Roentgenographic Underestimation of Early Asbestosis

To the Editor:

The special report, "Roentgenographic Underestimation of Early Asbestosis" (Chest 1988; 93:1088-91), underlines an inherent limitation of a population-based epidemiologic tool when applied to individual subjects. Rockoff and Schwartz note that 10 to 20 percent of workers with histologic evidence of asbestosis will have normal chest x-ray film by ILO criteria. The finding of deficiencies in this context is hardly surprising; negative ILO readings were never intended as definitive clinical diagnoses. Their present preeminence in some clinical or legal arenas was not envisioned and should be regarded as inappropriate.

An equally important deficiency of the system, when applied to individuals, is that a positive ILO reading of pulmonary fibrosis may still pertain to a normal chest. It is known that the most expert observers are relatively conservative compared to their less experienced colleagues for coal miners' films.1 We recently analyzed reader results of more 100,000 randomly distributed, singly-interpreted, US Navy medical surveillance roentgenograms. Civilian readers who instruct the course leading to ILO certification are 24 percent less likely to observe opacities ≥1/0 than their certified but presumably less experienced colleagues. The prevalence range among 23 certified readers interpreting an average 4,506 randomly distributed films was 0.05 to 10.93 percent (mean 2.36 percent)—more than 200-fold from top to bottom. One observer contributed 20.5 percent of ≥1/0 interpretations from 4.4 percent of distributed films.2

Some certified readers apparently rarely see roentgenographic evidence of fibrosis; others see it far more frequently than their colleagues. Predictive values of positive and negative readings probably depend on who is doing the reading. Yet in the absence of a gold standard, it is not clear whose ILO performance most closely approximates clinical truth.

To expand a little on the thesis of Rockoff and Schwartz, neither the presence nor absence of a positive ILO interpretation is definitive. Asbestosis is a clinical diagnosis; roentgenographic interpretations are a useful, although distressingly subjective, component of that diagnosis.

A final question: the ILO system is intended for epidemiologic comparisons—how comparable are population studies based on interpretations by different certified observers?

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To the Editor:

Rockoff and Schwartz1 base the statement that "there is a 10 to 20 percent probability of having a normal chest x-ray film in the presence of histologically significant pulmonary asbestosis in asbestos-exposed populations" on two studies in the literature2,3 and one of their own. I find their conclusion to be misleading—it suggests that clinical asbestosis exists in the presence of normal chest x-ray results, when in fact their conclusion is neither supported by their own study nor by their references. A more accurate statement would be that there may be areas of fibrosis in the lungs of asbestos-exposed workers who have normal chest x-ray film; however, these workers do not have clinical asbestosis, nor do they have pulmonary impairment. Accordingly, I will review their study and their references in detail.

Rockoff and Schwartz' first reference is the frequently-cited study of Epler et al4 who reported that 44 of 458 patients (9.6 percent) had chronic diffuse infiltrative lung disease despite a normal chest x-ray film (eg, desquamative interstitial pneumonia, sarcoidosis, and allergic asplenia). Six patients had asbestosis with a normal chest x-ray film—the pathologist rendered a diagnosis for each patient, "whether or not he thought the lesions were likely to be important functionally." In five out of six patients with asbestosis, "the structural abnormality . . . was so mild . . . as to suggest minimally altered function despite the 'nameable lesion.'" These patients had normal diffusing capacities and normal exercise alveolar arterial oxygen gradients, thus none had pulmonary impairment.

Gaensler and Carrington5 extended this series from 458 patients to 502 patients, and attempted to estimate functional impairment by judging the overall severity of the anatomic lesion. Pathologic severity, graded from 0 to 5, referred to the pathologist's estimate of functional impairment. Of the eight patients with a normal chest x-ray film who were diagnosed with asbestosis, five of eight were graded 0, and three were graded 1. The authors stressed that, at the time of biopsy, they had carefully selected average areas of disease rather than most severely diseased areas, and that "often the most abnormal regions are biopsied to aid the pathologist."

The second study that Rockoff and Schwartz relied upon was Kipen's6 attempt to correlate x-ray results with pathology by studying career insulators who died of lung cancer—patients with heavy asbestos exposure. Of 350 workers, 138 had suitable x-ray films and tissue samples (submitted from surgical specimens, biopsy, or necropsy) to permit the assessment of diffuse pulmonary fibrosis and its degree. All 138 cases had "histologic evidence of parenchymal fibrosis," 25 (18 percent) had normal x-ray results. X-ray films showed increasing profusion of small opacities with increasing duration from onset of exposure; however, no such correlation was found between exposure duration and pathologic severity. One wonders whether the tissue reviewed was truly representative tissue, or most severely affected tissue. Unfortunately, no clinical or physiologic data was presented. Kipen states that their findings
are in accord with two large studies of patients with various interstitial fibrosis, including asbestosis. Actually, these two large studies were the above-reviewed studies of Epler and Gaensler and Carrington, essentially the same cohort group.

Rockoff and Schwartz reported fissural thickening on chest x-ray films in 54.5 percent of 320 asbestos-exposed workers. A second group of 59 workers (ten or more years of asbestos exposure) were evaluated clinically—eight (19.5 percent) were felt to have clinical findings "indicative or diagnostic of pulmonary asbestosis." In those patients who underwent pulmonary function testing, two had mild restriction, one severe obstruction (pathology showed severe pulmonary fibrosis) and four had mild small airways obstruction. Diffusing capacities were not reported. Pathology findings revealed interstitial fibrosis in four patients.

There is general agreement with Rockoff and Schwartz that sole reliance upon the ILO-classified chest x-ray film for "determination of the presence of early pulmonary asbestosis in individual cases is inappropriate. The presence of asbestos induced lung disease can best be diagnosed by complete review of clinical, roentgenographic, laboratory and, when available, pathologic data." A diagnosis of clinical asbestosis should be made in accord with the official statement published by the American Thoracic Society Ad Hoc Committee of Scientific Assembly on Environmental and Occupational Health in conjunction with the American College of Chest Physicians in 1986. Of these criteria, findings on chest roentgenogram were said to be the most important.

Since neither Rockoff's study nor his references satisfy these criteria for diagnosing asbestosis, Rockoff and Schwartz's statistical analysis of these studies cannot logically conclude that asbestosis exists in 10 to 20 percent of asbestos-exposed individuals with normal chest x-ray results.

I have performed over 1,000 comprehensive disability evaluations on asbestos-exposed workers in the San Francisco Bay area over the past ten years. In reviewing the medical records, I occasionally encountered a diagnosis of asbestosis in workers with normal chest x-ray film and borderline normal pulmonary physiologic testing (eg, lowered vital capacity and/or lowered diffusing capacity). Usually, Epler's study was cited as a supporting reference.

I believe that such diagnoses are erroneous, and that the borderline pulmonary function tests are explainable by such factors as obesity, lack of maximal patient effort, other disease entities such as COPD, failure to correct for racial differences, or interlaboratory variations in techniques and/or predicted values. Hopefully, clinicians will adhere to the ATS guidelines when making a diagnosis of asbestosis and no longer diagnose asbestosis in an asbestos-exposed worker with a normal chest x-ray film.

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To the Editor:

We read with interest the article by Rockoff and Schwartz on roentgenographic underestimation of early asbestosis by ILO criteria. Although it has a valid point to make—that "asbestosis" may be present in the face of a normal chest x-ray film—we feel that this point is not placed in proper clinical perspective. It is our opinion that the authors' arguments do not do full justice to all sides of the issues, and that they have set up the ILO system as a straw man.

In their introduction, the authors state without supporting references that "we have become aware that the chest roentgenographic examination tends to underestimate the presence of early interstitial disease" and do not refer to the more prevalent opposite side of the coin as presented in articles in their own bibliography—overreading of roentgenograms compared to histologic appearance.

Over 33 percent of chest x-ray films from normal, occupationally-exposed control subjects may be interpreted as demonstrating irregular opacities of low profusion (1/0 to 1/2). Marked pleural disease may be misclassified as parenchymal disease on radiologic interpretation.

Overreading of chest roentgenograms is addressed in other articles not cited by Rockoff and Schwartz. One study found an 11 percent incidence of what was interpreted as grade 1/0 through 2/1 profusion of small opacities in patients with no documentable dust exposure or any other specific medical etiology. Smoking was considered a possible contributing factor. A recent review article presents a strong case that smoking causes diffuse interstitial pulmonary fibrosis which is radiologically visible with low profusion (0/1 to 1/0) in low prevalence, creating ambiguity in distinguishing roentgenologic signs of early asbestosis from changes related to smoking. Another recent article found a false-positive rate for asbestosis of 17 percent on chest roentgenogram interpretation by B-readers.

Drs. Rockoff and Schwartz write that the ILO classification is based on consensus, gives only semiquantitative data and is purely descriptive. This is hardly news to anyone who has taken the American College of Radiology course on the pneumoconioses—the ILO system does not purport to be anything else! They then state, in a perjorative fashion, that "the ILO classification is applied by an x-ray reader without knowledge of the worker's dust exposure history, clinical symptoms, physical signs, or laboratory data" and that the B-reader examination does not require expertise in these areas of pulmonary medicine. This should not be viewed as a criticism. In order to function properly as an independent variable in the clinical assessment of an individual exposed to asbestos, the chest x-ray film (or chest CT) should be interpreted without knowledge of these clinical data!

In the paragraph outlining the "failure of roentgenographic-histologic correlation in early asbestosis", the authors cite a paper with one patient with asbestosis and no evidence of interstitial lung disease on chest x-ray film and three papers with large numbers of patients and substantial percentages of normal lungs radiologically in the face of histologically-proven asbestosis. The latter two papers are from the same institution with most of the same authors, so those are probably the same patients. Gaensler reported that in his eight patients with asbestosis and normal chest x-ray results, "the lesions (histologic) were so slight, so few, or so small that the pathologist's estimate of functional loss was graded 0+". Pulmonary function test results from these eight patients cannot be gleaned from this paper. Epler reported that six of 58 patients with a