Manuscript #450

1. a. Full Title: Dissertation Project: A Cohort Study Examining Particulate Air Pollution and the Occurrence of Pulmonary Outcomes in the Washington County Atherosclerosis Risk in Communities (ARIC)

   b. Abbreviated Title: Pollution and pulmonary outcomes

2. Writing Group:

   Lead: Maureen Cadorette, Ph.D. Candidate, Dept. of EHS, Div. O&E Health
   Address: 4611 Roland Avenue, Baltimore, MD 21210
   Home Phone: (410) 243-0673
   Office Phone: (410) 955-4082
   Fax: (410) 955-1811
   E-mail: mcadoret@jhu.shph.edu

   Moyses Szklo, MD, DrPH, MPH - Dept. of Epi - ARIC Advisor
   Patrick Breysee, Ph.D., Advisor - Division of Env. Eng.
   Jacqueline Agnew, Ph.D., Co-Advisor - Division of O&E Health
   Sheila Fitzgerald, Ph.D., Co-Advisor - Division of O&E Health
   Hugh Ellis, Ph.D. Co-Advisor - Chairman Dept. of Geog. & Env. Eng., Homewood

3. Timeline:

   It is anticipated that this research project will take approximately 2 years from the time of approval

4. Rationale:

   Mortality from Chronic Obstructive Pulmonary Disease (COPD) and related conditions, in Maryland has increased from 21 per 100,000 in 1980 to 30 per 100,000 in 1991. The estimated prevalence of COPD's (Chronic Bronchitis, Emphysema, Asthma) was 7% in 1970 and 11.3% in 1993. In 1985, the National Ambulatory Medical Care Survey reported between 107 and 111 physician office visits per 1000 males and females, aged 55-64 years, for the treatment of COPD.

   The U.S. Dept. of Health and Human Services estimated the percentage of current smokers, aged 45-64 years, in 1983 was 35.9%, and by 1993 the percentage had decreased to 29.2%. While smoking rates are decreasing nationwide, chronic pulmonary diseases continue to rise and alternate causes of these diseases should be investigated.
In the past few years, epidemiological studies of particulate air pollution (PM$_{10}$) conducted in 16 different locations and on three different continents, have shown associations between the type of air pollution and adverse health endpoints. In 1994, Dockery and Pope published a review of the epidemiological literature for evidence of adverse health effects from exposure to PM$_{10}$. "Combined effects were estimated as percent increase" in health indicators, associated with each 10µg/m$^3$ increase in daily mean PM$_{10}$ exposure. The results included: total mortality increased by 1%, respiratory mortality increased by 3.4%; cardiovascular mortality increased by 1.4%; hospital admissions and emergency room visits increased about 1% for all respiratory symptoms, and 2-3% for asthma; asthma exacerbations and lower respiratory symptoms increased by 3%; and small decreases in lung function were also observed.

I propose to examine the association between exposure to particulate air pollution emitted from point (industry) and non-point sources (automobiles & trucks) and the occurrence of pulmonary outcomes in the Washington County ARIC cohort. Exposure to PM$_{10}$ will be estimated through the development of a model which integrates a Geographical Information System (GIS), the EPA’s Industrial Source Complex Dispersion model (ISC-3) and a model demonstrating the contribution of non-point sources of particulate air pollution to the region.

5. Main Hypothesis:

The occurrence of pulmonary outcomes is higher in the Washington County ARIC cohort members who are exposed to point and non-point sources of particulate air pollution than it is in the unexposed Washington County ARIC cohort members.

6. Specific Aims of the Research Project:

1) To examine the association between respiratory morbidity/disease and particulate air pollution. This will be accomplished by examining the association between particulate air pollution and the occurrence of pulmonary outcomes.
2) To develop a method to measure the exposure of cohort members to particulate air pollution using a GIS, an industrial smokestack plume dispersion model (EPA ISC-3) and a measure of the contribution of non-point sources of particulate air pollution.
3) To identify confounders which will modify the association between the occurrence of pulmonary outcomes (dependent variable) and particulate air pollution (independent variable).
4) To identify the independent variables which may modify (positively or negatively) the primary relationship of interest - particulate air pollution and the occurrence of pulmonary outcomes.

7. Data:

Exposed - cohort members living in the modeled dispersion pathways of particulate emissions from point and non-point sources.
Unexposed - cohort members living outside the modeled dispersion pathways of particulate emissions from point and non-point sources.

Diseased - cohort members with: (1) diagnosed respiratory disease, (ICD-9 codes 490-496, Chronic Obstructive Pulmonary Disease and Allied Conditions) at any time during the study period (1986-1993); (2) any of 6 symptoms reported on the ARIC Respiratory Questionnaire at the baseline examination, the second examination or at any follow-up interview; (3) a diagnosis of COPD on Pulmonary Function Tests at the time of the first or second examination and/or a reported change in PFTs from the first to the second examination; and (4) cohort members with respiratory related restricted activity days (RRAD), related to a chronic respiratory condition, as reported on the annual follow-up questionnaire. *Exclusions*: cohort members with lung cancer, tuberculosis or restrictive lung diseases.

Non-Diseased - cohort members with: (1) no diagnosed respiratory disease (IDC-9 Codes 466-496); (2) no symptoms on the baseline respiratory questionnaire; (3) no history of RRAD days - does not include restricted activity days due to colds or flu unrelated to the specific chronic respiratory conditions, as reported on the annual follow-up questionnaire.

8. Independent Variables:

age, socioeconomic status (as defined by median family income, occupation, place of residence), education level, duration of residence at present address, race, smoking status, exposure to passive smoking, gender, co-existing chronic diseases, other possible exposures (wood burning stoves, hobbies, et., if available), weather (temperature, humidity, prevailing winds, inversion days), and time of the year surveyed.

9. Time Window:

This proposal requests the use of the Washington County data from both physical examination periods, all annual follow-up data, and all survey data which contains any information regarding respiratory symptoms/disease for the entire period of ARIC cohort study.

**References:**


