Grant: AFC820-15

Title: Reducing Mortality Risks in the Extended Diesel Exhaust and Miners Study (DEMS)

Organization: University of California at Berkeley

Principal Investigators: Ellen A. Eisen,

Topic: Injury and Disease Exposure and Risk Factors

Priority Area: Cardiovascular disease and and Respiratory Disease

SYNOPSIS

Problem Statement*:* Mining is a hazardous occupation, particularly underground where workers are exposed to high levels of toxic dusts, vapors, and fumes that may cause elevated risk of work-related disease and death. We know that long- term exposure to respirable diesel exhaust and dust can cause chronic heart and lung disease, but we are only beginning to understand how much disease and how many deaths could be prevented if concentrations were reduced below specific values. In addition, we know little about the acute health risks of involuntary job loss when miners are forced to leave work due to illness, injury, or layoff. We will examine risk of fatal self-injury, due to suicide or drug overdose, as another potentially devastating work-related health outcome in this population of miners.

Research Approach: We propose to study the impact of long-term exposures to two specific agents, respirable diesel exhaust and dust, i.e., particulate matter (PM), on chronic heart and lung disease mortality in the Diesel Exhaust in Miners Study (DEMS). Our analytic approach is rooted in a causal framework and focused on evaluating the number of deaths that could be avoided by complying with hypothetical interventions to reduce exposures below a series of specified levels. Our proposal leverages our past (Alpha funded) work with the DEMS cohort mortality study of 12,315 miners at 8 non-metal U.S. mines, and takes advantage of new follow-up data recently collected by our collaborators at the National Cancer Institute (NCI). With extended vital status follow-up from 1997 through 2015, we will have access to more than twice the numbers of deaths due to Ischemic Heart Disease (IHD) and Chronic Obstructive Pulmonary Disease (COPD) mortality. This additional power offers us the opportunity to corroborate the generally positive results of our previous exposure-response studies with more specificity and greater confidence. The additional follow-up data also allow us to examine the potential impact of involuntary job loss on self-injury – suicide and drug overdose – and the extent to which these outcomes, tragic in themselves, may also be obscuring some of the exposure-related risk of chronic disease mortality in mining populations.

Impact of the Research: The epidemiologic approach we will apply – the parametric g-formula – provides a direct estimate of the impact of an intervention designed to reduce all exposures below a specified limit. There are no transformations or extrapolations required. In fact, the interpretable form of the output is one of the primary reasons we choose to use this method. Another reason is that it addresses the healthy worker survivor effect, which is critically relevant when studying chronic diseases in occupational cohorts. Our previous results suggested that exposure to diesel exhaust increases the risk of mortality due to both IHD and COPD, although confidence intervals were wide, particularly for COPD. The additional 18 years of follow-up substantially increases our power. This additional power for our casual inference approach allows us to estimate the impact of a series of alternative exposure limits on the number of deaths due to heart and lung disease with greater confidence (narrower confidence intervals). Ultimately, if the proposed research provides further evidence of excess mortality risk at current exposure limits, MSHA will be able to use our results to justify enforcing lower exposure limits for diesel exhaust and for dust (particulate not otherwise specified) in U.S. mines. Further, our study of self-injury may call attention to this additional risk faced by miners who lose their jobs.