 and PM_{10} significantly correlated with monthly hospital admissions. FVC, FEV_1, and PEF for asthmatics were 6–11% lower than normal predicted values.

* Last updated June 2006.

Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
TAIPEI,CHINA (*Continued*)							
Lee YL, Lin YC, Hsiue TR, et al. 2003. Indoor and outdoor environmental exposures, parental atopy, and physician-diagnosed asthma in Taiwanese schoolchildren. Pediatrics 112:389.	Cross section	Taipei,China	2001	35,036 schoolchildren (6–15 yr)	PM_{10}, SO_2, NO_x, CO, O_3	Physician-diagnosed asthma	Parental atopy contributed more to childhood asthma than indoor or outdoor environmental factors. Girls may be more susceptible to indoor factors than boys.
Lee YL, Lin YC, Hwang BF, et al. 2005. Changing prevalence of asthma in Taiwanese adolescents: two surveys 6 years apart. Pediatr Allergy Immunol 16:157–164.	Cross section	Taipei,China	1995–1996, 2001	44,104 children during 1995–1996, 11,048 children in 2001 (12–15 yr)	PM_{10}, NO_x, CO, O_3	Prevalence of asthma	The results suggested that a substantial increase in the lifetime prevalence of asthma in Taiwanese adolescents, but the changes did not seem associated with ambient air pollution level changes over time.
Lee YL, Lin YC, Lee YC, et al. 2004. Glutathione S-transferase P1 gene polymorphism and air pollution as interactive risk factors for childhood asthma. Clin Exp Allergy 34:1707–1713.	Cross section	Southern Taipei,China	2001	156 schoolchildren 4th–9th grade, (61 cases, 95 controls)	SO_2, NO_x	GSTP1-105 genotypes and asthma	There was a significant gene–environment interaction between GSTP-105 alleles and air pollution. There was a dose–response relationship between asthma and outdoor air pollution in children with Ile-105 homozygotes, but not in children without Ile-105 homozygotes.
Lee YL, Shaw CK, Su HJ, et al. 2003. Climate, traffic-related air pollutants and allergic rhinitis prevalence in middle-school children in Taiwan. Eur Respir J 21:964–970.	Cross section	Taipei,China	1995–1996	331,686 middle-school children	PM_{10}, SO_2, NO_x, CO, O_3	Morbidity: allergic rhinitis	Physician-diagnosed allergic rhinitis associated with higher nonsummer temperatures and traffic-related air pollutants, including CO, NO_x, O_3.
Lin CM, Li CY, Yang GY, et al. 2004. Association between maternal exposure to elevated ambient sulfur dioxide during pregnancy and term low birth weight. Environ Res 96:41–50.	Cohort	Kaohsiung and Taipei	1995–1997	92,288 full-term, live singletons	PM_{10}, SO_2, NO_2, CO, O_3	Term low birth weight	Maternal exposure to ambient SO_2 level exceeding 11.4 ppb was associated with 26% increased term low birth weight, compared to the mothers exposed to < 7.1 ppb SO_2. Stratified by trimester, mothers exposed to > 12.4 ppb SO_2 in the last trimester showed 20% higher risk of term low birth weight delivery than others with lower exposure (< 6.8 ppb).
Lin MC, Chiu HF, Yu HS, et al. 2001. Increased risk of preterm delivery in areas with air pollution from a petroleum refinery plant in Taiwan. J Toxicol Environ Health A 64:637–644.	Case control	Kaohsiung	1993–1996	498,755 first-parity singleton live births	Petrochemical air pollution	Preterm delivery	Compared to controls, preterm births occurred significantly more frequently among mothers living in a petroleum refinery area.

* Last updated June 2006.

Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
TAIPEI,CHINA (*Continued*)							
Lin MC, Yu HS, Tsai SS, et al. 2001. Adverse pregnancy outcome in a petrochemical polluted area in Taiwan. J Toxicol Environ Health A 63:565–574.	Cross section	Lin-Yuan (exposed area), Taihsi (control area)	1993–1996	2545 births	Petrochemical air pollution	Term low birth weight	The prevalence of low birth weight in a petrochemical community and in a control community were 3.22% and 1.84%, respectively.
Lin RS, Sung FC, Huang SL, et al. 2001. Role of urbanization and air pollution in adolescent asthma: A mass screening in Taiwan. J Formos Med Assoc 100:649–655.	Cross section	Taipei,China	1995–1996	1,018,031 middle-school students	CO, urban air pollution	Prevalence of asthma	On the basis of questionnaire data, adolescents living in highly polluted areas were more likely to have asthma than those in an area with no or light pollution. Boys were more likely to be affected than girls.
Pan BJ, Hong YJ, Chang GC, et al. 1994. Excess cancer mortality among children and adolescents in residential districts polluted by petrochemical manufacturing plants in Taiwan. J Toxicol Environ Health 43:117–129.	Ecologic	Kaohsiung	1971–1990	Children (0–19 yr)	Petrochemical air pollution	Cancer death	Review of death certificates of children (0–19 yr) living near petrochemical and petroleum complexes revealed statistically significant excess deaths due to cancers at all sites when compared with national and local reference groups. Excess cancer deaths of bone, brain, and bladder were clustered in the 10–19 yr age group, who had been possibly exposed for a longer period.
Tang FC, Chen PC, Chan CC, et al. 1997. Predictive pulmonary function of school children in an area of low air pollution in Taiwan. J Formos Med Assoc 96:397–404.	Cross section	Dachen, Mailiau, Taihsi	–	836 children (7–12 yr)	Ambient air pollution	Respiratory symptoms, FVC/FEV_1	Data from a parental questionnaire and spirometry tests were used to quantify lung function among children living in an area of low air pollution.
Tsai SS, Chen CC, Hsieh HJ, et al. 2006. Air pollution and postneonatal mortality in a tropical city: Kaohsiung, Taiwan. Inhal Toxicol 18:185–189.	Case crossover	Kaohsiung, Taipei,China	1994–2000	Infants (27 days–1 yr)	PM_{10}, SO_2, NO_2, CO, O_3	Daily postneonatal mortality	Established link between air pollution levels and infant mortality may not be as strong in cities with tropical climates.
Tsai SS, Cheng MH, Chiu HF, et al. 2006. Air pollution and hospital admissions for asthma in a tropical city: Kaohsiung, Taiwan. Inhal Toxicol 18:549–554.	Case crossover	Kaohsiung, Taipei,China	1996–2003	17,682 asthma hospitalizations	PM_{10}, SO_2, NO_2, CO, O_3	Daily asthma hospitalizations	Study provides evidence that higher levels of ambient pollutants increase the risk of hospital admissions for asthma.
Tsai SS, Goggins WB, Chiu HF, et al. 2003. Evidence for an association between air pollution and daily stroke admissions in Kaohsiung, Taiwan. Stroke 34:2612–2616.	Case crossover	Kaohsiung	1997–2000	23,179 hospital admissions for stroke	PM_{10}, SO_2, NO_2, CO, O_3	Daily hospital admissions for stroke	The ambient level of PM_{10}, NO_2, SO_2, CO, and O_3 were significantly associated with hospital admissions for both primary intracerebral hemorrhage and ischemic stroke on warm days (>20°C). On cool days, only CO levels and ischemic stroke hospital admissions were significantly associated.

* Last updated June 2006.

Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
TAIPEI,CHINA (*Continued*)							
Tsai SS, Huang GH, Goggins WB, et al. 2003. Relationship between air pollution and daily mortality in a tropical city: Kaohsiung, Taiwan. J Toxicol Environ Health 66:1341–1349.	Case crossover	Kaohsiung	1994–2000	All nonaccidental deaths	PM_{10}, SO_2, NO_2, O_3, CO	RespD and circulatory mortality	No significant effects were found between PM_{10} and SO_2 levels and respiratory mortality.
Tsai SS, Yu HS, Chang CC, Chuang HY, Yang CY. 2004. Increased risk of preterm delivery in women residing near thermal power plants in Taiwan. Arch Environ Health 59:478–483.	Cohort	Taipei,China	1993–1996	23,072 first-parity singletons	Industrial pollution	Preterm delivery	After controlling for possible confounders, the incidence of preterm delivery was greater among women living less than 3 km from a thermal power plant than those living 3–4 km from the plant.
Tsai SS, Yu HS, Liu CC ,et al. 2003. Increased incidence of preterm delivery in mothers residing in an industrialized area in Taiwan. J Toxicol Environ Health A 66:987–994.	Cohort	Taipei,China	1994–1997	14,545 births in industrial areas, 49,670 births in other regions of Taiwan (controls)	Industrial air pollution	Preterm delivery	The prevalence of preterm delivery in the industrial area was significantly higher than that in control area.
Wang JY, Hsiue TR, Chen HI. 1992. Bronchial responsiveness in an area of air pollution resulting from wire reclamation. Arch Dis Child 67:488–490.	Cross section	Wanli, Tainan	–	178 primary-school children (86 in polluted area, 92 in nonpolluted area)	Industrial air pollution	Lung function, respiratory symptoms, asthma	The long-term exposure to air pollution resulting from wire reclamation was associated with the decreased lung function and increased bronchial responsiveness in primary-school children.
Wang TN, Ko YC, Chao YY, et al. 1999. Association between indoor and outdoor air pollution and adolescent asthma from 1995 to 1996 in Taiwan. Environ Res 81:239–247.	Cross section	Kaohsiung and Pintong	1995–1996	165,173 high-school students (11–16 yr)	Airborne dust, TSP, PM_{10}, SO_2, NO_2, CO, O_3, HC	Morbidity: asthma prevalence, respiratory and allergic illness (wheeze, nocturnal dry cough, wheezing after exercise, sneeze, conjunctivitis symptoms, atopic dermatitis, and rhinitis)	Using questionnaire data, TSP, NO_2, CO, O_3, and airborne dust particles were all found to display independent associations with asthma with an 8–29% increased risk of asthma among these adolescents.
Wu JS. 1998. Adolescent asthma in northern Taiwan [in Chinese]. Taiwan J Public Health17:214–225.	Cross section	Taipei city, Taipei county, Keelung city and Ilan county	1995–1996	313,090 middle-school students	Ambient air pollution	Asthma	Students who lived in areas in which parents reported heavy air pollution were 1.8 times more likely to have a history of asthma than those who lived in areas with no pollution.

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Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
TAIPEI,CHINA (*Continued*)							
Yang CY, Chang CC, Chuang HY, et al. 2003. Evidence for increased risks of preterm delivery in a population residing near a freeway in Taiwan. Arch Environ Health 58:649–654.	Cohort	Sanming district (freeway pass through)	1992–1997	6,251 first-parity singleton births	Traffic emissions	Preterm delivery	The prevalence of preterm delivery was significantly higher among mothers living within 500 m of the freeway than mothers living 500 m to 1500 m away from freeway.
Yang CY, Chang CC, Chuang HY, et al. 2004. Increased risk of preterm delivery among people living near the three oil refineries in Taiwan. Environ Int 30:337–342.	Cohort	51 boroughs around three refineries	1994–1997	57,483 first-parity singleton live births	Petrochemical air pollution	Preterm delivery	The prevalence of preterm delivery was significantly higher among mothers living near oil refinery plants than mothers living in control area.
Yang CY, Chang CC, Chuang HY, et al. 2004. Relationship between air pollution and daily mortality in a subtropical city: Taipei, Taiwan. Environ Int 30:519–523.	Case crossover	Taipei	1994–1998	2.64 million residents	PM_{10}, SO_2, NO_2, CO, O_3	Daily mortality for all causes, respiratory diseases, and circulatory diseases	Effects were observed for NO_2 and CO levels on death due to respiratory disease, while weaker associations were observed for PM_{10}, SO_2, and O_3.
Yang CY, Chen YS, Chiu HF, Goggins WB. 2005. Effects of Asian dust storm events on daily stroke admissions in Taipei, Taiwan. Environ Res 99:79–84.	Time series (episode)	Taipei	1996–2001	All residents	Asian dust storms (PM_{10}, NO_2, SO_2, CO, O_3)	Daily stroke admissions	Statistically significant associations between Asian dust storm and daily primary intracerebral hemorrhagic stroke and ischemic stroke were found.
Yang CY, Chen YS, Yang CH, et al. 2004. Relationship between ambient air pollution and hospital admissions for cardiovascular diseases in causing, Taiwan. J Toxicol Environ Health A 67:483–493.	Case crossover	Kaohsiung	1997–2000	1.46 million residents	PM_{10}, SO_2, NO_2, CO, O_3	Hospital admissions for CVD	Significant associations were found between PM_{10}, SO_2, NO_2, CO, O_3, and hospital admissions for CVD on warm days (>20°C), and for all pollutants except for O_3 on cool days (<20°C).
Yang CY, Cheng BH, Hsu TY, et al. 2002. Association between petrochemical air pollution and adverse pregnancy outcomes in Taiwan. Arch Environ Health 57:461–465.	Cohort	Taipei,China	1993–1996	39,750 singleton births	Petrochemical air pollution	Low birth weight (< 2500 g) and preterm delivery (< 37 wk)	The prevalences of preterm delivery and of low birth weight were higher among women living near petrochemical industrial complexes but were not significantly different when compared with a control group.
Yang CY, Cheng MF, Chiu JF, et al. 1999. Female lung cancer and petrochemical air pollution in Taiwan. Arch Environ Health 54:180–185.	Case control	Taipei,China	1990–1994	399 cases and 399 controls matched for sex, year of birth, and year of death	Petrochemical air pollution	Female lung cancer mortality	Women living in areas with a high level of petrochemical air pollution had a significantly higher risk of developing lung cancer than a group living in an area with low petrochemical air pollution.

* Last updated June 2006.

Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
TAIPEI,CHINA (*Continued*)							
Yang CY, Chiu HF, Tsai SS, et al. 2002. Increased risk of preterm delivery in areas with cancer mortality problems from petrochemical complexes. Environ Res 89:195 200.	Cohort	Kaohsiung	1993–1996	57,127 singleton births	Petrochemical air pollution	Preterm delivery (< 37 wk)	The prevalence of preterm delivery was significantly higher among women living near petrochemical industrial complexes than in a control group.
Yang CY, Tsai SS, Chang CC, Ho SC. 2005. Effects of Asian dust storm events on daily admissions for asthma in Taipei, Taiwan. Inhal Toxicol 17:817–821.	Time series (episode)	Taipei	1996–2001	2.6 million residents	Asian dust storms (PM_{10}, NO_2, SO_2, CO, O_3)	Daily asthma admissions	Effects of dust storms on daily asthma admissions were not found to be statistically significant, which may be due to inadequate sample size for detecting association.
Yang CY, Tsai SS, Cheng BH, et al. 2000. Female lung cancer mortality and sex ratios at birth near a petroleum refinery plant. Environ Res 83:33–40.	Cohort	Nantzu, Tsoying	1971–1996	–	Petrochemical air pollution	Sex ratio, female lung cancer mortality	Standardized mortality ratios for female lung cancer revealed that lung cancer deaths rose gradually 30–37 years after introduction of the local petroleum refinery camp. The sex ratio was not affected.
Yang CY, Tsai SS, Cheng BH, et al. 2000. Sex ratio at birth associated with petrochemical air pollution in Taiwan. Bull Environ Contam Toxicol 65:126–131.	Cross section	Taipei,China	1987–1996	208,501 births	Petrochemical air pollution	Sex ratio	The sex ratio in 16 petrochemical industrial municipalities during 1987–1992 and 1992–1996 were significant higher than national live-birth sex ratio.
Yang CY, Tseng YT, Chang CC. 2003. Effects of air pollution on birth weight among children born between 1995 and 1997 in Kaohsiung, Taiwan. J Toxicol Environ Health A66:807–816.	Cohort	Kaohsiung	1995–1997	13,396 singleton births	PM_{10}, SO_2	Birth weight	Birth weight was estimated to be reduced 0.52 g for a 1 μg/m^3 increase in either SO_2 or PM_{10} in the first trimester of pregnancy.
Yang CY, Wang JD, Chan CC, et al. 1997. Respiratory and irritant health effects of a population living in a petrochemical-polluted area in Taiwan. Environ Res 74:145–149.	Cross section	Lin-Yuan (exposed area), Taihsi (control area)	1995	2036 in exposed area, 1976 in control area (30–64 yr)	PM_{10}, SO_2, NO_2	Morbidity: chronic respiratory symptoms and irritative symptoms	Among residents of a petrochemical-polluted area, cough, wheezing, and chronic bronchitis, reported by questionnaire, were not significantly more prevalent than among the control population. Eye irritation, nausea, throat irritation, and chemical odor perception were significantly more common.

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Table 2. China Studies*

Citation	Design	Study Location	Study Period	Study Sample	Exposure	Health Outcome	Summary of Published Findings
TAIPEI,CHINA (*Continued*)							
Yang CY, Wang JD, Chan CC, et al. 1998. Respiratory symptoms of primary school children living in a petrochemical polluted area in Taiwan. Pediatr Pulmonol 25:299–303.	Cross section	Taihsi, Linyuan	1994–1995	1071 primary-school children (406 in polluted area, 611 in control area)	Petrochemical air pollution (PM, SO_2, NO_2, acid aerosols)	Respiratory symptoms among primary-school children	Primary-school children living in a petrochemical area were exposed to significantly higher levels of PM, SO_2, NO_2, and acid aerosols than children in a control area. The exposed children had significantly more upper respiratory symptoms and asthma. A causal relation could not be confirmed.
Yang CY, Yu ST, Chang CC. 2002. Respiratory symptoms in primary schoolchildren living near a freeway in Taiwan. J Toxicol Environ Health A 65:747–755.	Cross section	Yangming, Zhuangjing	1999	6190 primary-school students	NO_2	Chronic respiratory symptoms, such as asthma, cough, wheeze, dyspnea, bronchitis, and upper respiratory symptoms (sneezing, nose irritation, running and stuffy nose)	Data from a parental questionnaire indicate that a freeway surrounding a child's school may not be associated with an increased risk of respiratory symptoms.
Yau KIT, Fang LJ, Shieh KH. 1999. Factors predisposing infants to lower respiratory infection with wheezing in the first two years of life. Ann Allergy Asthma Immunol 82:165–170.	Cross section	Taipei	1992–1994	71 full-term infants	Environmental and demographic features	Acute lower respiratory illness	Lung function tests on 71 healthy infants chosen randomly failed to identify any differences that predicted the 18 infants who developed a lower respiratory infection within the first 2 yr of life.
Yu JH, Lue KH, Lu KH, et al. 2005. The relationship of air pollution to the prevalence of allergic diseases in Taichung and Chu-Shan in 2002. J Microbiol Immunol Infect 38:123–126.	Cross section	Taichung, Chu-Shan, Taipei,China	–	14,201 schoolchildren	Urban air pollution	Allergic rhinitis, asthma	Allergic rhinitis and asthma were both more prevalent in the city than in rural areas. The results also showed that CO and NO were related significantly to the prevalence of allergic disease.

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