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Michael Hendryx, PhD; Cynthia Persily, RN, PhD; Jamison Conley, PhD, & Evan Fedorko

*West Virginia Rural Health Research Center
West Virginia University, Morgantown, WV*

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INTRODUCTION

Coal workers' pneumoconiosis (CWP), or black lung disease, is an occupational lung disease caused by inhalation of coal dust (1). The disease is not curable, is progressive and can advance from simple CWP to progressive massive fibrosis (PMF). PMF is characterized by extensive scarring and thickening of lung tissue, emphysema, and compromised lung function leading to death. In efforts to control CWP, regulations were implemented in U.S. coal mines beginning in 1969 to limit dust exposure levels among workers. These regulations were successful in dramatically lowering disease risk (2). However, recent evidence indicates that rates of coal workers' pneumoconiosis began to increase in the early 2000s (2-6). This recent increase is of concern because safety standards should be able to prevent most black lung disease from occurring.

The current study investigated the prevalence rates of black lung disease among active miners in relationship to the location of Health Resources and Services Administration (HRSA)-funded Black Lung Clinics. The study addressed two research questions: 1) what were the comparative rates of black lung prevalence in areas closer to, and farther from, Black Lung Clinics, including overall rates and rates by disease severity stage, and 2) within Black Lung Clinic service areas, which areas showed relatively higher and lower black lung prevalence rates, overall and by disease severity stage?

METHODS

Data on the location of HRSA-supported Black Lung Clinics were available from HRSA (7). Data on black lung prevalence rates were taken from the Enhanced Coal Workers' Health Surveillance Program (3). The data on cases of CWP were organized on a county level. Cases were classified as showing the presence or absence of CWP, and then were further classified according to the severity of disease progression. Analyses include descriptive and geographic spatial summaries to show the variability in black lung rates in different geographic areas, and in relation to the location of HRSA-funded Black Lung Clinics.

RESULTS

All Tables and Figures are presented in an Appendix to this report. Table 1 shows the overall rate of CWP by stage; evidence for CWP at any stage was detected in 2.9% of cases, or 900 miners.

Figure 1 shows a map of the location of Black Lung Clinics in relation to CWP test results. The circles represent clinic locations, and the shaded counties show areas where CWP

was observed. Counties with greater CWP severity results are shown in progressively darker shades. This Figure also shows that clinics tend to be located near the surveillance program testing areas, but that there are some clinics that are not close to CWP test areas, and some CWP test areas (especially in the West) are not close to clinics.

Table 2 shows whether the percent of tested miners falling within each CWP severity level was significantly different between counties served by, or adjacent to, Black Lung Clinics, compared to counties farther away from Clinics. For cases at Stage 1, and for combined cases across all Stages, there was significantly higher presence of CWP in areas near clinics than in areas farther away from clinics. For CWP cases classified as PMF, State 3 or Stage 2, the differences trended toward higher severity in the areas near clinics, but the results did not reach statistical significance.

DISCUSSION

The study addressed two research questions: 1) what were the comparative rates of black lung prevalence in areas with and without black lung clinics including overall rates and rates by disease severity stage, and 2) within black lung clinic service areas, which areas showed relatively higher and lower black lung incidence rates, overall and by disease severity stage.

The results indicated that black lung rates overall are higher in areas closer to Black Lung Clinic service areas. The rates were higher for all disease severity stages, but reach statistical significance only for cases at Stage 1 (which is less severe and more common than other stages), and for CWP combined across stages. This indicates that Black Lung Clinics have been located in areas of greatest recognized need, where mining activity is most intense and risk of CWP is greater. However, there is evidence that CWP has been observed in some areas of the West that are more distant from the nearest clinic. Given the predominant use of surface mining in the West, and evidence that CWP can occur among surface miners (8), additional research may be useful to examine CWP among Western miners and ensure that appropriate services for CWP are available for these miners. It should also be noted that we would not expect to see significantly lower rates of CWP near Black Lung Clinics, because these clinics are intended to treat, not to prevent, black lung disease.

Regarding the second research question, the spatial analyses indicated that areas of central Appalachia tend to have not only the most cases of CWP, but also the most severe cases. Appalachia also has relatively good representation of clinic locations. Of the 27 Black Lung Clinics in the dataset, 19 (70%) are in or near central Appalachia, including clinics in West Virginia (N=9), Pennsylvania (N=3), Ohio (N=3), Kentucky (N=2), Tennessee (N=1), and Virginia (N=1); these states have among the highest levels of underground mining in the US.

Limitations of the study include the fact that the surveillance program was limited to active miners, and does not include former or retired miners. It is unknown what the relationship may be between the presence of Black Lung Clinics and the prevalence and severity of black lung disease among former and retired workers. A second limitation concerns the potential confound between the presence of Black Lung Clinics and access to care for miners. It is possible, although unknown, that miners in areas with Black Lung Clinics more likely receive testing for CWP through the surveillance program because prior treatment at the clinic has indicated to the miner that there is a problem. A third limitation is that the severity measure created for Figure 1 was developed for this study, and different severity weighting measures might lead to different patterns, although the measure seems reasonable and agrees with prior literature on the concentration of CWP found in central Appalachia.

CONCLUSIONS & POLICY IMPLICATIONS

The proximity of Black Lung Clinics close to areas of more common CWP cases indicates that Clinics are largely well placed to pursue their mission. In addition, this proximity provides an opportunity to use Clinics as a means to not only treat CWP, which they currently do, but to expand their education and outreach efforts to help prevent future cases from developing. This opportunity arises from the knowledge that CWP can be prevented if safety standards in mines are carefully followed. Black Lung Clinics could take a more proactive role in working with mining operators and employees to improve safety standards for miners. This could be done by expanding and targeting the educational programs that are currently offered to both operators and miners on the importance of following dust control regulations. Programs may be targeted to mining areas that have been identified by prior research as being at the highest risk, such as smaller mines in parts of central Appalachia (4). Additional research is indicated to understand how educational and outreach programs offered by Black Lung Clinics may be made as effective as possible, for example, by understanding how to best reach employees who may be reluctant to pursue services. Clinics may also undertake efforts to expand their geographic reach so they may offer education to prevent CWP, or testing and treatment for CWP, to more areas. Possibilities to expand this reach include making greater use of telemedicine technology. Another possibility is for Black Lung Clinics to partner with other HRSA-funded clinics such as Federally Qualified Health Centers that may be more proximate to mining populations in some areas to coordinate education, outreach and treatment services.

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Additional Information

This Policy Brief represents a shorter version of the full report for this study. For the full report, please visit our website: <http://publichealth.hsc.wvu.edu/wvrhrc>

APPENDIX

Table 1: Summary of coal workers' pneumoconiosis (CWP) stage for all tested miners (N=30,590) 2000-2009.

CWP Stage	Number of Miners	Percent of Total
0	29,690	97.1
1	679	2.2
2	106	0.3
3	17	0.1
PMF	98	0.3

Table 2: Mean percent (and standard deviation) of tested miners in each CWP stage, and combined across stages, in counties that contained, or were adjacent to, a Black Lung Clinic, compared to counties farther away from clinics. P values represent two-tailed t-test results.

	Counties containing, or adjacent to, a clinic (N=55)	Counties not containing, or adjacent to, a clinic (N=55)	
CWP Stage	Percent (standard deviation)	Percent (standard deviation)	P<
1	.0475 (.046)	.0168 (.024)	.0001
2	.006 (.009)	.0042 (.015)	.40
3	.0015 (.004)	.0009 (.003)	.47
PMF	.0067 (.011)	.0032 (.010)	.08
Combined 1 through PMF	.0618 (.054)	.0251 (.036)	.0001

Figure 1: Map showing location of Black Lung Clinics (circles) and count and severity of CWP (shaded counties).

