Online Supplement for: **Short-term effects of air pollution on hospital admissions in 8 cities in Korea, 2003-2008**, Ji-Young Son, Jong-Tae Lee, Yoon Hyeong Park, Michelle L. Bell, *Epidemiology*

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eTable 1. Comparison of the environmental, health, and economic indicators for South Korea to other countries (World Bank 2012)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Maternal mortality ratio per 100,000 live births, modeled estimate (2010) | Life expectancy at birth for males (2010) [years] | Life expectancy at birth for females (2010) [years] | % with access to improved sanitation facilities (2010) | CO2 emissions (2008) [metric tons/capita] | % urban population (2011) | Motor vehicles /1,000 persons (2009) | GDP per capita (2011) [$US] |
| South Korea | 16 | 77 | 84  | 100% | 10.4 | 83% | 355 | 22,424 |
| India | 200 | 64 | 67  | 34% | 1.5 | 31% | 18 | 1,489 |
| Thailand | 48 | 71  | 77  | 96% | 4.2 | 34% | - | 4,972 |
| China | 37 | 72  | 75  | 64% | 5.3 | 51% | 47 | 5,455 |
| Japan | 5 | 80  | 86  | 100% | 9.5 | 91% | 589 | 45,903 |
| Canada | 12 | 79  | 83  | 100% | 16.3 | 81% | 607 | 50,345 |
| France | 8 | 78  | 85  | 100% | 5.9 | 86% | 598 | 42,377 |
| United Kingdom | 12 | 79  | 82  | 100% | 8.5 | 80% | 523 | 38,818 |
| United States | 21 | 76  | 81  | 100% | 18.0 | 82% | 802 | 48,442 |

eTable 2. Correlation coefficients among air pollutants by city and on average across cities

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | O3 | NO2 | SO2 | CO |
| Seoul |  |  |  |  |
| PM10 | 0.1 | 0.5 | 0.5 | 0.5 |
| O3 |  | -0.2 | -0.2 | -0.4 |
| NO2 |  |  | 0.7 | 0.8 |
| SO2 |  |  |  | 0.8 |
| Busan |  |  |  |  |
| PM10 | 0.3 | 0.5 | 0.5 | 0.5 |
| O3 |  | 0.0 | 0.1 | -0.1 |
| NO2 |  |  | 0.7 | 0.8 |
| SO2 |  |  |  | 0.7 |
| Incheon |  |  |  |  |
| PM10 | 0.1 | 0.5 | 0.5 | 0.5 |
| O3 |  | -0.1 | -0.1 | -0.3 |
| NO2 |  |  | 0.7 | 0.7 |
| SO2 |  |  |  | 0.7 |
| Daegu |  |  |  |  |
| PM10 | 0.2 | 0.5 | 0.5 | 0.4 |
| O3 |  | -0.3 | -0.3 | -0.4 |
| NO2 |  |  | 0.7 | 0.7 |
| SO2 |  |  |  | 0.7 |
| Daejeon |  |  |  |  |
| PM10 | 0.2 | 0.4 | 0.5 | 0.4 |
| O3 |  | -0.2 | -0.2 | -0.4 |
| NO2 |  |  | 0.7 | 0.8 |
| SO2 |  |  |  | 0.7 |
| Gwangju |  |  |  |  |
| PM10 | 0.3 | 0.5 | 0.5 | 0.5 |
| O3 |  | -0.1 | -0.1 | -0.2 |
| NO2 |  |  | 0.6 | 0.7 |
| SO2 |  |  |  | 0.6 |
| Ulsan |  |  |  |  |
| PM10 | 0.3 | 0.5 | 0.5 | 0.4 |
| O3 |  | 0.0 | 0.2 | -0.1 |
| NO2 |  |  | 0.5 | 0.7 |
| SO2 |  |  |  | 0.5 |
| Jeju |  |  |  |  |
| PM10 | 0.4 | 0.3 | 0.4 | 0.4 |
| O3 |  | 0.2 | 0.1 | 0.2 |
| NO2 |  |  | 0.4 | 0.4 |
| SO2 |  |  |  | 0.4 |
| Average of city-specific correlations  |  |  |
| PM10 | 0.2 | 0.5 | 0.5 | 0.5 |
| O3 |  | -0.1 | -0.1 | -0.2 |
| NO2 |  |  | 0.6 | 0.7 |
| SO2 |  |  |  | 0.6 |

eTable 3. Percent increase in risk of hospitalization per IQR increase in air pollutant by cause for each city and overall

|  |  |  |
| --- | --- | --- |
| City | Cause | Air pollutant |
| PM10 | O3 | NO2 | SO2 | CO |
| Seoul | Allergic disease | 2.7 | 1.1 | 4.4 | 6.1 | 2.3 | 10.1 | 1.8 | 0.1 | 3.5 | 2.3 | -0.8 | 5.6 | 1.4 | -0.3 | 3.1 |
| Asthma | 3.1 | 1.5 | 4.8 | 6.5 | 2.6 | 10.6 | 1.4 | -0.2 | 3.1 | 3.1 | -0.1 | 6.4 | 1.0 | -0.7 | 2.7 |
| Respiratory | 1.8 | 0.8 | 2.8 | 2.0 | 0.6 | 3.5 | 1.4 | 0.4 | 2.4 | 2.2 | 0.3 | 4.1 | 1.1 | 0.1 | 2.1 |
| Cardiovascular | 0.6 | -0.2 | 1.5 | -1.1 | -2.4 | 0.3 | 1.3 | 0.4 | 2.2 | 0.8 | -0.7 | 2.4 | 0.9 | 0.0 | 1.8 |
| Busan | Allergic disease | 1.0 | -1.8 | 3.9 | 10.2 | 4.9 | 15.7 | 2.9 | -0.1 | 6.0 | -0.8 | -3.8 | 2.4 | 0.5 | -2.7 | 3.8 |
| Asthma | 1.8 | -1.0 | 4.7 | 10.7 | 5.4 | 16.2 | 2.9 | -0.1 | 5.9 | -0.6 | -3.7 | 2.5 | 0.9 | -2.3 | 4.2 |
| Respiratory | 2.4 | 0.8 | 4.0 | 4.5 | 2.4 | 6.6 | 4.5 | 2.7 | 6.3 | 1.7 | -0.1 | 3.6 | 2.6 | 0.7 | 4.6 |
| Cardiovascular | 0.5 | -0.8 | 1.9 | -3.1 | -4.9 | -1.2 | 3.2 | 1.6 | 4.8 | 0.7 | -0.8 | 2.3 | 1.4 | -0.3 | 3.2 |
| Incheon | Allergic disease | 3.1 | 0.5 | 5.8 | 7.9 | 2.7 | 13.4 | 1.8 | -0.8 | 4.4 | 1.1 | -2.4 | 4.8 | 1.9 | -0.3 | 4.2 |
| Asthma | 3.8 | 1.2 | 6.5 | 9.0 | 3.8 | 14.5 | 1.6 | -1.0 | 4.1 | 1.8 | -1.6 | 5.4 | 2.3 | 0.1 | 4.5 |
| Respiratory | 1.0 | -0.4 | 2.5 | 3.3 | 1.4 | 5.3 | 1.2 | -0.2 | 2.7 | 0.6 | -1.4 | 2.6 | 0.5 | -0.8 | 1.8 |
| Cardiovascular | 0.4 | -0.9 | 1.6 | -2.3 | -4.0 | -0.5 | 2.0 | 0.6 | 3.4 | 0.6 | -1.1 | 2.3 | 0.7 | -0.5 | 1.9 |
| Daegu | Allergic disease | 3.9 | 0.3 | 7.8 | 6.7 | 0.8 | 12.9 | 1.8 | -1.7 | 5.5 | -0.1 | -4.6 | 4.6 | 0.4 | -2.4 | 3.3 |
| Asthma | 3.8 | 0.2 | 7.5 | 6.4 | 0.7 | 12.5 | 1.3 | -2.2 | 4.9 | 0.2 | -4.2 | 4.8 | -0.2 | -3.0 | 2.6 |
| Respiratory | 1.5 | -0.2 | 3.3 | 3.9 | 2.0 | 5.9 | 1.6 | -0.2 | 3.4 | 0.9 | -1.2 | 3.2 | -0.2 | -1.6 | 1.3 |
| Cardiovascular | 1.2 | -0.2 | 2.6 | -2.5 | -4.2 | -0.7 | 2.2 | 0.7 | 3.8 | 1.2 | -0.5 | 3.0 | 0.3 | -0.9 | 1.5 |
| Daejeon | Allergic disease | 2.4 | -2.2 | 7.2 | 12.1 | 4.3 | 20.6 | 5.7 | 0.3 | 11.5 | 3.1 | -4.2 | 10.9 | 1.6 | -1.9 | 5.3 |
| Asthma | 3.0 | -1.6 | 7.9 | 11.4 | 3.6 | 19.8 | 7.9 | 2.3 | 13.8 | 4.8 | -2.5 | 12.8 | 2.9 | -0.6 | 6.6 |
| Respiratory | 1.1 | -1.9 | 4.2 | 2.7 | -0.8 | 6.4 | 0.6 | -3.2 | 4.5 | 0.8 | -4.3 | 6.1 | -1.0 | -3.4 | 1.6 |
| Cardiovascular | 0.0 | -1.7 | 1.6 | -1.8 | -3.9 | 0.4 | 1.9 | -0.3 | 4.1 | 1.0 | -1.6 | 3.7 | 0.2 | -1.2 | 1.7 |
| Gwangju | Allergic disease | -1.3 | -5.0 | 2.5 | 3.2 | -3.0 | 9.8 | 1.1 | -3.1 | 5.5 | 0.4 | -5.4 | 6.6 | -1.3 | -3.9 | 1.4 |
| Asthma | -0.6 | -4.4 | 3.2 | 4.0 | -2.3 | 10.7 | 0.2 | -4.1 | 4.7 | -1.2 | -7.0 | 5.1 | -2.1 | -4.7 | 0.6 |
| Respiratory | 1.7 | -0.1 | 3.5 | 3.3 | 1.1 | 5.5 | 1.9 | -0.2 | 4.0 | 1.2 | -1.7 | 4.1 | 0.0 | -1.3 | 1.2 |
| Cardiovascular | -0.1 | -1.8 | 1.7 | 0.2 | -2.1 | 2.6 | 1.2 | -0.9 | 3.3 | 0.7 | -1.8 | 3.3 | -0.1 | -1.4 | 1.2 |
| Ulsan | Allergic disease | 3.8 | -0.6 | 8.3 | 12.7 | 4.8 | 21.1 | 2.3 | -2.7 | 7.6 | 2.3 | -2.3 | 7.0 | 0.8 | -3.5 | 5.3 |
| Asthma | 3.9 | -0.5 | 8.5 | 13.2 | 5.1 | 21.8 | 1.9 | -3.2 | 7.2 | 2.5 | -2.1 | 7.4 | 0.8 | -3.6 | 5.3 |
| Respiratory | 1.3 | -1.9 | 4.7 | 6.3 | 2.2 | 10.5 | 1.7 | -2.1 | 5.6 | 2.7 | -0.8 | 6.3 | 4.6 | 1.2 | 8.2 |
| Cardiovascular | 1.9 | 0.0 | 4.0 | -1.8 | -4.4 | 0.9 | 2.4 | -0.1 | 4.9 | 0.8 | -1.2 | 2.8 | 1.0 | -1.1 | 3.2 |
| Jeju | Allergic disease | 0.8 | -4.5 | 6.4 | -0.1 | -8.2 | 8.7 | 6.3 | -4.2 | 17.9 | -0.5 | -8.4 | 8.1 | 1.7 | -4.9 | 8.6 |
| Asthma | 3.1 | -1.7 | 8.2 | 4.0 | -3.8 | 12.4 | 5.8 | -3.9 | 16.5 | 2.6 | -4.5 | 10.3 | 0.9 | -5.1 | 7.2 |
| Respiratory | 3.3 | -0.3 | 7.0 | 1.7 | -2.6 | 6.2 | 10.7 | 3.2 | 18.8 | 4.3 | -1.0 | 9.8 | 2.8 | -1.8 | 7.6 |
| Cardiovascular | 1.9 | -0.3 | 4.1 | 0.1 | -2.7 | 3.0 | 9.4 | 4.2 | 14.8 | 5.5 | 2.1 | 9.0 | 4.5 | 1.3 | 7.8 |
| Overall | Allergic disease | 2.2 | 0.5 | 3.9 | 7.4 | 4.2 | 10.7 | 2.3 | 0.6 | 4.0 | 0.9 | -1.1 | 3.0 | 0.9 | -0.6 | 2.3 |
| Asthma | 2.8 | 1.3 | 4.4 | 8.0 | 5.0 | 11.1 | 2.2 | 0.3 | 4.1 | 1.5 | -0.7 | 3.6 | 0.8 | -0.8 | 2.4 |
| Respiratory | 1.7 | 0.9 | 2.6 | 3.4 | 2.1 | 4.6 | 2.2 | 0.6 | 3.7 | 1.6 | 0.4 | 2.8 | 0.9 | -0.4 | 2.2 |
| Cardiovascular | 0.7 | 0.0 | 1.4 | -1.6 | -2.7 | -0.6 | 2.2 | 1.1 | 3.4 | 1.1 | 0.1 | 2.1 | 0.8 | 0.0 | 1.5 |

*Note:* IQR for PM10, 30.7 ㎍/m3; O3, 19.4 ppb; NO2, 12.2 ppb; SO2, 2.9 ppb; CO, 0.3 ppm. Lags for allergic disease PM10 [lag03] O3 [lag02] NO2 [lag0] SO2 [lag03] CO[lag0]; Asthma PM10 [lag03], O3 [lag02], NO2 [lag0] SO2 [lag03], CO[lag0]; Respiratory PM10 [lag03], O3 [lag1], NO2 [lag0], SO2 [lag03], CO[lag0]; Cardiovascular PM10 [lag02], O3 [lag0], NO2 [lag0], SO2 [lag02], CO[lag0].

eTable 4. Percent increase in risk of hospitalization per IQR increase in air pollutant by cause, overall across the cities by lag structure

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Pollutant | Lag | Allergic disease | Asthma | Respiratory | Cardiovascular |
| Estimate % | 95% PI | Estimate % | 95% PI | Estimate % | 95% PI | Estimate % | 95% PI |
| PM10 | Lag 0 | 1.1 | -0.2 | 2.3 | 1.2 | -0.1 | 2.4 | 0.8 | 0.2 | 1.4 | 0.5 | 0.0 | 1.0 |
| Lag 1 | 1.2 | 0.0 | 2.3 | 1.5 | 0.4 | 2.6 | 0.9 | 0.3 | 1.4 | 0.4 | -0.1 | 0.9 |
| Lag 2 | 0.9 | -0.2 | 1.9 | 1.2 | 0.2 | 2.2 | 0.6 | 0.1 | 1.1 | 0.3 | -0.2 | 0.7 |
| Lag 3 | 0.6 | -0.4 | 1.6 | 0.8 | -0.2 | 1.8 | 0.5 | 0.0 | 1.0 | 0.0 | -0.4 | 0.5 |
| Lag 0-1 | 1.6 | 0.1 | 3.2 | 1.9 | 0.4 | 3.6 | 1.2 | 0.6 | 1.9 | 0.6 | 0.0 | 1.3 |
| Lag 0-2 | 2.0 | 0.4 | 3.5 | 2.4 | 1.0 | 3.9 | 1.5 | 0.7 | 2.2 | 0.7 | 0.0 | 1.4 |
| Lag 0-3 | 2.2 | 0.5 | 3.9 | 2.8 | 1.3 | 4.4 | 1.7 | 0.9 | 2.6 | 0.7 | 0.0 | 1.4 |
| O3 | Lag 0 | 1.8 | -0.4 | 4.0 | 1.7 | -0.3 | 3.8 | 0.5 | -0.7 | 1.7 | -1.6 | -2.7 | -0.6 |
| Lag 1 | 5.0 | 2.7 | 7.4 | 5.5 | 3.3 | 7.8 | 3.4 | 2.1 | 4.6 | 0.5 | -0.6 | 1.5 |
| Lag 2 | 3.4 | 1.5 | 5.4 | 4.0 | 2.0 | 5.9 | 2.3 | 1.2 | 3.3 | 0.8 | -0.1 | 1.7 |
| Lag 3 | 1.8 | -0.4 | 4.1 | 1.9 | -0.6 | 4.5 | 1.3 | 0.1 | 2.6 | 1.0 | 0.0 | 2.1 |
| Lag 0-1 | 5.8 | 2.7 | 9.1 | 6.1 | 3.3 | 9.1 | 3.4 | 1.9 | 4.9 | -0.7 | -2.0 | 0.5 |
| Lag 0-2 | 7.4 | 4.2 | 10.7 | 8.0 | 5.0 | 11.1 | 4.5 | 2.8 | 6.2 | 0.0 | -1.4 | 1.4 |
| Lag 0-3 | 7.6 | 4.0 | 11.4 | 8.2 | 4.6 | 12.0 | 4.9 | 3.0 | 6.8 | 0.7 | -1.0 | 2.4 |
| NO2 | Lag 0 | 2.3 | 0.6 | 4.0 | 2.2 | 0.3 | 4.1 | 2.2 | 0.6 | 3.7 | 2.2 | 1.1 | 3.4 |
| Lag 1 | -0.1 | -2.0 | 1.9 | -0.4 | -2.1 | 1.3 | 0.1 | -1.1 | 1.4 | 0.0 | -0.9 | 0.9 |
| Lag 2 | 0.0 | -1.6 | 1.7 | 0.2 | -1.5 | 2.0 | 0.3 | -0.6 | 1.3 | 0.2 | -0.6 | 1.0 |
| Lag 3 | 0.2 | -2.0 | 2.5 | 0.6 | -1.6 | 2.7 | 1.1 | -0.1 | 2.2 | -0.1 | -0.8 | 0.6 |
| Lag 0-1 | 1.7 | -0.5 | 3.9 | 1.3 | -0.9 | 3.6 | 1.8 | 0.0 | 3.6 | 1.6 | 0.5 | 2.8 |
| Lag 0-2 | 1.4 | -0.9 | 3.8 | 1.3 | -1.1 | 3.8 | 1.8 | -0.2 | 3.9 | 1.5 | 0.3 | 2.7 |
| Lag 0-3 | 1.6 | -1.1 | 4.4 | 1.7 | -1.0 | 4.5 | 2.6 | 0.1 | 5.1 | 1.2 | 0.0 | 2.5 |
| SO2 | Lag 0 | 0.4 | -1.2 | 1.9 | 0.2 | -1.4 | 1.9 | 0.7 | -0.1 | 1.5 | 0.5 | -0.1 | 1.2 |
| Lag 1 | 0.6 | -0.9 | 2.1 | 0.8 | -0.7 | 2.4 | 0.6 | -0.3 | 1.5 | 0.7 | -0.1 | 1.4 |
| Lag 2 | 0.2 | -1.2 | 1.5 | 0.6 | -0.8 | 2.0 | 0.6 | -0.2 | 1.4 | 0.5 | -0.2 | 1.2 |
| Lag 3 | 0.4 | -1.0 | 1.8 | 0.7 | -0.8 | 2.2 | 0.6 | -0.1 | 1.4 | -0.5 | -1.2 | 0.3 |
| Lag 0-1 | 0.7 | -1.1 | 2.6 | 0.8 | -1.3 | 3.0 | 1.0 | 0.0 | 2.1 | 0.9 | 0.0 | 1.7 |
| Lag 0-2 | 0.7 | -1.2 | 2.7 | 1.1 | -1.0 | 3.3 | 1.3 | 0.1 | 2.5 | 1.1 | 0.1 | 2.1 |
| Lag 0-3 | 0.9 | -1.1 | 3.0 | 1.5 | -0.7 | 3.6 | 1.6 | 0.4 | 2.8 | 0.7 | -0.5 | 1.9 |
| CO | Lag 0 | 0.9 | -0.6 | 2.3 | 0.8 | -0.8 | 2.4 | 0.9 | -0.4 | 2.2 | 0.8 | 0.0 | 1.5 |
| Lag 1 | 0.1 | -1.7 | 1.8 | 0.1 | -1.6 | 1.8 | 0.4 | -1.1 | 1.8 | 0.2 | -0.5 | 1.0 |
| Lag 2 | -0.4 | -2.0 | 1.2 | 0.1 | -1.4 | 1.7 | 0.3 | -0.7 | 1.2 | 0.1 | -0.5 | 0.8 |
| Lag 3 | -0.3 | -2.3 | 1.8 | 0.2 | -1.7 | 2.1 | 0.4 | -0.4 | 1.1 | -0.1 | -0.8 | 0.7 |
| Lag 0-1 | 0.7 | -1.2 | 2.6 | 0.7 | -1.3 | 2.7 | 1.1 | -0.9 | 3.0 | 0.7 | -0.3 | 1.8 |
| Lag 0-2 | 0.3 | -2.0 | 2.6 | 0.7 | -1.5 | 3.0 | 1.1 | -0.9 | 3.2 | 0.7 | -0.5 | 2.0 |
| Lag 0-3 | 0.1 | -2.6 | 3.0 | 0.8 | -1.7 | 3.4 | 1.3 | -0.8 | 3.3 | 0.6 | -0.7 | 2.0 |

*Note*: IQR for PM10, 30.7 ㎍/m3; O3, 19.4 ppb; NO2, 12.2 ppb; SO2, 2.9 ppb; CO, 0.3 ppm.

eTable 5. Percent increase in risk of hospitalization per IQR increase in air pollutant by cause, overall across the cities by degree of freedom for meteorological variables (temperature, relative humidity, and pressure)

|  |  |  |
| --- | --- | --- |
| pollutants | Degree of freedom for temperature, humidity, pressure | Estimate % (95% PI) |
| Allergic disease | Asthma | Selected respiratory disease | Cardiovascular disease |
| PM10 | 3, 3, 3 | 2.2 (0.5, 3.9) | 2.8 (1.2, 4.4) | 1.7 (0.9, 2.6) | 0.7 (-0.0, 1.4) |
| 4, 4, 4 | 2.2 (0.5, 3.9) | 2.8 (1.2, 4.4) | 1.7 (0.8, 2.5) | 0.8 (0.1, 1.5) |
| 5, 5, 5 | 2.2 (0.6, 3.9) | 2.8 (1.2, 4.4) | 1.7 (0.8, 2.5) | 0.8 (0.1, 1.5) |
| 6, 6, 6 | 2.2 (0.5, 3.9) | 2.8 (1.2, 4.4) | 1.7 (0.9, 2.6) | 0.8 (0.1, 1.4) |
| O3 | 3, 3, 3 | 7.4 (4.2, 10.8) | 8.0 (5.1, 11.1) | 3.4 (2.1, 4.6) | -1.6 (-2.7, -0.6) |
| 4, 4, 4 | 7.4 (4.1, 10.8) | 8.0 (4.9, 11.1) | 3.4 (2.1, 4.6) | -1.6 (-2.6, -0.5) |
| 5, 5, 5 | 7.5 (4.2, 10.8) | 8.0 (4.9, 11.1) | 3.4 (2.1, 4.6) | -1.5 (-2.6, -0.4) |
| 6, 6, 6 | 7.4 (4.2, 10.8) | 8.0 (4.9, 11.1) | 3.3 (2.1, 4.6) | -1.5 (-2.5, -0.4) |
| NO2 | 3, 3, 3 | 2.3 (0.6, 4.0) | 2.2 (0.3, 4.1) | 2.2 (0.6, 3.7) | 2.2 (1.1, 3.3) |
| 4, 4, 4 | 2.3 (0.6, 4.0) | 2.1 (0.2, 4.1) | 2.2 (0.6, 3.7) | 2.3 (1.1, 3.5) |
| 5, 5, 5 | 2.2 (0.5, 3.9) | 2.1 (0.2, 4.0) | 2.1 (0.6, 3.6) | 2.3 (1.1, 3.4) |
| 6, 6, 6 | 2.1 (0.4, 3.8) | 2.0 (0.1, 3.9) | 2.1 (0.5, 3.7) | 2.3 (1.1, 3.4) |
| SO2 | 3, 3, 3 | 0.9 (-1.2, 3.0) | 1.4 (-0.8, 3.6) | 1.6 (0.3, 2.8) | 1.1 (0.1, 2.1) |
| 4, 4, 4 | 0.9 (-1.1, 3.0) | 1.4 (-0.8, 3.6) | 1.6 (0.4, 2.8) | 1.2 (0.2, 2.2) |
| 5, 5, 5 | 0.9 (-1.2, 3.0) | 1.4 (-0.8, 3.6) | 1.6 (0.4, 2.8) | 1.1 (0.1, 2.1) |
| 6, 6, 6 | 1.0 (-1.1, 3.1) | 1.4 (-0.7, 3.6) | 1.7 (0.4, 2.9) | 1.2 (0.1, 2.2) |
| CO | 3, 3, 3 | 0.8 (-0.6, 2.3) | 0.7 (-0.9, 2.3) | 0.9 (-0.4, 2.2) | 0.7 (-0.0, 1.5) |
| 4, 4, 4 | 0.8 (-0.6, 2.3) | 0.7 (-1.0, 2.4) | 0.9 (-0.3, 2.1) | 0.8 (0.1, 1.6) |
| 5, 5, 5 | 0.8 (-0.7, 2.2) | 0.6 (-1.1, 2.4) | 0.9 (-0.4, 2.1) | 0.9 (0.1, 1.6) |
| 6, 6, 6 | 0.7 (-0.7, 2.2) | 0.6 (-1.1, 2.3) | 0.9 (-0.4, 2.1) | 0.9 (0.1, 1.7) |

*Note:* IQR for PM10, 30.7 ㎍/m3; O3, 19.4 ppb; NO2, 12.2 ppb; SO2, 2.9 ppb; CO, 0.3 ppm. Lags for allergic disease PM10 [lag03] O3 [lag02] NO2 [lag0] SO2 [lag03] CO[lag0]; Asthma PM10 [lag03], O3 [lag02], NO2 [lag0] SO2 [lag03], CO[lag0]; Respiratory PM10 [lag03], O3 [lag1], NO2 [lag0], SO2 [lag03], CO[lag0]; Cardiovascular PM10 [lag02], O3 [lag0], NO2 [lag0], SO2 [lag02], CO[lag0].

eTable 6. Percent increase in risk of hospitalization per IQR increase in air pollutant by cause, overall across the cities by lag structure for meteorological variables (temperature, relative humidity, and pressure)

|  |  |  |
| --- | --- | --- |
| pollutants | Cause | Weather lag |
| Lag0 | Lag0-3 |
| PM10 | Allergic disease | 2.2 (0.5, 3.9) | 2.5 (0.6, 4.5) |
| Asthma | 2.8 (1.3, 4.4) | 3.0 (1.1, 4.9) |
| Selected respiratory disease | 1.7 (0.9, 2.6) | 1.7 (0.8, 2.7) |
| Cardiovascular disease | 0.7 (0.0, 1.4) | 0.6 (-0.1, 1.2) |
| O3 | Allergic disease | 7.4 (4.2, 10.7) | 7.5 (4.2, 10.8) |
| Asthma | 8.0 (5.0, 11.1) | 7.5 (4.5, 10.7) |
| Selected respiratory disease | 3.4 (2.1, 4.6) | 3.1 (1.9, 4.4) |
| Cardiovascular disease | -1.6 (-2.7, -0.6) | -0.8 (-1.7, 0.0) |
| NO2 | Allergic disease | 2.3 (0.6, 4.0) | 1.9 (0.4, 3.5) |
| Asthma | 2.2 (0.3, 4.1) | 1.9 (0.2, 3.6) |
| Selected respiratory disease | 2.2 (0.6, 3.7) | 2.2 (0.9, 3.6) |
| Cardiovascular disease | 2.2 (1.1, 3.4) | 2.4 (1.4, 3.4) |
| SO2 | Allergic disease | 0.9 (-1.1, 3.0) | 0.9 (-1.4, 3.1) |
| Asthma | 1.5 (-0.7, 3.6) | 1.2 (-1.1, 3.6) |
| Selected respiratory disease | 1.6 (0.4, 2.8) | 1.6 (0.3, 3.0) |
| Cardiovascular disease | 1.1 (0.1, 2.1) | 1.2 (0.1, 2.3) |
| CO | Allergic disease | 0.9 (-0.6, 2.3) | 1.0 (-0.2, 2.2) |
| Asthma | 0.8 (-0.8, 2.4) | 1.0 (-0.3, 2.3) |
| Selected respiratory disease | 0.9 (-0.4, 2.2) | 1.1 (0.2, 2.1) |
| Cardiovascular disease | 0.8 (0.0, 1.5) | 1.0 (0.4, 1.6) |

*Note*: IQR for PM10, 30.7 ㎍/m3; O3, 19.4 ppb; NO2, 12.2 ppb; SO2, 2.9 ppb; CO, 0.3 ppm. Lags for allergic disease PM10 [lag03] O3 [lag02] NO2 [lag0] SO2 [lag03] CO[lag0]; Asthma PM10 [lag03], O3 [lag02], NO2 [lag0] SO2 [lag03], CO[lag0]; Respiratory PM10 [lag03], O3 [lag1], NO2 [lag0], SO2 [lag03], CO[lag0]; Cardiovascular PM10 [lag02], O3 [lag0], NO2 [lag0], SO2 [lag02], CO[lag0].

eTable 7. Air pollution levels by season

|  |  |
| --- | --- |
|  | Mean (SD) |
|  | Spring | Summer | Fall | Winter |
| PM10 | 65.2 (39.1) | 44.7 (21.0) | 46.7 (23.9) | 54.5 (24.7) |
| O3 | 43.6 (12.0) | 36.6 (16.1) | 30.2 (11.2) | 23.1 (7.9) |
| NO2 | 24.6 (7.7) | 17.9 (5.7) | 24.1 (8.8) | 26.8 (9.4) |
| SO2 | 5.7 (2.2) | 4.4 (1.4) | 4.8 (1.9) | 7.0 (2.8) |
| CO | 0.7 (0.2) | 0.5 (0.1) | 0.7 (0.3) | 0.9 (0.3) |

*Note:* Values are the average of city-specific values.

eTable 8. Percent increase in risk of hospitalization per IQR increase in air pollutant by cause for each city and overall by season.

(A) Allergic disease

|  |  |  |
| --- | --- | --- |
|  |  | Percent increase in risk of hospitalization per IQR increase |
| Spring | Summer | Fall | Winter |
| PM10 | Seoul | 1.7 | -0.5 | 4.0 | 6.0 | 0.7 | 11.6 | 1.7 | -2.0 | 5.5 | 2.3 | -1.7 | 6.4 |
| Busan | 1.9 | -2.1 | 6.0 | 12.1 | 1.4 | 23.9 | 2.6 | -4.2 | 10.0 | -3.3 | -10.6 | 4.6 |
| Incheon | 1.7 | -2.3 | 5.8 | 7.0 | -2.2 | 17.2 | 6.2 | 0.6 | 12.0 | 2.0 | -4.1 | 8.5 |
| Daegu | 6.5 | 1.0 | 12.4 | 3.8 | -10.5 | 20.3 | 4.5 | -4.5 | 14.3 | -2.4 | -11.2 | 7.3 |
| Daejeon | 8.6 | 1.8 | 15.8 | 4.0 | -10.3 | 20.7 | -0.6 | -11.0 | 11.0 | -1.3 | -11.7 | 10.4 |
| Gwangju | -0.3 | -6.6 | 6.5 | 7.3 | -4.7 | 20.7 | -1.9 | -9.9 | 6.7 | -2.7 | -11.9 | 7.5 |
| Ulsan | 0.5 | -5.9 | 7.3 | 3.5 | -11.6 | 21.3 | 15.2 | 3.2 | 28.7 | 1.5 | -9.6 | 14.0 |
| Jeju | 1.6 | -6.7 | 10.7 | 22.1 | 1.3 | 47.2 | -5.8 | -16.1 | 5.6 | 0.2 | -12.2 | 14.3 |
| Overall | 2.6 | 0.0 | 5.1 | 7.5 | 2.1 | 13.1 | 2.7 | -1.5 | 7.1 | 0.1 | -3.6 | 3.9 |
| O3 | Seoul | 2.6 | -4.3 | 10.0 | 4.2 | -1.3 | 9.9 | 7.7 | -0.5 | 16.6 | 9.1 | -6.3 | 27.1 |
| Busan | 17.6 | 6.3 | 30.2 | 14.1 | 5.4 | 23.5 | 5.4 | -5.0 | 17.0 | 16.2 | -2.2 | 38.1 |
| Incheon | 0.8 | -8.1 | 10.5 | 4.8 | -3.1 | 13.4 | 7.4 | -3.3 | 19.2 | 12.1 | -6.9 | 34.8 |
| Daegu | 7.3 | -5.0 | 21.1 | -0.9 | -9.3 | 8.3 | 13.3 | 1.1 | 27.0 | -3.2 | -21.1 | 18.8 |
| Daejeon | 18.7 | 4.1 | 35.3 | 3.8 | -7.8 | 16.9 | 15.3 | -3.1 | 37.2 | 18.1 | -5.4 | 47.4 |
| Gwangju | 0.4 | -12.6 | 15.4 | 9.1 | -1.5 | 20.7 | -1.6 | -13.6 | 12.1 | -7.7 | -26.1 | 15.4 |
| Ulsan | -1.8 | -15.8 | 14.5 | 6.8 | -4.7 | 19.7 | 28.8 | 10.1 | 50.7 | 25.5 | -4.7 | 65.2 |
| Jeju | -3.1 | -20.1 | 17.5 | 12.5 | -1.9 | 29.0 | -0.9 | -15.7 | 16.5 | -26.0 | -43.4 | -3.2 |
| Overall | 5.5 | -1.3 | 12.9 | 6.3 | 1.5 | 11.3 | 8.5 | 1.6 | 15.9 | 5.2 | -7.2 | 19.3 |
| NO2 | Seoul | 0.7 | -2.2 | 3.8 | 3.6 | -1.1 | 8.6 | 2.5 | -0.6 | 5.7 | -0.3 | -3.5 | 3.0 |
| Busan | 3.2 | -2.0 | 8.7 | 11.5 | 2.9 | 20.9 | 3.2 | -2.8 | 9.5 | 0.6 | -5.4 | 7.0 |
| Incheon | -1.7 | -6.6 | 3.4 | 10.2 | 1.2 | 20.1 | 4.1 | -0.4 | 8.8 | -0.1 | -4.9 | 4.9 |
| Daegu | 4.5 | -3.5 | 13.1 | 13.4 | -2.7 | 32.0 | 2.2 | -4.4 | 9.2 | -3.4 | -9.1 | 2.7 |
| Daejeon | -0.5 | -10.8 | 10.9 | 5.8 | -13.5 | 29.3 | 7.7 | -2.9 | 19.4 | 6.0 | -2.9 | 15.7 |
| Gwangju | -0.8 | -9.9 | 9.3 | 19.7 | 2.2 | 40.2 | 1.1 | -7.3 | 10.3 | -1.3 | -8.5 | 6.5 |
| Ulsan | 4.9 | -4.6 | 15.5 | 6.0 | -8.6 | 22.8 | 3.2 | -7.1 | 14.5 | -1.0 | -10.3 | 9.4 |
| Jeju | 11.1 | -8.2 | 34.3 | 25.7 | -6.8 | 69.6 | -0.9 | -19.5 | 22.1 | 2.5 | -17.6 | 27.6 |
| Overall | 1.5 | -1.9 | 5.0 | 9.4 | 2.8 | 16.5 | 3.1 | -0.0 | 6.3 | -0.2 | -3.3 | 3.1 |
| SO2 | Seoul | 4.6 | -1.1 | 10.5 | 8.0 | -6.2 | 24.3 | 2.6 | -3.8 | 9.5 | -1.9 | -6.9 | 3.3 |
| Busan | 5.0 | -1.7 | 12.2 | 7.6 | -2.5 | 18.8 | -0.9 | -8.7 | 7.5 | -1.1 | -6.2 | 4.4 |
| Incheon | -5.0 | -11.7 | 2.2 | 0.1 | -12.3 | 14.2 | 4.1 | -2.7 | 11.3 | 1.0 | -4.6 | 7.0 |
| Daegu | -2.4 | -12.1 | 8.3 | 17.3 | -10.0 | 53.0 | 11.7 | -0.1 | 24.7 | -4.4 | -10.7 | 2.3 |
| Daejeon | 11.6 | -4.3 | 30.2 | 5.0 | -25.4 | 47.9 | -6.3 | -21.4 | 11.6 | -1.0 | -11.6 | 10.9 |
| Gwangju | -10.5 | -21.6 | 2.0 | 2.6 | -27.1 | 44.3 | 6.8 | -7.1 | 22.8 | -3.5 | -12.3 | 6.1 |
| Ulsan | 0.2 | -7.9 | 9.0 | 7.1 | -3.8 | 19.2 | 7.9 | -5.4 | 23.1 | 1.2 | -7.2 | 10.4 |
| Jeju | 19.4 | -0.2 | 42.7 | -0.9 | -21.9 | 25.7 | 24.7 | 1.4 | 53.2 | -5.5 | -17.2 | 8.0 |
| Overall | 1.6 | -4.4 | 7.9 | 5.9 | -2.0 | 14.3 | 4.6 | -1.1 | 10.7 | -1.6 | -4.8 | 1.8 |
| CO | Seoul | 0.4 | -3.6 | 4.7 | 4.5 | -2.3 | 11.7 | 3.5 | 0.4 | 6.8 | -0.8 | -3.2 | 1.7 |
| Busan | 3.9 | -3.1 | 11.5 | 9.8 | -0.6 | 21.3 | 1.5 | -4.9 | 8.2 | -0.2 | -5.9 | 5.9 |
| Incheon | -5.9 | -11.4 | 0.0 | 7.8 | -2.0 | 18.5 | 5.0 | 0.8 | 9.2 | 0.7 | -2.6 | 4.1 |
| Daegu | 5.4 | -2.3 | 13.8 | 8.4 | -3.3 | 21.5 | 6.5 | 0.6 | 12.8 | -4.0 | -8.1 | 0.3 |
| Daejeon | 1.0 | -7.4 | 10.1 | -4.9 | -18.7 | 11.3 | 4.3 | -3.3 | 12.6 | 2.0 | -3.1 | 7.3 |
| Gwangju | -5.0 | -11.1 | 1.5 | 8.7 | -2.3 | 20.8 | -1.5 | -7.0 | 4.3 | -2.5 | -6.5 | 1.7 |
| Ulsan | 6.1 | -4.1 | 17.5 | -2.1 | -14.5 | 12.0 | 3.5 | -5.7 | 13.5 | -3.1 | -10.0 | 4.3 |
| Jeju | -1.6 | -13.5 | 11.9 | -3.5 | -18.8 | 14.8 | 11.8 | -2.8 | 28.7 | 11.2 | -2.6 | 26.9 |
| Overall | 0.1 | -4.0 | 4.4 | 4.8 | -0.6 | 10.5 | 3.6 | 0.6 | 6.8 | -0.7 | -3.1 | 1.8 |

*Note*: IQR for PM10, 30.7 ㎍/m3; O3, 19.4 ppb; NO2, 12.2 ppb; SO2, 2.9 ppb; CO, 0.3 ppm. Lags for allergic disease PM10 [lag03] O3 [lag02] NO2 [lag0] SO2 [lag03] CO[lag0]; Asthma PM10 [lag03], O3 [lag02], NO2 [lag0] SO2 [lag03], CO[lag0]; Respiratory PM10 [lag03], O3 [lag1], NO2 [lag0], SO2 [lag03], CO[lag0]; Cardiovascular PM10 [lag02], O3 [lag0], NO2 [lag0], SO2 [lag02], CO[lag0].

(B) Asthma

|  |  |  |
| --- | --- | --- |
|  |  | Percent increase in risk of hospitalization per IQR increase |
| Spring | Summer | Fall | Winter |
| PM10 | Seoul | 2.3 | 0.1 | 4.5 | 7.3 | 1.7 | 13.2 | 0.8 | -2.8 | 4.6 | 2.6 | -1.3 | 6.6 |
| Busan | 1.7 | -2.3 | 5.9 | 14.1 | 3.2 | 26.1 | 5.4 | -1.5 | 12.8 | -4.0 | -11.3 | 3.8 |
| Incheon | 2.8 | -1.1 | 6.7 | 3.6 | -5.4 | 13.4 | 6.4 | 0.8 | 12.2 | 2.8 | -3.2 | 9.2 |
| Daegu | 5.2 | -0.2 | 10.8 | 16.0 | 0.7 | 33.7 | 2.4 | -6.1 | 11.7 | -0.5 | -9.4 | 9.4 |
| Daejeon | 6.2 | -0.4 | 13.1 | 15.1 | -1.0 | 33.8 | 1.3 | -9.5 | 13.4 | 2.0 | -9.4 | 14.7 |
| Gwangju | 0.3 | -6.2 | 7.2 | 12.7 | -0.1 | 27.0 | -1.7 | -9.7 | 6.9 | -4.5 | -13.5 | 5.6 |
| Ulsan | 0.6 | -5.8 | 7.5 | 4.1 | -11.3 | 22.0 | 16.4 | 4.2 | 30.0 | -0.9 | -12.1 | 11.7 |
| Jeju | 4.7 | -2.8 | 12.9 | 9.2 | -8.2 | 29.8 | -3.7 | -13.7 | 7.5 | 5.4 | -6.3 | 18.6 |
| Overall | 2.7 | 0.5 | 5.0 | 9.5 | 3.8 | 15.4 | 3.1 | -1.2 | 7.6 | 0.7 | -3.2 | 4.7 |
| O3 | Seoul | 2.0 | -4.9 | 9.4 | 4.9 | -0.8 | 11.0 | 6.5 | -1.5 | 15.2 | 12.9 | -2.7 | 31.0 |
| Busan | 18.3 | 6.7 | 31.0 | 11.9 | 3.3 | 21.2 | 6.8 | -3.7 | 18.4 | 14.2 | -3.8 | 35.5 |
| Incheon | 3.9 | -4.9 | 13.6 | 5.0 | -2.9 | 13.5 | 9.3 | -1.4 | 21.2 | 9.8 | -8.2 | 31.3 |
| Daegu | 5.1 | -6.7 | 18.4 | 2.8 | -5.6 | 11.9 | 10.7 | -0.9 | 23.5 | -4.3 | -22.1 | 17.5 |
| Daejeon | 18.6 | 4.0 | 35.3 | 7.1 | -4.9 | 20.5 | 14.3 | -4.0 | 36.2 | 12.9 | -10.5 | 42.3 |
| Gwangju | -0.1 | -13.3 | 15.1 | 13.8 | 2.8 | 26.1 | -3.4 | -15.1 | 10.0 | -5.8 | -24.7 | 18.0 |
| Ulsan | 0.9 | -13.6 | 17.9 | 8.4 | -3.2 | 21.4 | 28.8 | 10.0 | 50.8 | 23.8 | -6.5 | 64.0 |
| Jeju | 9.5 | -8.6 | 31.3 | 8.3 | -4.9 | 23.3 | -0.2 | -14.7 | 16.8 | -11.8 | -30.1 | 11.2 |
| Overall | 6.8 | 0.3 | 13.8 | 7.3 | 2.9 | 11.9 | 8.1 | 1.3 | 15.4 | 6.2 | -4.1 | 17.6 |
| NO2 | Seoul | 0.9 | -2.0 | 3.9 | 3.5 | -1.4 | 8.7 | 2.5 | -0.5 | 5.6 | -1.9 | -4.9 | 1.3 |
| Busan | 1.6 | -3.5 | 7.1 | 10.5 | 1.9 | 19.8 | 5.9 | -0.1 | 12.2 | -0.6 | -6.5 | 5.7 |
| Incheon | -0.6 | -5.4 | 4.5 | 9.5 | 0.6 | 19.2 | 3.1 | -1.3 | 7.8 | 0.5 | -4.1 | 5.4 |
| Daegu | 1.5 | -6.1 | 9.7 | 13.9 | -1.7 | 31.9 | 1.9 | -4.5 | 8.6 | -3.5 | -9.2 | 2.6 |
| Daejeon | 2.6 | -7.8 | 14.2 | 11.6 | -8.9 | 36.6 | 6.2 | -4.2 | 17.8 | 7.9 | -1.6 | 18.3 |
| Gwangju | 1.1 | -8.4 | 11.5 | 18.4 | 0.9 | 38.9 | -1.4 | -9.7 | 7.7 | -3.1 | -10.3 | 4.6 |
| Ulsan | 2.7 | -6.7 | 13.2 | 10.1 | -5.1 | 27.6 | 3.0 | -7.2 | 14.4 | -1.6 | -11.1 | 8.8 |
| Jeju | 13.8 | -4.6 | 35.9 | 20.6 | -8.1 | 58.3 | -8.2 | -25.0 | 12.4 | 4.1 | -14.6 | 26.8 |
| Overall | 1.4 | -1.8 | 4.7 | 9.6 | 3.1 | 16.6 | 2.7 | -0.5 | 6.1 | -0.7 | -4.0 | 2.7 |
| SO2 | Seoul | 4.8 | -0.8 | 10.8 | 16.2 | 0.4 | 34.5 | 2.3 | -4.1 | 9.0 | -1.8 | -6.6 | 3.3 |
| Busan | 3.0 | -3.6 | 10.2 | 9.4 | -0.8 | 20.8 | 2.4 | -5.6 | 11.0 | -1.8 | -6.9 | 3.5 |
| Incheon | -4.1 | -10.7 | 3.0 | 4.2 | -8.6 | 18.7 | 5.0 | -1.8 | 12.2 | 1.7 | -3.8 | 7.6 |
| Daegu | -1.9 | -11.4 | 8.7 | 22.9 | -4.9 | 58.9 | 9.0 | -2.0 | 21.3 | -2.8 | -9.3 | 4.0 |
| Daejeon | 9.0 | -6.3 | 26.8 | 4.1 | -26.0 | 46.4 | -4.5 | -19.9 | 13.8 | 2.4 | -9.0 | 15.2 |
| Gwangju | -11.5 | -22.8 | 1.3 | 1.1 | -28.2 | 42.4 | 4.7 | -9.0 | 20.5 | -5.0 | -13.8 | 4.6 |
| Ulsan | 0.5 | -7.8 | 9.5 | 5.3 | -5.4 | 17.2 | 12.7 | -1.2 | 28.6 | -0.9 | -9.4 | 8.5 |
| Jeju | 17.1 | -0.3 | 37.5 | -23.4 | -38.7 | -4.4 | 18.6 | -3.0 | 45.0 | 2.9 | -7.6 | 14.6 |
| Overall | 1.3 | -4.3 | 7.1 | 5.2 | -5.7 | 17.4 | 5.1 | -0.1 | 10.6 | -1.0 | -4.2 | 2.4 |
| CO | Seoul | 1.3 | -2.8 | 5.6 | 4.5 | -2.5 | 12.1 | 3.4 | 0.3 | 6.6 | -1.9 | -4.2 | 0.5 |
| Busan | 1.9 | -5.1 | 9.4 | 12.1 | 1.4 | 23.8 | 4.2 | -2.2 | 11.1 | -0.4 | -6.1 | 5.5 |
| Incheon | -3.1 | -8.6 | 2.7 | 5.2 | -4.3 | 15.5 | 4.7 | 0.6 | 9.0 | 1.3 | -2.0 | 4.6 |
| Daegu | 3.2 | -4.3 | 11.2 | 9.0 | -2.4 | 21.6 | 5.7 | 0.0 | 11.8 | -4.5 | -8.7 | -0.2 |
| Daejeon | 3.7 | -4.6 | 12.7 | -3.0 | -17.2 | 13.7 | 3.1 | -4.5 | 11.3 | 3.8 | -1.6 | 9.4 |
| Gwangju | -3.6 | -9.8 | 3.0 | 6.2 | -4.7 | 18.4 | -3.3 | -8.7 | 2.5 | -3.9 | -7.9 | 0.2 |
| Ulsan | 6.9 | -3.6 | 18.5 | 1.9 | -11.0 | 16.7 | 2.8 | -6.3 | 12.9 | -4.2 | -11.1 | 3.4 |
| Jeju | -4.7 | -15.5 | 7.5 | -1.7 | -16.2 | 15.3 | 12.8 | -1.1 | 28.7 | 8.4 | -3.5 | 21.7 |
| Overall | 0.5 | -3.0 | 4.1 | 5.1 | -0.0 | 10.6 | 3.5 | 0.3 | 6.8 | -1.0 | -3.9 | 2.1 |

*Note*: IQR for PM10, 30.7 ㎍/m3; O3, 19.4 ppb; NO2, 12.2 ppb; SO2, 2.9 ppb; CO, 0.3 ppm. Lags for allergic disease PM10 [lag03] O3 [lag02] NO2 [lag0] SO2 [lag03] CO[lag0]; Asthma PM10 [lag03], O3 [lag02], NO2 [lag0] SO2 [lag03], CO[lag0]; Respiratory PM10 [lag03], O3 [lag1], NO2 [lag0], SO2 [lag03], CO[lag0]; Cardiovascular PM10 [lag02], O3 [lag0], NO2 [lag0], SO2 [lag02], CO[lag0].

(C) Selected respiratory disease

|  |  |  |
| --- | --- | --- |
|  |  | Percent increase in risk of hospitalization per IQR increase |
| Spring | Summer | Fall | Winter |
| PM10 | Seoul | 1.1 | -0.3 | 2.5 | 4.1 | 1.2 | 7.1 | 1.9 | -0.3 | 4.3 | 2.1 | -0.5 | 4.7 |
| Busan | 2.9 | 0.7 | 5.2 | 4.9 | -0.4 | 10.5 | 3.6 | -0.4 | 7.8 | 3.7 | -1.2 | 8.8 |
| Incheon | -0.9 | -3.0 | 1.2 | 4.3 | -0.7 | 9.5 | 3.3 | 0.2 | 6.4 | 2.0 | -1.7 | 5.9 |
| Daegu | 2.1 | -0.3 | 4.6 | 9.0 | 2.1 | 16.5 | 2.2 | -2.5 | 7.0 | 3.2 | -1.4 | 8.0 |
| Daejeon | 2.4 | -2.1 | 7.1 | 7.9 | -3.4 | 20.5 | -1.7 | -9.1 | 6.3 | -1.5 | -9.0 | 6.6 |
| Gwangju | 5.0 | 2.0 | 8.1 | 3.9 | -1.1 | 9.3 | 2.3 | -1.8 | 6.5 | -5.3 | -9.8 | -0.6 |
| Ulsan | -1.7 | -6.5 | 3.5 | 13.0 | 0.3 | 27.3 | 2.5 | -5.9 | 11.6 | 8.2 | -0.4 | 17.4 |
| Jeju | -0.4 | -5.6 | 5.0 | 10.4 | -1.7 | 24.1 | -2.6 | -10.2 | 5.7 | 10.3 | 0.9 | 20.7 |
| Overall | 1.5 | -0.4 | 3.4 | 5.6 | 2.5 | 8.9 | 2.1 | 0.0 | 4.2 | 2.2 | -1.4 | 5.8 |
| O3 | Seoul | 2.1 | -0.4 | 4.7 | 2.0 | 0.2 | 3.9 | 0.4 | -2.7 | 3.6 | 8.5 | 2.6 | 14.7 |
| Busan | 4.8 | 1.0 | 8.6 | 3.3 | 0.3 | 6.3 | 4.9 | 0.7 | 9.4 | 9.1 | 1.9 | 16.9 |
| Incheon | 2.4 | -0.9 | 5.7 | 3.6 | 0.6 | 6.7 | 1.3 | -2.6 | 5.3 | 4.6 | -2.5 | 12.2 |
| Daegu | 2.4 | -0.9 | 5.9 | 3.7 | 1.0 | 6.5 | 4.6 | 0.2 | 9.1 | 6.6 | 0.0 | 13.6 |
| Daejeon | 0.1 | -5.8 | 6.4 | 1.0 | -4.9 | 7.2 | 4.5 | -3.2 | 12.9 | 8.7 | -1.9 | 20.6 |
| Gwangju | 2.1 | -1.9 | 6.2 | 2.8 | -0.3 | 6.1 | 0.6 | -3.9 | 5.3 | 5.7 | -1.7 | 13.6 |
| Ulsan | 4.2 | -3.3 | 12.2 | 4.9 | -1.6 | 11.8 | 9.4 | 1.1 | 18.4 | 10.4 | -2.9 | 25.5 |
| Jeju | 2.2 | -5.7 | 10.7 | 2.3 | -4.6 | 9.8 | -4.0 | -12.2 | 5.0 | 8.4 | -4.9 | 23.7 |
| Overall | 2.6 | 0.7 | 4.5 | 2.9 | 1.4 | 4.5 | 2.5 | -0.3 | 5.4 | 7.4 | 3.8 | 11.2 |
| NO2 | Seoul | 1.4 | -0.3 | 3.2 | 3.1 | 0.5 | 5.7 | 1.3 | -0.5 | 3.1 | -0.3 | -2.3 | 1.8 |
| Busan | 3.7 | 0.7 | 6.8 | 5.8 | 1.5 | 10.3 | 6.5 | 2.8 | 10.2 | 2.9 | -0.9 | 6.9 |
| Incheon | -0.6 | -3.3 | 2.2 | 7.7 | 2.9 | 12.8 | 2.3 | -0.2 | 4.8 | -0.2 | -3.1 | 2.9 |
| Daegu | 4.5 | 0.9 | 8.3 | 2.6 | -4.2 | 9.8 | 2.4 | -1.1 | 6.1 | 0.4 | -2.6 | 3.6 |
| Daejeon | -2.8 | -10.2 | 5.1 | 7.9 | -7.1 | 25.2 | -1.4 | -8.1 | 5.7 | 2.4 | -4.0 | 9.3 |
| Gwangju | 0.9 | -3.4 | 5.5 | 4.0 | -2.8 | 11.3 | 1.6 | -2.6 | 6.0 | 1.0 | -2.7 | 4.7 |
| Ulsan | -3.4 | -10.3 | 4.0 | 5.8 | -5.9 | 18.8 | -0.2 | -7.8 | 7.9 | 2.8 | -4.5 | 10.6 |
| Jeju | 4.1 | -7.0 | 16.6 | 15.9 | -5.5 | 42.2 | 6.5 | -8.7 | 24.2 | 14.6 | -1.6 | 33.6 |
| Overall | 1.4 | -1.1 | 3.9 | 5.0 | 1.7 | 8.5 | 2.3 | -0.1 | 4.7 | 1.0 | -1.1 | 3.2 |
| SO2 | Seoul | 1.6 | -1.7 | 5.0 | 11.5 | 3.5 | 20.2 | 2.2 | -1.4 | 6.0 | -0.9 | -4.1 | 2.3 |
| Busan | 1.6 | -2.2 | 5.5 | 5.5 | 0.2 | 11.1 | 2.3 | -2.4 | 7.3 | 3.2 | -0.1 | 6.6 |
| Incheon | -1.8 | -5.6 | 2.1 | 2.1 | -4.8 | 9.6 | 3.5 | -0.1 | 7.3 | -1.7 | -5.1 | 1.8 |
| Daegu | 1.4 | -3.2 | 6.2 | 12.4 | -0.5 | 26.9 | 0.5 | -5.1 | 6.4 | 0.6 | -2.6 | 3.9 |
| Daejeon | 0.1 | -10.2 | 11.5 | 1.4 | -21.8 | 31.3 | -2.7 | -13.7 | 9.6 | -2.0 | -9.6 | 6.3 |
| Gwangju | -5.1 | -10.6 | 0.6 | 17.6 | 2.0 | 35.6 | 7.3 | 0.3 | 14.8 | -5.5 | -9.7 | -1.1 |
| Ulsan | 0.4 | -6.0 | 7.2 | -1.8 | -9.6 | 6.7 | -0.5 | -9.4 | 9.3 | 4.7 | -1.6 | 11.4 |
| Jeju | -0.9 | -11.0 | 10.4 | -1.4 | -17.0 | 17.1 | 6.3 | -8.5 | 23.5 | 6.6 | -1.8 | 15.7 |
| Overall | -0.1 | -2.7 | 2.6 | 5.8 | -0.2 | 12.1 | 2.5 | -0.4 | 5.6 | 0.2 | -2.8 | 3.3 |
| CO | Seoul | 2.4 | -0.1 | 4.9 | 4.0 | 0.3 | 7.8 | 0.8 | -1.0 | 2.6 | -0.1 | -1.6 | 1.5 |
| Busan | 2.8 | -1.3 | 7.1 | 3.3 | -1.9 | 8.9 | 5.7 | 1.8 | 9.7 | 2.7 | -1.0 | 6.6 |
| Incheon | -1.2 | -4.4 | 2.1 | 3.8 | -1.4 | 9.3 | 2.4 | 0.1 | 4.7 | -0.8 | -2.9 | 1.3 |
| Daegu | 3.5 | -0.1 | 7.2 | 2.9 | -2.2 | 8.3 | 1.6 | -1.5 | 4.8 | -0.2 | -2.4 | 2.1 |
| Daejeon | -4.1 | -10.0 | 2.3 | -0.4 | -11.6 | 12.2 | -3.3 | -8.2 | 1.9 | 0.9 | -2.8 | 4.7 |
| Gwangju | -0.6 | -3.5 | 2.5 | 1.2 | -3.3 | 5.9 | -0.7 | -3.4 | 2.1 | -0.3 | -2.3 | 1.7 |
| Ulsan | -0.2 | -7.9 | 8.1 | 16.8 | 5.7 | 29.0 | 1.9 | -5.0 | 9.2 | 2.8 | -2.7 | 8.5 |
| Jeju | -1.7 | -9.4 | 6.7 | 9.6 | -2.5 | 23.1 | -0.7 | -10.5 | 10.1 | 9.7 | 0.0 | 20.4 |
| Overall | 0.6 | -1.7 | 3.0 | 4.1 | 0.7 | 7.6 | 1.2 | -1.1 | 3.5 | 0.4 | -1.2 | 2.1 |

*Note*: IQR for PM10, 30.7 ㎍/m3; O3, 19.4 ppb; NO2, 12.2 ppb; SO2, 2.9 ppb; CO, 0.3 ppm. Lags for allergic disease PM10 [lag03] O3 [lag02] NO2 [lag0] SO2 [lag03] CO[lag0]; Asthma PM10 [lag03], O3 [lag02], NO2 [lag0] SO2 [lag03], CO[lag0]; Respiratory PM10 [lag03], O3 [lag1], NO2 [lag0], SO2 [lag03], CO[lag0]; Cardiovascular PM10 [lag02], O3 [lag0], NO2 [lag0], SO2 [lag02], CO[lag0].

(D) Cardiovascular disease

|  |  |  |
| --- | --- | --- |
|  |  | Percent increase in risk of hospitalization per IQR increase |
| Spring | Summer | Fall | Winter |
| PM10 | Seoul | 0.4 | -0.6 | 1.5 | 0.2 | -1.9 | 2.4 | 2.3 | 0.0 | 4.7 | -0.4 | -2.5 | 1.7 |
| Busan | -0.2 | -1.8 | 1.6 | -1.5 | -5.1 | 2.2 | 4.3 | 0.3 | 8.4 | 2.5 | -1.5 | 6.7 |
| Incheon | -0.4 | -2.2 | 1.4 | -1.7 | -5.1 | 1.7 | 2.4 | -0.6 | 5.6 | 0.1 | -3.0 | 3.2 |
| Daegu | 1.6 | -0.2 | 3.5 | -0.8 | -5.1 | 3.6 | 3.7 | -0.3 | 7.8 | 0.2 | -3.8 | 4.3 |
| Daejeon | -1.4 | -3.6 | 0.9 | 0.5 | -4.2 | 5.5 | 4.8 | -0.1 | 9.9 | -1.1 | -5.0 | 3.0 |
| Gwangju | 0.5 | -2.0 | 3.1 | -2.5 | -6.6 | 1.8 | 3.7 | -0.7 | 8.3 | -2.5 | -6.9 | 2.1 |
| Ulsan | 2.0 | -0.7 | 4.7 | 2.8 | -3.0 | 9.1 | 6.1 | 0.4 | 12.1 | 0.2 | -5.0 | 5.7 |
| Jeju | -0.3 | -3.7 | 3.2 | 2.6 | -3.4 | 8.9 | 3.5 | -1.3 | 8.5 | 4.9 | -0.9 | 11.0 |
| Overall | 0.3 | -0.7 | 1.3 | -0.4 | -2.2 | 1.5 | 3.5 | 1.7 | 5.2 | 0.2 | -1.7 | 2.1 |
| O3 | Seoul | 0.4 | -2.0 | 2.8 | -1.0 | -2.8 | 0.8 | -0.9 | -4.8 | 3.1 | -3.0 | -7.9 | 2.2 |
| Busan | -2.6 | -6.2 | 1.1 | -0.6 | -3.1 | 2.1 | -6.4 | -10.9 | -1.7 | -6.1 | -11.7 | -0.1 |
| Incheon | -1.2 | -4.3 | 2.0 | -1.7 | -4.1 | 0.8 | -4.0 | -8.1 | 0.3 | -5.4 | -11.3 | 0.9 |
| Daegu | -0.2 | -4.0 | 3.7 | -2.2 | -4.7 | 0.3 | -3.1 | -7.7 | 1.8 | -5.5 | -11.2 | 0.6 |
| Daejeon | 0.0 | -3.8 | 4.0 | -1.9 | -5.3 | 1.7 | 1.7 | -4.4 | 8.3 | -3.9 | -9.5 | 2.2 |
| Gwangju | 1.1 | -3.5 | 5.8 | -1.0 | -4.3 | 2.4 | 2.6 | -3.5 | 9.0 | 0.0 | -7.3 | 8.0 |
| Ulsan | -6.2 | -11.1 | -1.0 | 0.5 | -3.5 | 4.6 | -3.2 | -9.4 | 3.4 | -4.4 | -12.6 | 4.7 |
| Jeju | -0.9 | -7.3 | 6.0 | -1.9 | -6.2 | 2.7 | 4.0 | -2.6 | 11.0 | -1.4 | -10.8 | 9.0 |
| Overall | -0.9 | -2.9 | 1.0 | -1.3 | -2.5 | 0.0 | -1.6 | -4.5 | 1.5 | -3.9 | -6.8 | -1.0 |
| NO2 | Seoul | 1.3 | -0.2 | 2.8 | 0.2 | -1.9 | 2.3 | 2.4 | 0.4 | 4.5 | 0.7 | -1.2 | 2.7 |
| Busan | 4.1 | 1.5 | 6.8 | 1.2 | -2.2 | 4.8 | 6.8 | 2.9 | 10.9 | 1.7 | -1.6 | 5.2 |
| Incheon | 2.1 | -0.4 | 4.8 | 1.9 | -1.8 | 5.7 | 2.6 | 0.0 | 5.4 | 2.5 | -0.4 | 5.4 |
| Daegu | 1.9 | -1.1 | 4.9 | -0.8 | -5.7 | 4.4 | 2.1 | -1.1 | 5.5 | 2.9 | 0.0 | 5.8 |
| Daejeon | -0.4 | -4.5 | 3.8 | 0.5 | -6.4 | 8.1 | 4.0 | -1.1 | 9.4 | 2.6 | -1.1 | 6.4 |
| Gwangju | 2.8 | -1.4 | 7.2 | -0.8 | -6.9 | 5.6 | 2.6 | -2.3 | 7.9 | 0.7 | -3.0 | 4.6 |
| Ulsan | 1.3 | -3.0 | 5.9 | -0.8 | -6.8 | 5.7 | 8.6 | 2.6 | 15.0 | 3.3 | -1.6 | 8.4 |
| Jeju | 7.3 | -1.7 | 17.0 | 19.4 | 5.5 | 35.2 | 12.9 | 1.4 | 25.7 | 6.0 | -4.4 | 17.6 |
| Overall | 2.1 | 0.4 | 3.8 | 0.9 | -1.6 | 3.5 | 4.0 | 1.6 | 6.5 | 2.0 | 0.4 | 3.6 |
| SO2 | Seoul | 1.6 | -0.9 | 4.1 | -1.1 | -6.6 | 4.7 | 3.1 | -0.8 | 7.2 | -0.6 | -3.3 | 2.1 |
| Busan | 0.2 | -2.7 | 3.1 | -0.1 | -3.6 | 3.6 | 3.3 | -1.4 | 8.2 | 1.3 | -1.4 | 4.1 |
| Incheon | 0.3 | -2.8 | 3.5 | -0.3 | -5.3 | 4.9 | 2.9 | -0.9 | 6.8 | 0.3 | -2.7 | 3.4 |
| Daegu | 1.2 | -2.2 | 4.6 | -3.1 | -10.7 | 5.2 | 3.9 | -1.0 | 9.0 | 1.5 | -1.2 | 4.3 |
| Daejeon | 0.0 | -5.0 | 5.3 | -2.4 | -12.8 | 9.2 | 4.8 | -3.1 | 13.4 | 0.7 | -3.3 | 4.8 |
| Gwangju | 0.6 | -4.2 | 5.6 | 7.8 | -4.1 | 21.2 | 4.6 | -2.8 | 12.6 | -1.2 | -5.2 | 2.9 |
| Ulsan | 0.8 | -2.7 | 4.5 | 0.4 | -3.6 | 4.5 | 8.4 | 1.7 | 15.5 | -0.2 | -4.0 | 3.7 |
| Jeju | 7.4 | 0.1 | 15.2 | 6.0 | -3.9 | 17.0 | 4.7 | -5.5 | 16.1 | 7.3 | 2.0 | 12.9 |
| Overall | 1.1 | -0.6 | 2.8 | 0.2 | -2.7 | 3.2 | 4.0 | 1.5 | 6.7 | 0.8 | -0.9 | 2.6 |
| CO | Seoul | 2.8 | 0.7 | 4.9 | 0.5 | -2.5 | 3.5 | 1.1 | -1.0 | 3.3 | 0.1 | -1.4 | 1.5 |
| Busan | 3.9 | 0.4 | 7.5 | -0.7 | -4.8 | 3.6 | 4.5 | 0.3 | 8.8 | -1.0 | -4.2 | 2.3 |
| Incheon | 2.6 | -0.4 | 5.7 | -0.5 | -4.5 | 3.6 | 0.5 | -2.0 | 3.0 | 0.7 | -1.2 | 2.6 |
| Daegu | 1.3 | -1.6 | 4.3 | -1.8 | -5.5 | 2.0 | 1.1 | -1.8 | 4.0 | 0.2 | -1.8 | 2.3 |
| Daejeon | -0.4 | -3.6 | 2.9 | 4.3 | -1.3 | 10.3 | 1.4 | -2.3 | 5.2 | 0.2 | -1.9 | 2.3 |
| Gwangju | 0.8 | -2.0 | 3.6 | 2.6 | -1.6 | 6.9 | 1.8 | -1.4 | 5.1 | -1.0 | -3.0 | 1.1 |
| Ulsan | 2.7 | -1.9 | 7.5 | 2.5 | -3.1 | 8.5 | 5.4 | 0.2 | 10.9 | 0.5 | -3.0 | 4.1 |
| Jeju | 4.1 | -2.1 | 10.7 | 2.9 | -4.1 | 10.5 | 4.3 | -3.3 | 12.5 | 4.5 | -1.8 | 11.2 |
| Overall | 2.0 | 0.5 | 3.6 | 0.8 | -1.3 | 3.0 | 1.9 | 0.1 | 3.6 | 0.1 | -1.0 | 1.2 |

*Note*: IQR for PM10, 30.7 ㎍/m3; O3, 19.4 ppb; NO2, 12.2 ppb; SO2, 2.9 ppb; CO, 0.3 ppm. Lags for allergic disease PM10 [lag03] O3 [lag02] NO2 [lag0] SO2 [lag03] CO[lag0]; Asthma PM10 [lag03], O3 [lag02], NO2 [lag0] SO2 [lag03], CO[lag0]; Respiratory PM10 [lag03], O3 [lag1], NO2 [lag0], SO2 [lag03], CO[lag0]; Cardiovascular PM10 [lag02], O3 [lag0], NO2 [lag0], SO2 [lag02], CO[lag0].

eTable 9. Percent increase in risk of hospitalization per IQR increase in O3 by cause for each city and overall by season, for weekdays only.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| City | Allergic disease | Asthma | Selected respiratory disease | Cardiovascular disease |
| Estimate % | 95% CI | Estimate % | 95% CI | Estimate % | 95% CI | Estimate % | 95% CI |
| Seoul | 3.7 | -0.8 | 8.3 | 3.3 | -1.2 | 7.9 | 1.7 | 0.1 | 3.4 | -1.2 | -2.8 | 0.4 |
| Busan | 11.0 | 4.8 | 17.6 | 11.5 | 5.3 | 18.2 | 4.3 | 1.8 | 6.8 | -3.3 | -5.4 | -1.1 |
| Incheon | 6.8 | 0.7 | 13.3 | 8.3 | 2.2 | 14.7 | 3.7 | 1.4 | 5.9 | -2.0 | -4.0 | 0.0 |
| Daegu | 3.8 | -2.8 | 10.9 | 3.4 | -3.0 | 10.3 | 2.6 | 0.4 | 4.8 | -2.3 | -4.3 | -0.2 |
| Daejeon | 10.9 | 1.5 | 21.3 | 12.2 | 2.6 | 22.7 | -1.1 | -5.1 | 3.1 | -1.8 | -4.2 | 0.7 |
| Gwangju | 3.4 | -4.1 | 11.4 | 3.6 | -3.8 | 11.5 | 1.9 | -0.6 | 4.5 | 0.5 | -2.2 | 3.1 |
| Ulsan | 12.5 | 3.4 | 22.4 | 12.2 | 3.0 | 22.2 | 2.8 | -1.9 | 7.7 | -1.6 | -4.5 | 1.4 |
| Jeju | 1.0 | -8.5 | 11.5 | 4.9 | -4.1 | 14.8 | 0.9 | -4.3 | 6.3 | -1.2 | -4.4 | 2.1 |
| Overall | 6.5 | 2.8 | 10.3 | 7.0 | 3.2 | 10.8 | 2.4 | 0.9 | 3.8 | -1.7 | -2.8 | -0.6 |

*Note*: IQR for O3, 19.4 ppb. Lags for allergic disease, lag02; Asthma, lag02; Respiratory, lag1; Cardiovascular, lag0.

eTable 10. Overall percent increase in risk of hospitalization per IQR increase in air pollutant by cause and sex

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Cause | Sex | PM10 | O3 | NO2 | SO2 | CO |
| Estimate % | 95% PI | Estimate % | 95% PI | Estimate % | 95% PI | Estimate % | 95% PI | Estimate % | 95% PI |
| Allergic disease | Male | 1.8 | -0.1 | 3.8 | 7.5 | 3.7 | 11.5 | 2.5 | 0.3 | 4.7 | 1.3 | -1.3 | 4.0 | 2.0 | 0.2 | 3.7 |
| Female | 1.6 | -0.5 | 3.8 | 5.5 | 2.0 | 9.2 | 0.9 | -1.2 | 3.0 | -0.1 | -3.4 | 3.3 | -1.0 | -3.1 | 1.0 |
| Asthma | Male | 2.4 | 0.6 | 4.3 | 7.2 | 3.6 | 10.9 | 2.0 | 0.0 | 4.1 | 1.8 | -0.9 | 4.5 | 1.8 | -0.1 | 3.7 |
| Female | 2.0 | 0.0 | 4.0 | 6.2 | 2.1 | 10.6 | 1.0 | -1.0 | 3.2 | 0.6 | -2.5 | 3.8 | -0.7 | -2.5 | 1.1 |
| Respiratory | Male | 1.5 | 0.5 | 2.4 | 3.1 | 1.8 | 4.3 | 2.1 | 0.3 | 3.9 | 1.2 | -0.4 | 2.8 | 1.0 | -0.3 | 2.3 |
| Female | 1.9 | 0.7 | 3.1 | 3.8 | 2.1 | 5.4 | 2.2 | 0.4 | 4.0 | 2.0 | 0.4 | 3.6 | 0.7 | -0.7 | 2.1 |
| Cardiovascular | Male | 0.4 | -0.4 | 1.2 | -1.6 | -2.7 | -0.5 | 2.2 | 1.0 | 3.4 | 1.2 | -0.1 | 2.5 | 0.7 | -0.1 | 1.6 |
| Female | 1.1 | 0.1 | 2.2 | -1.7 | -3.0 | -0.3 | 2.2 | 0.9 | 3.4 | 1.0 | -0.2 | 2.2 | 0.7 | -0.2 | 1.7 |

*Note*: IQR for PM10, 30.7 ㎍/m3; O3, 19.4 ppb; NO2, 12.2 ppb; SO2, 2.9 ppb; CO, 0.3 ppm.

Lags for allergic disease PM10 [lag03] O3 [lag02] NO2 [lag0] SO2 [lag03] CO[lag0]; Asthma PM10 [lag03], O3 [lag02], NO2 [lag0] SO2 [lag03], CO[lag0]; Respiratory PM10 [lag03], O3 [lag1], NO2 [lag0], SO2 [lag03], CO[lag0]; Cardiovascular PM10 [lag02], O3 [lag0], NO2 [lag0], SO2 [lag02], CO[lag0].

eTable 11. Overall percent increase in risk of hospitalization per IQR increase in air pollutant by cause and age

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Cause | Age (years) | PM10 | O3 | NO2 | SO2 | CO |
| Estimate % | 95% PI | Estimate % | 95% PI | Estimate % | 95% PI | Estimate % | 95% PI | Estimate % | 95% PI |
| Allergic disease | 0-14  | 1.9 | -0.3 | 4.2 | 7.0 | 3.7 | 10.5 | 2.1 | -0.1 | 4.4 | 1.4 | -1.2 | 4.1 | 0.8 | -1.4 | 3.0 |
| 15-64 | -0.4 | -2.5 | 1.8 | 1.3 | -3.7 | 6.6 | 0.4 | -2.5 | 3.4 | -1.8 | -6.4 | 3.1 | -0.6 | -3.0 | 1.9 |
| 65-74 | 0.5 | -2.1 | 3.1 | 4.9 | 0.1 | 10.0 | 0.4 | -3.1 | 3.9 | -0.3 | -4.6 | 4.2 | 1.2 | -1.6 | 4.2 |
| ≥75 | 2.3 | -0.2 | 4.8 | 4.3 | -0.1 | 9.0 | 1.1 | -2.9 | 5.3 | 2.3 | -1.1 | 5.9 | 2.3 | -2.2 | 7.0 |
| Asthma | 0-14  | 2.4 | 0.2 | 4.6 | 7.3 | 4.0 | 10.7 | 2.1 | -0.1 | 4.2 | 1.6 | -1.1 | 4.4 | 0.4 | -1.7 | 2.6 |
| 15-64 | 0.9 | -1.2 | 3.0 | 2.3 | -2.1 | 6.9 | -1.3 | -3.7 | 1.3 | -0.3 | -3.5 | 3.1 | -1.1 | -3.1 | 0.9 |
| 65-74 | 0.8 | -1.5 | 3.1 | 3.4 | -2.7 | 9.8 | 1.3 | -1.5 | 4.2 | -0.2 | -3.8 | 3.4 | 1.6 | -1.1 | 4.4 |
| ≥75 | 2.9 | 0.2 | 5.7 | 4.9 | 0.3 | 9.6 | 0.0 | -4.0 | 4.2 | 1.9 | -1.2 | 5.1 | 0.7 | -2.7 | 4.1 |
| Respiratory | 0-14  | 0.9 | -0.2 | 1.9 | 3.2 | 1.9 | 4.5 | 2.6 | 0.5 | 4.7 | 1.2 | -0.3 | 2.7 | 0.8 | -0.5 | 2.1 |
| 15-64 | 2.4 | 0.6 | 4.3 | 3.4 | 1.6 | 5.2 | 1.6 | -0.5 | 3.7 | 2.0 | 0.0 | 4.2 | 0.9 | -0.6 | 2.3 |
| 65-74 | 2.7 | 0.3 | 5.2 | 1.5 | -0.8 | 3.9 | 1.4 | -0.9 | 3.8 | 1.0 | -2.4 | 4.6 | 1.0 | -0.7 | 2.8 |
| ≥75 | 3.4 | 1.0 | 5.7 | 4.3 | 1.1 | 7.5 | 1.2 | -1.1 | 3.7 | 2.3 | -0.2 | 4.9 | 1.4 | -1.7 | 4.7 |
| Cardiovascular | 0-14  | -1.4 | -3.7 | 1.0 | -1.1 | -4.6 | 2.5 | -0.1 | -3.8 | 3.8 | -1.7 | -4.4 | 1.2 | 0.5 | -3.4 | 4.6 |
| 15-64 | 0.5 | -0.3 | 1.2 | -1.9 | -3.1 | -0.7 | 2.0 | 0.9 | 3.1 | 1.1 | -0.2 | 2.3 | 0.3 | -0.5 | 1.1 |
| 65-74 | 0.6 | -0.4 | 1.7 | -1.9 | -3.3 | -0.4 | 2.2 | 0.7 | 3.7 | 0.9 | -0.5 | 2.4 | 1.4 | 0.1 | 2.7 |
| ≥75 | 1.8 | 0.4 | 3.2 | -0.7 | -2.5 | 1.1 | 2.5 | 0.8 | 4.3 | 1.6 | 0.0 | 3.2 | 2.1 | 0.6 | 3.7 |

*Note*: IQR for PM10, 30.7 ㎍/m3; O3, 19.4 ppb; NO2, 12.2 ppb; SO2, 2.9 ppb; CO, 0.3 ppm.

Lags for allergic disease PM10 [lag03] O3 [lag02] NO2 [lag0] SO2 [lag03] CO[lag0]; Asthma PM10 [lag03], O3 [lag02], NO2 [lag0] SO2 [lag03], CO[lag0]; Respiratory PM10 [lag03], O3 [lag1], NO2 [lag0], SO2 [lag03], CO[lag0]; Cardiovascular PM10 [lag02], O3 [lag0], NO2 [lag0], SO2 [lag02], CO[lag0].

eTable 12. Comparison of findings with other Asian studies of air pollution and hospital admissions

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Study | Location(Time period) | Population | Pollutant | IQR | Hospitalization causes | Estimate %(95% confidence interval) |
| This study | Seoul (2003-2008) | All ages | PM10 | 30.7 | Allergic disease | 2.7 (1.1, 4.4) |
|  |  |  |  |  | Asthma | 3.1 (1.5, 4.8) |
|  |  |  |  |  | Selected respiratory disease | 1.8 (0.8, 2.8) |
|  |  |  |  |  | Cardiovascular disease | 0.6 (-0.2, 1.5) |
|  | Overall (2003-2008) |  | PM10 | 30.7 | Allergic disease | 2.2 (0.5, 3.9) |
|  |  |  |  |  | Asthma | 2.8 (1.3, 4.4) |
|  |  |  |  |  | Selected respiratory disease | 1.7 (0.9, 2.6) |
|  |  |  |  |  | Cardiovascular disease | 0.7 (0.0, 1.4) |
|  | Seoul (2003-2008) |  | NO2 | 12.2 | Allergic disease | 1.8 (0.1, 3.5) |
|  |  |  |  |  | Asthma | 1.4 (-0.2, 3.1) |
|  |  |  |  |  | Selected respiratory disease | 1.4 (0.4, 2.4) |
|  |  |  |  |  | Cardiovascular disease | 1.3 (0.4, 2.2) |
|  | Overall (2003-2008) |  | NO2 | 12.2 | Allergic disease | 2.3 (0.6, 4.0) |
|  |  |  |  |  | Asthma | 2.2 (0.3, 4.1) |
|  |  |  |  |  | Selected respiratory disease | 2.2 (0.6, 3.7) |
|  |  |  |  |  | Cardiovascular disease | 2.2 (1.1, 3.4) |
| Yi et al. (2010) | Seoul (2001-2006) | All ages | PM10 | 30.7 | Cardiovascular | 2.4 (1.6, 3.1) |
|  |  |  |  |  | Respiratory | 3.7 (2.9, 4.5) |
| Lee et al. (2002) | Seoul (1997-1999) | Children (under 15 years) | PM10 | 30.7 | Asthma | 5.3 (3.0, 7.6) |
|  |  |  | NO2 | 12.2 | Asthma | 12.4 (8.3, 16.6) |
| Lee et al. (2003) | Seoul (1997-1999) | Elderly (64+ years) | PM10 | 30.7 | Ischemic cardiovascular disease | 3.8 (0.8, 6.9) |
|  |  |  | NO2 | 12.2 | Ischemic cardiovascular disease | 6.6 (2.5, 11.0) |
| Chen et al. (2010) | Shanghai, China (2005-2007) | All ages | NO2 | 12.2 | Total hospital admissions | 1.2 (0.1, 2.3) |
|  |  |  |  |  | Cardiovascular admissions | 1.0 (0.1, 1.8) |
| Cheng et al. (2009a) | Kaohsiung, Taiwan (1996-2006) | All ages | PM10 | 30.7 | Myocardial infarction | Cool days: 18.1 (12.6, 24.0) |
|  |  |  | NO2 | 12.2 | Myocardial infarction | Warm days: 13.7 (3.7, 24.7)Cool days: 41.4 (30.8, 52.8) |
| Cheng et al. (2009b) | Kaohsiung, Taiwan (1996-2006) | All ages | PM10 | 30.7 | Pneumonia with URI | Warm days: 13.0 (5.3, 21.3)Cool days: 30.1 (22.3, 38.4) |
|  |  |  | NO2 | 12.2 | Pneumonia with URI | Warm days: 28.2 (14.4, 43.6) |
| Chiu et al. (2009) | Taipei, Taiwan(1996-2004) | All ages | PM10 | 30.7 | Pneumonia | Warm days: 12.6 (9.1, 16.1)Cool days: 10.3 (8.0, 12.6) |
|  |  |  | NO2 | 12.2 | Pneumonia | Warm days: 27.3 (23.5, 31.2)Cool days: 8.6 (4.9, 12.4) |
| Hsieh et al. (2010) | Taipei, Taiwan(1996-2006) | All ages | PM10 | 30.7 | Myocardial infarction | Warm days: 10.2 (5.7, 15.0)Cool days: 7.9 (4.5, 11.5) |
|  |  |  | NO2 | 12.2 | Myocardial infarction | Warm days: 14.2 (9.4, 19.1)Cool days: 15.4 (10.6, 20.3) |
| Lee et al. (2008) | Taipei, Taiwan(1996-2005) | All ages | PM10 | 30.7 | Congestive heart failure | With hypertension: 26.1 (16.9, 35.9)With diabetes: 22.6 (13.5, 32.5)With dysrhythmia: 19.2 (9.0, 30.4)With COPD: 23.8 (7.9, 42.0) |
|  |  |  | NO2 | 12.2 | Congestive heart failure | With hypertension: 26.4 (16.7, 37.0)With diabetes: 22.8 (13.1, 33.3)With dysrhythmia: 20.4 (9.5, 32.3)With COPD: 25.2 (9.5, 43.2) |
| Tsai et al. (2012) | Taipei, Taiwan(1999-2009) | All ages | PM10 | 30.7 | Myocardial infarction | With hypertension: warm days 7.9 (0.0, 16.5); cool days 9.1 (3.4, 15.0)With diabetes: warm days 11.3 (2.3, 21.2)  |
|  |  |  | NO2 | 12.2 | Myocardial infarction | With hypertension: warm days 14.2 (7.1, 21.9); cool days 16.6 (9.5, 24.3)With diabetes: warm days 16.6 (8.3, 25.6); cool days 14.2 (5.9, 23.2)With CHF: warm days 16.6 (3.5, 31.4); cool days 14.2 (2.4, 27.5)With arrhythmia: warm days 17.8 (2.4, 35.7) |

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