

Project Title: Ischemic Heart Disease and Lung Cancer Mortality in Relation to Respirable Particulate Matter and Diesel Exhaust in Non-metal Miners

Organization: University of California, Berkeley

Partnerships: None

Investigator(s): Ellen A. Eisen

Focus Area: Health

SYNOPSIS

Problem Statement: This research will estimate the exposure-response relationships between respirable particulate matter (RPM) and elemental carbon (REC) and ischemic heart disease (IHD) and lung cancer mortality in a cohort of miners without bias from the healthy worker effect. Miners are exposed to levels of RPM that far exceed general population exposures in air pollution. Yet although RPM in traffic-related air pollution is recognized as an important risk factor for heart disease and IHD has rarely been studied in relation to dust exposure among miners. Moreover, most of the few existing studies on this topic compare miners to the general population; such comparisons can lead to misleading results because miners are an unusually healthy and physically fit workforce. The Diesel Exhaust in Miners Study (DEMS), originally designed to study lung cancer, offers the unique opportunity to examine IHD mortality in relation to respirable PM and EC exposure without healthy worker bias by relying on internal comparisons between higher and lower exposed miners.

Impact of Research: The goal of the project is to provide exposure-response curves for ischemic heart disease and lung cancer mortality that can be used to guide MSHA regulations for RPM and REC in coal and other non-metal mines.

Objectives and Research Methods: Our objective is to estimate quantitative exposure-response curves between each of two exposures, RPM and REC, and two mortality outcomes, IHD and lung cancer. The particular challenge is to estimate these relationships without bias due to the healthy worker survivor effect or confounding by cigarette smoke. Using the analytical approach described below, this project will provide answers to the following questions:

1. What is the unbiased quantitative relationship between exposure to respirable particulate matter (RPM) and IHD mortality? Lung cancer mortality?
2. What is the unbiased quantitative relationship between exposure to respirable elemental carbon (REC) and IHD mortality? Lung cancer mortality?

We will answer these questions by applying Cox models with penalized splines to allow non-linearity, and focus on time windows of exposure, with a particular interest in the impact of recent exposure among the actively employed. We will then apply g-methods to correct for the downward bias due to the healthy worker survivor effect, adjusting selection bias from both left and right truncation by incorporating censoring weights into the Cox models. We will adjust for smoking and BMI by leveraging smoking data collected for a case-control study of lung cancer nested in the cohort and conduct sensitivity analysis for both primary exposure-response analyses with and without adjustment for cigarette smoking.