CXR Screening

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Radiography, CXR, X-ray
Screening, not diagnosis
• At field level - Normal or Abnormal.
• By employing intentional over-reading it is expected that there will be some CXR which are labelled ‘abnormal’ at the field level but ‘normal’ at the central level. As long as this percentage is small, it is acceptable.
• **Normal CXR** – A normal chest X-ray means clear lung fields and no abnormality detected. Participants with normal CXR have no radiological basis for undergoing bacteriological examination.

• **Abnormal CXR** - An abnormal chest X-ray means any lung (including pleura) abnormality detected on interpretation by the medical officer (e.g. opacities, cavitation, fibrosis, pleural effusion, calcification(s), any unexplained or suspicious shadow, etc.). Congenital abnormalities, normal variants, and bony abnormalities like fractures are excluded by definition as are findings like increased heart size and other heart-related abnormalities.
• A more detailed interpretation (audited reading) can be performed at the central level
• The central team should classify x-rays based on a classification decided upon earlier (as mentioned in the x-ray reference manual)
• May help identify quality issues with lab
CXR Selection

- ? Technology
- ? Number of units
- ? Value additions (e.g. CAD, Teleradiology)
X-ray technologies

CONVENTIONAL
• Conventional radiography
• Conventional with autoprocessor

DIGITAL
• Computed radiography (CR)
• Direct radiography (DR, DDR)
Conventional radiography
Autoprocessor
Computed Radiography (CR)

1. X-ray Exposure
   Patient

2. Image Reader

3. Image Scaling

4. Image Record

5. Computed Radiograph

X-ray system

Phosphor plate

unexposed

exposed
Direct Radiography
DDR

- Flat panel
- CCD
- CMOS
- Slot-scan
Post processing – Digital only
Value additions

• Teleradiology
• CRRS
• Computer-Aided-Detection (CAD)
• Computed-Aided-Diagnosis (CADx)
• Temporal subtraction imaging
## Comparison chart

<table>
<thead>
<tr>
<th>No.</th>
<th>Feature</th>
<th>Conventional</th>
<th>CR</th>
<th>Digital</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Electronic data collection, reporting and storage, data management &amp; privacy, back-up data</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>2</td>
<td>High Image readability and quality</td>
<td>NO</td>
<td>YES/NO</td>
<td>YES</td>
</tr>
<tr>
<td>3</td>
<td>Value additions (CAD, Teleradiology)</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>4</td>
<td>Use of films and chemicals (potential environmental issues)</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>5</td>
<td>Radiation safety</td>
<td>NO*</td>
<td>NO*</td>
<td>YES*</td>
</tr>
<tr>
<td>6</td>
<td>Cost*</td>
<td>Cheap initially</td>
<td>Intermediate</td>
<td>Cheap in long run</td>
</tr>
<tr>
<td>7</td>
<td>Faster throughput</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>8</td>
<td>Immediate image reproducibility</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>
Costs

• Conventional: 10-25,000 USD
• Autoprocessor: 7-12,000 USD
• CR: 50-70,000 USD
• DR with imaging panel: 100-120,000 USD
• DDR: 150,000 USD and above
Long term costs
Hidden costs
Fine print
Logistics, maintenance, breakdown
Field Radiography for Prevalence Survey

- Cost Constraint ++
  - Moderate work load, adequate manpower
    - Conventional Radiography
  - High work load, inadequate manpower
    - Conventional + AFP
- Cost Constraint +/-
  - Non digital
  - Digital
    - Moderate work load
    - Heavy work load
- No Cost Constraint
  - Direct Digital Radiography
CXR Requirements

- Planning
- Procurement
- Teamwork
- Allied equipment
- Radiation safety
- Legal and regulatory requirements
- Logistic requirements
- Technical assistance
Planning & Procurement

• Local technical expertise with TA
• Frequent bottleneck and time-consuming step
• Initiate early
• Attention to minute details
  – Accessories
  – Software/hardware
• Legal/regulatory issues
Radiation exposure

• MBUR Referral guidelines, Royal College of Radiologists London: ‘typical effective dose = 0.02 mSv = 3 days app. Equivalent period of natural background radiation

• HPA – RCR: CXR associated risk of childhood cancer is very low and acceptable when compared with natural risk. Radiation doses resulting from Dx procedures present a negligible risk of induced hereditary disease in descendants of the unborn child

• ACR: Some procedures (incl. CXR in 1st & 2nd trimester) render so low exposures that pregnancy status need not be considered for a “medically indicated” exam, as long as good radiation practice is ensured

• At 1 meter, occupational exposure (if no apron is worn) is 0.1% of that which enters the patient.
Regulatory

- No ‘safe’ radiation, use regulated
- Radiation regulatory authority/body clearance
- Ethics committee clearance
- Consent, voluntary participation
- Exclude children, pregnant participants
- Good comprehensive protocol
- Timely engagement
Logistics
Fieldwork
Technical Assistance

• WHO
• TBTEAM
• CDC
• KNCV
• JICA
Thank you!