PUBLIC HEALTH IMPLICATIONS OF THE VARIABILITY IN THE INTERPRETATION OF "B" READINGS

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BACKGROUND

Despite the care that has been given to interpretation, competent observers have repeatedly encountered difficulties in the consistent classification of radiographs. Researchers have been aware of the variability present in the interpretation of chest radiographs for many decades. As early as 1947, Birkelo published a paper evaluating the prevalence of tuberculosis observed in chest radiographs.[1]

Shortly after this study was conducted, Garland published a classic study on the scientific evaluation of diagnostic procedures. In this paper, Garland states that "though useful when, as occasionally happens, the chest radiograph is used as the sole examination, its reliability may be evanescent." He goes on to say in "nearly every activity that can be tested, it has been repeatedly demonstrated that humans, even experts in a given field, exhibit enormous variations in their ability to be consistent with themselves and others equally competent in applying to mass-survey work. ... Consequently, every day persons throughout the country are being informed that their chests are free from disease when, in point of fact, they probably are not (and visa versa). This results in false security on the one hand and needless alarm on the other hand."[2]

The purpose of this paper is to discuss the public health implications of the reliability of the "B" reading program, that is, the ability of different "B" readers to accurately and consistently reproduce findings during repeated examination of radiographs of people with disease of known or unknown status. For example, when a problem with pneumoconiosis is suspected, films may be submitted to one or several readers for interpretation. If multiple readers agree, then it is likely that their interpretation is correct. It is possible that readers may agree and still be incorrect in their interpretation. If agreement is low, then the usefulness of the interpretation is suspect.

METHODS

The issues on which this paper is based arose from a call received by the Minnesota Department of Health (MDH) in January, 1985, from a "B" reader and radiologist (Reader 1) in northern Minnesota. This is an area that has historically had many problems related to asbestos in mine tailings. The radiologist stated he had found diffuse and/or circumscribed pleural thickening in approximately 30% of 500 sequential chest radiographs taken during the preceding two months in his clinic practice. Subsequent review of the films by MDH staff led to consultation with the National Institute for Occupational Safety and Health (NIOSH).

At the request of the MDH, a "B" reader (Reader 2) from NIOSH came to Minnesota to review these findings. Reader 2 reviewed 259 films interpreted by Reader 1 and 310 films from other regional clinics. Reader 2 confirmed the apparent increase in pleural changes seen by Reader 1 and noted similar increases in other regional clinics. Because of the confirmed increase, two additional radiographic evaluations were arranged.

Five hundred and sixty-six films were transported to Reader 3, a pulmonary physician and experienced "B" reader in New York City. Following this third reading, the films were shipped to NIOSH in Morgantown, West Virginia. At NIOSH, the films were randomly allocated in equal numbers among ten blocks. Negative and positive control films were added so there were 100 films per block. Positive control films were selected for the presence of pleural changes. Films were then interpreted independently by three readers who had been selected from a panel of five readers. The trial was a randomized incomplete block design with each of five readers being assigned six blocks and each film read a total of three times. Films were read in Morgantown, and readers were unaware of the origin of the films. Except for Reader 1, all readers interpreted the films according to the 1980 International Labor Office (ILO) classification system. Reader 1 interpreted films only for pleural changes.

ANALYSIS AND RESULTS

A kappa statistic was used to measure concordance between Readers 1 through 3. Concordance was not measured in this way between members of the NIOSH panel because of the large number of possible combinations. This statistic measures agreement between readers and simultaneously accounts for agreement due to chance. A kappa statistic is continuous and ranges between −1 and +1. A statistic of 0 or less represents poor agreement and a statistic of +1 reflects complete agreement.[3]

As seen in Table I, concordance between Readers 1 and 2 was moderate (kappa = 0.58) for the presence of any pleural thickening. Readers 2 (NIOSH consultant) and 3 (New York reader) agreed on 70 films being positive for pleural changes and the kappa statistic was 0.39, once again indicating a moderate degree of concordance (Table II). However, when

Table I

Presence of Pleural Thickening: Concordance Between Readers 1 and 2

Pleural Thickening (First Reader)	Pleural Thickening (Second Reader) Absent	Present	Total
Absent	97 (37.4)*	23 (8.9)	120 (46.3)
Present	32 (12.4)	107 (41.3)	139 (53.7)
Total	129 (49.8)	130 (50.2)	259 (100.0)

*Percent
KAPPA = 0.58

Table II

Presence of Any Pleural Changes: Concordance Between Readers 2 and 3

Pleural Thickening (Second Reader)	Pleural Thickening (Third Reader) Absent	Present	Total
Absent	[illegible] (63.5)*	13 (2.3)	364 (65.8)
Present	119 (21.5)	70 (12.7)	189 (34.2)
Total	470 (85.0)	83 (15.0)	553**

* Percent
** Excludes 13 films rated as not readable.
KAPPA = 0.39

pleural plaquing and diffuse pleural thickening were examined by side (Tables III and IV), concordance was poor, with a kappa statistic of 0.26 and 0.20 respectively. Thus under more stringent criteria, agreement appeared to diminish considerably.

According to Readers 1 and 2, approximately 70% of males and 25% of females from Reader 1's clinic had pleural abnormalities. The proportion of males and females read as positive varied considerably between Readers 2 and 3. Overall, Reader 2 noted 54% of males and 15% of females had pleural abnormalities. Reader 3 found 25% of males and 5% of females had pleural abnormalities. The NIOSH readers found 8% of males and less than 1% of females positive for pleural changes. These differences between readers were statistically significant using McNemar's test.[3]

Table V shows the number of Minnesota films read as positive by zero, one, two, or three of the NIOSH (Morgantown) readers. A total of 24 (4.2%) of the Minnesota films were read as positive by at least two readers. In addition, the number of positive control films (n=34) read as positive (i.e., sensitivity) was approximately 55% but varied slightly from reader to reader. The number of negative control films (n=400) read as negative (i.e., specificity) was 98% or more for all readers.

Data from the control films were used to estimate the conditional probability of a film being positive given zero, one, two, or three positive readings (Table VI). The value for "Π" represents the approximate probability of a film being positive if it was drawn at random from the batch of all Minnesota films. The value for "p1" represents sensitivity and the value for "p2" represents specificity. For this trial, we see that the conditional probability of a film being positive for any pleural changes given zero, one, two, or three positive readings (under the conditions of this trial) was

Table III

Pleural Plaquing*: Concordance Between Reader 2 and Reader 3 Bilaterally

Pleural Plaquing (Second Reader)	Pleural Plaquing (Third Reader) None	Unilateral Left	Unilateral Right	Bilateral	Total
None	393	1	6	1	401
Unilateral Left	17	3	0	0	20
Unilateral Right	17	1	4	1	23
Bilateral	77	8	10	14	109
Total	504	13	20	16	553

* Only includes plaques noted on the chest wall
KAPPA = 0.26

Table IV

Diffuse Pleural Thickening: Concordance Between Reader 2 and Reader 3 Bilaterally

Diffuse Thickening (Second Reader)	Diffuse Thickening (Third Reader) None	Unilateral Left	Unilateral Right	Bilateral	Total
None	503	4	1	1	509
Unilateral Left	10	4	0	0	14
Unilateral Right	7	0	1	1	9
Bilateral	19	1	1	0	21
Total	539	9	3	2	553

KAPPA = 0.20

Table V

Number of Films with Zero, One, Two, or Three Positive Readings for Pleural Changes*

	Category of Film Reading			
	Zero	One	Two	Three
Number	436	44	14	10

*NIOSH readers only.
Sixty two unread films are not counted.
(N = 566, including unread films.)

Table VI

Probability of a Film Being Positive Given Zero, One, Two, or Three Positive Readings for Pleural Changes*

	Number of Positive Readings			
	0	1	2	3
$\Pi = 0.09$				
$P_1 = 0.55$	0.01	0.36	0.97	~1.0
$P_2 = 0.98$				

*NIOSH readers only.

0.01, 0.36, 0.97, and approximately 1.0 respectively. It should be noted that values for Π, sensitivity, and specificity are dependent upon the mix of positive and negative radiograph readings.

In order to further evaluate the reasons for the variability observed in the NIOSH trial, logistic regression procedures were used with the absence and presence of pleural changes coded 0 and 1 respectively. Independent variables used in the prediction equation were age ($<60, \geq 60$), sex, parenchymal opacity profusion (two levels, $\leq 0/1$ and $\geq 1/0$), and the presence of other pulmonary abnormalities (two levels: none, any). The regression model fit well and there were no significant interaction terms. Assumptions required for logistic regression were satisfied. The summary odds ratios and 95% confidence intervals for each of five NIOSH readers are presented in Table VII. For example, Reader 1 was 5.5 times more likely to find evidence of pleural changes if the film being interpreted had evidence of parenchymal opacities of 1/0 or greater compared to films with opacities rated 0/1 or less. As seen in this table, age and sex did not influence radiograph interpretation for pleural changes. However, for some readers, profusion and/or the presence of other diseases

Table VII

Odds Ratio and 95% Confidence Intervals for Four Factors Used in Predicting the Presence or Absence of a Positive Reading for Pleural Disease

	Factor			
Reader	Age	Sex	Profusion	Other Abnormalities
1	NS*	NS	5.5 (1.6, 18.6)	4.6 (1.5, 13.9)
2	NS	NS	NS	NS
3	NS	NS	NS	3.4 (1.2, 10.0)
4	NS	NS	26.1 (7.7, 88.3)	NS
5	NS	NS	NS	4.7 (1.2, 18.2)

* Not significant.

appeared to exert a moderate to strong influence on the interpretation of films for the presence of pleural abnormalities.

DISCUSSION

Many studies have been published evaluating factors that affect the interpretation of radiographs. These factors include: film quality, subject age and weight, presence of disease, and reader.[4-10]

Liddell found that film quality tended to be higher for radiographs of men with no evidence of coal worker's pneumoconiosis and to decrease with increasing chest wall thickness. The subject's age was not found to substantially affect film quality.[5] Pearson et al. found that the proportion of unsatisfactory films increased with increasing values of the ratio of weight to sitting height.[8] These findings are of interest because it has been demonstrated that technical faults are, in general, randomly distributed and attributable to errors in taking and processing films rather than in differences between subjects even though there may be a slight tendency for the proportion of unsatisfactory films to increase with increasing weight.[8]

Further, Liddell found film quality introduced only slight biases into the reading of pneumoconioses although readers tended to find more parenchymal abnormalities in overexposed films and fewer parenchymal abnormalities in underexposed films when compared to good films.[5] Other investigations, however, have found that readers tend to read more abnormalities in underexposed films and less abnormality in overexposed films.[6,7] In Minnesota, film quality was adequate for all but a handful of radiographs. For this reason, it seems unlikely that film quality affected the results of the Minnesota study.

Reader experience also plays a role in the evaluation of radiographs. Different readers appear to compensate differently for changes in film quality. Reger et al. found that experienced readers were better able to compensate for changes in film quality. In addition, certain readers either consistently find more abnormalities or less abnormalities on films compared with their colleagues.[9] Felson et al. found that readers with minimal training tended to find more cases of coal workers with pneumoconiosis than experienced readers. Felson attributed the differences between readers found in his study to several factors: 1) inherent interobserver disagreement; 2) lack of experience with the classification system in use; and 3) lack of familiarity with the radiographic manifestations of coal workers' pneumoconiosis.[10]

The problems encountered during the MDH investigation were in many ways similar to those described above. The percentage of films interpreted as abnormal varies among readers. These readers appeared to have been influenced by factors such as the presence of disease, and anecdotally, reader experience may have played a major role. The original readers were both newly certified "B" readers and were not experienced in interpreting films with asbestos-related disorders. These were also the readers who found the highest percent of individuals with pleural changes.

Two years after the original investigation was completed, eight radiographs that the investigators thought were "definitely positive" were sent to a pulmonary physician for review. After reviewing the medical records and films, this physician felt that the pleural and/or parenchymal abnormalities in six of the cases (75%) could be best explained by the presence of diseases unrelated to the pneumoconioses.

This finding, in part, led the MDH to once again evaluate the original data and develop the logistic regression model described above. This model confirms that the reading of radiographs for the presence of pleural abnormalities is at times strongly influenced by the presence of parenchymal opacities and/or diseases; however, it was not possible to define the nature of this relationship.

The magnitude of inter-reader agreement has undergone considerable scrutiny. Early studies on this problem were conducted by Birkelo, Garland, Fletcher, and Yerushalmy.[1,2,10,11] In 1970, Reger and Morgan had 2,337 radiographs evaluated by 4 readers. The percent of films interpreted as having complicated coal workers' pneumoconiosis ranged from 8.0% to 22.5%.[9] In only slightly more than one half (56.7%) of these films was there agreement between readers. Felson et al. evaluated inter-reader agreement for 3 readers. For films read as normal, pairs of readers agreed with each other between 10.1% and 68.9% of the time. For abnormal films, agreement ranged between 5.5% and 10.2%.[10]

Several studies have examined the variability in the radiographic assessment of pleural changes. In a review of 674 radiographs of naval dockyard workers, Sheers et al. found the prevalence of pleural changes to range between 14% and 30%.[12] Reger et al. evaluated inter-reader variability in the radiographic detection of pleural changes in 555 radiographs.[13] Radiographs were evaluated twice for each worker—first using a posterior-anterior (PA) film and then using PA plug oblique films. The prevalence of pleural abnormalities in this study ranged between 40% and 81% and a higher detection rate was found with the use of additional radiographs. Using PA films only, the kappa statistic for inter-reader agreement for the presence of pleural plaques averaged 0.33 and for diffuse pleural thickening 0.43. The addition of oblique films caused a decrement of the kappa statistic to 0.23 and 0.25 for pleural plaques and pleural thickening respectively.[13]

A higher detection rate of pleural abnormalities using three radiographs (left anterior, oblique, right anterior oblique and PA) compared with PA only was also shown by Baker and Green.[14] The high detection rate, however, appears to be at the expense of sensitivity, specificity and reliability.[13] The number of positive control films read as positive (i.e., sensitivity) was only 55% in the MDH study. It seems that any further decrement in sensitivity resulting from the use of oblique films would, in most instances, be unwarranted.

Green et al. examined the effect of using a broad (any pleural thickening) versus a strict criterion (pleural thickening of 2 mm or greater) on the prevalence of pleural changes in high risk (asbestos exposed) and low risk (no or little asbestos exposure) groups. Using a broad criterion, prevalence ranged from 45.1% (low risk) to 40.9% (high risk), and, using a strict criterion, prevalence ranged from 2.6% (low risk) to 9.4% (high risk).

Depending upon the number of positive readings and the readers selected, the percent of Minnesota films positive for pleural changes varied between 2% and 38% (Table VIII). Thus, we were faced with a problem where "case definition" was highly dependent upon the judgement of the investigators and it was not clear which was the best set of interpretations to use. We do not feel the results of the MDH study support the use of a specific (e.g., 2 mm) threshold criteria. However, we concur with the conclusion of Green et al. that there is a "great need for specific criteria and uniform methodology" in the interpretation of pleural findings.

The low sensitivity and high inter-reader variability present in the evaluation of films for asbestos-related pleural or parenchymal changes could significantly influence the results of an epidemiologic study. Readers 1 and 2 found a large

Table VIII
Number of Positive Pleural Readings by Sex
(N = 2755 Readings)*

Number of Positive Readings	Sex: Male	Sex: Female	Percent Of Total	Total
0	122	231	62	353
1	82	38	21	120
2	38	8	8	46
3	23	5	5	28
4	10	0	2	10
5	8	1	2	9
Total	283	283		566

* Five B Readers per film (10 not read by reader 2, 3 not interpreted by reader 3, and 62 not interpreted by members of the NIOSH panel.

number of abnormalities in both men and women indicating what appeared to be a generalized environmental exposure to asbestos. Subsequent investigation revealed widespread steam tunnels to many regional homes. These tunnels, as well as the pipes within homes, appeared to be asbestos-lined. Another possible source of exposure was piles of taconite mine tailings near or within town limits. Because of concern about environmental exposures, the third and subsequent readings were done. In later readings, when substantially fewer abnormalities were found in women, it was thought that the problem was probably occupational rather than environmental in origin.

It is felt that the low sensitivity of the interpretation of radiographic changes of the pleural should be more widely recognized among those involved in occupational disease surveillance. The impact of this variability in radiographic readings on public health decisions was illustrated in Minnesota and, to date, the significance of these apparent abnormalities is still difficult to evaluate.

Based on these findings and a review of the epidemiologic literature, we feel further consideration should be given to resolving the issues presented here. We would like to make the following recommendations to optimize the use of information found on the chest radiograph:

1. A threshold for determining the presence or absence of pleural changes should be developed. In part, the problem encountered by the MDH arose because of the ambiguity in defining pleural changes. Dr. E. Nicholas Sargent (personal communication) recommends the use of a scoring system similar to that used for parenchymal changes (e.g., 0/0, 0/1, 1/0, 1/1) with 0/0 indicating a high degree of certainty that a particular shadow does not represent a pleural abnormality (e.g., muscle, fat) and 1/1 indicating a high degree of certainty that a shadow does represent a pleural abnormality (e.g., plaque);

2. Experiments should be conducted in which the "B" reader is asked to interpret films with and without an abbreviated medical history. At the end of each reading, the interpreter should be asked to conclude if, given the patient's (worker's) medical history, any changes seen are most likely due to a pneumoconiosis, other disease, both, or if such a determination cannot be made;

3. It appears that the interpretation of pleural changes may be too complex. This complexity makes the interpretation of inter-reader agreement difficult. If possible, the reading of pleural changes should be simplified;

4. One third of the "B" reading form is devoted to interpreting changes of the pleura. However, there are very few films in the set of ILO standard films devoted to these changes. These films should be enhanced to reflect the degree and nature of changes that are presented on the ILO-NIOSH "B" reading form; and

5. "B" readers, in the course of their training, should be cautioned about the implications and utility of "B" reading. Knowledge of the problems involved in the epidemiologic use of radiographs should be a routine part of the "B" reader examination and/or course of study.

Inter-reader variability in the interpretation of radiographs has been evaluated in the past. This is the first instance known to the authors where this problem has had a direct impact on public health. When initially presented with this problem, the authors (DP and AB) consulted national experts on asbestos-related disorders; all agreed that we might have a major public health problem related to environmental asbestos exposure. As our investigation evolved, it appeared that this was not really an environmental problem at all, but was due to inter-reader variability in the interpretation of radiographs, thus substantiating previous studies on the problem of inter-reader variability.

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THE CANADIAN PNEUMOCONIOSIS READING PANEL STUDY

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ABSTRACT

The Canadian Pneumoconiosis Reading Panel was organized to determine the reading levels of volunteer Canadian physicians on the 1980 pneumoconiosis classification, and to develop a feedback method for influencing a uniform level of readings. 999 chest X-rays were selected from three groups:[1] 40–70 year old males with no fibrogenic dust exposure and whose X-rays were taken because of a statutory requirement. No films from this group were rejected because of symptoms or radiologic abnormality.[2] Workers in silica or asbestos exposure with normal initial films who later developed silicosis or asbestosis.[3] Additional films represented several other industrial lung diseases. 30 randomized films were read every 2 weeks in rotation by 26 readers. Feedback analysis indicated whether a reading was within 1 minor category of the group average for a given film on small opacities or was over or under that criterion. It is hypothesized that with continuing experience most readers will eventually read near the group mean and outliers may be identified. Subsequent group readings are proposed on an annual or bi-annual basis. At the present stage all films have not been read by every member and no overall group mean categorization of each film is available. Feedback has, therefore, been provided in relation to readings by a single reader from the National Coal Board who has evaluated all films. Results of the first returns show that 31% of films were overread by panel members in comparison with this reader, 4% were underread and 65% were in agreement, as defined above. Subsequent feedback results are under analysis. Advantages and disadvantages associated with the method will be discussed.

The ILO Classification was developed to help in the coding of X-ray appearances of the Pneumoconioses for epidemiologic purposes. This should allow comparison between readings done under different jurisdictions.

Since its introduction in 1958, the ILO system has undergone several changes, until the (1980) protocol confirmed that reference films and the not definitions should take precedence in cases of doubt.[1] The absence of such proviso prior to 1980 has led to quite marked differences of opinions between expert readers in different areas. The 1980 modification of the ILO Classification was introduced for routine use by the Chest Clinics run by the Government of the Province of Ontario in 1983, once the MESU (Medical Surveillance) computer data entry facilities became available.

With routine use of the ILO Classification arose a need to ensure that all readers interpret the code uniformly. While various attempts to meet this problem have been made elsewhere, there existed no system of quality control of ILO readers in Canada. A national network of readers was required in order to assure that consistency and reliability of readings are maintained. The Canadian Pneumoconiosis Reading Panel[2] was formed to meet two essential requirements: 1) to determine the current reading levels of physicians in all Canadian provinces who employ the ILO 1980 radiographic pneumoconiosis classification, and 2) to develop a method of feedback which would influence those physicians to approach a uniform standard level of reading.

The initiative to form the panel came from physicians at the Ministry of Labour (Ontario) and from the McMaster University. The two best known models of quality control of ILO readers, the British and the American were reviewed.

In the United Kingdom the program is run entirely by the National Coal Board which decides who shall sit on the panel of readers. Panel members are regularly tested and their reading patterns evaluated. Incorrigible outliners are eliminated.

As run by the National Coal Board, the British system is very efficient. It is however, designed for and operating in a small, densely populated country.

In the United States, a different system is used. Regulations under the Federal Mine Safety and Health Act[3] give statutory recognition to official users of the ILO system who are known as "A" and "B" readers. The status of an A or B reader is obtained after successfully passing appropriate examinations set up by NIOSH. The recent proposals for requalification every three years rather than four indicates that some doubt arose about qualified readers being able to sustain an even quality of readings between examinations and in maintaining uniformity of readings in International comparisons. Some 40 Canadian physicians known to be reading pneumoconiosis films were contacted and agreed to become members of an all-provinces germinal body of the reading panel.

METHODOLOGY

More than 10,000 films were gathered by the Ministry of Labour and from that quantum a test collection of 1,000 plates was made. The final selection of films was made by three readers from the Ministry of Labour and one from the University of McMaster (Table I).

The 309 "normal" films were from government employees whose X-rays were taken because of a statutory requirement of the day, and who according to records had never worked in fibrogenic dust exposure; they were males between the ages of 40 and 70; and no films were rejected because of symptoms or observed abnormality.

Table I
Sources for Film Selection

Civil servants, obligatory films	309
Asbestos (insulators)	104
Asbestos (Quebec miners)	49
Asbestos + silica	4
Silica (foundry)	57
Silica (Ontario hard roch miners)	339
Coal workers (British)	100
Nepheline syenite	15
Hard metal (tungsten c. - cobalt)	8
Talc	6
Beryllium	4
Bauxite (hydrous aluminum oxide)	5
TOTAL	1,000

Three hundred and thirty-nine films were selected from known Ontario hard rock miners in silica exposure who had normal initial films and who by consensus reading eventually developed silicosis.

A large proportion of films from that series were selected from the stage where half of the selection panel readers read 1/0 and the other half 1/1 for small regular opacities.

Analogous selection methods were used for choosing 104 films from Ontario Asbestos Workers. Additional films were received from the British National Coal Board and from Quebec Asbestos Mine Survey.

The selected films were completely randomized, their labels of origin blackened out and then divided into lots of 30 films which were sent every two weeks in rotation to each of 26 readers, who remained available of the original 40.

Readers record their findings and return reports to a central depository. At quarterly intervals, feedback is provided with indication of whether a reader is within 1 minor category of the group average for a given film or is over or under the criterion. For this presentation, complete records are available on only 16 readers. Ten dropped out because of inability to maintain a regular flow of 30 films every 2 weeks and held up the distribution process.

It is hypothesized that with continuing feedback most serious readers will eventually read near the group mean and the outliners will be identified.

After an initial development period, group readings with all available members are proposed on an annual or bi-annual basis.

At the present stage all films have not been read by each member of the panel and no overall group mean categorization of each film is available. Feedback has therefore been provided in relation to readings by a single reader from the British National Coal Board who has evaluated all films.

DISCUSSION

Looking at the available data (Table II, Figures: 1, 2, 3, 4 and 5) it appears that our hypothesis is supported by subsequent facts. During the time of the study, 14 out of the 16 readers agree more with the standard while 2 of them agree less. Also there is less over as well as under reading. However, one has to be very much aware of the shortcomings

Table II
88-07-19 ILO Panel Comparisons
Analyzed Data Presented as a Percentage of Valid Readings

PHYS	OVER-READING			AGREEMENT			UNDER-READING		
	1ST	2ND	3RD	1ST	2ND	3RD	1ST	2ND	3RD
01	23	15	17	74	75	77	3	10	6
02	27	30	32	68	64	61	5	7	6
03	35	35	25	62	61	70	3	4	5
04	21	11	7	73	82	89	7	7	4
05	17	11	9	74	81	84	9	8	7
06	40	35	40	57	61	56	3	3	4
07	29	24	21	69	70	74	2	5	5
08	20	12	7	74	82	93	6	5	0
09	50	42	25	49	57	75	2	2	0
10	27	25	15	68	74	85	0	0	0
11	6	9	5	86	81	88	8	9	7
12	28	22	13	71	72	82	2	6	5
13	35	29	21	63	70	75	3	1	3
14	18	13	11	76	81	88	5	6	7
15	30	—	18	66	—	78	4	-	4
16	38	19	23	61	80	74	1	1	3

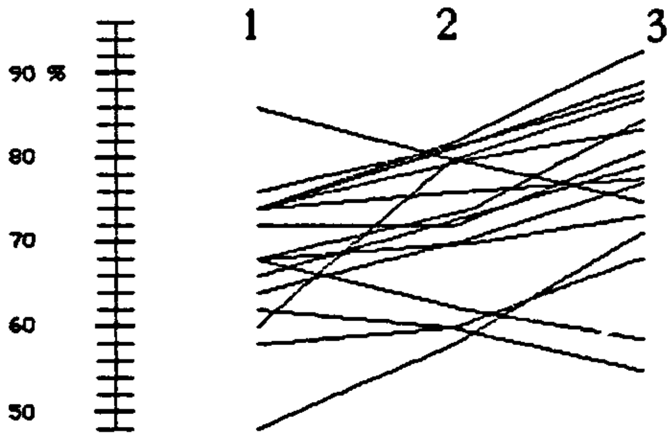

Figure 1. Agreement with provisional standard.

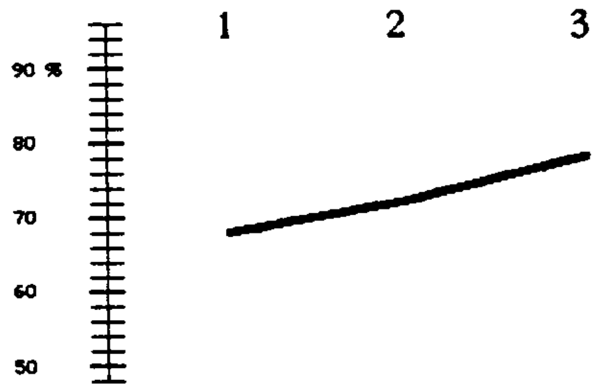

Figure 2. Average agreement with standard.

	Agree	Over-read	Under-read
More	14	1	8
No change	0	1	3
Less	2	14	5

Figure 3. Change in agreement with standard.

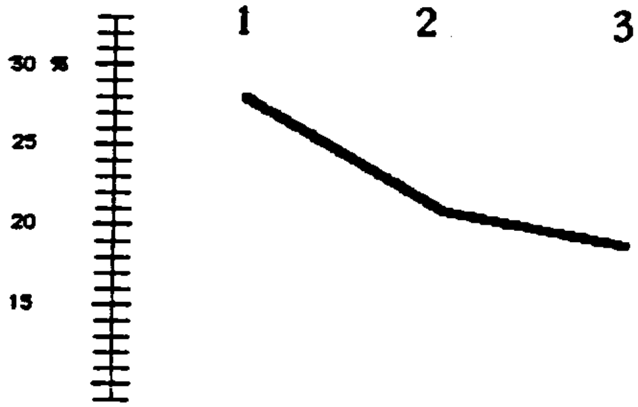

Figure 4. Over-reading of small opacities.

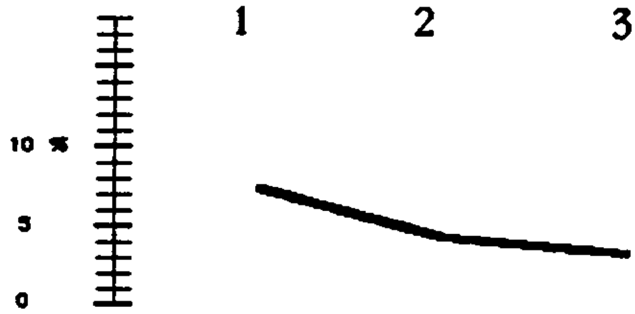

Figure 5. Under-reading of small opacities.

of this study which is no more than a preliminary communication on an ongoing project.

The number of readers was small as is the number of films reported in the third reading, (due to a slow distribution system that had to be revised). In this context, it should be noted however, that the apparent trend is the product of roughly 8,000 individual reports, as each of the 16 readers has read around 500 of the test films currently available.

No comparison with other countries other than Great Britain. Last, but not least, there were no controls. Bluntly put, one does not know to what extent the apparent trend is the result of the feedback information offered, and what would happen if members of the panel were left to their own devices.

Future efforts therefore, should include 1) setting up a control group of readers who will receive less or no feedback; 2) current standard may need to be revised using a larger number of films.

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CHEST IMAGING: A NEW LOOK AT AN OLD PROBLEM

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The chest is one of the most complex segments of the body to examine radiographically. Comparison radiographs of the chest are challenging to an interpreter. Since radiographic technique can affect the management of the patient, it is extremely important to document the technical factors used for a chest examination. Follow-up studies must be technically consistent.

The use of a short exposure time (10 ms or less) helps stop motion. Minute vascular patterns or calcification must not be "blurred out." If one were to purchase a state-of-the art chest radiographic room, at the present time a typical recommendation would be a three phase generator with 150 kVp output combined with a 10:1 or 12:1 ratio grid. Techniques required for pneumoconiosis utilize lower kilovoltage values (approx. 110 kVp) with high ratio grids. Although the air gap technique has been popularized in Canada by Wilkinson and Fraser, this technique is not in common use in the United States.

The enactment of Public Law, 91-173, stating that every underground coal miner shall have an opportunity to have a chest X-ray examination for the purpose of establishing health and safety standards for the nations coal miners, generated new interest in chest radiographic technique.

CONTROL OF SCATTER RADIATION

Scatter radiation can segmentally damage a radiographic image. A chest radiograph can appear to be properly exposed, but portions of that image can be damaged by scatter. In a non-grid chest image, up to 65% of the radiation reaching the screen/film can be scatter. Non-grid chest radiographs are usually made at approximately 85 kVp, often with a single phase generator with a timer of questionable accuracy. Modern chest studies utilize high ratio grids with high kilovoltage values.

Common problems encountered with grid radiography of the chest include:

1. Improper processing conditions, particularly with hand processing. The use of an automatic processor does not guarantee quality radiographs unless a Quality Assurance program is utilized.
2. Grid focus. Often an improperly focused grid is used for chest radiography. If a medium focus grid (40" FFD) instead of a long focus grid (72" FFD) is used for chest radiography, a bilateral grid cutoff (approximately 2" of each side of the chest radiograph) occurs. Both costophrenic angles seem underexposed. This bilateral artifact can be interpreted as poor screen contact. Incidentally, poor centering to a grid can produce unilateral cutoff of an image. The use of a laser positioning device helps center the central ray to the grid as well as the patient to the film holder.
3. A low to moderate kilovoltage value with a high ratio grid, can be disastrous with a high contrast radiographic film. As kilovoltage is raised, for example to 140 kVp, a high ratio grid (12:1) must be used. As kilovoltage is lowered, for example to 90 kVp, a 6:1 low ratio grid is required.

   There is a difference in radiographic techniques when using either single phase or three phase equipment. Three phase radiation is virtually ripple free as opposed to single phase X-ray (100% ripple). Dramatic technical adjustments in kilovoltage must be considered, for example, a single phase 125 kVp technique requires approximately 108 kVp when using a three phase generator. Since three phase current is virtually ripple free, higher ratio grids are often required.
4. Poor inspiration. This problem is compounded when using an automatic exposure control such as a photo timer or an ionization chamber. If a patient is exposed at maximal expiration, even though the diaphragms are elevated and the cardiac silhouette is widened, an adequate density is often produced by an automatic exposure control. Proper density (blackening) cannot overcome cardiac distortion or compacting of the lungs due to expiration.

MEDIASTINAL INFORMATION

Information gained regarding the mediastinum is often at the expense of proper exposure of the lung fields. The use of a compensatory filter to "see through" the mediastinum is a substitute for a film with appropriate sensitometric characteristics. Latitude or extended latitude films are required for mediastinal information. A compensatory filter has a fixed opening for mediastinal penetration; "one size does not fit all."

THREE PHASE

If the same kilovoltage value, for example, 110 kVp is used with single phase and three phase generators, the three phase image will produce scatter similar to a single phase 125 kVp exposure. Unless, mAs values are lowered either manually or by an automatic exposure control, the three phase image will be approximately 2X overexposed. Even when an appropriate mAs adjustment is made, there is a difference in contrast with the three phase study. A higher ratio grid may be required for three phase imaging techniques. Three phase exposures are shorter than single phase exposures and help to stop motion.

AUTOMATIC EXPOSURE CONTROL

An Automatic Exposure Control (AEC) helps insure that exposures are of consistent density. The radiographer initiates the exposure but the AEC determines its length. Positioning skills are essential. Relationship of a patient to the AEC sensor must be a constant concern. In the lateral projection, if the patient moves slightly backward, a large portion of the cassette will be exposed to the primary ray. This "primary beam leak" produces considerable scatter that can strike the lateral sensor, shortening the exposure time.

When using an AEC, concern for the minimal response (minimal reaction) time of the unit is essential. The minimal response time is defined as the shortest possible automatic exposure achievable by your AEC. The use of faster screen/film combination produces more film blackening per unit of exposure, and can accentuate your minimal response time difficulties particularly with older equipment. Often, a small to medium patient will require less radiation for proper exposure of their chest radiograph, than an AEC is capable of delivering at a predetermined kilovoltage and milliampere setting. If a high kilovoltage three phase technique is used, the MRT may produce technical difficulties with more than half of your images. If a proper kilovoltage has been selected with an appropriate grid, and if your minimum response time (often 100th/sec) cannot be changed, then the milliampere setting must be lowered to match patient size. For example, a frail, approximately 100 lb. patient could require 50 mA, while a muscular adult might require 300–400 mA.

CAUTION: Never reduce kilovoltage to compensate for an MRT difficulty. A reduction in kilovoltage produces short scale contrast with blackened lungs and chalk-like osseous and mediastinal structures.

COLLIMATOR DIFFICULTIES

On occasion, an image "cutoff" can occur on a radiograph if one of the internal shutters of the collimator is out of alignment. The shutters within the collimater closest to the X-ray tube can be misaligned. If a shutter slips into the primary beam, there is a radiation cutoff. Unfortunately, the light beam pattern on the patient formed by the collimator is created by the exit shutters. A simple test to determine if this difficulty is occurring with your unit will be demonstrated during this presentation as well as during the poster-board demonstration.

A COMPARISON OF THE PROFUSION AND TYPE OF SMALL OPACITIES REPORTED WITH THE 1980 AND 1971 ILO CLASSIFICATIONS USING READINGS FROM THE COALWORKERS' X-RAY SURVEILLANCE PROGRAM

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INTRODUCTION

The 1980 ILO classification differs markedly from its predecessor in the way small opacities are handled (see Appendix). The 1971 system required the separate assessment of the profusion of rounded and of irregular opacities. Based on these, a combined score had then to be determined. Under the latest classification the profusion of both types of opacity is assessed simultaneously in one score. The interpreter has then to make a qualitative judgment on the relative contributions of each type of opacity to the overall profusion by stating which is primary and which is secondary.

This change, which seems fairly trivial, has certain possibly serious implications. First, it makes for difficulty in the comparison of information on rounded or irregular opacities with past data. For instance. since the new combined score for small opacities cannot be quantitatively apportioned into separate scores for rounded and irregular opacities, prevalences of specific categories of rounded, and of irregular opacities cannot be derived for comparison with figures obtained under the 1971 revision. Instead, only the comparison of prevalences based on combined opacities from the 1971 classification with those using the small opacities score from the 1980 revision is possible.

More importantly, perhaps, is the possibility that the mere change in the method of reporting has made a profound change in the manner in which small opacities are now perceived and reported. It may be, now that readers can forego the difficult task of separate assessment of the profusion of rounded and irregular opacities while still having to record the different types of opacity present, that mixtures of opacities will be reported more often.

In order to explore this and other related questions, information on profusion and type of small opacity was extracted from records of the Coalworkers' X-ray Surveillance Program (CWXSP).[1] This is a nationwide program which enables all underground coal miners to receive free periodic X-rays. Miners with signs of coalworkers' pneumoconiosis (CWP) are notified, and may at their discretion work in low dust areas of the mine. The program has been in operation since 1970. Up until 1981 it used the 1971 ILO classification.[2] At that time a change was made to the current system.[3]

METHODS

The analyses were undertaken on data for all readable films from both sets. No special account was taken of film quality. Information on tenure underground, supplied by the miners at examination, was grouped into ranges and used for stratification in the analysis.

All of the X-rays were read by interpreters who had passed the NIOSH B-reader test,[4] and all X-rays were taken at facilities that had to conform to certain NIOSH requirements for quality.[5] Each interpretation used in this analysis was that of one B reader. Sixteen B readers were utilized in the CWXSP during 1981, 15 of these being employed throughout the year.

This analysis concentrates on the profusion of small opacities, and on the primary and secondary type of small opacities reported. The zones of involvement were not considered, nor were any other abnormalities.

During 1981 the CWXSP changed from using the 1971 to using the 1980 classification. In that year 7338 X-rays were read using the former classification, and 7438 using the latter. The data for this one year therefore provide a useful base for the comparison of the two classifications. Accordingly these data were used in the following comparison.

Since the two classification systems were different, the readings from one had to be converted into the format of the other in order to be comparable. Since the 1980 data cannot be quantitatively broken down into separate assessments of round and irregular opacities, while the 1971 revision scores are capable of being combined into pseudo-1980 determinations, the earlier data were converted for comparison with the later. The following is a description of the operations performed to do this.

1971 Classification

The 1971 classifications were converted to pseudo-1980 readings using the following algorithm.

1. The 1971 combined small opacity profusion was taken as the 1980 small opacity profusion.

2. Primary Type

   Acting on the assumption that the 1980 primary type is synonymous with the greatest profusion of rounded or of irregular opacities seen under the 1971 revision, the algorithm compared the two 1971 profusions. If the rounded opacities were reported as most profuse the primary type was defined as rounded. On the other hand, if the profusion of irregular opacities was greater than that for rounded the primary type was set equal to irregular. If the two profusions were equal, the type was assigned randomly.

3. Secondary type

   If both rounded and irregular opacities had been recorded, the secondary type was set equal to the type for whichever profusion was the less. If the profusions were equal, the secondary type was whichever of the two that was not allocated to the primary type. If only rounded, or only irregular opacities were reported in the 1971 scheme, the secondary type was put equal to the primary type.

   Note that the above procedure, while simulating the process a reader might go through under the 1980 scheme in assessing an X-ray, cannot fully duplicate all patterns of possible responses. While mixtures of rounded and irregular types can be obtained as primary and secondary entities, mixtures of types within the rounded range (p, q, r), or within the irregular range (s, t, u), are impossible as the information is just not available in the 1971 classification. As a result such combinations as p/q or s/u are absent from these pseudo-1980 scores, with a consequential problem in comparison with the actual scores from the 1980 classification.

1980 Classification

The readings from the 1980 classification were analyzed as reported, using the actual scores. In the few cases where small opacities were reported but the secondary type was left blank it was put equal to the primary type.

RESULTS

The numbers of readings were 7,338 and 7.438 for the 1971 and 1980 classifications respectively. The mean tenure underground was 5.3 years for the first group, and 4.8 years for the second.

Profusion

Overall, the percentage of films read as showing small opacities was the same under both classifications, at 6.1%. Table I shows these percentages plus those for other profusions obtained using each classification. Figure 1 shows these data plotted against various tenure ranges.

Primary Opacity Type

The proportions of positive X-rays (category 0/1 or greater) tabulated according to opacity type by each classification are

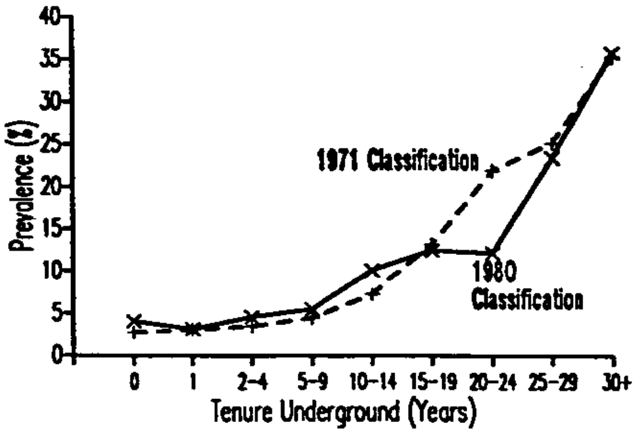

Figure 1. Percentage of films noted as showing category 0/1 or greater small opacities by tenure underground and classification used.

shown in Table II. No major change was seen in the general reporting of rounded and irregular opacities, 56% of all opacities being reported as rounded using the 1971 classification and 52% using the 1980 revision. Moreover, within the rounded opacity group, the percentages of opacities reported as being p, q and r remained about the same after the introduction of the 1980 scheme. However, there was a major change in the way small irregular opacities were interpreted, with type s being reported twice as frequently as before ($X^2 = 38$, 5 d.f., $p < .001$), mainly at the expense of type t.

Figure 2 explores this topic in more detail by breaking the data down by profusion of small opacities (0/1, 1/0 and 1/1+). It shows that the readings for categories 0/1 and 1/0 are similar to those overall, with type s opacities being recorded more often than type t under the 1980 classification. However, for the small number of films classified as 1/1 or greater the findings are different, and indicate a movement from recording type p opacities to noting those of type s. While the proportions of films classified as rounded under the two classifications are quite similar for the 0/1 and 1/0 categories, the greater willingness to note type s opacities results in more irregular opacities being reported for 1/1 or greater films when read using the 1980 scheme.

Miners with longer tenure were also found to be more likely to be classified as having rounded opacities under the 1971 system (Figure 3). This was probably another manifestation of the phenomenon seen in the data of Figure 2 and associated with the higher categories of small opacities.

Secondary Types

As noted earlier, the restrictions in the way data on secondary type was derived from the 1971 classification, and the presence of missing values in the 1980 classification data complicates the interpretation of this information.

Table III gives the percentages of positive films classified by secondary type in a manner analogous to Table II.

Table I
Percentage of Films Showing Small Opacities of Various Profusions by Classification Used

Classification	Percentage of films showing 0/1+	1+	2+	Number of Films
1971	6.1	2.7	.2	7338
1980	6.1	3.1	.2	7438

Table II
Percentage of Films with Small Opacities by Reported Type of Primary Opacity

Classification	Percentage classified as type: p	q	r	s	t	u	Number of Positive Films
1971	16	39	1	15	29	0	443
1980	13	38	1	31	18	0	454

Table III
Percentage of Films with Small Opacities by Reported Type of Secondary Opacity

Classification	Percentage classified as type: p	q	r	s	t	u	Number of Positive Films
1971	16	38	1	17	29	0	443
1980	15	34	1	26	25	0	454

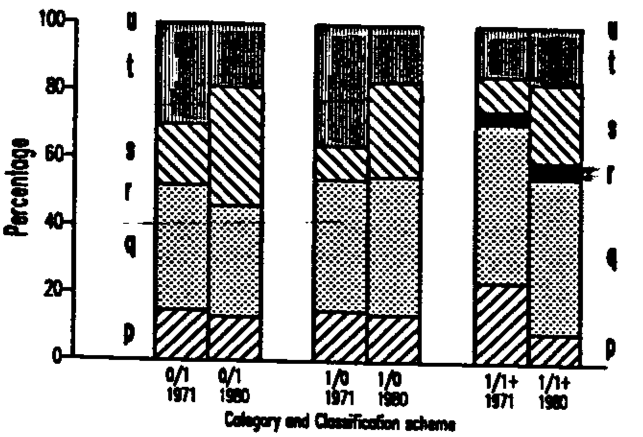

Figure 2. Rounded opacities as a percentage of all small opacities by profusion category and classification used.

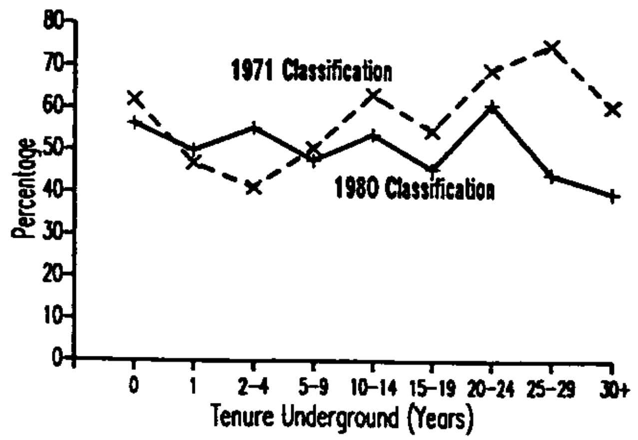

Figure 3. Rounded opacities as a percentage of all small opacities by tenure underground and classification used.

The data show similar trends to those seen for the primary type. In particular the 1971 secondary type distribution is almost identical to the primary type distribution given in Table II. While the 1980 secondary type distribution follows that for the primary type, fewer type s and more type t opacities were reported, although the division between rounded and irregular is not affected.

The relationships with secondary type and profusion, and with tenure were similar to those for the primary type for each classification scheme.

Primary and Secondary Type Together

This analysis looks at the pairs of scores for primary and secondary type among all films noted as showing small opacities (Table IV).

The main observation from this table is that the percentage of films where both primary and secondary types were reported as rounded is diminished under the 1980 scheme, the balance going to cells where mixtures of rounded and irregular opacities were reported (X^2 = 7.1, 1 d.f., $p < .01$). On the other hand, the percentage of films where irregular opacities were reported as primary and secondary remained the same.

Larger Temporal Changes

The above analysis has concentrated on readings obtained during the one year both classifications were in effect. Before concluding this analysis it seemed sensible to place these changes in the wider perspective of larger temporal changes. In this way the transitoriness of any effects brought about by the introduction of the 1980 classification could be assessed.

Figure 4 gives some data from 1978 to 1986 on the prevalence of various categories of rounded opacities seen in the CWXSP (Note: these must not be taken as estimates of prevalence in working miners as the CWXSP records are not representative of this group). The data show a trend towards lower prevalence with time, a trend that was not disturbed by the change to the new classification. (The apparent cyclical trend is an artifact arising from the procedures under which the CWXSP operates.)

The percentage of positive films recorded as having primarily rounded opacities in each year is shown in Figure 5. There is a clear indication of a trend towards more frequent re-

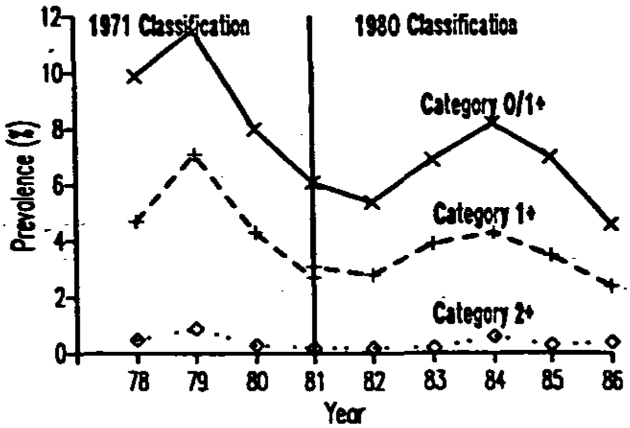

Figure 4. Percentage of films noted as showing various categories of rounded opacities by year of examination and classification used.

Table IV
Percentage of X-rays Classified by Both Primary and Secondary Type and by Classification Scheme

		1971 Secondary			1980 Secondary		
		Rounded	Irregular	Total	Rounded	Irregular	Total
PRIMARY	Rounded	215 (48.5)	33 (7.4)	248 (55.9)	187 (41.2)	47 (10.4)	234 (51.6)
	Irregular	22 (5.0)	173 (39.1)	195 (44.1)	37 (8.1)	183 (40.3)	220 (48.4)
	Total	237 (53.5)	206 (46.5)	443 (100.0)	224 (49.3)	230 (50.7)	454 (100.0)

Note: percentages of total for each classification are in parentheses.

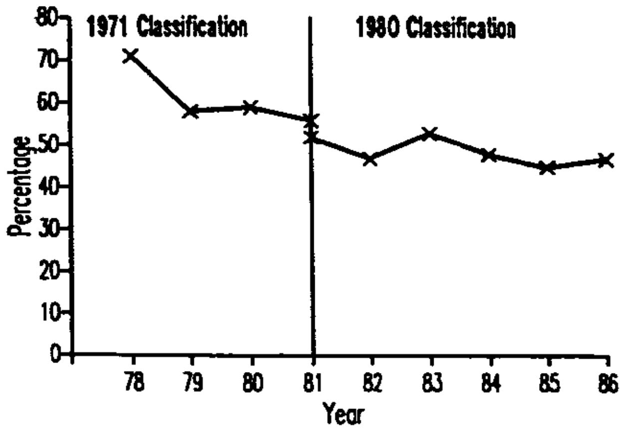

Figure 5. Small rounded opacities as a percentage of all small opacities by year of examination and classification used.

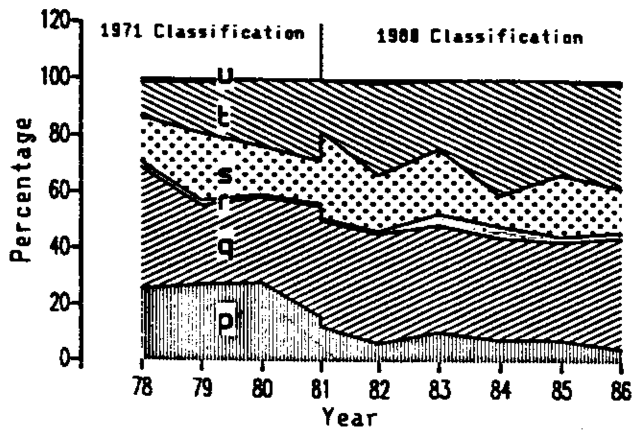

Figure 6. Small rounded opacities as a percentage of all small opacities by year of examination and classification used.

porting of irregular opacities, this being unaffected by the classification change. Figure 6 shows that this trend occurred at the expense of type p opacities, and again, the new classification is not implicated in this. Interestingly, the switch between the recording of type s and type t opacities in 1981 noted earlier is seen to be largely transient; by 1983 readers were again reporting type t opacities more frequently. Throughout the whole period r and u type opacities were infrequently reported, and no obvious trend is apparent.

DISCUSSION AND CONCLUSIONS

The data presented here indicate that the introduction of the 1980 classification had little lasting effect on the reporting of small opacities. In 1981 no marked increase or decrease in the percentage of positive film was seen, and the general temporal variation in prevalence in the program continued quite smoothly through the classification changeover.

Furthermore, although there was a switch to more frequent reporting of type s opacities at the expense of type t in 1981, this appeared to be transient, and the new classification did not interrupt a trend towards an apparent greater willingness to report irregular opacities, both as primary and secondary types. Researchers should be aware of these trends; further work is underway on this topic. In particular, the temporal trend seen in Figure 6 is being examined to see if it is reader artifact, or whether it reflects a change in the exposure and tenure of the miners x-rayed over that period.

It should also be noted that there are other differences between the 1971 and 1980 classifications which may have directly or indirectly influenced X-ray interpretation. For example, in the 1980 scheme, the standard radiographic illustrations of the small opacities take precedence over their written definitions. Many different standard X-rays were also used in the 1980 scheme. Based on the findings in this report, these changes also seemed to have had little lasting effect on the trends of reading small opacities.

It is important to note that these findings may not be applicable to readings obtained on other occupational groups. The films read in this study were all of coal miners, or coal miners to be, and the general level of abnormality reported was slight. Findings for other groups, such as those for workers exposed to fibers, and for films showing greater abnormality may well be different. Of course, it is also true that readers other than those considered in this study may not have exhibited the trends reported on here.

In summary, the conclusions are as follows. Adoption of the 1980 classification in the CWXSP did not lead to any change in the amount of small opacities reported. There was, however, a short lived switch to the greater reporting of type s opacities at the expense of those of type t. There was also an indication that fewer type p opacities were reported for X-rays with profusions of 1/1 or greater. These effects were found to be small, however, when compared with temporal trends seen over the last 10 years. These indicate that there has been a gradual but continuous movement from the reporting of rounded opacities towards irregular opacities.

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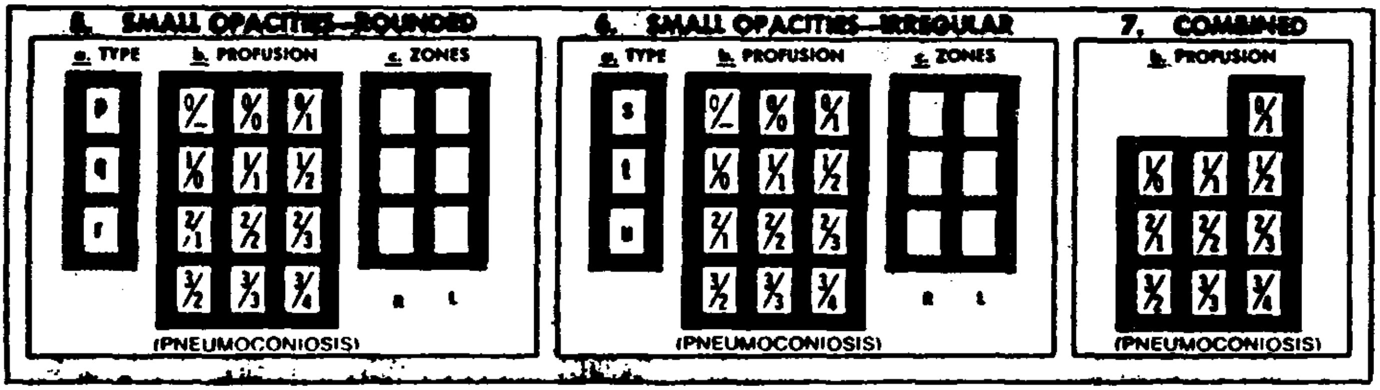
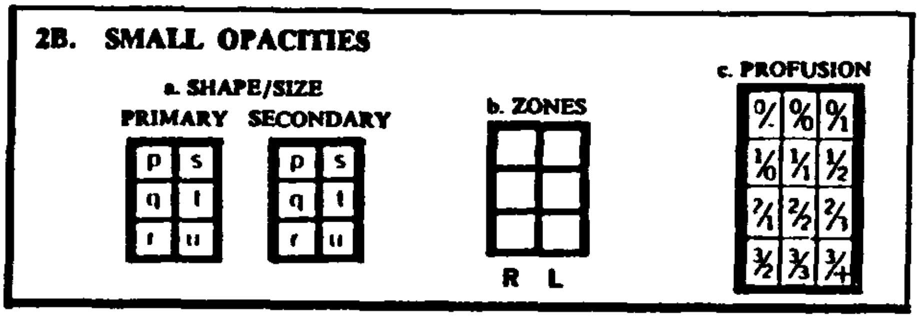
APPENDIX



1971 Classification of small opacities



EDUCATIONAL STANDARDS-SETTING PROGRAMS OF THE ACR TASK FORCE ON PNEUMOCONIOSIS IN SUPPORT OF NIOSH

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The Task Force on Pneumoconiosis of the American College of Radiology is in its eighteenth year of providing advice, counsel and educational programs in support of activities of the National Institute for Occupational Safety and Health. This is a remarkable length of service for a partnership between a public health agency and a national medical specialty society. The task force was created to solve problems stemming from the 1969 enactment of the Coal Mine Health and Safety Act. This established in the United States a national surveillance program for active coal miners and a compensation program for former miners and their survivors. The key bit of medical evidence specified in the law was a chest radiograph of good quality, interpreted by a qualified physician using a standardized descriptive system.

Unlike many countries which created earlier miner surveillance programs, the American law did not allow NIOSH to establish an expanded public health agency to undertake the entire program. Instead, NIOSH turned to the private sector of medicine for help.

In 1969, only a few American physicians were familiar with coal workers' pneumoconiosis, despite the prevalence of mining in this country. Even fewer understood the International Labor Office Classification of Chest Radiographs, which the new law specified for use. The miners were suspicious of the intentions of the mine operators and their plans for providing the needed chest X-ray examinations. In short, everything needed doing immediately.

Under a series of contracts, the task force developed programs in three areas.

1. Setting standards for physicians and facilities to participate in the surveillance programs established under the law.
2. Developing new and innovative teaching methods to acquaint radiologists and other physicians with the radiologic manifestations of CWP and the use of the ILO classification system.
3. Developing a climate of cooperation between NIOSH and other federal agencies and interested physician groups in several appropriate disciplines.

The task force was built upon the five radiologists who made up the Public Health Service panel. They were Drs. Eugene P. Pendergrass, George Jacobson, Russell H. Morgan, Benjamin Felson and Leonard Bristol. Drs. Felson and Bristol remain active. To this core, the ACR added other radiologists, chest physicians, physicists, pathologists, radiographers and epidemiologists to provide expertise and liaison. Dr. Edgar L. Dessen became the chairman and remains so. Several other members of the task force have served during the entire span of its existence. They include Drs. Jerome Wiot, E. Nicholas Sargent, and Jerome Kleinerman who are active in this conference.

STANDARD SETTING

The task force served as a panel of experts to advise NIOSH on the development of criteria for physicians and for facilities.

The A and B reader system was devised to assure that physician participants are skilled in chest radiographic interpretation. Physicians from several disciplines routinely interpret chest radiographs in this country. Thus, NIOSH could not rely entirely upon a single specialty certification.

The A reader qualification is necessary to supervise an approved facility and to make primary interpretations for the program. It is attained by most physicians through attendance at one of the seminars offered for NIOSH by the task force.

The B reader status is achieved by sitting and passing a six hour examination involving 125 chest radiographs. The radiographs must be scored correctly using the current version of the ILO system. More than 500 American physicians and perhaps 50 from other countries have become B readers. This provides a reservoir of talent for federal programs, for industrial programs and, increasingly, for litigation of disability claims. The B reader test was devised by Dr. Russell Morgan and validated by the task force.

The task force also advised NIOSH about technical standards for facilities. The difficult task of detecting early signs of CWP is made almost impossible by poor quality radiography. Standards for film, equipment and personnel were recommended and adopted. The task force developed measuring programs, designed phantoms, tested film-screen combinations and processing systems and devised training sessions for radiographers and physicists. These efforts involved other public health agencies, state radiation programs and leading manufacturers of film and equipment.

The criteria for radiographic quality which originated with these efforts have become a standard part of the education of radiologists and radiographers and a basic element in the marketing of X-ray imaging systems.

PHYSICIAN EDUCATION

At the beginning of the program, NIOSH had an obligation to interest private physicians in becoming part of a demanding radiologic process so that the mandated examinations would be available to miners in the many communities throughout some 20 of our 50 states. The task force organized a series of teaching programs.

The most innovative of these was the viewbox seminar which will be demonstrated at the end of this conference and offered for the 29th time this weekend. The method involves a test-teach-test sequence in which each participant works with his own set of radiographs and is required to make decisions on each case, using the ILO system to record his conclusions.

For several years, the task force presented seminars at the American Medical Association conferences on occupational health. It conducted one seminar specifically for academic radiologists, pulmonologists and radiographers and provided each attendee with a set of teaching materials devised by the task force.

In addition, the task force has offered seminars for radiographers, for industrial and union physicians, for administrative law judges who decide most compensation claims, for attorneys who contest such claims and for other public health groups. Two syllabi on radiographic technique remain in general usage.

When asbestos related disease emerged as a significant public health problem, the task force worked with NIOSH and the National Cancer Institute to develop a teaching module and monograph on asbestos related disease. The package contained radiographs, micrographs, clinical and statistical data and a historic summary of the problem. The modules were placed in the audio-visual centers of every American medical and osteopathic school. Hundreds of copies of the monograph were sold to individual physicians.

Articles in the scientific literature have described the task force's efforts and results.

LIAISON

From its beginning, a major effort of the task force was to involve other medical disciplines, allied health scientists, public health agencies and the manufacturing and supplier community in coordinated efforts to support NIOSH and other federal programs.

With the approval of NIOSH, the task force has provided advice and monitoring to the coal miner compensation programs of the Social Security Administration and the Department of Labor. It has advised the Navy Department, the State Department and the Food and Drug Administration. It built working relationships with the American College of Chest Physicians, the American Occupational Medical Association, the American Medical Association, the American Osteopathic College of Radiology, the American Society of Radiologic Technologists, the College of American Pathologists and other groups.

When interest was expressed in revising the ILO system, the task force, supported by NIOSH, organized the international committees and efforts which led to the 1980 version which is in world-wide use today. The ACR Institute is the designated supplier of standard radiograph sets to ILO.

The U.S. Congress amended the Coal Mine Health and Safety Act in 1972 and again in 1977 to broaden benefits and ease qualification requirements. On both occasions, the task force provided expert testimony about medical and technical aspects of the proposed legislation.

When the U.S. was suggested as a possible site for this seventh International Conference on the Pneumoconioses, the task force supported NIOSH by developing the feasibility study and a general plan for the meeting. Members of the task force have served on the committees for the meeting. The seminar demonstration on Friday and the full seminar were planned for the convenience of conference attendees.

SUMMARY

For nearly two decades, the task force has provided a broad base of support to NIOSH and through its good graces to other public and professional channels dealing with the radiologic definition of dust retention diseases. From a situation in 1969, in which Americans were far behind other nations dealing with CWP, task force efforts have been crucial to the development of national programs for miner and other worker surveillance, to physician education, to quality assurance efforts and for liaison between public sector agencies and professional medical and allied health societies. The task force is currently in the first year of its fifth contract with NIOSH.

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