Teasing Apart the Role of Location and Atmospheric Conditions in Air Pollution Exposures for Health Effect Analyses: Results from the CABS Air Pollution Exposure Substudy

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A weakness of most air pollution health effect studies is that they use ambient monitor data averaged over one or more ambient monitors to represent daily air pollution exposures for individuals. These studies implicitly rely on the assumption of a homogeneous spatial distribution for particulate matter (PM). We conducted a case-crossover study to assess the effect of PM on the risk of out of hospital sudden cardiac arrest. One advantage of this design over an ecologic time series design is the direct ability to use subject-specific exposures and confounders. To partially assess the impact of substituting regional PM (i.e. the average of three ambient monitor measurements) for individual PM exposure, we conducted an exposure substudy to identify the influence of location factors, specifically urban versus suburban classification and topographic features ("upstream" versus "downstream"), on local ambient measurements. Using nephelometer measurements collected over one year in four locations, we developed regression models to predict local PM as a function of regional PM, atmospheric stagnation, and location. Most notable, we found a significant interaction between atmospheric stagnation and topography, with the most "upstream" site having reduced PM levels on high stagnation days after controlling for regional PM. This interaction reorders the usual exposures in the case-crossover analysis for subjects living in upstream locations, potentially producing different case-crossover study results from the analysis using regional PM as the exposure.

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