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Application of the ILO International Classification of Radiographs of Pneumoconioses to Digital Chest Radiographic Images

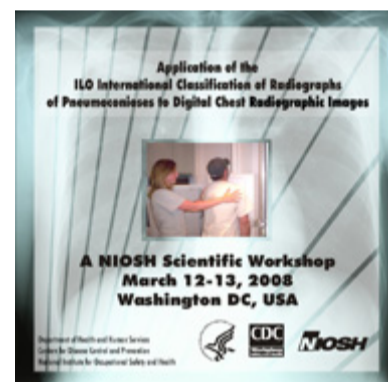
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[Go back to Workshop Index page.](#)

A NIOSH Scientific Workshop

The following content has been adapted from a presentation given at the NIOSH Scientific Workshop: Application of the ILO International Classification of Radiographs of Pneumoconioses to Digital Chest Radiographic Images.



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Perspectives for Revision of the ILO 2000 Classification of Radiographs

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Presentation topics

1. Conventional chest radiography
2. Digital radiography
3. Revision of the ILO 2000 Classification

Presentation topic I

Conventional chest radiography

Chest Radiography

- Impressive technical advances in diagnosis of lung diseases during the last 20 years
- CXR has been useful in screening and health surveillance, clinical care, diagnosis and evaluation of response to treatment
- Widely used in epidemiologic studies of occupational and environmental lung disorders
- CXR remains universally available tool
- Minor radiation exposure and inexpensive

Conventional chest radiograph

Advantages

- Simple to perform
- Cost effective
- Relatively specific in certain conditions
 - advanced silicosis, advanced coal worker's pneumoconiosis or advanced asbestosis
 - extensive and/or calcified pleural thickening
- Low radiation exposure: effective dose 0.03 mSv
- Standardized classification method – ILO Scheme

Chest radiograph vs pathologic findings

- Relatively good correlation between lung pathological findings and radiographic interpretation for dust-exposed workers with high profusion of small opacities
- Good correlation between the dust content in the lung and the profusion of small opacities in coal miners

Chest Radiography in Dust Exposed Workers

- Chest radiography remains the most common and widely used tool in screening and surveillance of dust exposed workers
- Dust-related pulmonary disorders may amount up to 30% of all work-related illnesses
- Chest radiograph may be an important sentinel for failure of dust control
- Chest radiograph is helpful in exposure response relationships

Limitations of Radiographic Imaging

- Imperfect tool, not diagnostic gold standard
- Airway disorders are not always seen
- Functional impairment does not always correlate with imaging
- Can not provide certainty about the etiology of observed findings due to limited lung response patterns

Medical screening and health surveillance

- Chest radiography remains most widely used radiological tool for screening of large populations
- Radiographs of good quality, classified with the ILO scheme, reported with consistency and accuracy, are the most important tool for medical screening and health surveillance of workers exposed to mineral dust

Presentation topic II

Digital radiography

Digital techniques for chest radiograph

- Conventional radiograph: film-screen system
- Digital techniques
 - Computed radiography: using imaging plate to store x-ray image, then a scanning device convert x-ray image to digital data
 - Digital radiography: flat-panel detector for converting x-ray to digital data

Advantages of digital radiography

Film-less imaging system

- produces better quality of images for diagnosis
- eliminates over- and under-exposure
- digital images can be manipulated to help with interpretation
- easy access to images, cheaper storage, less subject to loss
- use of PACS for telemedicine
- teleradiology for image transmission through network connections

Digital radiography – challenges

- High equipment cost, lower film/image cost
- Hardware & software should be standardized
- Trials needed to decide on comparability of films
- Digital standard images are necessary
- Use of CR/DR will soon become standard practice in many countries
- Replacement of CXR in diagnosis, medical screening and health surveillance

Medical Monitor QA Standard

	IEC 61223-2-5	DIN V 6868-57	EUREF	AAPM-TG18	JESRA
Testing	Constancy testing	Acceptance testing + Constancy testing (QS guideline)	Acceptance testing+ Constancy testing	Acceptance testing+ Constancy testing	Acceptance testing+ Constancy testing
Established	1994	February 2001	November 2003	April 2005	August 2005
Performer		Vendors	Medical physicists	Medical physicists	Manufacturer Or Hospital
Performer of Constancy testing/ Interval	None specified 3 months	Hospitals 1/3, 6 months	Medical physicists 6 months	Medical physicists 1/3, 12 months	Hospitals 1/3/, 12 months

Other Information	Will be new IEC by 2009	Enshrined into law Acceptance testing: in July 2002 Constancy testing: in December 2003	Digital mammography QA guideline	OR3	Based on AAPM and IEC
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Difficulties when introducing digital x-ray for diagnosis and screening of pneumoconiosis

- Does the law provides for use of CXR or digital images (CR/DR?)
- Compensation for lung injury
- Availability of equipment for digital radiography
- Cost as compared with CXR
- ILO digital standard images are not yet available for comparisons with CR/DR subject films

Future scheme for medical screening of Pneumoconioses

- Using digital subject films with standard digital images of ILO Classification
 - CRT/LCD reading
 - PACS: telemedicine
- Using CT Classification of pneumoconioses as supplementary method
- Classification of radiographs will remain a major screening tool

Presentation topic III

- Revision of ILO 2000 Classification

ILO 2000 Classification

Uses of the Classification

- Epidemiological research
- Screening and surveillance of workers in dusty occupations
- Clinical purposes
- Promotes improved international comparison of data concerning the pneumoconioses

ILO 2000 Classification

Object

- To codify the radiological abnormalities of pn in a simple, reproducible manner

The Classification:

- does not define pathological entities
- does not take into account working capacity
- does not imply legal definitions of pn for compensation purposes
- does not set or imply a level at which compensation is payable

In: Journal of Thoracic Imaging, 17:179-188, 2002

"The ILO system has worked, is working and has substantially achieved the intended task. It continues to play a key role in research and epidemiology of occupational lung disease and in the compensation of exposed individuals. Improvements in or modifications to the system, especially the integration of new imaging technologies, could provide both young and established investigators many opportunities."

ILO Classification

- Evidence from many different disciplines has demonstrated that the ILO profusion score correlates with occupational exposure, dust burden in the lung, histologic fibrosis and, more recently, with physiologic impairment and mortality.
- The ILO classification has therefore been validated as a scientific tool
- In: Am. J. Ind. Med. 50:63-67, 2007

ILO Classification

- Intensively used and validated over the last 25 years
- The Classification continues to provide the univervally recognized method to systematically record abnormalities on chest radiographs of individuals exposed to dusts
- Voluntarily used for comensation of individuals exposed to dusts although it was not designed for this purpose
- New technologies such as digital radiography will be driving its modification

ILO 2000 CLASSIFICATION

ILO 2000 Classification of Radiographs of Pneumoconioses

Universal tool to improve health surveillance, conduct epidemiological research and compare statistical data

Legal requirements – voluntary use for compensation claims

ILO Panel at 10th ICORD

"Proceed with the selection of new standard films taken with the use of digital techniques"

Revision of ILO Classification – I

- Using "hard" copies of current 22 CXR standards
- Producing CD with the same 22 standard images as digital "soft" copies to respond to users of modern digital techniques
- Producing a chapter with recommendations for use of digital standard images
- Creating new edition of 2008 Classification

Revision of ILO Classification – II

- Selecting new 22 "soft" standards from digitally acquired images
- Producing new "hard" copies from 22 standard digital images
- Revising a chapter with recommendations for use of digital standard images
- Creating next edition of 200X Classification

Future of ILO Classification

- Use of hard copies will be decreasing
- Use of soft (digital) copies will be increasing
- New 200X edition may create a «filmless» environment

ILO 2008 Classification

Draft text with Recommendations

- Meeting in South Africa, 2007
- NIOSH/ILO consultations, 2007
- Meeting of experts in Japan, 2007
- To be finalized by ILO Panel – USA, 2008

Digital standard images

- Tests by Canon experts in Japan, 2007
- CD is prepared in Germany, 2008

Revision of ILO Classification

Technical issues

- standardization of digital file formats for pneumoconiosis classification
- implications for image processing and display with different brands of equipment
- assuring image quality for classification of digital chest radiographs
- compensation level determined with different sets? (1/1 analogue may look like 1/0 digital)

Revision of ILO Classification

Technical issues

- Protocol for selection – countries
- Compatibility of candidate digital radiographs
- Digital format of CRs/DRs – DICOM 3?
- New 22 digital standards to be used with different equipment – consistency
- Prescription of different parameters for diagnosis and for viewing/teaching
- Issues that can transpire from NIOSH Workshop

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