

## Coal Workers' Pneumoconiosis Mortality in the United States, 1999 - 2015

Ki Moon Bang\*

Former Professor, Department of Community Health and Family Practice, Howard University College of Medicine, Washington, DC, United States

**\*Corresponding Author:** Ki Moon Bang, Former Professor, Department of Community Health and Family Practice, Howard University College of Medicine, Washington, DC, United States.

**Received:** November 08, 2017; **Published:** November 22, 2017

### Abstract

**Background:** Coal Workers' Pneumoconiosis (CWP) is an occupational respiratory disease and it is preventable. CWP causes by respirable coal mine dust at the underground mines or surface mines. Since 1999, over 10,000 miners died from CWP in the United States (U. S.). Temporal trend in CWP mortality has not been reported for recent decades after 1999.

**Objective:** To describe the temporal trends in CWP deaths and death rates during 1999 - 2015.

**Materials and Methods:** Using 1999 - 2015 national deaths data in the U. S. CWP deaths were identified. The CWP death rates were age-adjusted to the 2000 U.S. standard population and 95% confidence intervals were calculated by Poisson analysis. The proportionate mortality ratios (PMRs) were calculated by industry and occupation for 1999 - 2011.

**Results:** During 1999 - 2015, a total of 10,283 CWP deaths were identified. Of these, 10,061 (97.8%) were males and 9,941 (96.7%) were whites. The overall age-adjusted CWP death rate declined from 5.7 per million population in 1999 to 1.3 in 2015. Industry with the highest PMR was coal mining (78.5) and occupation with the highest PMR was mining machine operators (77.2).

**Conclusion:** The CWP deaths significantly declined during the period 1999 - 2015. However, the number of CWP deaths including young deaths are still occurring each year. This finding suggests that more comprehensive prevention and intervention for CWP and continuous monitoring of temporal trends in CWP deaths are needed.

**Keywords:** Coal Workers' Pneumoconiosis; Mortality; Industry; Occupation; Proportionate Mortality Ratio

### Introduction

CWP has been recognized as an occupational disease for many centuries and it causes by exposure to respirable coal mine dust. Although exposure to coal mine dust occurs most commonly in underground mines, there is some exposure in handling and transportation of coal above ground as well.

Among the inorganic dust diseases, CWP would be the most widely appreciated disease with minimally fibrotic reaction. The coal mine dust is deposited in the region of the respiratory bronchioles, where it is taken up by macrophages and is either cleared or remained in the interstitium [1]. CWP exists both in simple and complicated forms. Simple CWP appears as soft, black indurated nodules and it increases the likelihood for future development of the complicated form. The complicated CWP is known as progressive massive fibrosis which is the most severe form of the disease [2].

The recognition of the burden and costs of CWP on individual and the state motivated the first major U. S. federal coal mine dust exposure limit of 2.0 milligrams per cubic meter of air ( $\text{mg}/\text{m}^3$ ) in 1969. For further prevention of CWP, the U.S. federal government reduced the coal mine dust exposure limit of 1.5  $\text{mg}/\text{m}^3$  in 2014 and the new lowered exposure limit was effective in 2016 [3].

---

**Citation:** Ki Moon Bang. "Coal Workers' Pneumoconiosis Mortality in the United States, 1999 - 2015". *EC Pulmonology and Respiratory Medicine* 5.5 (2017): 231-235.

The purpose of this report is to describe the recent trend in CWP mortality based on CWP deaths data available from 1999 to 2015. There is a previous report on CWP mortality surveillance between 1968 and 2005 [4].

**Materials and Methods**

The CWP mortality data were based on multiple cause (underlying or contributing) of death data obtained from the U.S. National Center for Health Statistics from 1999 to 2015. The CWP mortality data with other respiratory mortality data have been compiled in the National Occupational Respiratory Mortality system by the U. S. National Institute for Occupational Safety and Health [5].

For analysis of the mortality data, classification code of CWP deaths was International Classification of Disease (ICD), 10<sup>th</sup> revision diagnosis code ICD-J60 [6]. Deaths of person aged 25 years and older were analyzed. The death rates were age-adjusted using the 2000 U. S. standard population and 95% confidence intervals (CIs) were calculated by Poisson analysis [7]. The proportionate mortality ratios (PMRs) were calculated by industry and occupation. The PMR for CWP deaths is defined as the observed number of CWP deaths in a specific industry or occupation divided by the expected number of CWP deaths. The specific industry and occupation codes used 3-digit codes based on the Bureau of Census Industry Code (CIC) and Occupation Code (COD) [8]. For this report, the PMRs were only for industries and occupations with five or more CWP deaths in the 1999 - 2011 period which information on industry and occupation from death certificates were available.

**Results**

During 1999 - 2015, a total of 10,283 CWP deaths were identified. Of these deaths, 10,061 (97.8%) were males and 9,941 (96.7%) were white. The overall age-adjusted death rate was 3.0 per million population per year and males (7.6) had a 76-fold higher rate than female (0.1) (Table 1).

Sex	Death		Age-adjusted death rate (95% CI)	
	No.	%		
Male	10,061	97.8	7.6 (7.5 - 7.8)	
Female	222	2.2	0.1 (0.1 - 0.1)	
Race	White	9,941	96.7	3.3 (3.3 - 3.4)
	Black	312	3.0	1.1 (1.0 - 1.2)
	Other	30	0.3	0.2 (0.1 - 0.3)
Total	10,283	100.0	3.0 (3.0 - 3.1)	

**Table 1:** Number and percent distribution of CWP deaths and age-adjusted death rate (per million population) by sex and race, U. S. residents aged ≥ 25 years, 1999 - 2015.

By age group, the age-specific death rates increased from 0.1 per million population in the age group 25 - 44 years to 13.8 in the oldest age group of 65 years and older (Table 2).

Age Group (Years)	Death		Death Rates (95% CI)
	No.	%	
25 - 44	148	1.4	0.1 (0.1 - 0.1)
45 - 64	1,117	10.9	0.8 (0.8 - 0.9)
65+	9,018	87.7	13.8 (13.5 - 14.1)

**Table 2:** Number and percent distribution of CWP deaths and death rate (per million population) by age group, U.S. resident aged ≥ 25 years, 1999 - 2015.

For 16 years since 1999, the CWP deaths significantly declined from 1,003 in 1999 to 324 in 2015. The age-adjusted death rate also significantly declined from 5.7 per million population in 1999 to 1.3 in 2015 (Table 3).

Year	No. of Deaths	Age-adjusted death rate (95% CI)
1999	1,003	5.7 (5.4 - 6.1)
2000	948	5.3 (4.9 - 5.6)
2001	887	4.9 (4.6 - 5.2)
2002	857	4.7 (4.4 - 5.0)
2003	772	4.1 (3.8 - 4.4)
2004	703	3.7 (3.4 - 4.0)
2005	650	3.4 (3.1 - 3.6)
2006	652	3.3 (3.1 - 3.6)
2007	523	2.6 (2.4 - 2.8)
2008	471	2.3 (2.1 - 2.5)
2009	478	2.3 (2.1 - 2.5)
2010	485	2.3 (2.1 - 2.5)
2011	410	1.9 (1.7 - 2.1)
2012	398	1.8 (1.6 - 1.9)
2013	359	1.6 (1.4 - 1.7)
2014	363	1.5 (1.4 - 1.7)
2015	324	1.3 (1.2 - 1.5)
1999-2015	10,283	3.0 (3.0 - 3.1)

**Table 3:** Number of CWP deaths and age-adjusted death rate (per million population) by year, U.S. resident aged  $\geq 25$  years, 1999 - 2015.

Significantly elevated PMRs by industry and occupation are shown in table 4. By industry, coal mining had the highest PMR of 78.5 [95% confidence limit (CI) 74.1 - 83.1] and the second highest PMR was 5.1 (95% CI 1.9 - 11.2) for non-specified type of mining. By occupation, mining machine-operators had the highest PMR of 77.2 (95% CI 72.7 - 82.0) and the second highest PMR was 5.5 (95% CI 2.8 - 9.8) for other extraction workers (Table 4).

Industry and Occupation (Bureau of Census Classification Code)	No. of deaths	PMR (95% CI)
<b>Industry</b>		
Coal mining (038)	1,180	78.5 (74.1 - 83.1)
Not specified type of mining (048)	6	5.1 (1.9 - 11.2)
Metal ore mining (039)	12	4.4 (2.2 - 7.6)
<b>Occupation</b>		
Mining machine operators (684)	1,074	77.2 (72.7 - 82.0)
Other extraction workers (694)	11	5.5 (2.8 - 9.8)
Material moving workers (975)	6	4.3 (1.6 - 9.4)
Compliance officers, except agriculture, construction, health and safety, and transportation	6	3.1 (1.1 - 6.7)

**Table 4:** CWP proportionate mortality ratio (PMR) and 95% confidence intervals by industries and occupations with the highest significantly elevated PMR. U.S. resident aged  $\geq 25$  years, 1999 - 2011.

## Discussion

This is a descriptive epidemiologic study on the trend in 10,283 CWP deaths over the period 1999 - 2015. Since 1999, the significantly declined trend in CWP deaths and age-adjusted death rates might be associated with several reasons. First, the reduction of federal coal mine dust exposure level to 2 mg/m<sup>3</sup> in 1969 and since then the Mine Safety and Health Administration (MSHA) did several actions to lower miners' exposure to respirable coal mine dust. On August 1, 2016, MSHA lowered the existing concentration limits for respirable coal mine dust from 2.0 mg/m<sup>3</sup> to 1.5 mg/m<sup>3</sup> at underground and surface coal mines [3]. This MSHA's final rule would not only reduce CWP deaths and new CWP cases in the U.S, but also lower the risk that miners will suffer material impairment of health or functional capacity over their working lives. Second, the yearly reduction in employment at coal mines would affect to reduce CWP mortality. The coal miners have been decreased over time because of the closed mines due to economic insecurity and also bankruptcy of the mine company. One study reported that the reduction of miners' employment was associated with declining CWP deaths in the U. S. [4].

CWP deaths still occurred among young persons aged 25 - 45 years. These young miners might be exposed to excess coal mine dusts at underground mines or surface mines. Young miners have been showed evidence of advanced and seriously debilitating CWP from excessive coal dust exposure [3]. This finding indicates the importance of educating at risk workers and their employers regarding the dangers of exposure to respirable coal mine dust at underground mines or surface mines.

Significantly elevated PMRs in mining machine operators, other extraction workers, and material moving workers indicate that these workers have been exposed to excessive coal mine dust at their workplaces. This finding suggests that employers need to control dust level at the workplaces and regular medical surveillance for these workers to prevent CWP.

The economic burden of CWP compensation to the federal government is enormous amount each year. As of December 2011, according to the Department of Labor's Office of Workers' Compensation Program, the federal government has paid over \$44 billion in Federal Black Lung benefits to beneficiaries (former miners, widows, dependents) since 1970 [3].

The findings in this report are subject to strength and limitations. The strength in this study is use of the national CWP mortality data available up to 2015 for 16 years in order to evaluate the most recent CWP mortality trend in the U. S. There are several limitations in this study. First, CWP deaths were not validated by medical records or follow-up with health care providers, thus death cases might be subject to misclassification. Second, the industry and occupation information were not available for the entire study period because not all states reported information on industry and occupation in the decedents' death certificates and also, they did not report them each year because of limited budget. And no individual work history was reported on death certificates. Therefore, it was not possible to identify those industries and occupations where the decedents' exposure to coal mine dusts occurred. Third, information on initial respirable coal mine dust level on each miner was not available to evaluate the dose-response for CWP deaths.

## Conclusion

The finding in this study suggests that the continuing decline in CWP mortality would be expected. However, CWP mortality surveillance should be continued to track temporal trend in mortality. Surveillance program can detect trends and clusters of CWP occurrences and allow secondary preventive interventions to slow the rate of progression in miners. More efficient comprehensive efforts based on hierarchy control of respirable coal mine dust exposure by engineering controls and policy regulation need to prevent new CWP cases.

## Conflict of Interest

I have no financial interest or no conflict of interest.

## Bibliography

1. Rom WN. "Environmental and Occupational Medicine, second edition". Little, Brown and Company Boston (1992): 254.

2. Christiani DC and Wegman DR. "Respiratory Disorders". In: Occupational Health Recognizing and Preventing Work-Related Diseases, 3<sup>rd</sup> edition. Little, Brown and Company, Boston (1995): 450-451.
3. U.S. Department of Labor, Mine Safety and Health Administration. Lowering Miner's Exposure to Respirable Coal Mine Dust, Including Continuous Personal Dust Monitors. Federal Register 79.84 (2014).
4. Attfield MD, *et al.* "Trends in pneumoconiosis mortality and morbidity for the United States, 1968 - 2005, and relationship with indicators of extent of exposure". *Journal of Physics* 151 (2009): 1-10.
5. National Institute for Occupational Safety and Health. National Occupational Respiratory Mortality (NORM) system.
6. WHO. International Statistical Classification of Diseases and Related Health Problems, Tenth revision (1992).
7. Bailar JC and Ederer F. "Significant factors for ratio of a Poisson variables to its expectation". *Biometrics* 20.3 (1964): 639-643.
8. U. S. Department of Commerce, Economic and Statistics Administration, Bureau of the Census. Classification Index of Industries and occupations, U.S. Government Printing Office, Washington, DC (1992).

**Volume 5 Issue 5 November 2017**

**©All rights reserved by Ki Moon Bang.**