

Continued Increase in Prevalence of Coal Workers' Pneumoconiosis in the United States, 1970–2017

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Objectives. To update prevalence estimates for coal workers' pneumoconiosis (CWP) among working underground coal miners in the United States.

Methods. We conducted a prevalence study using radiographs collected from 1970 to 2017. We classified each radiograph using international standards. We defined CWP as the presence of small opacities, with profusion greater than or equal to subcategory 1/0, or the presence of a large opacity larger than 1 centimeter.

Results. Following a low point in the late 1990s, the national prevalence of CWP in miners with 25 years or more of tenure now exceeds 10%. In central Appalachia (Kentucky, Virginia, West Virginia), 20.6% of long-tenured miners have CWP. When we excluded miners from central Appalachia, the prevalence for the remainder of the United States was lower, but an increase since 2000 remains evident.

Conclusions. The national prevalence of CWP among working coal miners is increasing. This increase is most pronounced in central Appalachia. Current CWP prevalence estimates will likely be reflected in future trends for severe and disabling disease, including progressive massive fibrosis.

Public Health Implications. Recently enacted protections to prevent coal mine dust exposure and identify CWP at its early stage remain essential to protect US coal miners. (*Am J Public Health*. Published online ahead of print July 19, 2018: e1–e3. doi:10.2105/AJPH.2018.304517)

The Coal Workers' Health Surveillance Program (CWHSP) was established following enactment of the 1969 Federal Coal Mine Health and Safety Act (Coal Act). For nearly 50 years, the National Institute for Occupational Safety and Health (NIOSH) has administered the CWHSP to identify coal workers' pneumoconiosis (CWP, or "black lung") in working coal miners and prevent its progression. The Coal Act mandated the first nationwide permissible exposure limit for respirable coal mine dust, which was set at a level believed to be protective against disability and premature mortality resulting from progressive massive fibrosis (PMF), the most severe form of CWP.

In the years following adoption of the preventive measures required by the Coal Act, the national prevalence of CWP among coal miners who work underground declined sharply. In the mid-1970s, more than 30% of long-tenured (≥ 25 years of mining tenure) underground coal miners participating in the CWHSP had radiographic evidence of CWP,

and approximately 3.5% had PMF; by the late 1990s, the prevalence of CWP and PMF had declined to approximately 5.0% and 0.5%, respectively.¹ However, by 2000, these trends had reversed, and the prevalence of CWP among miners with 25 or more years of tenure was increasing, most notably in central Appalachia (Kentucky, Virginia, and West Virginia). By 2015, the prevalence of PMF among long-tenured miners in central Appalachia had surpassed 5% and reached the highest level ever recorded.² Subsequent investigations identified hundreds of additional PMF cases, primarily among recently

retired miners served by black lung³ and community radiology⁴ clinics in the Appalachian coalfields. Many of these former miners were seeking compensation through the Federal Black Lung Program, which provides benefits to miners disabled by CWP.

The core mission of the CWHSP is to serve working coal miners, and NIOSH does not systematically offer screening chest radiographs to former miners. However, because CWP is a chronic and progressive disease, current CWP trends in the working coal miner population will influence future PMF trends. Using the most recent data from the CWHSP, and a moving average calculation to account for the 5-year surveillance cycle, we update national prevalence trends for CWP among working underground coal miners in the United States, including a sub-analysis restricted to central Appalachia.

METHODS

We conducted a prevalence study using radiographic data collected by the CWHSP from working underground miners during 1970 to 2017. A description of the CWHSP and its methods are available on the program Web site.⁵ Briefly, all working coal miners in the United States are eligible for a chest radiograph at the beginning of their mining career, 3 years afterward, and approximately every 5 years thereafter. Radiographs are obtained at NIOSH-approved health facilities, including the NIOSH mobile

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examination unit. NIOSH-certified B readers⁶ classify radiographs for the presence, profusion, and type of lung parenchymal abnormalities using the International Labor Office Classification of Radiographs of Pneumoconioses.⁷ A final determination of the classification for each radiograph requires agreement of at least 2 B readers. For this analysis, we defined CWP as a final determination of the presence of small opacities, with profusion subcategory 1/0 or greater, or the presence of any large opacity larger than 1 centimeter (PMF). Because miners are eligible to receive a radiograph at 5-year intervals, we report prevalence estimates as 5-year moving averages.

RESULTS

Nationally, each tenure group with 10 years or more of underground mining tenure has experienced an increase in the prevalence of CWP during the most recent 5-year period (Figure 1). Following a low point in the late 1990s, the national CWP prevalence in miners with 25 years or more of tenure now exceeds 10%; among miners with 20 to 24 years of tenure, the prevalence exceeds 5%. In just central Appalachia, CWP trends have exhibited the same general pattern, with substantial declines during the 1970s, 1980s,

and early 1990s followed by an inflection in the late 1990s and a sharp rise thereafter (Figure 1b). For the most recent 5-year period, 20.6% of long-tenured coal miners in central Appalachia had radiographic evidence of CWP (16.1% simple CWP; 4.5% PMF)—the highest level recorded during the past 25 years. When miners from central Appalachia are removed from the calculation (Figure 1c), the prevalence for the remainder of the United States is substantially lower, although the overall pattern, showing an increase since approximately 2000, is still evident.

DISCUSSION

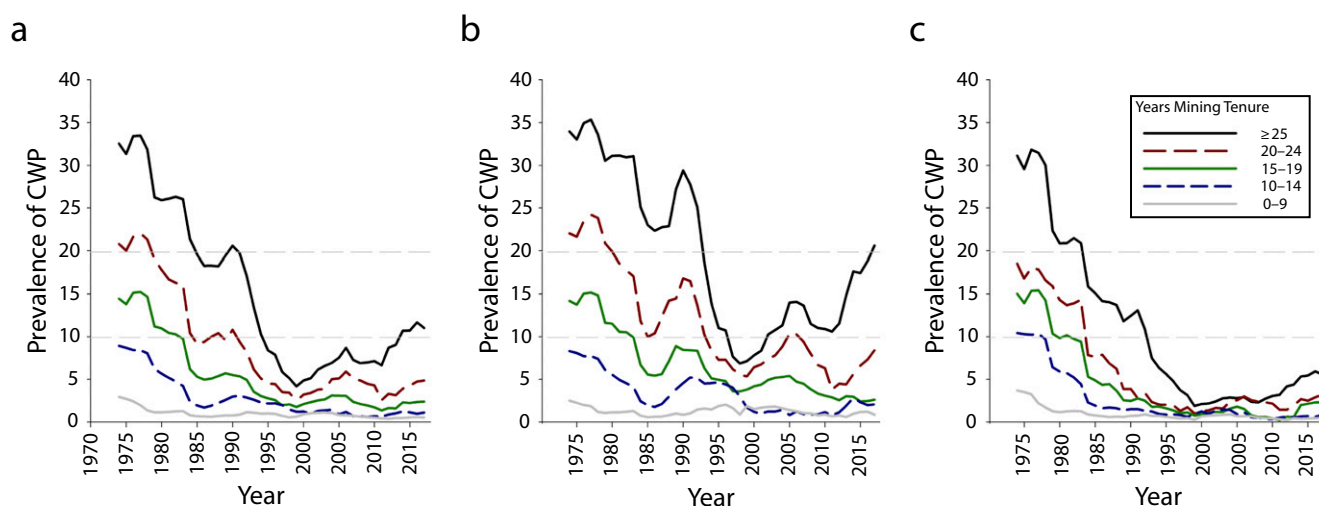
The national prevalence of CWP among underground coal miners was last reported using data from 2012⁸; to our knowledge, the prevalence of CWP within central Appalachia has not been reported in the scientific literature. At the national level, 1 in 10 long-tenured miners has radiographic evidence of CWP. However, looking solely at the national rates obscures important regional trends. Much of the increased prevalence observed in the national data is attributable to CWP identified in miners in central Appalachia, a population with a CWP prevalence that is 4-fold higher than is the prevalence among long-tenured underground miners elsewhere in the United States. One in 5

of these miners in central Appalachia has CWP, a significant predictor for developing PMF. Approximately 1 in 20 long-tenured miners in central Appalachia has CWP that has progressed to PMF, a condition that is by definition totally disabling.⁹ We can think of no other industry or workplace in the United States in which this would be considered acceptable.

A strength of the NIOSH-administered CWHSP is the consistency of radiograph acquisition and standardized interpretation for nearly 50 years. Coal miners are offered periodic radiographic screening at no cost to themselves, although they can decline to participate. Participation rates have fluctuated over time, and in recent decades participation has been between 30% and 40% on an annual basis. It is likely, however, that the prevalence reported by the CWHSP reflects the overall workforce. A previous study determined that participation and other selection factors did not influence the temporal trends in CWP reported by the CWHSP, although these data likely underestimate the true population-based prevalence.¹⁰

PUBLIC HEALTH IMPLICATIONS

These findings highlight a continued increase in the prevalence of CWP, nationally and regionally. CWP is a progressive disease,



Note. Central Appalachia includes Kentucky, Virginia, and West Virginia. Data are the 5-year moving average. Surveillance is conducted on a 5-year national cycle.

FIGURE 1—Prevalence of Coal Workers' Pneumoconiosis (CWP) Among Those Working Underground in (a) the United States, (b) Central Appalachia, and (c) the United States Excluding Central Appalachia: Coal Workers' Health Surveillance Program, Appalachia, 1970–2017

and current trends will likely be reflected in future trends for more severe manifestations of coal mine dust lung disease, including PMF. Although many consider black lung a disease of antiquity, it is undeniable that the responsible causative agent for these contemporary cases has resulted from injurious exposures encountered in the 21st century. In 2014, new standards were introduced to protect US coal miners, including lowering the allowable concentration of respirable dust in the mines and “closing several loopholes that masked their exposure to unhealthy coal mine dust.”¹¹ In December 2017, the Department of Labor filed a request for information soliciting public comment on existing standards and regulations.¹² Although it is too early to assess the health impact of these recent primary and secondary prevention measures, we are not aware of any evidence of a decline in CWP, severe CWP, federal or state disability compensation claims, or lung transplantation for CWP among miners in Appalachia. Enhancement and diligent enforcement of the 2014 standards remains critical for reversing these trends. **AJPH**

CONTRIBUTORS

The authors contributed equally to the conceptualization, writing, editing, and analysis of this brief.

HUMAN PARTICIPANT PROTECTION

The National Institute for Occupational Safety and Health approved this study.

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