Progressive Massive Fibrosis in Coal Miners From 3 Clinics in Virginia

Since 1970, the Coal Workers' Health Surveillance Program (CWHSP), administered by the National Institute for Occupational Safety and Health, has offered periodic chest radiographs to working US coal miners.[1] The primary purpose of the CWHSP is early detection of coal workers' pneumoconiosis to prevent progression to disabling lung disease, including progressive massive fibrosis (PMF). By the late 1990s, PMF was rarely identified among miners participating in the CWHSP. However, a 2014 report documented an increase in the prevalence of PMF in Appalachia.[2] On February 1, 2017, the director of a network of 3 federally funded black lung clinics (which primarily serve former miners, and are not affiliated with the CWHSP) in Southwest Virginia requested assistance to determine the burden of PMF in patients served by the clinics.

Methods | We defined a case of PMF as an International Labour Office classification of large opacity (any opacity >1 cm) category A (≥1 large opacities with combined dimension ≤5 cm), category B (≥1 large opacities with combined dimension >5 cm but not exceeding the equivalent area of the right upper lung zone), or category C (size greater than category B) pneumoconiosis in a former or working coal miner with a clinic-administered radiograph during January 1, 2013, through February 15, 2017. All case radiographs were classified by a B Reader, a physician certified as proficient in classifying radiographs for pneumoconiosis. Background small opacity profusion, an additional indicator of disease severity, was classified using 4 categories (0, 1, 2, 3), with each divided into 3 subcategories (range: 0/– to 3/+).[3] We calculated the proportion of radiographs with rounded opacities 3 mm to 10 mm in size (r-type) as the primary small opacity type because r-type opacities are associated with crystalline silica exposure.[4] Cases were identified using the clinics' electronic classification system. For each case, we abstracted radiographic findings and patient characteristics from clinical records. The National Institute for Occupational Safety and Health determined this investigation to be a nonresearch public health response.

Results | We identified 416 coal miners meeting the case definition, among approximately 11 200 observed during the study period. Each was white and male, mean age was 61.8 years (range, 38.6-88.7), and most resided in Kentucky or Virginia (**Table**). Mean coal mining tenure was 27.9 years (range, 8-64); 80 miners (22.7%) reported a tenure of 20 years or less. Forty-two (12.4%) cases were in persons still working as coal miners at the time of radiograph.

A total of 154 miners (37.0%) were classified as having category B or C large opacities and 272 (65.4%) had profusion of

Table. Radiographic Findings and Characteristics Among 416 Coal Miners With Progressive Massive Fibrosis From 3 Clinics in Virginia, January 2013-February 2017

	No. of Coal Miners (%)
Large opacity pneumoconiosis, category[a]	
A	262 (63.0)
B	120 (28.8)
C	34 (8.2)
Age, mean (range), y[b]	61.8 (38.6-88.7)
White race[b]	381 (100)[c]
Men[b]	388 (100)
State of residence[b]	
Kentucky	157 (42.1)
Tennessee	10 (2.7)
Virginia	181 (48.5)
West Virginia	19 (5.1)
Other states[d]	6 (1.6)
Smoking status[b]	
Never	113 (31.0)
Former	199 (54.7)
Current	52 (14.3)
Mining tenure, y[b]	
Mean (range)	27.9 (8-64)
≤10	5 (1.4)
>10-15	24 (6.8)
>15-20	51 (14.5)
>20-25	75 (21.3)
>25	197 (56.0)
Employment status[b]	
Currently working[e]	42 (12.4)
Retired	298 (87.6)
Mine type[b]	
Underground	283 (89.8)
Surface	32 (10.2)

[a] A case of PMF was defined as an International Labour Office classification of large opacity (any opacity >1 cm) category A (≥1 large opacities with combined dimension ≤5 cm), category B (≥1 large opacities with combined dimension >5 cm but not exceeding the equivalent area of the right upper lung zone), or category C (size greater than category B) pneumoconiosis.

[b] Missing data for categories was as follows: age, 27 miners; race, 35 miners; sex, 28 miners; state of residence, 43 miners; smoking status, 52 miners; mining tenure, 64 miners; employment status, 76 miners; mine type, 101 miners.

[c] Valid percentages (ie, missing data are excluded from the calculation). Race as self-reported and defined by coal miner patients; race was originally collected as part of standard patient registration and was assessed for this study to characterize demographics.

[d] Other states include Alabama, Maryland, North Carolina, and South Carolina.

[e] At the time of radiograph administration.

small opacities in the subcategory of 2/1 or greater (**Figure**). Nearly one-third of radiographs (n = 122, 29.3%) had background small opacities classified as r-type.

Figure. Small Opacity Profusion Classification by Large Opacity Category Among Chest Radiographs of Coal Miners at 3 Clinics in Virginia, January 2013-February 2017
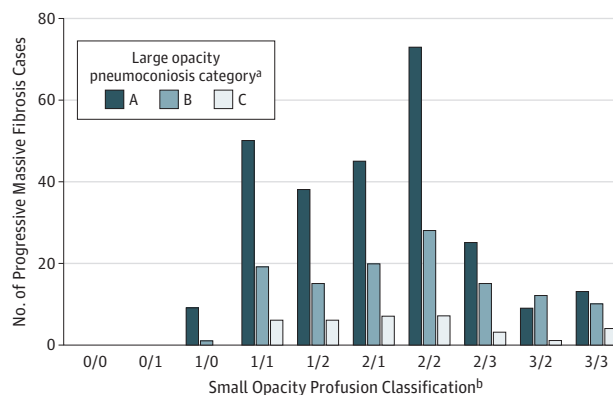
[a] A case of PMF was defined as an International Labour Office classification of large opacity (any opacity >1 cm) category A (≥1 large opacities with combined dimension ≤5 cm), category B (≥1 large opacities with combined dimension >5 cm but not exceeding the equivalent area of the right upper lung zone), or category C (size greater than category B) pneumoconiosis.

[b] Small opacity profusion was classified into 4 categories (0, 1, 2, 3), with each divided into 3 subcategories (0/−, 0/0, 0/1, 1/0, 1/1, 1/2, 2/1, 2/2, 2/3, 3/2, 3/3, 3/+).

Discussion | To our knowledge, this is the largest cluster of PMF reported in the scientific literature. A high proportion of these cases had r-type opacities, category B and C large opacities, and coal mining tenure of less than 20 years, which are indications of exceptionally severe and rapidly progressive disease. This report underestimates the total burden of PMF and other severe respiratory disease at these clinics because miners with PMF classifications outside the study period, those with non–B Reader classifications, and those with clinical notes indicating PMF but no accompanying B Reader classification form were excluded. An additional limitation is that only 3 clinics located in 1 state were included.

In 2014, a federal rule improved protections for miners, including decreased allowable dust concentrations, changes in dust monitoring, and expansion of the CWHSP.[5] During April 2016 through June 2016, 99% of more than 20 000 operator-provided samples from underground coal mines were in compliance with the new dust standard.[6] Whether these added protections will decrease severe occupational lung disease in coal miners requires continued surveillance.

David J. Blackley, DrPH
Laura E. Reynolds, MPH, BSN
Connie Short
Ron Carson
Eileen Storey, MD, MPH
Cara N. Halldin, PhD
A. Scott Laney, PhD

Author Affiliations: Respiratory Health Division, National Institute for Occupational Safety and Health, Morgantown, West Virginia (Blackley, Reynolds, Storey, Halldin, Laney); St Charles Respiratory Care Center, Stone Mountain Health Services, St Charles, Virginia (Short, Carson).

Accepted for Publication: November 3, 2017.

Corresponding Author: David J. Blackley, DrPH, Respiratory Health Division, National Institute for Occupational Safety and Health, 1095 Willowdale Rd, Mail Stop HG900.2, Morgantown, WV 26505 (dblackley@cdc.gov)

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COMMENT & RESPONSE

Prophylactic Low-Dose Oxygen for Patients With Acute Stroke

To the Editor Dr Roffe and colleagues reported that prophylactic low-dose oxygen therapy during the first 3 days after stroke in nonhypoxic adults did not reduce disability or death at 3 months.[1]

Hypoxia has been identified as a common companion of acute stroke, and it has been reported in 63% of patients with acute hemiparetic stroke.[2,3] Severity of stroke is one of the main factors for development of hypoxia.[3] Moreover, patients with total anterior circulation syndrome develop the greatest rate of hypoxia among different ischemic stroke types.[4] Supplemental oxygen could theoretically improve outcomes by preventing hypoxia and delayed cell death due to vasogenic edema or inflammation.[1] However, in the Stroke Oxygen Study Trial (SO$_2$S), many patients had mild strokes (median National Institutes of Health Stroke Scale [NIHSS] score, 5 [interquartile range {IQR}, 3-9]), which suggests that a low number of patients had large vessel occlusion. Theoretically, stroke patients with milder stroke would be at less risk for hypoxia or vasogenic edema early after acute stroke.