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Title: Continued Epidemiologic Analyses of Large Data Sets of Health Data on US Coal Miners

Organization: University of Illinois

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Partnerships: National Jewish Health, Denver, CO

Focus Area: Injury and Disease Exposure and Risk Factors: Musculoskeletal Disorders

SYNOPSIS

Problem Statement: Miners suffer an excess of chronic cardiopulmonary diseases as well as other adverse health effects from their occupational exposures despite dust control regulations.¹ Occupational exposure to respirable coal mine dust can cause a broad spectrum of disease, including pneumoconiosis, dust related diffuse fibrosis, lung function impairment,^{2,3} and chronic obstructive pulmonary disease (COPD),⁴ encompassed by the term coal mine dust lung disease (CMDLD).⁵ It is now widely recognized that prevalence rates of CMDLD in the United States, and especially coal workers' pneumoconiosis (CWP) and its most severe form, progressive massive fibrosis (PMF), have risen to levels not seen since the 1970s. This trend has been observed among active coal miners participating in the Coal Workers' Health Surveillance Program (CWHSP),⁶⁻⁸ as well as among former miners applying for Federal Black Lung Program (FBLP) benefits.⁹ The Central Appalachian states of Kentucky, Virginia, and West Virginia have seen the steepest increases in rates of this debilitating disease.^{6,7,9-12} To date, research relied almost exclusively on chest imaging evidence of disease measured at one point in time, though radiographic abnormalities do not reflect the full burden of CMDLD or heart disease among U.S. coal miners. Lung function impairment, measured by resting pulmonary function tests (PFTs) and cardiopulmonary exercise tests (CPET) with and without measurements of arterial blood gases (ABG), has not been extensively explored in this population. Further, the progression of disease, measured radiographically or physiologically, can help us understand how best to intervene and prevent severe disease from developing among U.S. coal miners.

Research Approach: Our research approach will include a diverse set of epidemiologic analyses that expands upon our previous Alpha Foundation work and includes three primary research components: 1) longitudinal analysis of lung function decline and radiographic progression of CMDLD among U.S. coal miners participating in the NIOSH CWHSP and the U.S. Department of Labor FBLP to better understand risk factors in this population throughout the working and retired lifetime of the miner; 2) expanded mortality analysis of miners participating in both the CWHSP and FBLP to evaluate mortality related to CMDLD among U.S. coal miners, with a particular attention to cardiovascular disease; and 3) characterization of CMDLD, including severity, progression, and cause of death, among a subset of Central Appalachian coal miners evaluated in a state-of-the-art Black Lung Clinic which performed in- depth physiologic testing and maintained clinical data beyond that available in either CWHSP or FBLP data.

Impact of Research: A key impact of this project will be identification of a broad spectrum of risk factors associated with increased rates of radiographic progression and physiologic decline among U.S. coal miners (e.g., job titles, mining tenure, mining region, and demographic risk factors). These findings will inform future efforts focused on prevention and early detection of mining-related cardiopulmonary disease and can inform current regulatory, clinical and health education strategies to reduce the burden of occupational cardiopulmonary disease in miners exposed to respirable coal mine dust. Our proposed work with expanded clinical data will also address important gaps in the scientific literature regarding relationships between radiographic disease and physiologic impairment measured by resting pulmonary function and cardiopulmonary exercise tests. This work will expand our understanding of the burden of CMDLD and heart disease in this population beyond radiographic pneumoconiosis. While recent attention paid to the resurgence of PMF has been necessary and warranted, the full burden of disease caused by coal mine dust is likely much larger than is currently recognized. A more complete understanding of the disease burden associated with prolonged coal mine dust exposure, along with the natural history of disease arising from this exposure, would better inform prevention during miners' working careers.