Air Pollution and Asthma:
The Effects of Ambient Exposure on Asthma Medication Use

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Asthma is a growing concern nationwide. The prevalence of self-reported asthma has increased by approximately 50 percent over the last 10 years with around 30 percent experienced by children under the age of 15. (Chestnut et al., 1999). While it is still not clear from the literature that air pollution exposure causes asthma, a number of studies have shown that short-term or daily increases in exposure to air pollution can exacerbate asthma. Most of these studies, however, have used emergency room visits and hospital admissions for asthma as the measure of asthma exacerbation (e.g., Walters et al., 1993; Schwartz et al., 1993; Sheppard et al., 1999; Sunyer et al., 1997; Lipsett et al., 1997; Hajat et al., 1999). By construction, these studies focus on severe asthma cases; however, the effects of pollution on asthma can also include less severe outcomes, such as increased use in medication to control asthma symptoms.

It is difficult to ascertain the effects of air pollution on less severe asthma exacerbation because of limited data sources. The few studies that do focus on more moderate effects, such as impaired lung function, increased medication use, and exacerbation of asthma symptoms not requiring immediate medical attention, tend to rely on panel data collected from small groups of asthmatics over time (Pope et al., 1991; Ostro et al., 1991). While panel data analysis can be a powerful tool to investigate the effects of air pollution on acute asthma symptoms, analysis can be complicated by serial correlation in the data and the heterogeneity among the sample subjects (Schwartz et al., 1991).

We have obtained several novel data sets that will allow us to investigate not only the acute effects of air pollution exposure on asthma medication use but also the longer-term effects of exposure on medication use. Using two data sets of daily asthma prescriptions, we will evaluate the relationship between short-term exposure to air pollution and asthma exacerbation. Asthma prescription data were obtained for the Los Angeles and San Francisco metropolitan areas for 1998 through 2001 from NDC Health Information Services (NDC), which tracks prescriptions dispensed from about 60% of the pharmacies in the United States, representing about 70% of all prescriptions. Daily prescriptions for asthma related therapies are stratified by age and asthma severity, with severity levels defined as mild intermittent, mild persistent, moderate persistent and severe persistent using the National Institutes of Health treatment guidelines for asthma. Daily air pollution data have been obtained for particulate matter, ozone, sulfur dioxide and nitrogen dioxide for monitors in the San Francisco and Los Angeles areas from the state of California. Daily temperature and humidity information have been obtained from the National Climatic Data Center. Analysis of the daily relationship between asthma prescriptions and air pollution, after controlling for weather, will be derived and the utility of the prescription database as a proxy for asthma exacerbation will be discussed.

In addition, cross-sectional asthma prescription data at the 5-digit zip code level for the entire state of California have also been obtained. A cross-sectional study using count-data models to explain the incidence of asthma attacks, as measured by the use of short-term "quick relief" medication is planned. The total count of prescriptions for quick relief asthma medication will be explained using measures of asthma triggers and other cofactors. Prescription data is provided for each five-digit zip code in the state and is segregated by five-year age groups and the level of asthma severity of the patient. Asthma triggers to be included in the study include air pollutants (e.g., particulate matter and ozone), which are the primary factors of concern, as well as weather, pollen, and the road network. Additional cofactors to be included are population demographics (e.g., age, income, and gender distributions), geographic factors (e.g., elevation and climatic factors), and seasonal or quarterly dummies. Models will be corrected for the spatial correlation of the error structure to account for prescriptions filled in zip-codes other than where the patient lives and trans-boundary air pollution movements.

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