

Challenges to Pediatric Radiology in Developing Countries: a focus on Africa

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Geography: Many Kinds of Africa



Some parts of Africa are productive



Some parts of Africa are primitive



Some parts of Africa are geographically inaccessible



Some parts of Africa are politically inaccessible

Children in Africa

Warriors



Just children



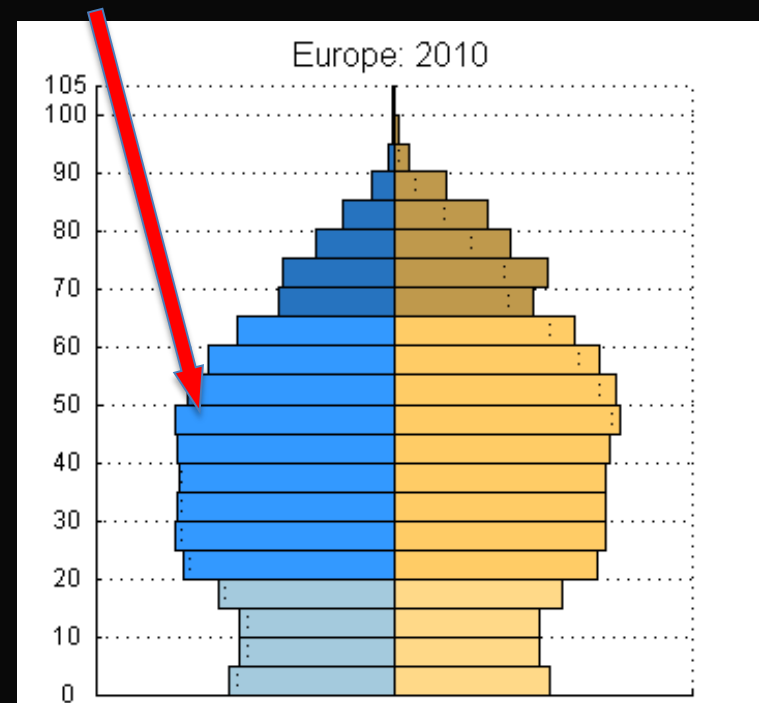
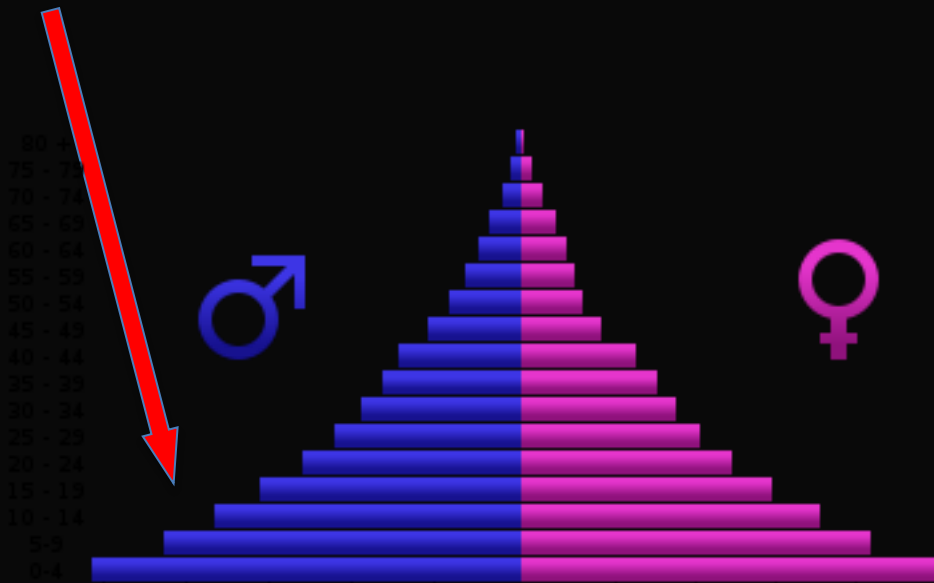
Population



- 1/3 of all children live in developing countries
- 44% of the population of Mozambique <14 years

African broad based (Angola) - many children

European population chart - adults



Poverty



Addis Ababa
Ethiopia 2013



Kano, Nigeria 2009



Khayelitsha, Cape
Town 2013

- 1/3 of African children have poor access to shelter
- 1/5 of African children have no access to safe water



Disease burden



- Top 30 infant mortality rates in the world are African
- 2/3 of HIV infections are in sub-Saharan Africa
- 91% of newly HIV infected children are born in Africa
- More than 90% of children with TB live in the developing world
- Incidence TB in sub-Saharan Africa is nearly twice South-East Asia (350/100,000)
- Cape Town South Africa has the highest rate of TB in the world at 948/100,000

Clinics and hospitals



Adis Ababa Black Lion Hospital
Ethiopia 2013



Swaziland hospitals 2009 -
doctor walking to work

- 1/7 of African children have no access to health services
- Electricity – frequent power outages
- Roads – access for patients, equipment, maintenance

Human Resources



- South Africa - best-staffed in sub-Saharan Africa (497 radiologists; 685 radiographers); Kenya had 248 radiologist
- 14 African countries no radiologist
- Workload cases per radiologist (Uganda 19 600 vs. USA 12 000 /yr)
- Handful of pediatric radiologists - most pediatric imaging interpreted by clinicians



Digital / CT / US /
Fluoro / MRI



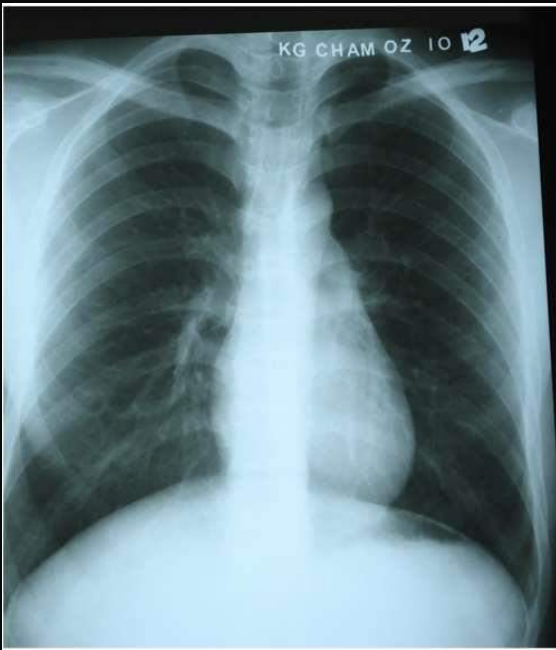
Equipment:
two worlds



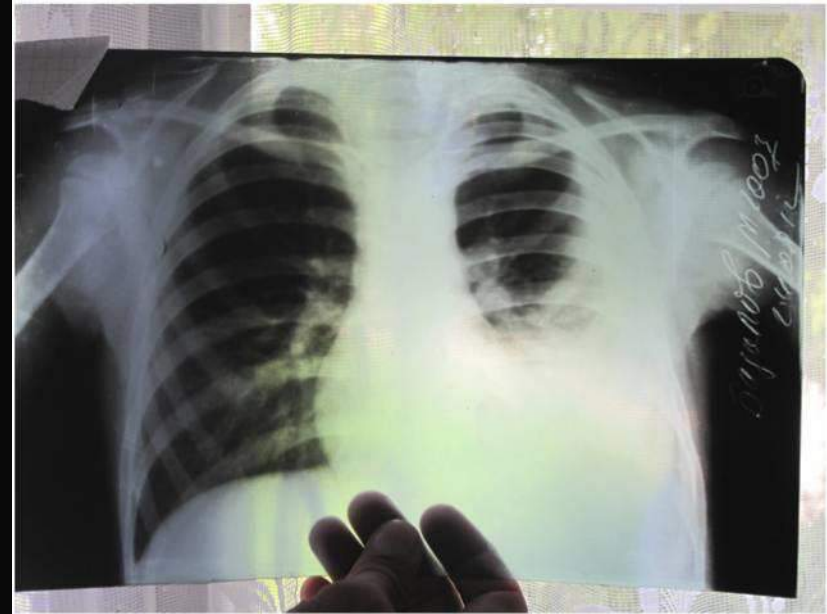
Analogue / wet film



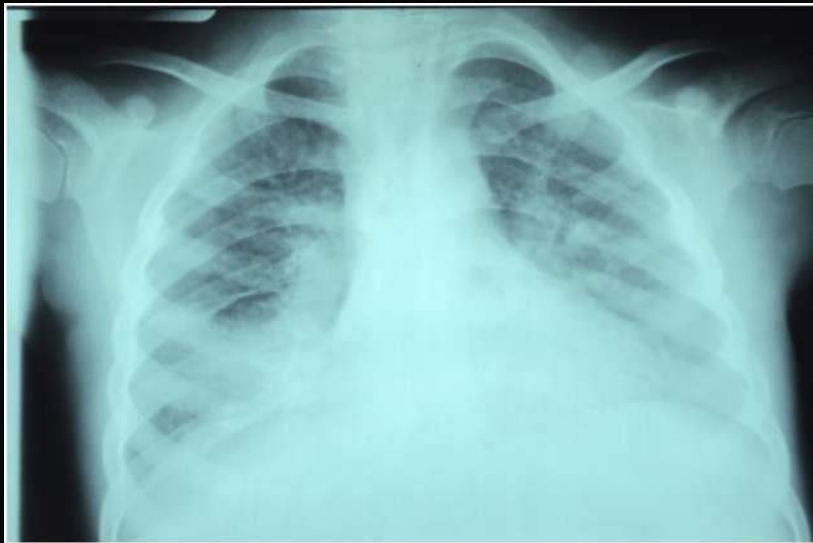
Quality



Cambodia [Kampong] -
digital high quality

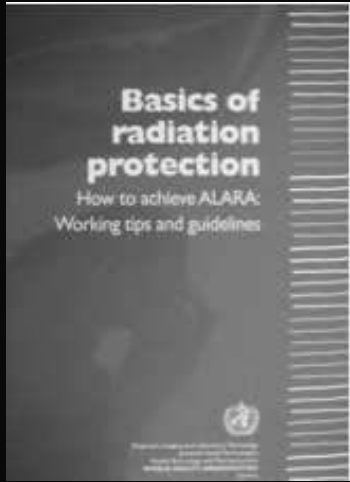


Tajikistan - poor quality and poor referral
Sent as a photograph with the fingers and all
against the curtain as a backdrop!



Malawi [Thyolo] - analogue

Safety

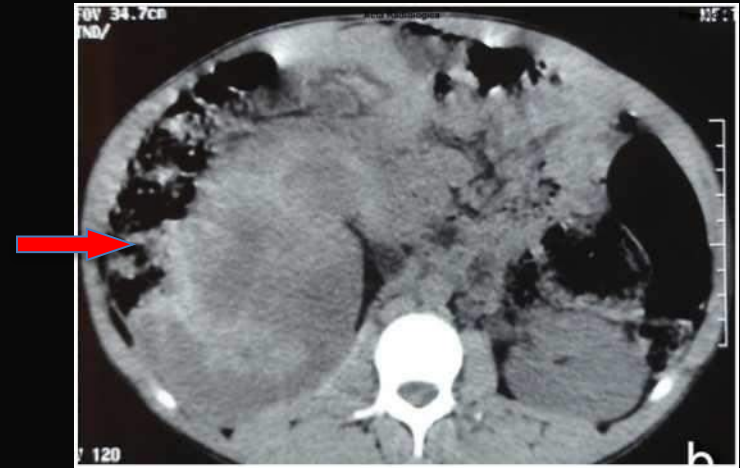




Radiation: CT multiphase

This submission for publication from an African institution with CT raised an alarm bell because there was a non-contrast phase.

So I looked at the Exam description DLP and did the calculation below



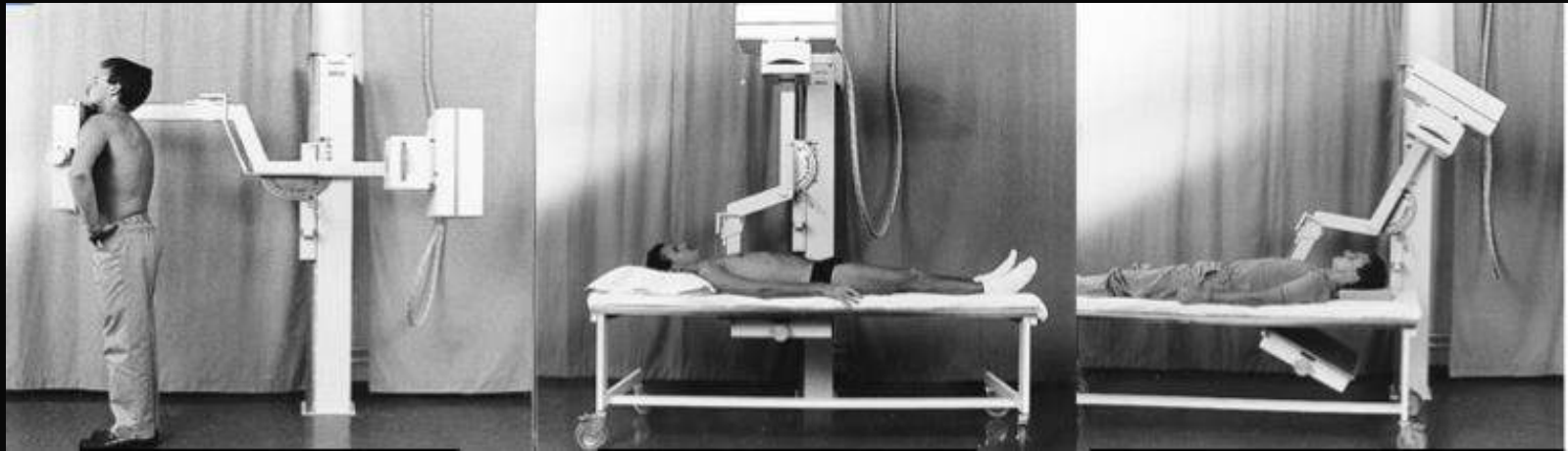
Exam Description: ABDOMINALE

Rapport de dose					
Series	Type	Scan Range (mm)	CTDIvol (mGy)	DLP (mGy-cm)	Phantom cm
1	Scout	-	-	-	-
2	Helical	S197.250-I152.750	8.24	307.60	Body 32
3	Helical	S195.750-I54.250	8.20	223.99	Body 32
3	Helical	S195.250-I194.750	8.65	357.52	Body 32
4	Helical	S195.250-I194.750	8.65	357.52	Body 32
Total Exam DLP:				1246.63	

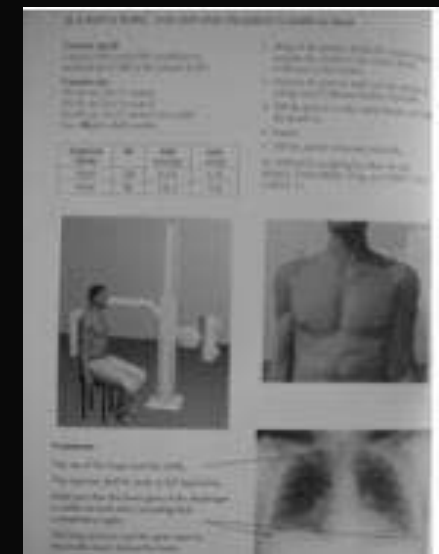
Dose = (DLP) 1246 X (abdo conversion F) 0.015 = **18.7 mSv**
= at least 934 CXR's

Solutions

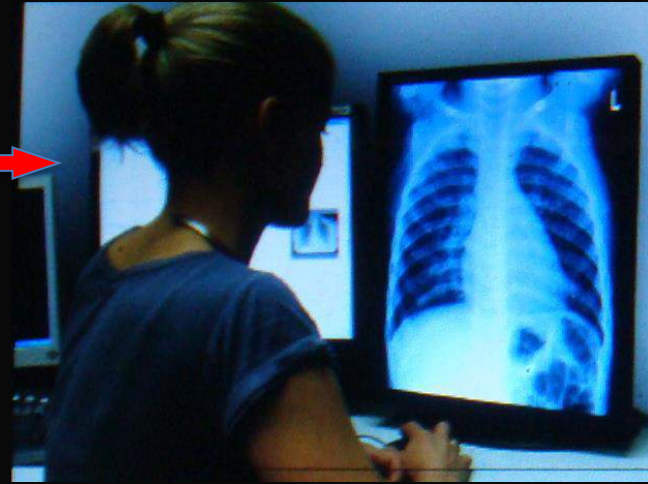
X-ray equipment for 'dummies': WHIS Rad



- Self shielding
- Works on batteries and wall power
- Fixed FFD
- Digital versions available
- Matching WHO manual
- Safe for children



Teleradiology





Teleradiology example: MSF reporting



SCT - MSF e-Referral System

Welcome Dr Savvas Andronikou (specialist) | Logout | Help

Cases for Dr Savvas Andronikou

Cases which you have already answered have a **green** marker; those waiting for a response have a **yellow** marker.
Click on the relevant case number. This will display all the messages associated with that case; you can also send a reply to the referrer.

Page 1 (1-23 of 23 case(s))

Status	Case no	Query no	Allocated	Patient	Referrer
Green	503	1	22-Nov-2012 07:42:53	THH 2038	Dr ARV TB Hospital
Green	492	1	21-Nov-2012 09:53:29	3388CAP9	Dr OCA CAR Boguila
Green	492	1	19-Nov-2012 18:31:31	3359SAM8	Dr OCA CAR Boguila
Green	566	1	26-Oct-2012 17:41:58	332AE1210296	Dr OCA CAR Boguila
Green	491	1	23-Oct-2012 16:46:41	3279U1210208	Dr OCA CAR Boguila
Green	513	1	23-Oct-2012 18:40:19	3089H1210279	Dr OCA CAR Boguila
Green	523	1	18-Oct-2012 16:12:37	3189E281	Dr OCA CAR Boguila
Green	523	1	13-Oct-2012 13:18:35	3089A1210306	Dr OCA CAR Boguila
Green	524	1	13-Oct-2012 13:18:08	307C1209228	Dr OCA CAR Boguila
Green	508	1	09-Oct-2012 13:43:56	KC 007	Dr DCP CAMBODIA Kampong
Green	393	1	02-Oct-2012 14:27:06	289YE189	Dr OCA CAR Boguila
Green	393	1	02-Oct-2012 14:21:03	2919D243	Dr OCA CAR Boguila
Green	385	1	26-Sep-2012 22:18:57	15	OCF Chirakito Hozari
Green	354	1	04-Sep-2012 11:39:20	1011	Dr OCA Tajikistan Dushanbe
Green	352	2	04-Sep-2012 07:07:59	1010	Dr OCA Tajikistan Dushanbe
Green	339	1	22-Aug-2012 18:37:56	1009	Dr OCA Tajikistan Dushanbe

SCT-MSF - Answer a Case

Date: 2012-11-21 05:18:34
From: Dr OCA CAR Boguila

Message type: New referral - patient 3BEOCAP9

Text: Control x-ray of radiological right femur fracture. Referral on cast since 3 months. Images numbered 318 are current, 260 1 month after fracture. Also attached x-ray 266 of the left femur, fractured ~6 months ago. Suspicion of underlying osteomyelitis. If possible, request expert opinion on removal of the cast.

Attached files

File	File name	Size(KB)	Legend
1	318-FROM-RAP300	1225	
2	318-FROM-RAP300	1136	
3	266-FP_L.jpg	668	
4	266-FP_R.jpg	963	

Your response

Moderate amount of callus
Osteomyelitis and skin necrosis
Growth plate at distal femur obscured

Your responses

I think that to improve the diagnosis of Osteomyelitis imperfecta as the underlying pathology further imaging is needed including the skull, other long bones, and spine
I would prefer however if this was done through someone with basic knowledge of pediatric bone disease
Please ask Dr. Kieran MURPHY AS THEY HAVE A PEDIATRIC BONE SPECIALIST
Dr. MURPHY

Recipient: Dr OCA CAR Boguila

Attachments: (Attach Files)

Message to SysOp (optional):

Your email: gocsav@web.co.za

Send Cancel

- WFPI readers for CAR / Tajikistan / Malawi / Cambodia etc.
- Collegium Telemedicum referral platform - organized and simple to use

Teleradiology example: Khayelitsha Hospital Cape Town – South Africa



- Uses e-mail as platform
- Tele – reading from July 2012
- Total of 555 referral cards and 1,106 radiographs for teleradiology
- 74.6% chest radiographs
- 14.2% of those were for tuberculosis.
- 40 volunteer teleradiologists from 17 countries
- Now University stewardship - Stanford

Other telereading projects

Malawi:

- Exploratory/teaching mission, June 2014
- Set up tele-reading & X-ray interpretation training
- POC ultrasound for a rural clinic [ITW site]



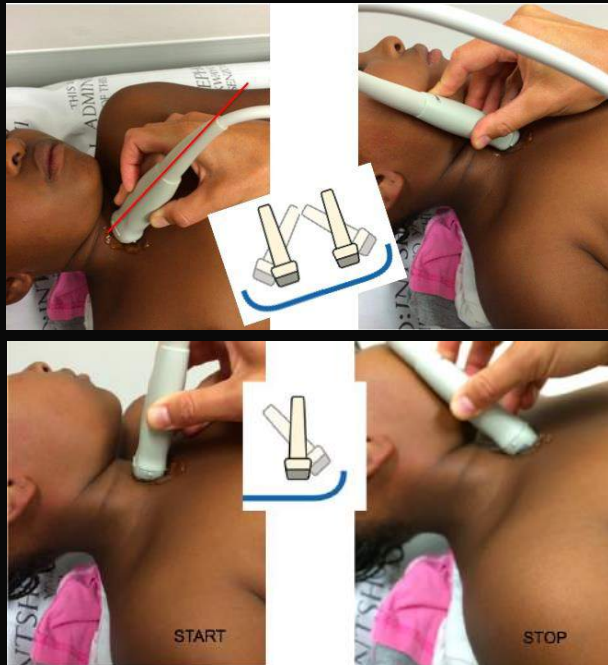
Indira Gandhi Children's,

Bangalore, India:

- 23 reports of CT
- Referrals: tuberculosis or fungal
- But QA: multiple scan phases (scanned pre- and post-contrast)
- 6 active tele-volunteers



Point of Care US: for TB and Pneumonia



POC innovations



- ▶ **Point of Care Ultrasound Solution**
- ▶ **Research projects** using volume sweep US
- ▶ Red Cross Children's Hospital in Cape Town, South Africa for mediastinal TB lymphadenopathy and pneumonia



Childs Nerv Syst. 2014 May 15. [Epub ahead of print]

The value of transcranial Doppler imaging in children with tuberculous meningitis.

van Toorn B¹, Schaaf HS, Belemans E, Laubscher JA, Schoeman JF

Author Information

Abstract

PURPOSE: Transcranial Doppler imaging (TCD) is potentially a valuable investigational tool in children with tuberculous meningitis (TBM), a condition often complicated by pathology relevant to Doppler imaging such as raised intracranial pressure (ICP) and cerebral vasculopathies.

METHODS: Serial TCDI was performed on 20 TBM children with the aim of investigating cerebrovascular haemodynamics and the relationship between pulsatility index (PI) and ICP.

RESULTS: We observed a poor correlation between ICP and PI in children with communicating hydrocephalus ($\rho = 0.72$). No decline in PI was noted following 7 days of medical therapy for communicating hydrocephalus ($\rho = 0.78$) despite a concomitant decline in ICP. Conversely, a decline in PI was noted in all four children with non-communicating hydrocephalus who underwent cerebrospinal fluid diversion. High blood flow velocities (BFV) in all the basal cerebral arteries were observed in 14 children (70%). The high BFV persisted for 7 days suggesting stenosis due to vasculitis rather than functional vasospasm. Complete middle cerebral artery (MCA) occlusion, subnormal mean MCA velocities (<40 cm/s) and PIs (<0.4) correlated with radiologically proven large cerebral infarcts.

CONCLUSIONS: TCDI-derived PI is not a reliable indicator of raised ICP in children with tuberculous hydrocephalus. This may be attributed to individual variation of tuberculous vascular disease, possibly compromising cerebral vascular compliance and resistance. Basal artery stenosis secondary to vasculitis is observed during the acute stage of TBM in the majority of children.

PMID: 24528794 [PubMed - as supplied by publisher]

Secrets of getting there: hitch a ride with NGO



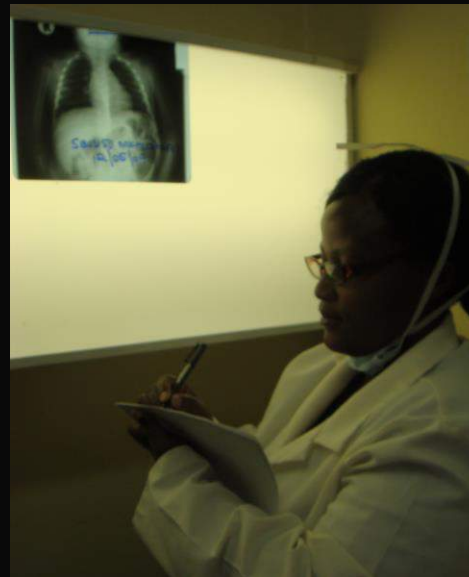
Teaching and training in Africa

Teaching and Training: task-shifting non radiologists and general radiologists



Teaching and training: Task shifting

WHO pattern
recognition book



Online Tools

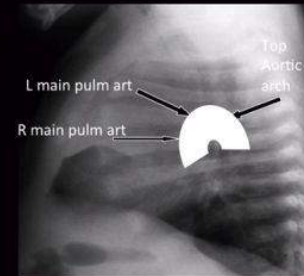
CHILDHOOD TUBERCULOSIS

BERNARD F. LAYA, MD, DO
Associate Professor of Radiology
St. Luke's Medical Center-Global City, Philippines

Lymphadenopathy on Lateral



- Normal structures (=horseshoe)
- Diverging vessels (=tentacles)
- Lymphadenopathy (=‘doughnut’)



International Commission on Radiology Education

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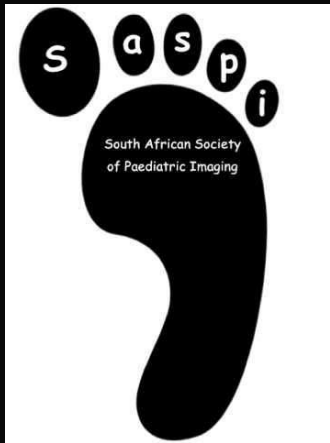
Lectures / recorded / Slide / Literature / Library / Manuals and guidelines / Pediatrics / Case studies

Contributors	Recorded Lectures	Slide Lectures	Library	Pediatrics
<ul style="list-style-type: none"> GGFED Asian-Oceania Society of Radiology American Roentgen Ray Society AFRS European Society of Radiology 	<ul style="list-style-type: none"> TB Pathogenesis in the 21st Century Pediatric Tuberculosis: Pathogenesis, Diagnosis, and Treatment of Latent Tuberculosis Tuberculosis: Diagnosis and Management Basic Chest Radiology for the TB Clinician Diagnosis of TB Disease 	<ul style="list-style-type: none"> Source: WHO/UNEP International Childhood pulmonary tuberculosis: imaging characteristics Abdominal tuberculosis: imaging features 	<ul style="list-style-type: none"> Pediatric Tuberculosis: Up-to-Date Diagnosis and Management Tuberculosis from Head to Toe Thyroid, Spleen and Spondylitis of Tuberculosis 	<ul style="list-style-type: none"> TRCCTILES Pediatric TB: A Review of the Literature Pediatric TB: A Review of the Literature CHILDHOOD TUBERCULOSIS

Teaching and training: radiologists – Ethiopia (CHOP / WFPI / AfSPI)



National and Continental activity: SASPI and AfSPI



Future South African Pediatric radiologists at ESPR in Athens - preparing for long careers to match the forefathers (Caffey society)



Oregon USA

