EPIDEMIOLOGIC SURVEILLANCE BY A STATE HEALTH DEPARTMENT USING THE ILO CLASSIFICATION SYSTEM FOR PNEUMOCONIOSES

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Since October, 1985, the Wisconsin Division of Health has provided radiologic consultation using the ILO classification system for pneumoconioses. X-ray interpretations have been provided to physicians and to workers with a significant history of occupational exposure to silica or asbestos. The X-ray interpretations when evaluated in association with their respective occupational histories, provide a data source to complement other methods of epidemiologic surveillance. This project has reviewed 1124 X-rays in 2 and 1/2 years. Of these, 663 or 59% were normal; 233 or 21% showed abnormalities consistent with pneumoconiosis; the remainder showed other abnormalities judged not related to dust exposure.

Data sources available for occupational disease surveillance include death certificates, workers' compensation cases, hospital discharges and third party liability lawsuits. These data sources which focus on end stage disease apparently underestimate the incidence of pneumoconiosis when compared with the results of the voluntary radiologic consultation program using the ILO classification. For example, during the two and 1/2 years of this program, 36 of the approximately 100,000 death certificates filed with the State Health Department listed pneumoconiosis as a cause of death, whereas our program, which is not population based and which employs selective criteria for participation identified 233 individuals with X-ray abnormalities consistent with pneumoconiosis. Thus, the active provision of radiologic consulting services can effectively supplement existing passive data sources for epidemiologic surveillance.

A strength of this program has been the ability to use medical surveillance to identify and remedy exposure hazards before the exposure has resulted in end stage disease. Impediments to the program have included the lack of occupational histories in most patients' medical files, physicians' difficulties in recognizing occupational disease and the unexpected finding that 24% of the films reviewed were of marginal quality for ILO Pneumoconiosis Classification. The experience of this program indicates a need for quality assurance programs to maintain film quality if the ILO Classification system and the B reader programs are to be used to their full potential.

INTRODUCTION

Wisconsin enjoys a well deserved reputation as a America's Dairyland. As of 1986, Wisconsin was the leading producer in the United States of milk, butter and cheese. Wisconsin is also the leading producer of green peas, beets, cabbage and sweet corn for processing. Although 41% of Wisconsin's land area is devoted to agricultural production, Wisconsin's population is more industrial than agricultural, with only 6% of the population engaged in agriculture, compared to 28% employed in manufacturing. Wisconsin's strength as an industrial producer is less well known, but we lead the nation in the production of small horsepower gas engines, outboard motors, power cranes and other mining and construction equipment. The state also leads in the production of writing paper, sanitary tissue products and laminated and coated process paper.

Wisconsin has had a progressive record in terms of recognizing the occupational health issues resulting from industrialization. In 1911 Wisconsin passed the first Workers' Compensation law in the U.S. Wisconsin also was the first state to recognize asbestosis disability outside of a manufacturing context when in 1932, a maintenance worker was compensated for disease arising from handling and using insulation materials.[1]

Despite Wisconsin's history of concern and the passage of the Federal Occupational Safety and Health Act in 1970, there is evidence that problems persist. Industrial bygiene evaluations of Wisconsin foundries in the mid 1970's measured 1270 air concentrations of silica and found 41% to be above the federal OSHA standard.[2] Other national studies have confirmed that silica as well as asbestos problems are widespread throughout the U.S. A 1980 U.S. Department of Labor Report to Congress predicted that 6% of all workers in silica exposed industries would develop silicosis.[3] In Wisconsin, with 25,000 silica exposed workers, this would mean, at a minimum, 50 new cases a year for the next 30 years.

NIOSH has identified the pneumoconioses as one of their top ten priority diseases for improved surveillance and prevention activities and the U.S. Public Health Service has

set forth the goal, that "among workers newly exposed after 1985, there should be virtually no new cases of four preventable diseases, asbestosis, silicosis, byssinosis and Coal Workers Pneumoconiosis."[4]

Unfortunately it is difficult too for us to quantify progress toward these goals in the U.S., since with the exception of the coal miners' programs, there are no comprehensive national reporting systems in the U.S. for asbestosis, silicosis or other occupational diseases. Those systems which are used to estimate occupational disease incidence have severe limitations. A recent National Academy of Sciences report has concluded that occupational diseases are grossly under reported.[5] However, a number of states have established occupational disease surveillance systems. Since the 1930's, Wisconsin has had laws requiring occupational disease reporting, but compliance has been minimal.

PROGRAM DESCRIPTION

In 1985, with the support and cooperation of NIOSH, Wisconsin began to implement new surveillance efforts, including a review of existing databases. Currently in Wisconsin, for the surveillance of pneumoconiosis and other dust diseases, only three systems provide population based information, death certificates, the tumor registry and workers compensation files. These three systems all record cases of end stage disease. The hospital discharge and ambulatory care surveys provide a broad range of morbidity outcomes, but their usefulness is limited since these data sets are currently only small samples of the annual disease incidence. What all these systems have in common is that they require physician recognition and reporting of the occupational nature of disease. Physician resources in occupational health are limited. In Wisconsin there are only 8 board certified occupational physicians and 9 certified B readers. For the surveillance of occupational disease to be improved, occupational links must be noted at the point of entry into the medical system, when the patient first sees the physician. Also, if occupational disease recognition is to lead to intervention and preventive activity, then more cases of early stage diseases must be recognized. While end stage disease is easier to recognize, it has less utility for prevention. Early stage disease while harder to recognize, provides more opportunity for prevention. For these reasons, Wisconsin, in cooperation with NIOSH, decided to focus our surveillance activities in two directions, a continuous review of data from existing systems, combined with a new radiographic abnormality reporting and interpretation program designed to facilitate the detection of early stages of pneumoconiosis, thje "State pneumoconiosis Radiologic Consultative Program."

In reviewing the existing data, we found that there was no uniform radiographic description of pneumoconiosis used by Wisconsin radiologists with the exception of the B-readers using the ILO Classification system. Thus, in order to meet our surveillance objectives for prevention and to facilitate consistency and uniformity in reporting, we selected the ILO Classification System for a standard definition of radiographic abnormality. (Figure 1) For individuals with asbestos exposure, the case definition for abnormal consistent with pneumoconiosis requires a small opacity profusion of 1/0 or greater and/or pleural thickening or plaques. For individuals with silica exposure, the case definition involves a small opacity profusion of 1/0 or greater. Since few radiologists are familiar with or trained in the ILO system, it became necessary for the state to have a B reader interpret films of exposed workers so as to provide the required consistency of interpretation. From all participants we require that a chest X-ray and a hrief occupational exposure history be submitted. In general, we limit participation to those whose first dust exposure occurred 15 or more years ago.

We have explored a variety of methods to promote the program's purposes and availability. These efforts have met with a variety of responses, ranging from indifference to enthusiasm. We have done mass mailings to 2000 pbysicians and to all AFL-CIO locals in the state and have found both efforts to be remarkably ineffective, generating less than ten requests for X-ray interpretation each. Face to face meetings with groups of exposed workers and physicians known to have an interest in occupational health have been more productive.

Another factor which may have influenced participation is the U.S. Department of Labor OSHA regulations concerning asbestos which were changed in June 1986 to require that physicians examining asbestos exposed workers have access to the standard X-rays prepared by the International Labor Office for the Classification of Pneumoconioses. It is difficult to assess the potential impact of these regulations on the utilization of our non-regulatory voluntary radiologic consultation program, but at a minimum, the 1986 OSHA regulations have increased the public awareness and the credibility of the ILO Classification System and the NIOSH B Reader certification program.

RESULTS

The X-rays received have been from diverse sources including employers, clinics, labor unions, individual workers, physicians and family members. From November, 1985 to July, 1988, multiple promotional activities have resulted in 1124 X-rays submitted. Of the 1124 X-rays submitted, 233 or 21% have shown abnormalities consistent with pneumoconiosis. (Figure 2)

It is interesting to compare the results of this targeted surveillance using the ILO system with the other, more traditional population-based epidemiological data sources available to us (Figure 3) Searching for both underlying and multiple contributing causes of death, silicosis was recorded as a cause of death on an average of 12 death certificates per year from 1981 to 1986. Asbestosis as a cause of death was recorded on an average of 4 death certificates per year during that time. Mesothelioma reports averaged 15 per year from 1981 to 1986 with increasing frequency. In 1987, 40 mesothelioma deaths occurred. In the workers compensation system slightly more silica disease and less asbestos disease has been recorded. From 1982 to 1986 an average of 17 silicosis and 6 asbestosis claims per year were closed. There were another 7 cases per year of other dust related diseases, such as mesothelioma. Our targeted X-ray surveillance system found an average of 86 new cases per year. In addition, our survey of other B readers in Wisconsin

found that they read approximately 600 Wisconsin films per year of which approximately 65 or 11% are abnormal consistent with pneumoconiosis. Although the case numbers from our active program are larger than in the existing data sources, our cases are not sufficiently representative to allow a population based description of the total impact of past dust exposure on the population.

In reviewing the industries which have participated in the program, (Figure 4) the paper industry, food processing machinery manufacturing, foundries and construction have contributed more than 60% of the X-rays. These same industries have contributed a similar proportion of the X-rays showing abnormalities consistent with pneumoconiosis. Evaluating the data concerning participation by occupational groups (Figure 5) a similar pattern emerges, with the number of abnormalities found in various occupations reflecting the degree of participation by the exposed group, rather than an indication of the relative risk of dust exposure by industry or occupation such as one could derive from an analysis of population based data.

Serves Two Purposes:

1. **Epidemiological:**

   Provide Information About Pneumoconiosis Incidence

   * **Offers Gradation of extent of abnormality**
   * **Offers Consistent, Uniform Descriptive Method**
   * **Can Be Easily Performed Outside Clinical Context**

2. **Service:**

   Supports Diagnostic Evaluation by Physicians

Figure 1. The ILO Pneumoconiosis Classification System as an epidemiological surveillance instrument.

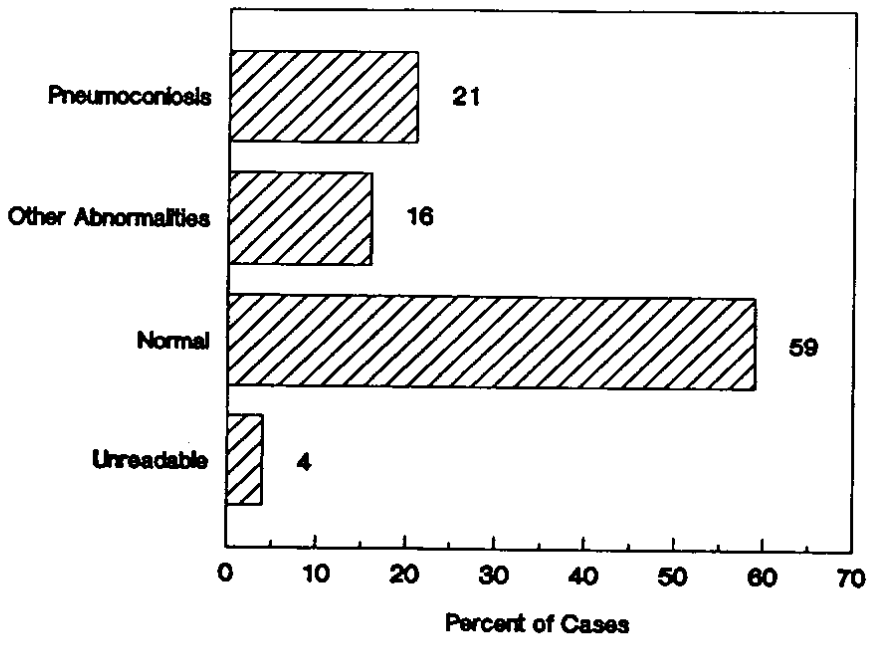

Figure 2. Summary of X-ray interpretations (1985–1988) using ILO Classification System—N: 1124.

Source	Time	Disease	Annual Incidence
* Death Certificates	1981-1986	Silicosis	12
		Asbestosis	4
		Mesothelioma	15
* Workers Compensation	1982-1986	Silicosis	17
		Asbestosis	6
* Third Party Suits	1980-1986	Asbestos Diseases	6
* Targeted Surveillance Using ILO System	11/85-7/88	Pneumoconiosis	86

Figure 3. Wisconsin occupational disease surveillance.

SIC	Industry Name	Number	(%)
2621	Paper Mills (with pulp mills)	315	(28.4)
3551	Food Products Machinery	171	(15.4)
3321	Gray iron foundries	157	(14.1)
1711	Plumbing, heating and air conditioning	85	(07.7)
3011	Tire manufacturing	51	(04.6)
3731	Ship building and repairing	51	(04.6)
3462	Iron and steel forgings	41	(03.7)
4911	Electric Services	34	(03.1)
4931	Electric and other services combined	30	(02.7)
1742	Plastering, drywall, acoustical and insulation	23	(02.1)
	All Other	153	(13.8)

Figure 4. State of Wisconsin, Department of Health and Social Services, Pneumoconiosis Surveillance Program. Industry participation in pneumoconiosis radiologic consultation program ranked by number X-rays submitted per standard industrial classification, November 1985 through July 1988 (N = 1111).

Census Code	Occupation	Number X-Rays	Percent of Total
777	Miscellaneous Machine Operators	102	(9.3)
783	Welders and Cutters	57	(5.2)
596	Sheetmetal duct installers	54	(4.9)
593	Insulators	50	(4.6)
709	Grinding, abrading, buffing and polishing machine operators	49	(4.5)
	All Other	784	(71.5)

Figure 5. State of Wisconsin, Department of Health and Social Services, Pneumoconiosis Program. Participation by occupations in pneumoconiosis radiologic consultation program ranked by number X-rays submitted per occupation, using 1980 U.S. census occupational classification system, November 1985 through July 1988 (N = 1096).

DISCUSSION

Our surveillance program has demonstrated some potential for disease prevention. We have conducted several follow-back field investigations prompted by groups of identified cases in single work places. In one facility, for example, the identification and confirmation of a single case led to an expanded screening program which found more radiographic abnormalities. This prompted a careful industrial hygiene survey and led to the eventual recognition and control of a previously unknown asbestos exposure in a paper making industry.

Two significant programmatic problems have persisted which must be addressed before the program can become more effective. We have had some difficulty obtaining thorough occupational histories. This problem will require increased effort to educate physicians, employers and employees on the value and importance of occupational histories in disease detection and prevention. These efforts will be strengthened by current Wisconsin regulations requiring such histories for hospital inpatients and cancer patients.

The other problem we have had concerns film quality. (Figure 6) This problem will be more difficult to correct. Of the films reviewed, 4% have been unreadable, while 19.7% have been category three or marginal quality for ILO classification. We have distributed the ILO guidelines for equipment and technology to those submitting large numbers of poor quality films, but we feel that more effort is needed in this area on national or international level.

There has been much attention to the errors or variability which may be introduced into the X-ray interpretation by the persons who read the films. For example, we have, in the U.S., a national program to train, test and certify physicians who interpret X-rays for pneumoconiosis. There have also been numerous studies which have evaluated inter-reader variability issues.[6,7] However, the effect of varying film quality on radiographic interpretation has not received sufficient attention. This is unfortunate, since inaccurate X-ray interpretations may result. Indeed, it is likely that poor quality films may introduce systematic bias into X-ray interpretations. Furthermore, if films must be repeated because of quality problems, unnecessary radiation exposure may result.

Originally intended as a program to provide coal miners with accurate readings of their X-rays through physician training and certification, the B reader program in the United States has expanded to included training and certification for physicians who read films of persons exposed to silica and asbestos. Maintenance of X-ray interpretation quality for coal miners' films is assured both by the certification of the physician readers and by the certification of the X-ray machines. A program to ensure the taking of high quality films for workers exposed to asbestos and silica dusts has not yet been implemented in the United States. We recommend that Congress, through NIOSH, establish a quality assurance program for facilities which provide X-rays for workers exposed to silica and asbestos, either on a voluntary or mandatory basis. The program which currently certifies and evaluates film quality for coal miners' X-rays could serve as a model.

RECOMMENDATIONS

We recommend: (1) the initiation of studies to determine the impact of film quality on X-ray interpretation using the ILO classification; (2) the development and distribution of instructions to radiology technicians as to how to achieve better film quality on X-rays taken for the evaluation of pneumoconioses; and (3) the development of quality assur-

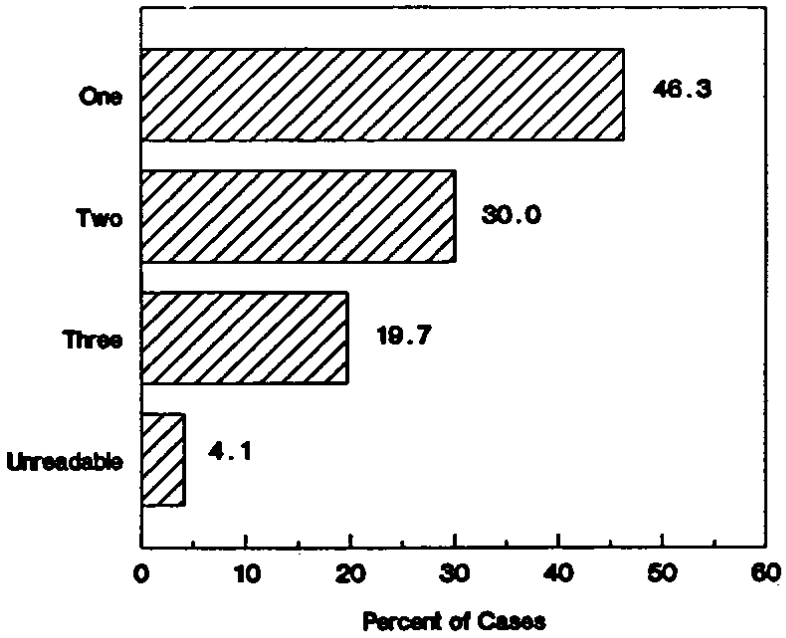

Figure 6. Film quality—total N: 1124 1985–1988.

ance programs for facilities providing X-ray services for the evaluation of workers exposed to silica and asbestos.

REFERENCES

1. Castlleman, B.I.: Asbestos: Medical and Legal Aspects, second edition. Clifton, N.J.: Law and Business, 1986.
2. Zimmerman, R.E., Barry, J.M.: Determining Crystalline Silica Compliance Using Respirable Mass. American Foundrymen's Society Transaction 1976:15-20.
3. Packer, A.H.J.: An Interim Report To Congress on Occupational Diseases, Washington, DC: U.S. Department of Labor, 1980.
4. Association of Schools of Public Health: Proposed National Strategies for the Prevention of Leading Work-Related Diseases and Injuries, Washington, DC: National Institute for Occupational Safety and Health, 1986.
5. Pollack, E.S., Keimig, D.G.: Counting Injuries and Illnesses in the Workplace: Proposals For a Better System. Washington, DC: National Academy Press, 1987.
6. Delclos, G.L., et al: Interobserver Variability using the ILO (1980) Classification in Asbestos-Exposed Subjects Referred for Compensation Evaluation, VII International Pneumoconiosis Conference, Pittsburgh, Pa.: Internation Labor Office, 1988.
7. Ducatman, A.M., Yang, W.N. and Forman, S.A.: "B Readers" and Asbestos Medical Surveillance. Journal of Occupational Medicine 1988 Volume 30, No. 8:644-647.

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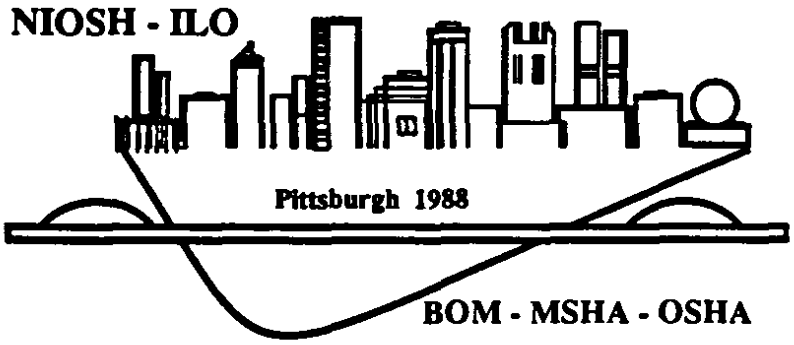

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