

Silicosis Screening in Surface Coal Miners — Pennsylvania, 1996–1997

Silicosis is an occupational respiratory disease caused by inhaling respirable crystalline silica dust. Silicosis is irreversible, often progressive (even after exposure has ceased), and potentially fatal. Exposure to silica dust occurs in many occupations, including mining (1). During 1996–1997, surface coal miners at eight sites in Pennsylvania were screened to estimate the prevalence of silicosis, to identify risk factors for silicosis, and to refer miners with a possible diagnosis of silicosis or other conditions for medical evaluation and treatment. This report summarizes the results of the screening, which indicated that an increased prevalence of and risk for silicosis is associated with miners' age and years of drilling experience, and provides recommendations for preventing silicosis among miners.

Enrollment in the screening was voluntary and available to anyone who had worked in surface mining for 1 year or more. Surface miners were informed of the screening by Mine Safety and Health Administration (MSHA) inspectors during routine mine visits. Screening was performed by a multiagency team from the Chronic Respiratory Disease Program of the Pennsylvania Department of Health (team leader), the Department of Health Evaluation Sciences of the Pennsylvania State University College of Medicine, MSHA, and CDC's National Institute for Occupational Safety and Health (NIOSH).

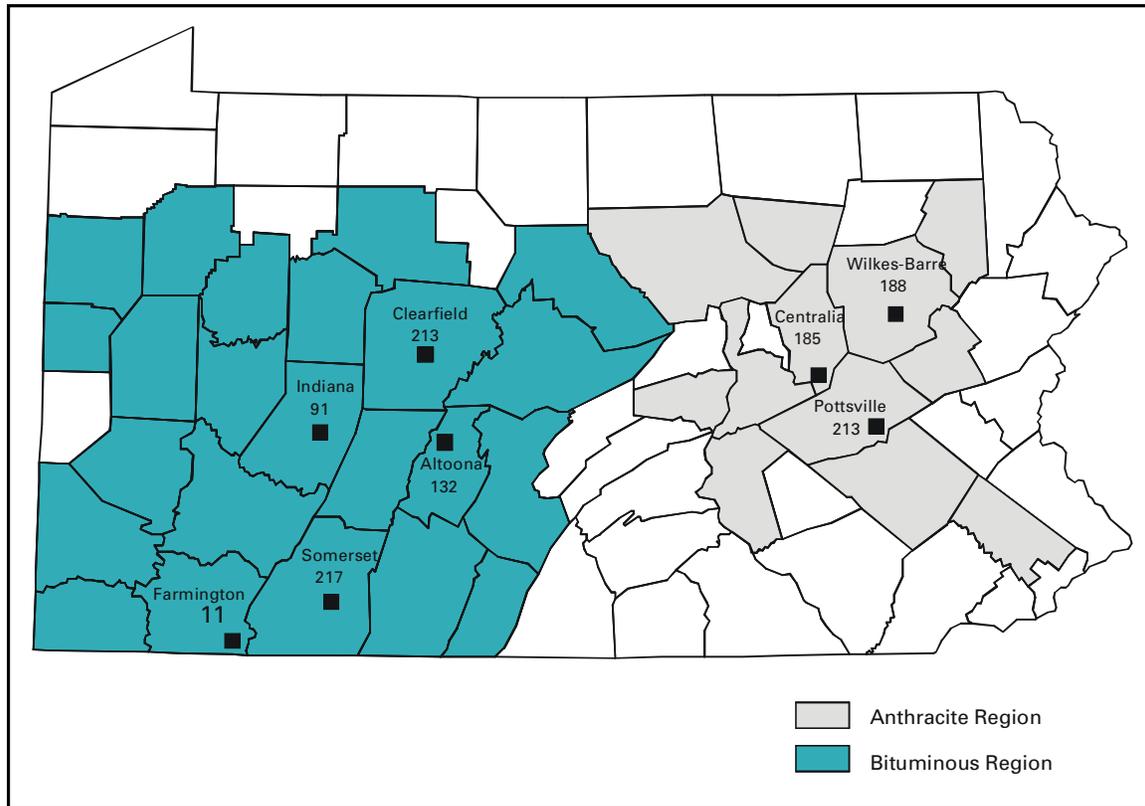
Screening was conducted during May–June 1996, at five mine sites in bituminous coalfields in western Pennsylvania (Altoona, Clearfield, Farmington, Indiana, and Somerset) and, in June 1997, at three mine sites in anthracite coalfields in eastern Pennsylvania (Centralia, Pottsville, and Wilkes-Barre). The screening was divided by coal type and region because of differences in geology and mining practices. Screening consisted of anterior-posterior chest radiographs; spirometry; and a survey containing questions about demographics; medical, work, and smoking history; and workplace exposures. Silicosis was defined as a radiographic finding of International Labour Organization (ILO) classification of profusion category $\geq 1/0$ (2); classification was based on consensus of at least two of three NIOSH-certified B readers*. Descriptive analyses were performed on all variables collected from the radiographs, spirometry, and surveys. Multivariable logistic regression models were used to determine risk factors for developing silicosis.

During 1996–1997, 1250 current and former coal miners were screened at the eight sites (664 in western and 586 in eastern Pennsylvania); and data from 1236 miners were suitable for analysis (Figure 1). Screened miners were almost exclusively white (99.9%), male (99.5%), and non-Hispanic (97.6%); the mean age was 46.2 years (range: 18–87 years). Of 1221 miners, 289 (23.7%) were current smokers, and 729 (59.7%) had ever smoked; 1120 (90.7%) of 1235[†] were employed full-time.

Radiographic evidence of silicosis was found in 83 (6.7%) of 1236 screened miners. Prevalence of silicosis did not vary by smoking status, and no significant differences in prevalence were noted by site except among the 213 participants at Clearfield (16.0%; $p=0.001$). When data from Clearfield were excluded, the prevalence of silicosis was

*A physician certified by NIOSH as having competency in the classification of chest radiographs to detect pneumoconiosis using ILO guidelines. If at least two of the three B readers categorized the profusion as $\geq 1/0$, the miner was classified as having silicosis; if at least two readers indicated the film was negative ($<1/0$), the miner was classified as not having silicosis.

[†]Denominators vary because of nonresponse to specific questions.

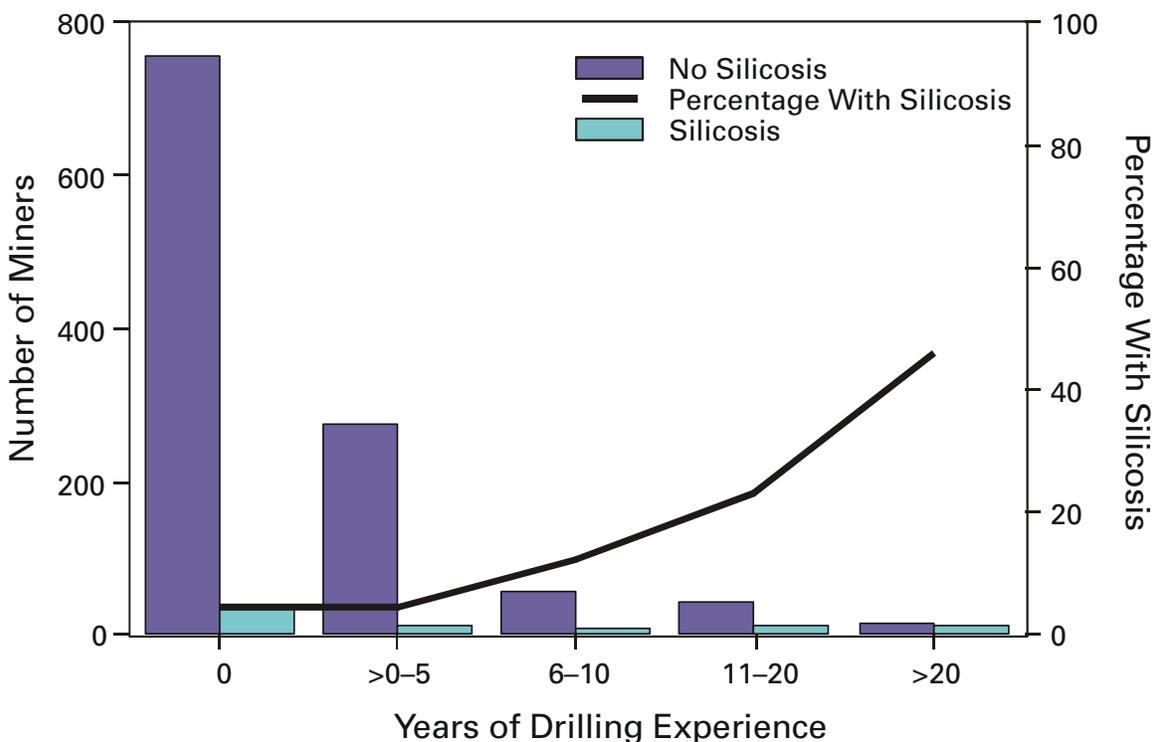
*Silicosis — Continued***FIGURE 1. Number of surface coal miners participating in silicosis screening, by region and site — Pennsylvania, 1996–1997**

similar for western (5.2%) and eastern (4.5%) Pennsylvania. The odds ratio (OR) for silicosis at the Clearfield site compared with other western sites was 4.4 (95% confidence interval [CI]=2.3–8.5); the OR for silicosis at eastern sites was 1.1 (95% CI=0.6–2.1) compared with western sites, excluding Clearfield.

The mean age of miners with silicosis was 50.6 years and without silicosis was 45.6 years ($p=0.0002$). When age was modeled as a quadratic function in the logistic regression model, a significant increase in silicosis occurred with increasing age. Compared with miners aged 30 years, miners aged 40, 50, and 60 years had progressively increased odds of silicosis: 3.7 (95% CI=1.7–8.2), 7.8 (95% CI=2.4–25.3), and 9.7 (95% CI=3.0–31.6), respectively. Silicosis prevalence increased as the number of reported years of drilling experience increased, from 37 (4.7%) of 792 miners reporting no drilling experience to 12 (46%) of 26 in miners reporting >20 years experience (Figure 2). Compared with miners with ≤ 5 years of drilling experience, those who had 6–10, 11–20, and >20 years experience had progressively increased odds of silicosis: 4.3 (95% CI=1.6–11.8), 7.0 (95% CI=2.6–18.6), and 14.5 (95% CI=4.8–43.6), respectively.

Reported by: PA Tyson, MSW, Chronic Respiratory Disease Program, Pennsylvania Dept of Health. JL Stauffer, MD, EA Mauger, PhD, JE Caulfield, MS, Pennsylvania State Univ College of Medicine, Hershey. DW Conrad, KG Stricklin, Mine Safety and Health Administration, US Dept of Labor. Div of Respiratory Disease Studies; Office for Mine Safety and Health, Pittsburgh Research Laboratory, National Institute for Occupational Safety and Health, CDC.

Silicosis — Continued

FIGURE 2. Number and percentage of surface coal miners with and without silicosis, by reported years of drilling experience — Pennsylvania, 1996–1997

Editorial Note: This report underscores the risk for silicosis associated with surface coal mining operations. Previous studies identified an increased risk for silicosis among rock drillers (3), and this report corroborates the increased prevalence of silicosis among surface coal mining drillers (4,5).

The findings in this report are subject to at least four limitations. First, the sample was voluntary and represented approximately 40% of Pennsylvania surface coal miners (63% of anthracite miners and 29% of bituminous miners[§]); therefore, the results do not necessarily represent all surface coal miners in Pennsylvania or the United States. Silicosis prevalence may be underestimated if miners with confirmed or suspected silicosis did not participate or may be overestimated if a higher percentage of affected workers participated. Second, B reader variability in the interpretation of chest radiographs was a possibility, although the study methods were designed to limit the effects of reader variability (6). Third, prevalence differences across sites must be interpreted cautiously; miners were not restricted in their choice of screening site, and the latency period for silicosis, several years to several decades following exposure, makes it difficult to determine a specific source of exposure in workers. Finally, the study collected data on years of drilling experience and not on years of overall mining experience; some miners may have performed numerous duties at different mines throughout the region.

[§] Data from MSHA, part 50. The Federal Mine Safety and Health Act of 1977 requires all mine operators to record and report to MSHA data on occupational injuries; illnesses; certain noninjurious accidents; and related employment, work time, and operating activity information. MSHA data cited for number of employees are for mine operator employees only; state-specific data are not available for contractor employees.

Silicosis — Continued

According to MSHA part 50 data for 1996 and 1997, Pennsylvania had almost one third of the U.S. surface coal mines; however, because of the many small operations in Pennsylvania, 3205 (approximately 10%) of the 31,308 surface coal miners in the United States are employed in Pennsylvania. Smaller mine operations may lack resources required to purchase or maintain optimal dust-control equipment, and small-scale operations represent special challenges for enforcement activities. The reason for the higher silicosis prevalence at Clearfield is unknown; however, influences may include site-specific geologic factors (e.g., quartz content of overlying rock), past work practices, mining methods, types of controls, or machinery maintenance.

Because no effective treatment exists for silicosis, prevention through exposure control is essential (7). When proper practices are not followed or controls are not maintained, silica exposures can exceed the MSHA Permissible Exposure Limit (PEL) or the NIOSH Recommended Exposure Limit (REL)[†]. Effective engineering controls in the mining environment include dust suppression (e.g., wet drilling), dust collection (e.g., dry drilling with particulates exhausted through a dust collection system), and use of enclosed isolation systems (e.g., air conditioned cabs under positive pressure and equipped with both filtered air supply and filtered recirculated air). In 1994, MSHA and NIOSH implemented a regional, and later a national, silicosis prevention program that promoted educational efforts and allowed coal mine inspectors to issue citations on the basis of visual inspection of dust-producing drilling equipment rather than more extensive sampling (8). As a result, some high-risk equipment has been discarded by the mines; however, because of the long latency period that usually precedes clinical onset of silicosis, the impact of these reforms on the incidence of silicosis remains unclear.

References

1. Wagner GR. Asbestosis and silicosis. *Lancet* 1997;349:1311–5.
2. International Labour Office. Guidelines for the use of ILO international classification of radiographs of pneumoconioses. Geneva, Switzerland: International Labour Office, 1980.
3. National Institute for Occupational Safety and Health. NIOSH alert: request for assistance in preventing silicosis and deaths in rock drillers. Cincinnati, Ohio: US Department of Health and Human Services, Public Health Service, CDC, 1992; DHHS publication no. (NIOSH)92-107.
4. Amandus HE, Hanke W, Kullman G, Reger RB. A re-evaluation of radiologic evidence from a study of U.S. strip coal miners. *Arch Environ Health* 1984;39:346–51.
5. Amandus HE, Petersen MR, Richards TB. Health status of anthracite surface coal miners. *Arch Environ Health* 1989;44:75–81.
6. Wagner GR, Attfield MD, Parker JE. Chest radiography in dust-exposed miners: promise and problems, potential and imperfections. *Occup Med* 1993;8:127–41.
7. CDC. Silicosis deaths among young adults—United States, 1968–1994. *MMWR* 1998;47:331–5.
8. US Department of Labor, Mine Safety and Health Administration. Code of federal regulations title 30; part 72.620. *Federal Register* 1994;59:8323–4.

[†] PEL for coal mining is 2.0 mg of respirable coal dust per cubic meter of air (2 mg/m³); however, when the respirable quartz (crystalline silica) content of the dust exceeds 5%, a reduced PEL is computed by dividing the percentage of respirable quartz into the number 10 (Title 30, Code of Federal Regulations, Part 71.101). NIOSH-recommended exposure limit (REL) for respirable crystalline silica is a 10-hour, time-weighted average level of 50 µg/m³.

MMWRTM
**MORBIDITY AND MORTALITY
WEEKLY REPORT**

- 605 Pregnancy Rates Among Adolescents
- 612 Silicosis Screening in Surface Coal Miners — Pennsylvania, 1996–1997
- 616 Hepatitis B Vaccination Coverage Among Asian and Pacific Islander Children — United States, 1998
- 619 Delayed Supply of Influenza Vaccine and Adjunct ACIP Influenza Vaccine Recommendations for the 2000–01 Influenza Season
- 622 Summary of the Joint Statement on Thimerosal in Vaccines

**National and State-Specific Pregnancy Rates Among Adolescents —
United States, 1995–1997**

Each year in the United States, 800,000–900,000 adolescents aged ≤ 19 years become pregnant. Adolescent pregnancy and childbearing have been associated with adverse health and social consequences for young women and their children. This report presents estimated national numbers of pregnancies and national and state-specific pregnancy rates for adolescents aged ≤ 19 years from 1995* to 1997. The findings indicate a decline in national and state-specific adolescent pregnancy rates during 1995–1997, and a continuing downward trend beginning in the early 1990s (1,2,4).

Number of pregnancies was estimated as the sum of live births, legally induced abortions, and estimated fetal losses (i.e., spontaneous abortions and stillbirths) among females aged ≤ 19 years. Live birth data were reported by the mother's state of residence. Because abortion data by residence were not available for all states, abortions were reported by state of occurrence.[†] Complete age-specific abortion information was not available for nine reporting areas in 1995 (including the District of Columbia [DC]), eight areas in 1996 (including DC), and six states in 1997. To calculate national adolescent pregnancy rates, estimates of abortions among adolescents were calculated for states with missing data (1). Estimates of fetal losses were based on sample survey data of women aged 15–44 years from the 1988 and 1995 National Surveys of Family Growth (NSFG) (3). A national estimate of fetal losses for all females aged 15–19 years was derived from NSFG data and used to create annual estimates of fetal losses based on the number of live births and legally induced abortions in a given year (CDC, unpublished

*National and state-specific adolescent pregnancy rates for 1995 were previously reported (1,2). National rates for 1995 are reported here because fetal loss estimates were not included in the earlier definition of pregnancy (1) and because of a change in the population denominator data supplied by the Bureau of the Census used in calculating rates; state-specific data for 1995 are reported again because of the change in the population denominator data. Adolescent pregnancy rates previously published by CDC (2) should not be used together with those reported here in time series analyses because of these changes in methods. Adolescent pregnancy rates in other sources (3) may not be comparable to data in this report because of different calculation methodologies.

[†] For 48 reporting areas in 1995–1996 and 49 in 1997, the number and characteristics of persons who had legal induced abortions were provided by state health departments and the health departments of New York City and the District of Columbia. For four areas in 1995–1996 and three in 1997, the number of abortions were provided from hospitals and other medical facilities.