Enterprise Medical Imaging in the Global South: Challenges and Opportunities

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Radiological Examination Process

1. **Patient walks in**
2. **Patient gets scanned**
3. **Captured through Mobile**
   - **Through RPACS**
   - **Captured through Camera**
4. **DICOM**
5. **Scanned images stored in server**
6. **Auto order and Auto Assignment Triggers**

- **Physician gets to see images and report**
- **Tech/Physician access report**
- **RAD finalizes report**
- **Transcriptionist transcribes report**
- **RAD views, dictates**
Motivation, Problem Area

Two fundamental challenges affecting effectiveness and efficiency of radiological services in the global south:

- Critical shortage of radiologists
- Limited use of modern medical imaging practices

Potential solution to address the second challenge:

- Implementation of Enterprise Imaging (EI)—techniques and workflows for
  - Acquiring
  - Indexing
  - Managing
  - Storing
  - Analysing ....clinical images
Research Objectives

To:

• Highlight challenges that adversely affect effective interpretation of medical images

• Explore the opportunities associated with the implementation and adoption of EI strategies in order to enhance medical imaging interpretation in Zambia
Study approach

• Mixed method approach
  – Case study at University Teaching Hospitals
  – Meta-analysis

Methodology

• Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis
  – Records analysis
  – Personal observations

• Enterprise Medical Imaging Meta-analysis
Major Outcomes/Results (1/2)

- 2815 health facilities in Zambia
- Owned by
  - Government of the republic of Zambia (GRZ)
  - Military
  - Non-Governmental Organisations (NGO)
  - Private
- Our work focused on public health facilities (GRZ)
**Major Outcomes/Results (2/2)**

- 151 facilities classified as Level 1, 2 or 3 Hospitals
  - Majority owned by GRZ
- Radiologically equipped according to level in GRZ facilities
- Only 8 GRZ Radiologists, operating in 5 facilities
Workflow challenges

- No Radiology Information System (RIS) or Hospital Information Service (HIS)
  - Inadequate request forms
  - Repetitive entries of patient details
  - Uncollected final reports
  - Tedious annual returns report generation
- No Picture Archiving and Communication System (PACS)
  - No systematic storage of images and reports
  - Manual reporting
  - Multiple registration of same patient
  - Use of non-DICOM image acquisition
- Long report turnaround time
  - Few Radiologists
  - Heavy workload
Major Outcomes/Results: UTH Case Study (2/2)

- Total examinations: 92,599
- Majority of modalities are X-rays and Ultrasound, mostly done in lower-level hospitals
Challenges affecting EMI implementation

- Challenges of integration of various clinical imaging disciplines into unified EI
  - Differences in workflows (e.g. ordering of an imaging exam)
  - Challenging patient identification in non-DICOM images
  - Differing image qualities and standards (measurements, image colour, patient positioning)
  - Linking of all patients’ images and reports in the EMI viewer to the patients’ EHR
  - Lack of EMI-specific ontology and standard nomenclature
  - Medico-legal concerns
  - Use of mobile devices for image acquisition and personal privacy
Additional challenges facing EI implementation in the global south
• Substantial cost and ongoing investment for maintenance
• Requirement for good Information and Communication Technology (ICT) support service,
• Training of users and requirement for a good understanding of complexities involved in EI implementation
SWOT Analysis: Strengths

- Well-trained radiologists
- Organised existing imaging stakeholder departments
  - Well-established administrators
  - Standard Operating Procedures (SOP)
  - Manual workflows in place, could be incorporated in EI-centric ecosystem
  - Fairly equipped imaging ecosystem at all levels (level 1, 2 and 3), DICOM-compatible machines
- Ongoing mobilisation of Teleradiology equipment
SWOT Analysis: Weaknesses

- Subsidiary departmental imaging services not integrated into mainstream clinical imaging
- Continued use of analog imaging in some modalities
- Use of visible light based image capturing equipment in some subsidiary services
- Poorly-serviced equipment with frequent and long downtimes
- Lack of good ICT infrastructure
SWOT Analysis: Opportunities

- Developing EHR system (SmartCare)
- Pre-existing e-Government services for internet connectivity
SWOT Analysis: Threats

- Unreliable internet connectivity
- Uncertain acceptability of EI
Conclusion and Outlook

• SWOT analysis was conducted; highlighted the challenges and opportunities of implementing successful EI strategies
  – Motivation for implementation of EI strategies
• Meta-analysis conducted to consolidate information on general challenges of EI implementation against local challenges
• Ongoing: Pilot study to fully understand current imaging workflows with expected outcome of automation of the workflows
• In pipeline: Implementation of
  – PACS and RIS
  – Machine learning models
• Further research required in exploration of automatic radiology report generation
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