Summary of air pollution epidemiologic findings in Korea

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A growing body of literature has demonstrated an association between day-to-day fluctuations in air pollution and daily morbidity and mortality. In recent years, a number of epidemiologic studies in Korea have reported that air pollution has an effect on human health conditions, including hospital admissions from asthma and ischemic heart diseases, decreased pulmonary functions, mortality from all-cause and stroke etc. These observations suggest that finer urban particles have a more adverse health impact to sensitive population such as children, the elderly, and people with lower socioeconomic condition. In regard to these suggestions, here I introduce three investigations on the health effect of urban air pollution in Korea. Each study had its own research hypothesis of estimating the health risks of urban air pollution.

The first study that I introduce is a panel study to investigate an association between particulate matter and the peak expiratory flow rate (PEFR) in the elderly and to compare estimated risks using PM_{10} or PM_{2.5} levels as a measure of exposure. During a 2-year longitudinal follow-up study, we contacted subjects living in an asylum for the elderly, provided them with a mini-Wright peak flow meter, and instructed to record all the flow readings, any respiratory symptoms, passive smoking activity, and hours spent outdoors for that given day. Daily levels of particulate matter were measured by two separate mini-volume air samplers (for PM_{10} and PM_{2.5}) placed on the rooftop of the two-story residence asylum building. In our statistical models, we assumed that the expected response varied linearly for each participant with a slope and intercept that depended on fixed or time-varying covariates using a mixed linear model. The daily mean levels of PM_{10} and PM_{2.5} were 78μg/m³ and 56μg/m³, respectively. For every 10μg/m³ increase in PM_{10} and PM_{2.5} levels, there was an estimated PEFR change of -0.39l/min (95% CI, -0.63, -0.14) and -0.54l/min (95% CI, -0.89, -0.19), respectively. These data also suggest that fine particles have a more adverse respiratory health impact for sensitive individuals such as the elderly and that more research and control strategies should focus on the smaller particles associated with air pollution.

The second study is designed to estimate the relative risk of mortality associated with Asian dust events. We used the daily counts of non-accidental deaths, air pollution and meteorological data in Seoul, Korea from 2000 to 2004. We divided all days during the study period into two groups according to the presence or absence of Asian dust events. For each group, we conducted time-series analysis to estimate the relative risk of total non-accidental death when the concentration of each air pollutant increased by the inter-quartile range (IQR). The average concentrations of every air pollutant on the days without a dust event were lower than those on the days with such an event. We found that the effect sizes of air pollution on daily death rates in the model without Asian dust events were larger than those in the model with Asian dust events, and were statistically significant for all air pollutants (PM_{10}, CO, NO_{2}, and SO_{2}) except for O_{3}. Our results suggest that we are likely to underestimate the risk of urban air particles if we analyze the effect size of air pollution on daily mortality during Asian dust events. We hypothesize that the real health effect is much larger than previous results suggested.

The last study is to see whether there were any health benefits of mitigated air pollution concentration due to reduced traffic flow during a citywide intervention for the 2002 Summer Asian Games. Relative risks of hospitalization for childhood asthma during the post-Asian Game period compared with the baseline period were estimated using a time-series analysis of the generalized additive Poisson model. Fourteen consecutive days of traffic volume control in Busan during the Games reduced all regulated air pollutant levels by 1–25%. The estimated relative risk of hospitalization during the post-Games period over the baseline period was 0.73 (95% confidence interval [CI] _0.49, 1.11). We observed that this reduced air pollution was unique in 2002 when the traffic volume reduction program was applied during the Games period. This empirical data provides epidemiologic evidence of the health benefits resulting from environmental interventions to reduce ambient air pollution.