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Every breath counts

New Diagnostic Tools for Childhood Tuberculosis – Digital Chest X-ray

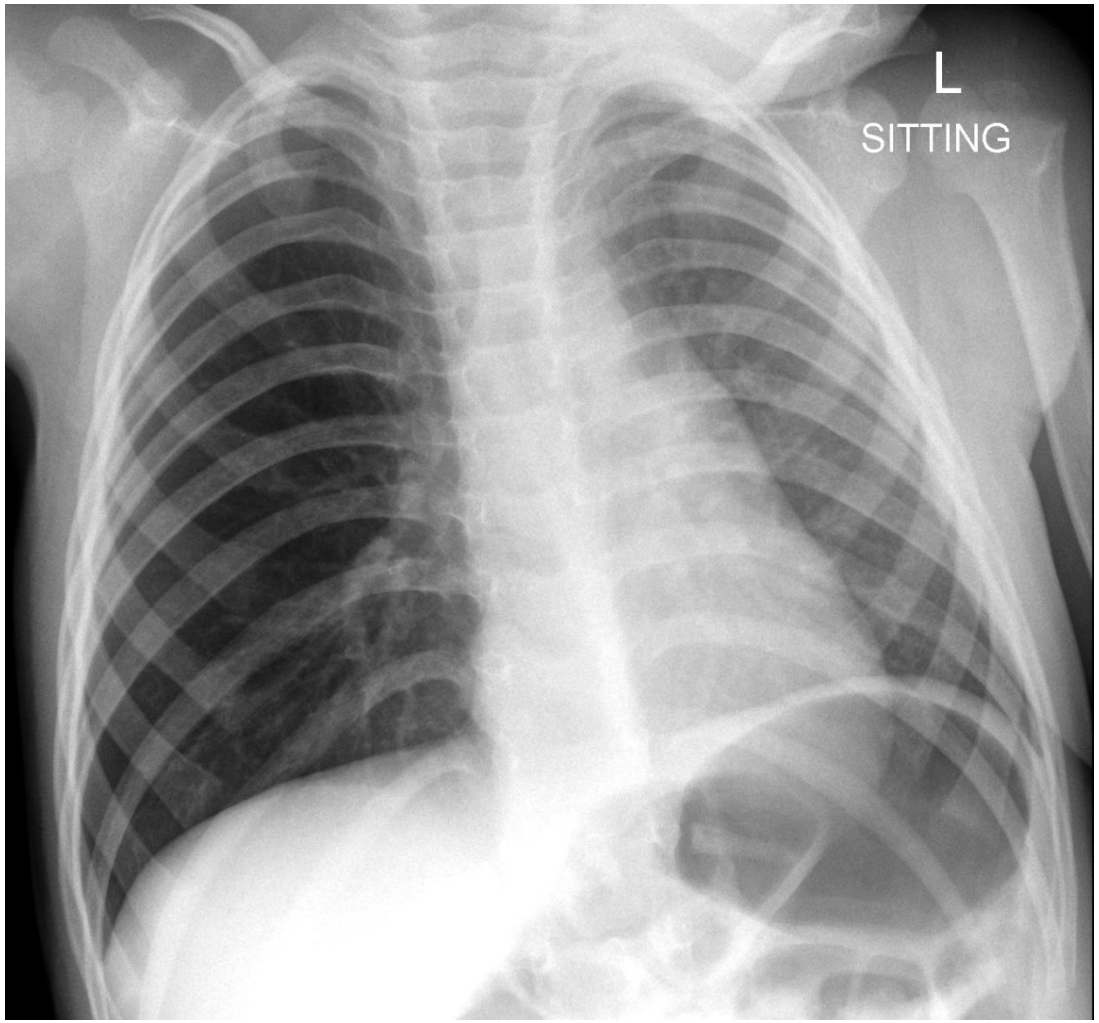
Child and Adolescent Tuberculosis Working Group
24th October 2018

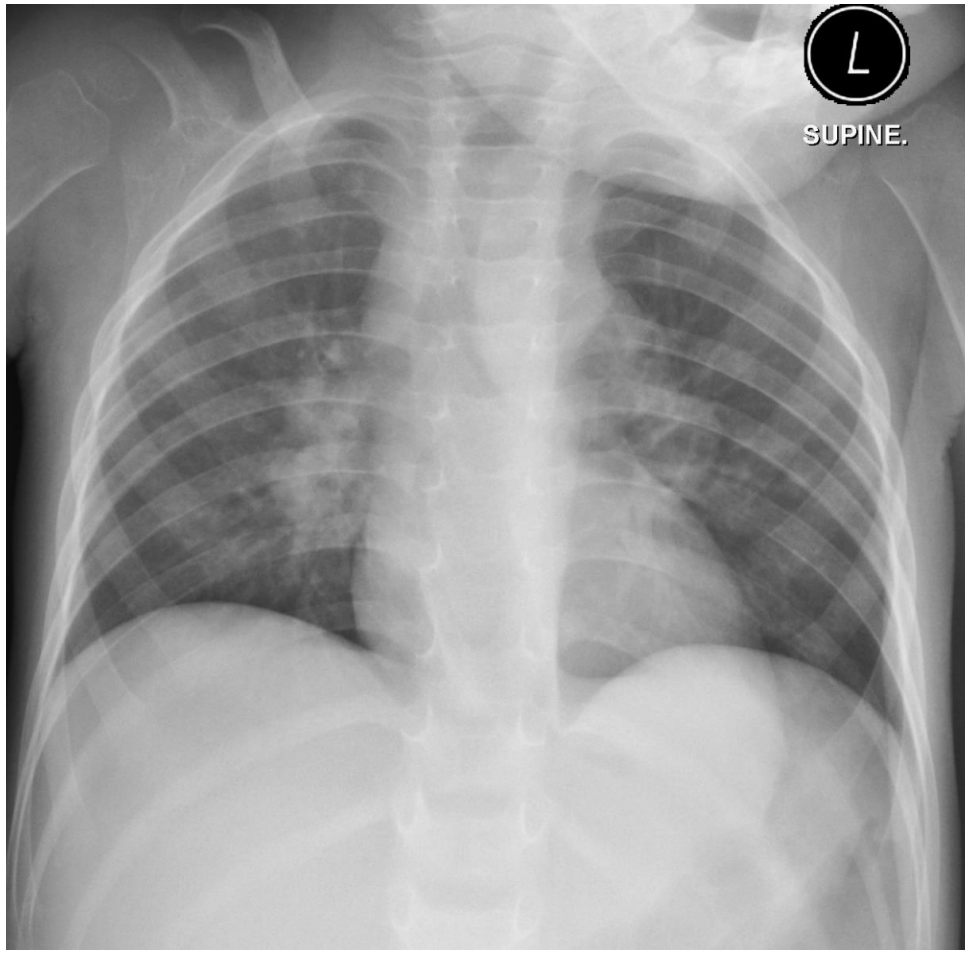
James Seddon
Clinical Senior Lecturer, Imperial College London
Honorary Senior Lecturer, Stellenbosch University

Child & Adolescent TB Working Group

Outline

- Advantages of digital chest x-ray
- CAD4TB
- Limitations of chest x-ray
- Other radiology
- Research Priorities





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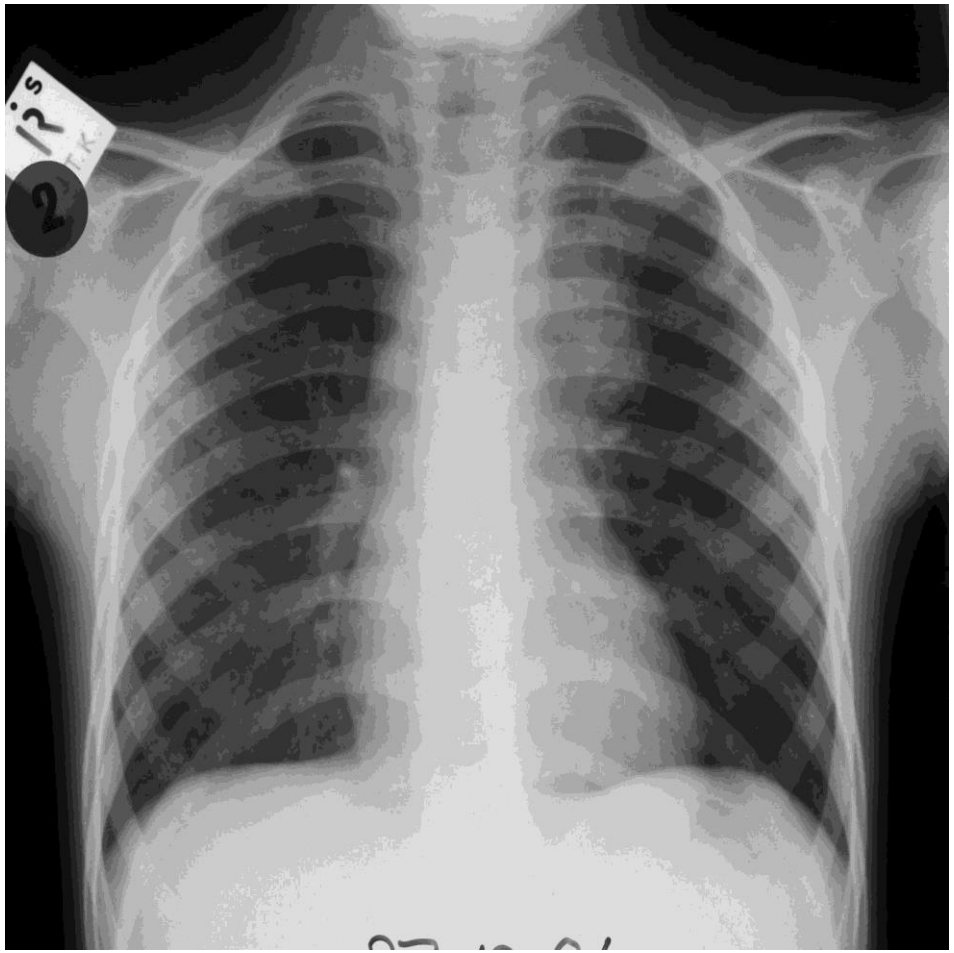

Advantages of digital chest x-ray

- Remote reading
- Quality
- Manipulation
- Storage
- Research

Computer-aided detection of pulmonary tu
chest radiographs: a systematic review

T. Pande,* C. Cohen,* M. Pai,* F. Ahmad

Computer-a

SCIENTIFIC REPORTS

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Evaluation of the diagnostic
uracy of Computer-Aided
ection of tuberculosis on Chest
iography among private sector
ients in Pakistan

ammad Asad Zaidi[1], Shifa Salman Habib[1], Bram Van Ginneken[2],
Abbas Ferrand[3], Jacob Creswell[4], Saira Khowaja[5] & Aamir Khan[5]

RESEARC

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Miriam H
Alexei Ko

SCIENTIFIC REPORTS

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OPEN

Using artificial intelligence to read chest radiographs for tuberculosis detection: A multi-site evaluation of the diagnostic accuracy of three deep learning systems

Zhi Zhen Qin[1], Melissa S. Sander[2], Bishwa Rai[3], Collins N. Titahong[2], Santat Sudrungrot[3], Sylvain N. Laah[2,4], Lal Mani Adhikari[3], E. Jane Carter[5], Lekha Puri[1], Andrew J. Codlin[1] & Jacob Creswell[1*]

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among
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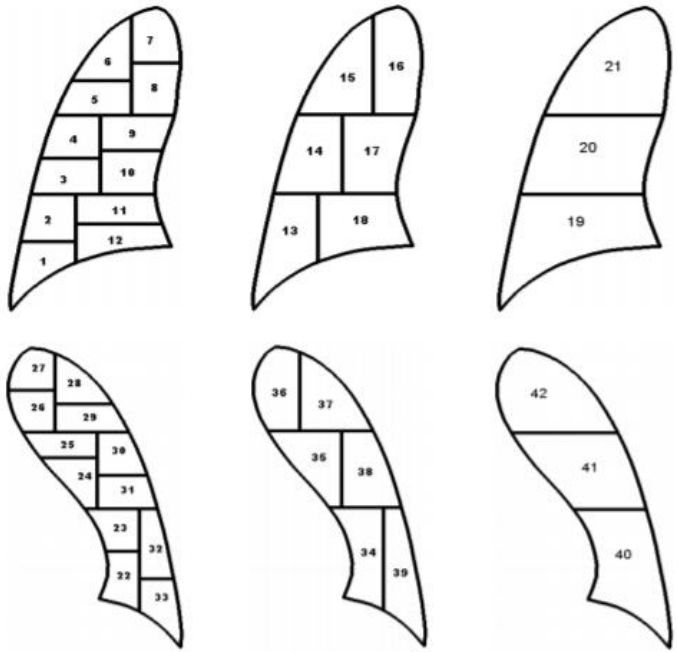
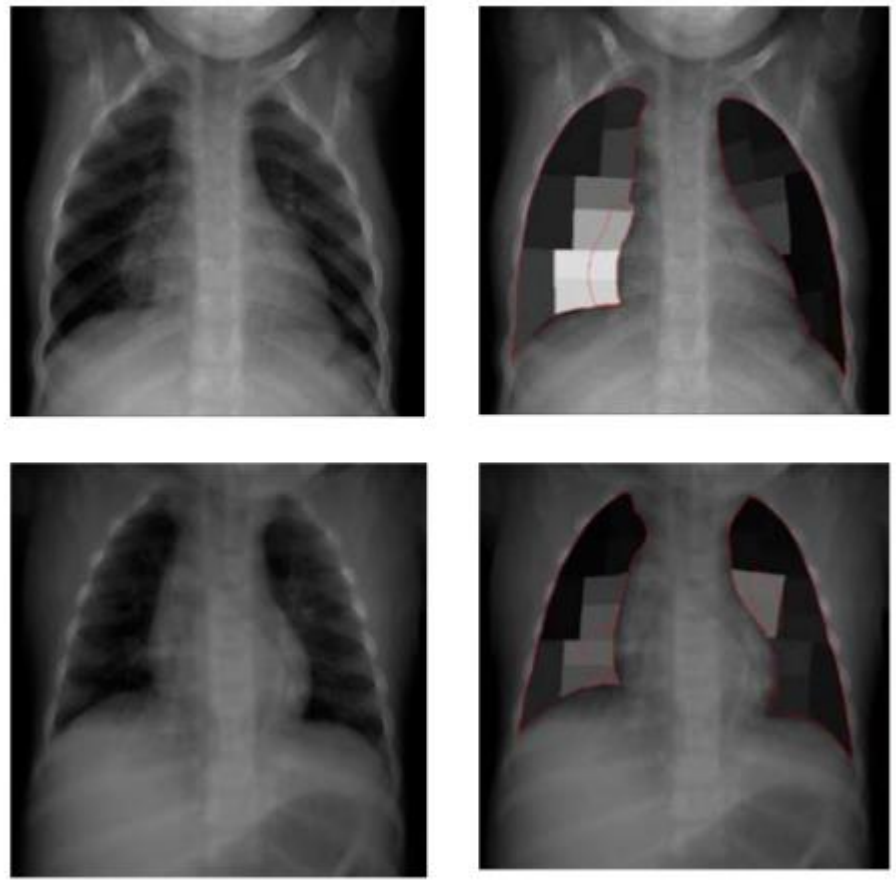
tuberculosis diagnosis

Monde Muyoyeta[1*], Nkatya Chanda Kasese[1], Deborah Milimo[1], Isaac Mushanga[1], Mapopa Ndhlovu[1], Nathan Kapata[2], Maureen Moyo-Chilufya[1] and Helen Ayles[1,3]

Computer-Aided Detection of Pulmonary Pathology in Pediatric Chest Radiographs

André Mouton[1], Richard D. Pitcher[2], and Tania S. Douglas[1]





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http://dx.doi.org/10.5588/ijtld.18.0122

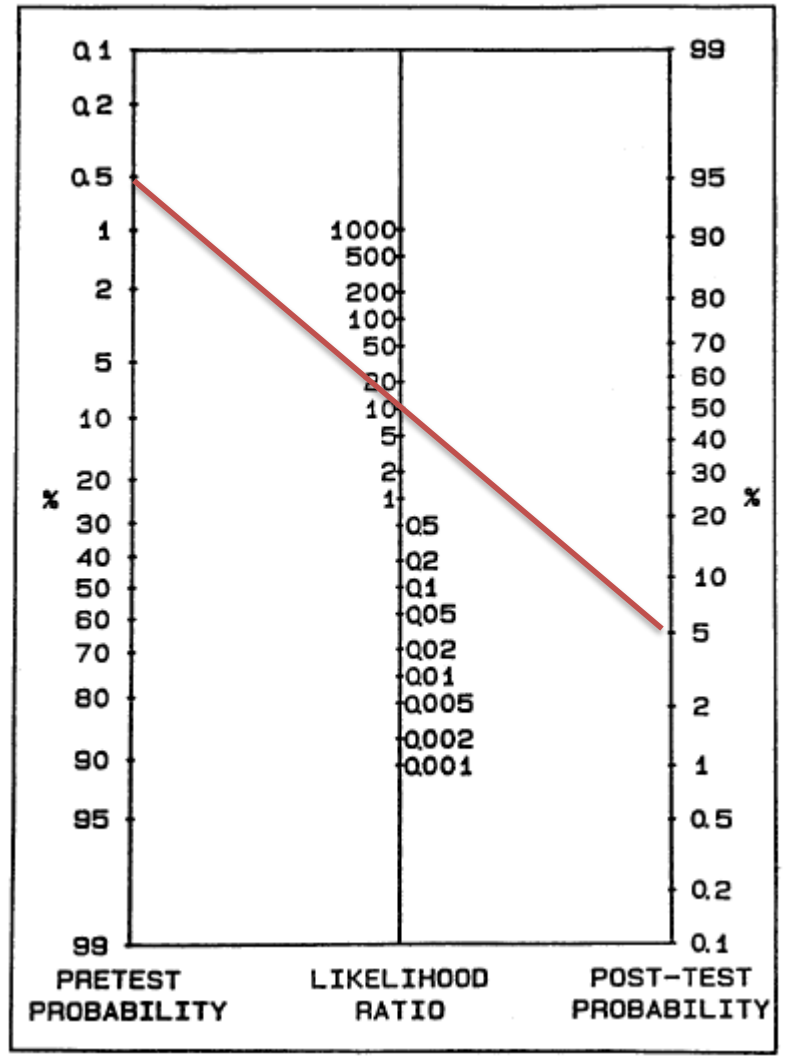
Value of chest X-ray in TB diagnosis in HIV-infected children living in resource-limited countries: the ANRS 12229-PAANTHER 01 study

L. Berteloot,* O. Marcy,†‡ B. Nguyen,§ V. Ung,¶# M. Tejiokem,** B. Nacro,†† S. Goyet,† B. Dim,† S. Blanche,‡‡ L. Borand,† P. Msellati,§§ C. Delacourt,¶¶ for the ANRS 12229 PAANTHER 01 Study Group

Table 3 Diagnostic accuracy of CXR features as determined by final consensus (case-control subanalysis)

	Sensitivity* *n/N* (%) (95%CI)	Specificity* *n/N* (%) (95%CI)	ODA %	*P* value
CXR consistent with TB	35/49 (71.4) (58.8–84.1)	74/148 (50.0) (41.9–58.1)	55.3	0.0089
Agreement on presence and site of:*				
Ghon focus	0/51 (0) (0.0–7.0)	150/151 (99.3) (98.0–100.0)	74.3	1.0000
Alveolar opacities	21/50 (42.0) (28.3–55.7)	97/150 (64.7) (57.0–72.3)	59.0	0.3978
Miliary	6/51 (11.8) (2.9–20.6)	149/151 (98.7) (96.9–100.0)	76.7	0.0037
Nodular opacities	9/51 (17.6) (7.2–28.1)	143/151 (94.7) (91.1–98.3)	75.2	0.0155
Excavation	2/51 (3.9) (0.0–9.2)	150/151 (99.3) (98.0–100.0)	75.2	0.1576
Paratracheal lymph nodes	3/51 (5.9) (0.0–12.3)	145/151 (96.0) (92.9–99.1)	73.3	0.6947
Peri-hilar lymph nodes	19/50 (38.0) (24.5–51.5)	106/151 (70.2) (62.9–77.5)	62.2	0.2808
Tracheal compression	1/51 (2.0) (0.0–5.8)	150/150 (100) (97.6–100.0)	75.1	0.2537
Bronchial compression	0/51 (0) (0.0–7.0)	147/150 (98.0) (95.8–100.0)	73.1	0.5725
Pleural effusion	3/51 (5.9) (0.0–12.3)	145/151 (96.0) (92.9–99.1)	73.3	0.6947
Gibbus	0/51 (0) (0.0–7.0)	151/151 (100) (97.6–100.0)	74.8	NA

* Excluding missing values.
CXR = chest radiograph; CI = confidence interval; ODA = overall diagnostic accuracy; TB = tuberculosis.


0.1
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20
30
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50
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70
80
90
95
99
%
1000
500
200
100
50
20
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5
2
1
0.5
0.2
0.1
0.05
0.02
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0.005
0.002
0.001
99
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70
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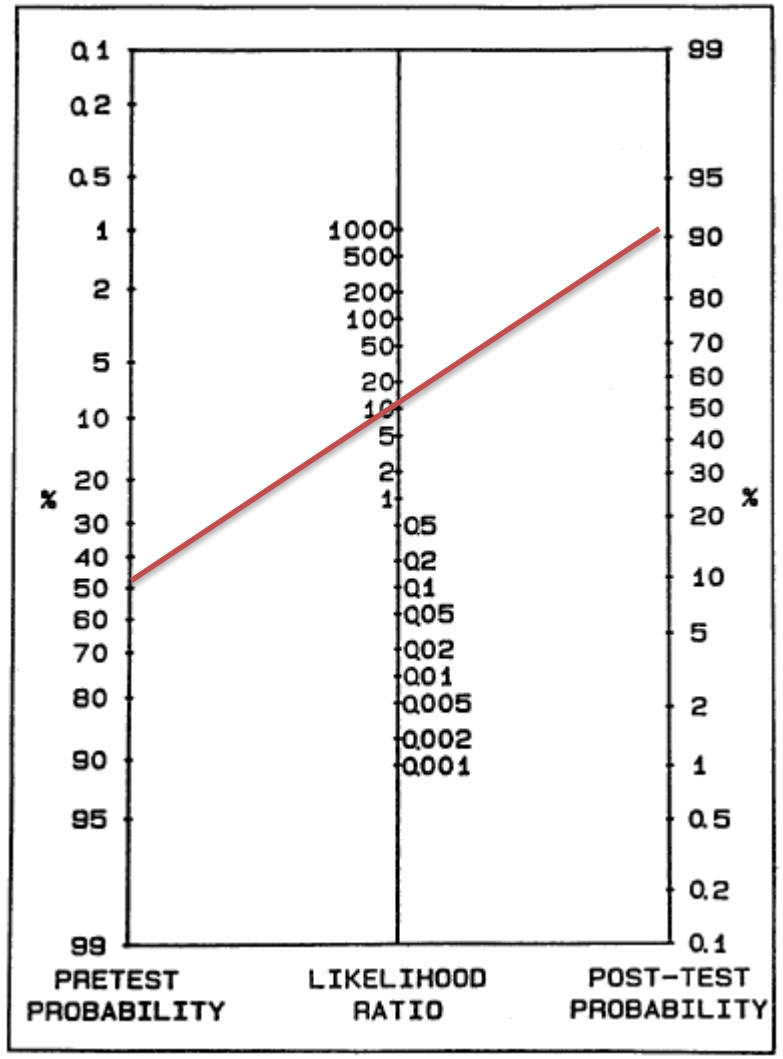
%
PRETEST PROBABILITY
LIKELIHOOD RATIO
POST-TEST PROBABILITY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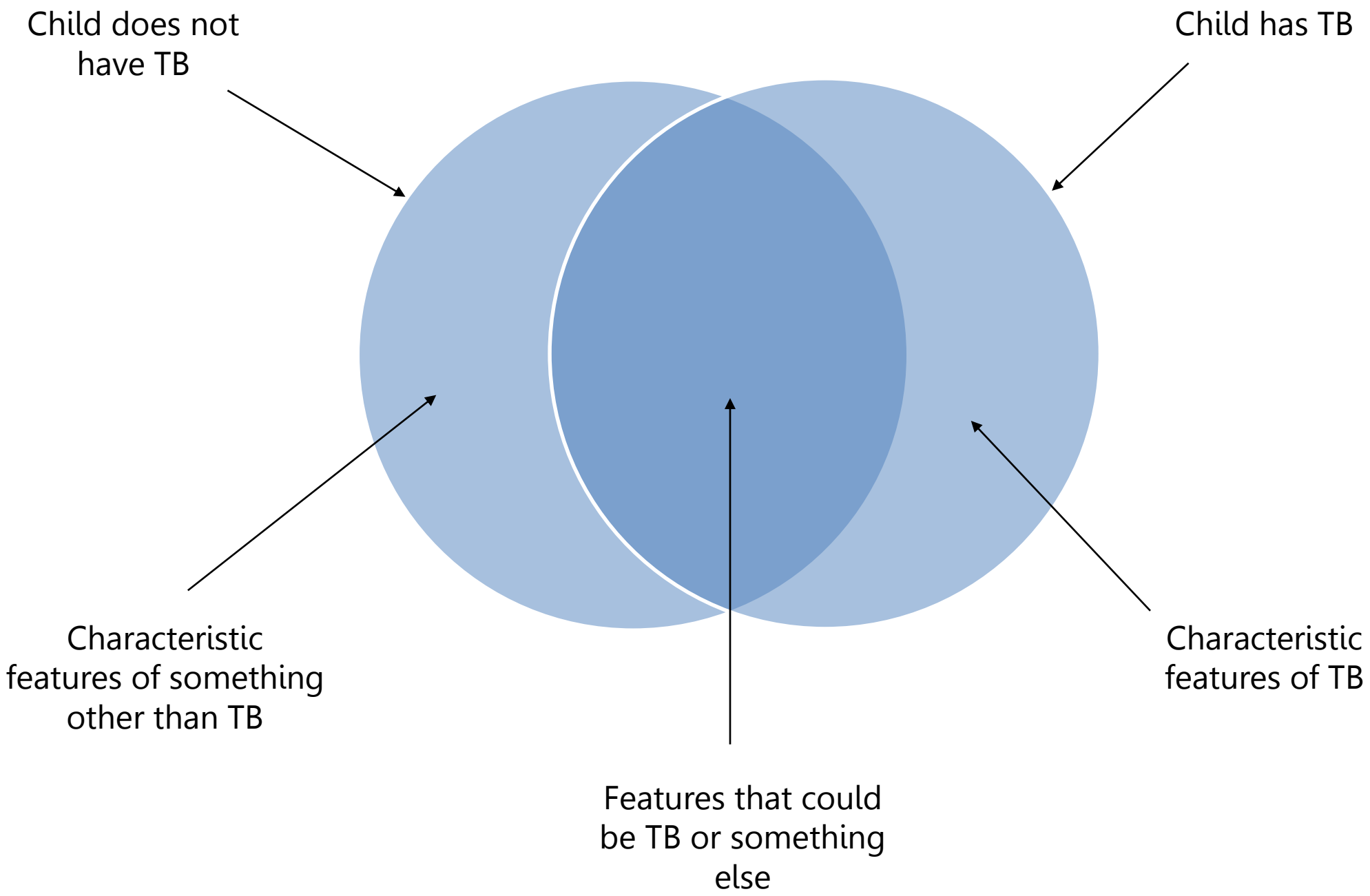
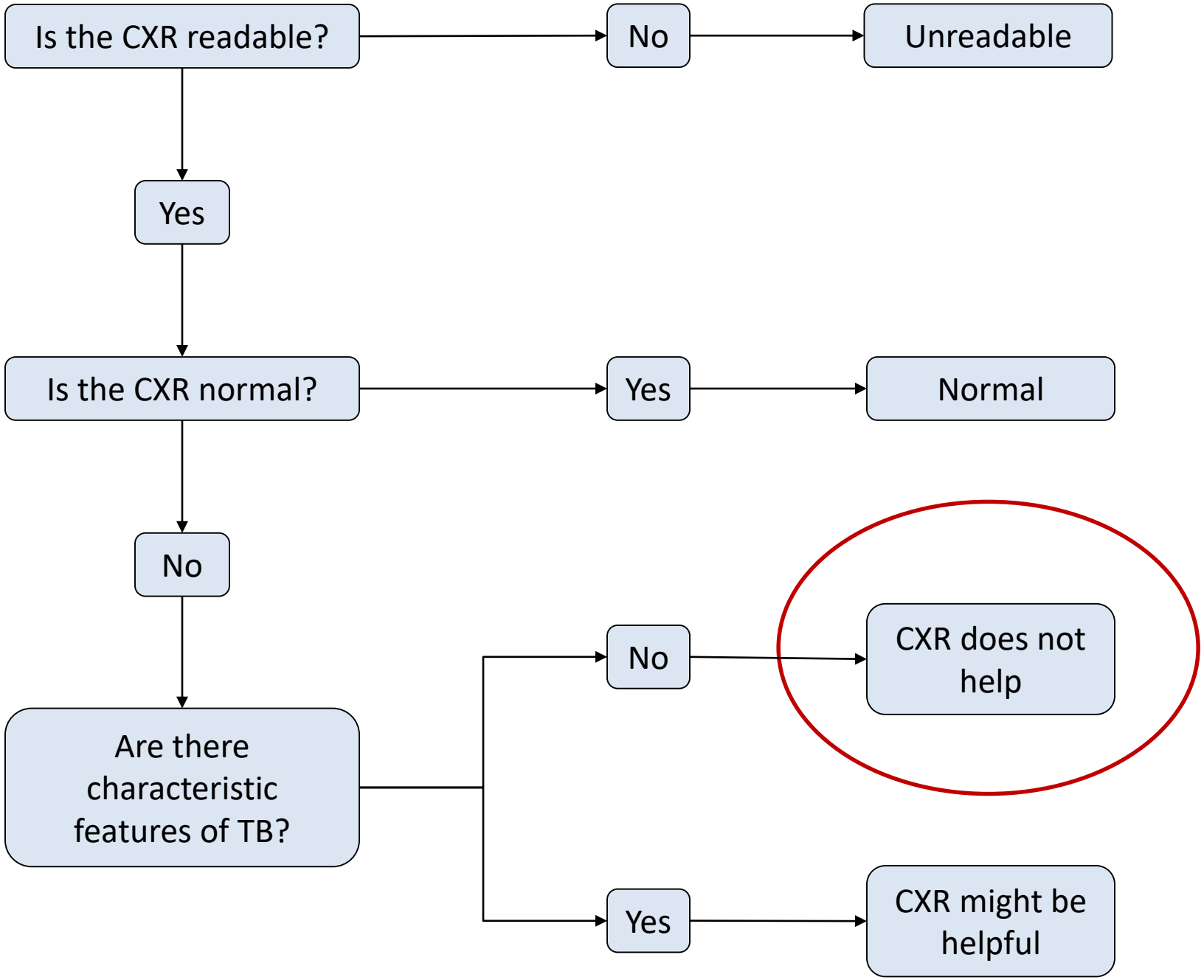
%
PRETEST PROBABILITY
LIKELIHOOD RATIO
POST-TEST PROBABILITY


Child does not have TB
Child has TB
Characteristic features of something other than TB
Features that could be TB or something else
Characteristic features of TB


Is the CXR readable?
No
Unreadable
Yes
Is the CXR normal?
Yes
Normal
No
Are there characteristic features of TB?
No
CXR does not help
Yes
CXR might be helpful

ORIGINAL RESEARCH Open Access

A semi-automatic technique to quantify complex tuberculous lung lesions on ^{18}F-fluorodeoxyglucose positron emission tomography/computerised tomography images

Stephanus T. Malherbe[1,2*], Patrick Dupont[3,4], Ilse Kant[4], Petri Ahlers[1,2], Magdalena Kriel[1,2], André G. Loxton[1,2], Ray Y. Chen[5], Laura E. Via[5,6], Friedrich Thienemann[6,7], Robert J. Wilkinson[6,7,8,9], Clifton E. Barry III[1,2,5,6], Stephanie Griffith-Richards[10], Annare Ellman[4], Katharina Ronacher[1,2,11], Jill Winter[12], Gerhard Walzl[1,2], James M. Warwick[4] and the Catalysis Biomarker Consortium

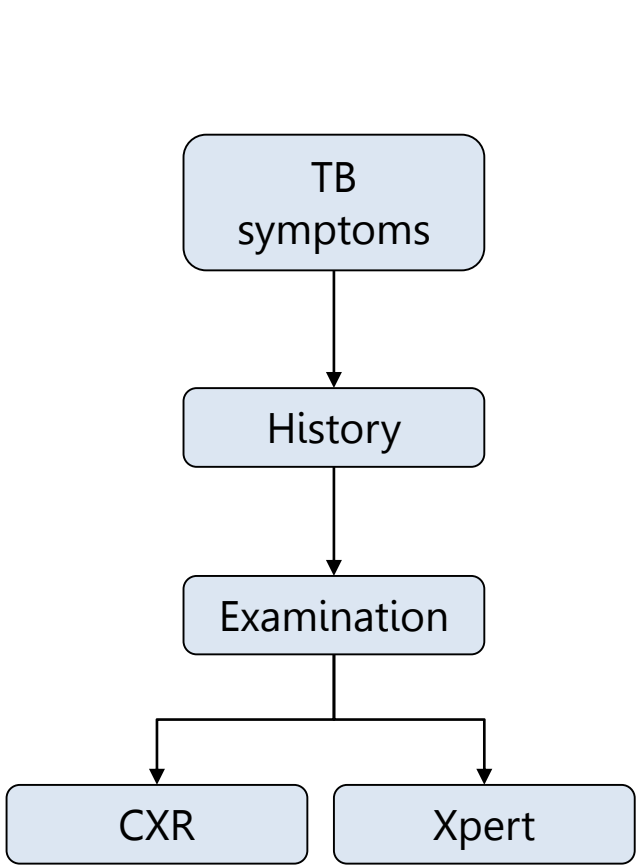
Fig. 1 3D rendered anterior view of fused ^{18}F-FDG-PET-CT scan, performed at diagnosis on a patient with sputum culture positive pulmonary tuberculosis. It shows a wide distribution of lesions with complex morphology, including a large cavity in the left upper lobe with surrounding nodular infiltrates and patches of consolidation in the left lower lobe

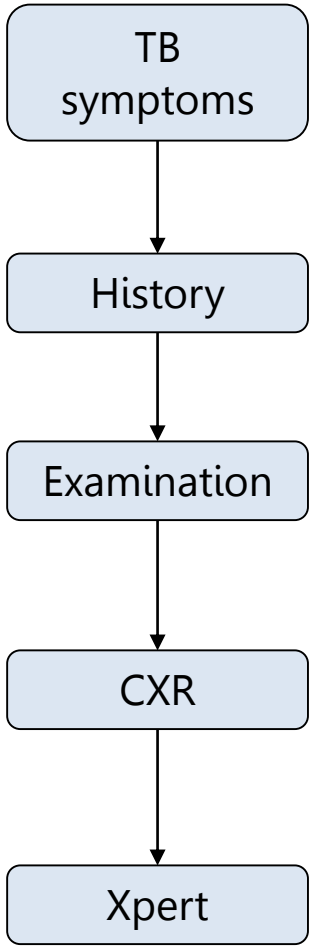
Chest ultrasound compared to chest X-ray for pediatric pulmonary tuberculosis

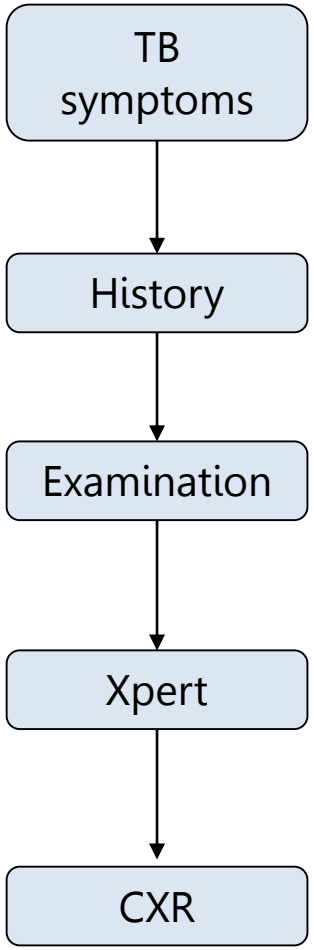
Charlotte C. Heuvelings MD[1,2] | Sabine Bélard PhD[1,2,3,4] | Savvas Andronikou PhD[2,5] | Henrique Lederman PhD[6,7] | Halvani Moodley MMED[8] | Martin P. Grobusch FRCP[1] | Heather J. Zar PhD[2]

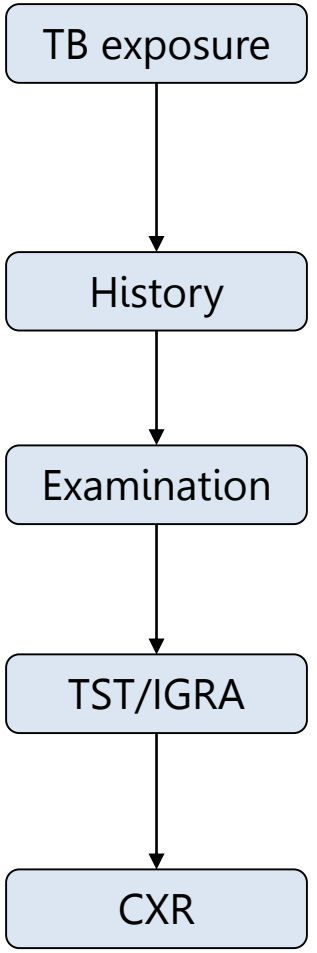
Utility of Point-of-care Ultrasound in Children With Pulmonary Tuberculosis

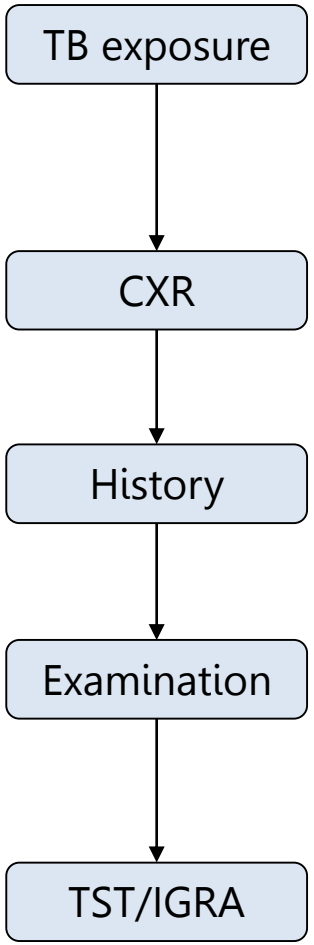
Sabine Bélard, MD,†‡§ Charlotte C. Heuvelings, MD,*† Ebrahim Banderker, FC Rad Diag (SA),¶ Lindy Bateman, MB ChB,* Tom Heller, MD,‖ Savvas Andronikou, PhD,*** Lesley Workman, MPH,* Martin P. Grobusch, FRCP,† and Heather J. Zar, PhD**


TB symptoms
History
Examination
CXR
Xpert


TB symptoms
History
Examination
CXR
Xpert


TB symptoms
History
Examination
Xpert
CXR


TB exposure
History
Examination
TST/IGRA
CXR


TB exposure
CXR
History
Examination
TST/IGRA

Priorities

- SOP/consensus statement to guide conduct, storage and interpretation of digital CXR in children
- Identify characteristics on CXR that are associated with TB
- Identify best ways of using CXR for clinical care
- Identify best ways of using CXR in research
- Increase evidence for CAD CXR in children
- Improve experience in other imaging modalities