WORK-RELATED LUNG DISEASE SURVEILLANCE REPORT 1996

Division of Respiratory Disease Studies
National Institute for Occupational Safety and Health

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Preface

This 1996 *Work-Related Lung Disease (WoRLD) Surveillance Report* is the fourth in a series of occupational respiratory disease surveillance reports produced by the National Institute for Occupational Safety and Health (NIOSH). The purpose of this 1996 report is to provide national and state-specific summaries of occupational respiratory disease surveillance data focusing on pneumoconiosis mortality. Selected occupational respiratory hazard sampling data relevant to pneumoconiosis are also presented.

The 1996 *WoRLD Surveillance Report* has three sections: 1) a highlights and limitations section that provides data highlights and data usage limitations; 2) a United States section that serves to update and expand overall national data provided in the 1994 *WoRLD Surveillance Report;* and 3) a state section that provides detailed profiles of pneumoconiosis data for each state in the U.S..

The United States section updates pneumoconiosis mortality surveillance data published previously in the 1994 *WoRLD Surveillance Report*, by including data available for 1991 and 1992. For each condition, this section presents national data such as counts, crude and age-adjusted mortality rates, and years of potential life lost to age 65 to and life expectancy. Proportionate mortality ratios by industry and occupation, are based on data from a subset of states (see state list, Appendix C) for which usual industry and occupation have been coded for decedents. Also presented are U.S. county level maps showing the geographic distribution of mortality for each pneumoconiosis condition. In addition, this section presents selected occupational exposure sampling data for asbestos, coal and coal mine dust, silica dust, cotton dust, etc. (see agent categories, Appendix D).

The State section provides more detailed pneumoconiosis mortality surveillance data for each state and for the District of Columbia. The State section is organized so that tables and graphs of data for each state are grouped together. Selected graphs, tables, and maps present pneumoconiosis mortality from 1968 to 1992 for each state, as well as for counties within each state. Surveillance data include counts, crude and age-adjusted mortality rates, and years of potential life lost to life expectancy.

Pneumoconiosis conditions highlighted in the report include asbestosis, coal workers' pneumoconiosis, silicosis, byssinosis, and pneumoconioses classified as either "unspecified" or "other," as well as all pneumoconioses aggregated. Although some experts do not consider byssinosis a typical pneumoconiosis, it is included because the International Classification of Disease (ICD) system places byssinosis (code 504) within the series of codes for the pneumoconioses (500-505) and because byssinosis is included with other pneumoconioses in a new occupational safety and health objective for the nation (#10.17 in *Healthy People 2000: Midcourse Review and 1995 Revisions*).

Data contained in the report originate from publications, reports, and data provided by the National Center for Health Statistics (NCHS), the Occupational Safety and Health Administration (OSHA), the Mine Safety and Health Administration (MSHA), and the Bureau of Mines (BoM). Details on the major data sources and on the methods used to compute specific statistics can be found in Appendices A and B, respectively. Interpreted with appropriate care, information contained in this report can help to establish priorities for investigation and intervention, as well as to track progress toward the elimination of an important subset of preventable occupational respiratory diseases.

A description of previous editions of the *WoRLD Surveillance Report*, along with revisions and errata can be found in Appendix E. Comments and suggestions from users of earlier editions have influenced the content and format of this 1996 edition. To increase the utility of future editions, comments on the current report and descriptions of how the information is used are invited.

Send comments, suggestions, tear-out reader response card and other correspondence to:

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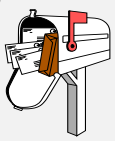

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Acknowledgments

This report was prepared primarily by the staff of the Surveillance Section, Epidemiological Investigations Branch, Division of Respiratory Disease Studies (DRDS), National Institute for Occupational Safety and Health (NIOSH). Key contributors included Rochelle B. Althouse, Robert M. Castellan, Steven R. Game, Ruth Ann Romero Jajosky, Jay H. Kim, Helen S. Montagliani, Kelly L. Pryor, John M. Wood, Ki Moon Bang, Section Chief, John E. Parker, Acting Branch Chief, Nancy J. Bollinger, Deputy Division Director, and Gregory R. Wagner, Division Director.

Dennis W. Groce and Janet M. Hale, of the Environmental Investigations Branch, DRDS, contributed information relating to occupational respiratory exposure sampling data.

Draft segments of this report were provided for review and comment to many individuals affiliated with academic institutions and public health organizations, as well as to others within NIOSH. Their thoughtful comments have resulted in a number of improvements in this final report.

Abbreviations

Avg. Sev.	average severity level
BoM	Bureau of Mines
CDC	Centers for Disease Control and Prevention
CFR	Code of Federal Regulations
CIC	Census Industry Code
COC	Census Occupation Code
CWP	coal workers' pneumoconiosis
DHHS	Department of Health and Human Services
DRDS	Division of Respiratory Disease Studies
ICD	International Classification of Disease
IMIS	Integrated Management Information System
LCL	lower confidence limit
MIDAS	Mine Inspection Data Analysis System
MMWR	Morbidity and Mortality Weekly Report
MRE	Mining Research Establishment
MSHA	Mine Safety and Health Administration
NCHS	National Center for Health Statistics
NEC	not elsewhere classifiable
n.e.c.	not elsewhere classified
NIOSH	National Institute for Occupational Safety and Health
NOS	not otherwise specified
OSHA	Occupational Safety and Health Administration
PEL	permissible exposure limit
PHS	Public Health Service
PMR	proportionate mortality ratio
SENSOR	Sentinel Event Notification Systems for Occupational Risks
TWA	time-weighted average
UCL	upper confidence limit
U.S.	United States
WONDER	Wide-ranging Online Data for Epidemiologic Research
WoRLD	Work-Related Lung Disease
YPLL	years of potential life lost

Contents

APPENDICES

HIGHLIGHTS and LIMITATIONS

Selected Highlights

The following paragraphs highlight data presented in the United States Section of this report. Many other highlights could have been mentioned, both from the United States Section and from the State Section.

Pneumoconiosis Mortality

During the 25-year period from 1968 to 1992 there were a total of **100,890 deaths with pneumoconiosis** among U.S. residents, age 15 and over.

Overall pneumoconiosis mortality in the U.S. has been gradually declining over the past two decades, from a peak of more than 5,000 deaths in 1972 to 3,230 in 1992. Mining industries have the two highest (and three of the five highest) proportionate mortality ratios for all pneumoconioses by industry. Ship building and repair, various manufacturing industries, and construction also have significantly elevated PMRs.

Asbestosis deaths represent 10 percent of pneumoconiosis deaths during the 25-year period from 1968 to 1992, and have increased from fewer than 100 to nearly 1,000 annually. Over the most recent three-year period, 1990 to 1992, however, asbestosis mortality appears to have leveled off. The geographic distribution of asbestos mortality tends to be coastal, and nearly 25 percent of asbestosis decedents during the 1968-1992 period were residents of California and New Jersey. Based on a large subset of the national data, various construction occupations account for many of these deaths.

Coal workers' pneumoconiosis (CWP) deaths clearly outnumber other types of pneumoconiosis, amounting to nearly 60 percent of pneumoconiosis deaths over the 25-year period from 1968 to 1992. Over the past decade, CWP mortality has declined each year and CWP deaths number fewer than 2,000 annually for 1990, 1991, and 1992. CWP mortality has been concentrated largely in coal producing states, and about two-thirds of all CWP decedents from 1968-1992 were accounted for by residents of Pennsylvania, alone. Nearly all CWP deaths were associated with employment in the coal mining industry, for which the CWP proportionate mortality ratio of 100 (95% CI = 97-104) was calculated based on a large subset of the national data from 1985 to 1992.

Silicosis deaths represent nearly 15 percent of all pneumoconiosis deaths in the U.S. from 1968 to 1992. Over these 25 years, mortality associated with silicosis has declined more than that associated with other types of pneumoconiosis, from well over 1,000 deaths annually before 1971 to less than 300 in 1992. Compared to asbestosis, CWP, and byssinosis, silicosis mortality is much less concentrated by geographic region or by industry.

In comparison with other pneumoconioses, **byssinosis** deaths (as enumerated from death certificate data) remain very few in number--less than 20 annually. Byssinosis mortality is concentrated in the textile producing areas of North and South Carolina, and only one industry ("yarn, thread, and fabric mills") was associated with high byssinosis mortality in the proportionate mortality ratio analysis (PMR=33; 95% CI=23-45).

The pattern of deaths from **unspecified/other pneumoconioses**, which account for 18 percent of all pneumoconiosis deaths during the 25-year period from 1968 to 1992, resembles CWP mortality with respect to: geographic distribution; a clear peak in 1972; and associated occupations and industries.

Occupational Respiratory Hazard Sampling

During a recent 2-year period (1993-1994), non-mining industries accounted for about 9 percent of all reported federal inspector samples for airborne pneumoconiotic agents. Within the non-mining industries, the **construction** industry was the most frequently sampled, but fewer than 1,000 samples were reported in this industry over these same two years. The average severity level for samples collected in the construction industry was 1.51. This indicates that, on average, measured exposure levels in the construction industry were about one and one-half times the applicable PEL.

Approximately one-half of all federal inspector samples for airborne pneumoconiotic agents (45,132 of 83,475 samples) reported for a recent 2–year period (1993-1994) were collected in the **coal mining** industry. The average severity level for respirable coal mine dust samples was less than 0.5, indicating that, on average, exposure concentrations measured by these inspectors were less than 1.0 mg/m^3. For comparison, the respirable coal mine dust permissible exposure limit (PEL), unadjusted for silica content, is 2.0 mg/m^3 MRE.

The data presented in this report indicate that, in recent years, OSHA and MSHA inspectors have found overexposures to **silica** more frequently and in more states than overexposures to other pneumoconiotic agents. For the years 1985-1994, approximately 15 percent of the 147,000 OSHA and MSHA inspector samples for silica were in excess of the PEL. By comparison, for the same time period, approximately 7 percent of the 268,000 OSHA and MSHA inspector samples for all other pneumoconiotic agents were in excess of the PEL. The OSHA inspectors in 42 states reported at least 10 percent of their silica samples in excess of the PEL for the years 1985-1994. MSHA inspectors in 29 states reported at least 10 percent of their silica samples in excess of the PEL in the same time period.

OSHA inspectors found overexposures to **cotton dust** for 31 percent of the 543 samples obtained during 1985-1994; the data were reported from six states.

Selected Limitations

Mortality Data

The focus of this report is on pneumoconiosis. Readers are therefore cautioned not to erroneously infer that the data presented are comprehensive for occupational lung diseases in general. Other types of lung disease (e.g., asthma and other obstructive airways disease) are also caused by exposure to respiratory hazards in the workplace. However, for most other work-related lung diseases, in contrast with pneumoconiosis, an assumption of an occupational etiology on the basis of death certificate information alone cannot be made without significant misclassification.

The assumption of work-relatedness of pneumoconiosis is reasonable for this surveillance report. Readers are cautioned, however, to realize that a very small proportion of those who die with pneumoconiosis may have developed disease as a result of non-occupational (e.g., avocational) exposure to pneumoconiotic agents.

The focus of this report is on pneumoconiosis mortality, since national pneumoconiosis morbidity data are not readily available. Readers are therefore cautioned not to erroneously infer that data presented are comprehensive for pneumoconiosis in general. Pneumoconiosis is typically (though not always) a chronic disease and, as reflected in median age at death data presented in this report, many affected individuals live to or past life expectancy. The fact that many individuals with pneumoconiosis do not die as a direct result of the pneumoconiosis has led to the decision to consider underlying and all contributing causes of death for each decedent in the data presented in this report. Readers are therefore cautioned to understand that for many pneumoconiosis decedents for which data are presented in this report, pneumoconiosis is a contributing cause of death, not necessarily the underlying cause.

Categorization of types of pneumoconiosis are limited by the ICD coding systems in use over the 25-year period covered by data presented in this report. ICD-8 to ICD-9 disease rubrics differ somewhat for all types of pneumoconiosis except for asbestosis (see table in Appendix B.) This fact alone may have had an effect on the classification of cause of death, although the effect is not considered substantial (e.g., there is no indication in the yearly trend in national silicosis mortality, despite a change in the ICD disease category related to silicosis).

As with any analysis based on death certificate data, there is undoubtedly some misclassification of cause of death. A treating physician may not correctly diagnose pneumoconiosis during a patient's life or, upon death, a certifying physician may fail to list an existing diagnosis of pneumoconiosis on the death certificate, particularly if other diseases were directly responsible for the decedent's death.

As mentioned in the *Preface*, some occupational lung disease experts do not consider byssinosis as a pneumoconiosis. One feature that clearly distinguishes byssinosis from the more typical pneumoconioses is the absence of characteristic lung opacities on radiographic examination of the chest. In advanced stages of the disease, byssinosis is therefore clinically indistinguishable from other chronic obstructive pulmonary diseases. This may lead to more substantial underdiagnosis of byssinosis compared with that of the pneumoconioses associated with radiographic abnormalities.

Physician diagnostic practices are influenced by many factors—not only advances in medical knowledge, including awareness of jobs and industries associated with particular hazardous occupational exposures, but also changing occupational disease compensation programs (e.g., a Federal "Black Lung" compensation program was established for coal miners following the passage of the Federal Mine Heath and Safety Act of 1969) and pressure associated with private litigation (e.g., many third party torts based on injury resulting from adverse health outcomes associated with asbestos have appeared in the courts over the past 20 years). These and other factors are undoubtedly reflected in data presented in this report (e.g., the obvious peak in CWP deaths in 1972).

County and state of residence at death may not represent the geographic location of the decedent's occupational exposure to pneumoconiotic agents. The geographic pattern of CWP mortality is illustrative in this regard, in that it highlights not only coal producing areas associated with risk of disease, but also areas in Florida and California to which many affected miners have retired.

Usual occupation and industry codes are often, but not always, those which were associated with the exposure responsible for the pneumoconiosis. Readers are therefore cautioned with regard to assuming causative inferences about all occupations and industries associated with pneumoconiosis in various tables in this report. Moreover, readers are reminded that usual occupation and industry data analyzed in this report represent only a subset of the mortality data (i.e., for selected states from 1985 to 1992, see Appendix C).

Denominators used to calculate rates presented in this report are based on general population estimates for the location (e.g., nation, state, or county) and for the years in which the deaths occurred. The resulting rates have clear public health significance, but readers are cautioned not to fail to realize, as suggested by the proportionate mortality ratios presented in this report by occupation and by industry, that rates are much higher in certain occupational groups. Apparent changes in mortality rates may reflect, in part or in whole, changes in employment patterns affecting the number of people at risk.

Over the 25-year period covered by data presented in this report, median ages at death have been generally increasing for all types of pneumoconiosis. The reader is cautioned to realize that this increase is the result of many factors, only one of which may be a general lessening of pneumoconiosis severity (e.g., due to enhanced diagnostic sensitivity in addition to fewer severe cases). Other contributing factors undoubtedly include less mortality pressure from other causes of death, in general.

Many tables and figures presented in this report contain small numbers. Those responsible for preparing this report decided to err on the side of providing all the data (i.e., not censoring on the basis of small numbers), recognizing that by doing so opportunities are being provided for over-interpretation of the data. The small-numbers issue applies especially in the State Section, where data are presented by county, but also applies in the United States Section of the report. Moreover, rates have been calculated on the basis of these small numbers and are shown, along with rankings of these rates. The reader is cautioned that **rates based on small numbers can be quite unstable**, so any inferences should be drawn with care. By keeping both rates and counts in mind while considering the tabled data, and/or by logically aggregating cells (e.g., county-specific data) on the basis of the location of particular industries within a particular state, knowledgeable individuals can use the data in this report to identify potential opportunities for enhancement of efforts to prevent pneumoconiosis.

Exposure Data

Industrial hygiene inspection records maintained by OSHA, MSHA, and the former Bureau of Mines were used in this report as a gauge of the range of exposures to pneumoconiotic agents in U.S. industry. These data are considered provisional and subject to revision as additional information becomes available. The inspector samples were gathered for regulatory compliance purposes, rather than for the surveillance of worker exposures. Nonetheless, the inspector data reported herein are the best available information for assessing the range of exposures encountered by U.S. workers on a national scale.

MSHA and OSHA inspection data for similar exposure agents are presented in this report in a parallel format. The reader is cautioned that MSHA and OSHA are separate agencies with separate regulatory jurisdictions. Thus, the number of samples gathered by one agency versus the other, or by one agency from year to year, is not necessarily a valid basis for comparison. A variety of factors

(e.g., Congressional actions, regulatory policies, and changes in analytical methods) can affect the number of samples and the exposure levels being reported by the inspectors.

The list of pneumoconiotic agents used to select inspection sample records from available OSHA and MSHA data files was defined based on the agents which MSHA and OSHA have included in their computerized data systems, and is not a comprehensive list of all agents associated with pneumoconiosis. Nevertheless, the listed agents are associated with what are widely recognized as the most prevalent types of pneumoconiosis. Some agents for which an association with pneumoconiosis is less clear-cut (e.g., OSHA data for "particulates not otherwise regulated") were not included in the analyzed data.

The exposure data analyzed in this report include 69,427 MSHA inspector samples for respirable particulates not otherwise regulated, from non-coal mines. MSHA inspector sampling policies indicate that these samples were, in fact, originally obtained due to the potential for silica exposures. For that reason, the report includes those 69,427 samples as a part of the silica exposure dataset. The reader is cautioned that this inclusion marks a departure from the analytical approach used in previous WoRLD Surveillance Reports.

The severity levels for pneumoconiotic agents were generally derived by dividing the exposure concentrations by the permissible exposure limit (PEL), and can therefore generally be considered related to actual enforceable PELs. However, there are important exceptions to this general rule. Specifically, due to complexities related to determination of enforceable PELs associated with respirable coal mine dust and with respirable coal mine quartz samples, denominators used to calculate the average severity levels for respirable coal mine dust and for respirable coal mine quartz were 2.0 mg/m^3 MRE and 0.1 mg/m^3 MRE, respectively (see Appendix B.)

Although available exposure data for agents associated with each type of pneumoconiosis are presented in this report following the presentation of mortality data for that same condition, the reader is reminded that the time period over which the exposure data were collected is not expected to correspond to the time period during which most of the decedents represented in the mortality data acquired their disease. For most pneumoconiosis deaths, there is a typical latency period of at least several years between first occupational exposure and onset of disease, and subsequent death typically occurs many years after disease onset.

For the time period covered by this report (through 1994), MSHA's respirable coal mine dust inspector samples with less than 0.45 mg net weight gain were not analyzed for quartz.