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A proposed addition to the international standard classification for recording tuberculosis on chest X-rays of silica-exposed individuals

Both silicosis, the pneumoconiosis caused by inhaling silica dust, and silicotuberculosis, the combination of silicosis and pulmonary tuberculosis (TB), remain globally prevalent.[1,2] Clinical screening by plain chest X-ray (CXR) is the mainstay of early diagnosis, treatment and management of these diseases in settings of silica dust exposure and high TB burden. Globally, silicosis is the most common of the pneumoconioses, and the populations affected are large, notably in China, India, Brazil and southern Africa. Silicosis is both a powerful risk factor for TB,[3] and potentially difficult to distinguish radiologically from TB fibrosis in its nodular and conglomerate form.[1,4]

Achieving standardisation in the reading of CXRs for pneumoconiosis remains challenging.[5] The International Labour Organization (ILO) *Classification of Radiographs of Pneumoconioses*, which originated in South Africa at a silicosis conference held in Johannesburg in 1930,[6] aims to standardise the recording of pneumoconiosis on the plain CXR. The classification has undergone a number of revisions, the latest being in 2022.[7] A notable inclusion in this revision is the statement that 'reading forms may be modified to include check box lists of other common findings' (reference 7, footnote 8).

The purpose of this editorial is to propose such a checklist aimed at an expanded description of TB on the CXR. The core of the ILO classification contains tick-box options for the nodular and pleural features of the pneumoconioses, capturing the variation across different dust exposures, notably silica and asbestos. To enable the recording of additional features as well as some common findings with no relation to pneumoconiosis, a list of symbols (lower-case abbreviations) referencing such features forms part of the classification.

The early version of the classification included two symbols for the presence of TB: 'tb' (active or inactive), and 'tba' (active disease).[8] The latter symbol was dropped from subsequent revisions. Currently the CXR reader has several other symbol options that could be applicable to active or past TB or silicotuberculosis. These are listed in Table 1, Panel A.[9] Notably, a judgement about whether the TB is active is not specifically called for.

However, there are a number of common radiological features of TB that are absent from the ILO classification. These are presented in Table 1, Panel B.[10] Our recommendation is that these features be appended to the ILO CXR reading form in settings where silica-exposed workers are at significant risk of TB. The list is based on our experience in reading CXRs for silicosis and TB in mining populations over many years. We have drawn on three previous checkbox reading sheets – two applicable to miners[9,11] and one with general population applicability[12] – as well as comparing our combined list against features listed in general radiological reviews of TB.[10,13]

It is important to note that the ILO classification is not a clinical algorithm for diagnosis, and that flagging active TB requires a low threshold for referral for microbiological confirmation. Nor is it meant to be a comprehensive list of all possible appearances of silicosis or TB on the CXR. The additional TB checklist should be used only if the reader believes there are features suggestive of TB. Where features are consistent with a disease other than TB, the symbol 'od, other disease' (on the general symbol list, not shown here) should be marked and expanded on in the comments section.

The expanded checklist has potential value for both clinical epidemiology and clinical practice. There is currently considerable interest in post-TB lung as a chronic lung condition requiring follow-up, and in some circumstances treatment.[14] In the occupational setting, silicotuberculosis is an under-recognised phenotype of post-TB lung disease, and has a worse prognosis than silicosis alone, a feature of importance in the assessment of work capability and adjudication of occupational disease.[1] Standardised informative descriptions of post-TB features (with or without accompanying silicosis) would allow more detailed study of relative frequency across different populations, associations with symptoms, lung function impairment, progression and recurrence, and the impact of silica exposure or silicosis on the appearance of TB on the CXR.[9,15]

While computed tomography (CT) is accepted as more accurate than the plain CXR in identifying features of silicosis and TB, it is unavailable in most settings in which occupational screening for silicosis and TB is needed. However, granular studies of the differences between CT and CXR would inform the CXR reading – alerting CXR readers to the risk of overinterpreting certain observed features and under-identifying others.

Recording of the expanded list would also focus readers on the features distinguishing silicosis from TB and active from previous TB, as well as on those consistent with silicotuberculosis.[1,7] Of the TB features listed in Table 1, hilar adenopathy, pleural effusion, cavitation, inflammatory or infective infiltrates and pneumonic consolidation are suggestive of active TB. Distortion of intrathoracic structures, apical pleural thickening, fibrocavitatory changes, linear fibrosis and bronchiectasis are more suggestive of previous TB. The reading of nodular silicosis and large opacities (progressive massive fibrosis) in conjunction with any of the above features points to silicotuberculosis. Practice in using the expanded form would contribute to the training of clinicians tasked with screening for these diseases in primary care settings.

There has been only one previous proposal for formal classification of TB on the CXR in the presence of silica exposure or silicosis, but to our knowledge this tool has not entered practice.[9] What we offer is a simpler approach building on the existing classification. We do not propose new symbols but instead the appending of a checklist to the current symbol list. Our intention is to advance a method suitable for readers who use the ILO classification but are not necessarily radiologists or specialist readers – for example, those who work in health services attending to silica-exposed populations, including the growing numbers of artisanal and small-scale miners.[2]

Almost a century after the 1930 silicosis conference in Johannesburg, the preventable co-occurrence of silica, silicosis and TB remains a global problem. The expanded classification provides an improved tool for clinical practice and epidemiology. As was the case with the ILO classification for the pneumoconioses,[16] research is needed into its utility and into the acceptability of the expanded version.[16] We believe that a collaborative effort akin to that invested in the pneumoconiosis section of the ILO classification would promote progress towards a global instrument applicable to TB and silicotuberculosis in silica-exposed workers.

Table 1. Radiological features relevant to silicosis, TB and silicotuberculosis in reading CXR images in silica-exposed populations

A. Current ILO classification (2022)

Symbol	Feature	Comment*
tb	TB	Active, inactive or both
cg	Calcified granuloma	
cv	Cavitation	
ef	Pleural effusion	
di	Distortion of an intrathoracic structure	Including tracheal deviation, hilar elevation, volume loss, lobar collapse
bu	Bullae	
at	Significant apical pleural thickening	
hi	Enlargement of non-calcified hilar or mediastinal lymph nodes	
em	Emphysema	Purely descriptive term, including hyperinflation

B. Proposed checklist

Number	Feature	Appearance on CXR
1	Bronchiectasis	'Ring shadows' and/or 'tramlines'
2	Fibrosis other than that due to pneumoconiosis	Hyperdense nodular, linear and/or conglomerate opacities, including along vascular bundles and irregular clusters of nodules†
3	Fibrocavitatory or fibrocystic changes	Discrete lucent areas superimposed on areas of reticulation and distortion
4	Inflammatory or infective infiltrates	'Fluffy' or 'cottonwool' opacities
5	Pneumonic consolidation	Dense opacification or consolidation, with/without air bronchograms
6	Miliary TB	Fine diffuse nodularity‡
7	Other features thought by reader to be due to TB	Free text box
8	Number of zones affected by TB	1 - 6 (right, left: upper, middle, lower)

TB = tuberculosis; CXR = chest X-ray; ILO = International Labour Organization.
*Comment by present authors, i.e. does not appear as such in current ILO classification.
†Described in Solomon *et al.*[9] as a feature of smear-negative ('indolent') TB in silica-exposed gold miners.
‡See Bhalla *et al.*,[10] p. 216, for fuller radiological description of miliary TB.

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