

## Synopsis

**Title:** Analysis of the Spectrum of Coal Mine Dust Lung Disease Throughout the Life of Modern U.S. Coal Miners and the Impact of the COVID-19 Pandemic

**Organization:** University of Illinois, Chicago

**Principal Investigators:** Robert A. Cohen

**Partnerships:** National Jewish Health

**Topic:** Injury & Disease Exposure & Risk Factors - **Priority Area:** Surveillance and Epidemiology Methods

**Research Need:** Excessive exposure to respirable coal mine dust causes a broad spectrum of disease beyond the classic findings of pneumoconiosis. These include dust-related diffuse fibrosis, lung function impairment, and chronic obstructive pulmonary disease (COPD), all of which have a tremendous burden among coal miners and are referred to as coal mine dust lung disease (CMDLD). Not only is there an elevated burden of lung disease, but the disease is severe. There has been a resurgence of the most advanced form, progressive massive fibrosis (PMF), as reflected in medical surveillance data from the Coal Workers' Health Surveillance Program (CWHSP), disability claims in the Federal Black Lung Program (FBLP), miners examined in the Black Lung Clinics Program (BLCP), and a specialized Black Lung Clinic in West Virginia (RASClinic). Our work has also shown an increase in the mortality odds ratios of these diseases over recent decades and birth cohorts of miners. The Central Appalachian states of Kentucky, Virginia, and West Virginia have seen the steepest increases in the prevalence and mortality from these debilitating diseases despite modern dust control regulations and provided the impetus for the newly promulgated Mine Safety and Health Administration standards for reducing miners' exposure to respirable crystalline silica. Much of the published research literature on CMDLD has focused on large datasets of chest imaging findings. However, these studies primarily investigate the scarring form of these diseases, and far less is known about physiologic lung function impairment associated with coal mine dust exposure. Pulmonary physiologic impairment from coal mine dust exposure is a major contributor to morbidity in this worker population yet is underrecognized due to confounding non-occupational exposures such as tobacco smoking. Recently, our group has studied lung function impairment, as measured by spirometry, diffusing capacity for carbon monoxide (DLCO), and cardiopulmonary exercise tests (CPET), and their predictive value detecting CMDLD and disability. There is an important need to update work we performed as part of AFCTG20-102, which utilized data through 2017. This data predated the COVID-19 pandemic, which has killed over 1.125 million Americans.<sup>18</sup> Importantly, studies have shown a significant impact of particulate exposure on COVID-19 mortality,<sup>19</sup> raising the possibility that miners with CMDLD were more vulnerable to developing severe disease than the general population. We propose to incorporate data through 2023, as well as linking additional data from Black Lung Clinics Program to understand the impact of COVID-19 on this vulnerable population and determine if the recent surge in CMDLD prevalence and severity is continuing. In addition, we propose to evaluate the predictive value of additional lung function measures including DLCO and CPET on CMDLD severity and mortality.

**Project Goals:** Our research will expand upon our prior work using the most recent data from four previously linked and one additional dataset to: 1) Evaluate the current prevalence, severity, and mortality of CMDLD among U.S. coal miners; 2) perform a longitudinal analysis of lung function decline and radiographic progression of CMDLD among U.S. coal miners participating in the CWHSP, FBLP, and BLCP to better understand risk factors throughout the working and retired lifetime of the miner; 3) update the analysis of miners participating in CWHSP, FBLP, and BLCP to evaluate mortality related to CMDLD, the impact of COVID-19, and cardiovascular disease; and 4) study the association of disease severity, progression, and cause of death risk factors with data from detailed medical, occupational, and social history, and advanced physiology measures from RASClinic.

**Impact of Research:** CMDLD and its most severe form, PMF, increased in prevalence throughout the early 2000s. This study would allow us to determine if the trends in prevalence, severity, and mortality are continuing. This population with underlying significant lung disease is particularly vulnerable to other respiratory insults, including, likely, COVID-19, and the impact of the pandemic on this population remains unknown. The additional data points will also allow further longitudinal analysis of risk factors associated with disease progression, and improve our understanding of mortality from CMDLD, cardiovascular disease, and lung cancer in this population. The predictive value of advanced physiology and personal risk factors will inform future efforts focused on prevention and early detection of mining-related cardiopulmonary disease in working coal miners.