Speaker's Profile

Dr. Kyaw Zin Thann

Program Manager at PATH Myanmar Country Programs

- Over 10 years experiences in public health, including seven years of experience in project management of public health programs
- Over 6 years experiences in TB/HIV programs as Site Manager in IBBS, (NAP) Program Manager at Challenge TB project (The Union), Project Lead at TB REACH Wave 7 Project (PATH), Program Manager at HIV/TB AIS (PATH), and Program Manager at TB REACH Wave 10 project (PATH)
- Over 4 years experiences in TB management in GP franchised with SUN community health (PSI)
- Over 3 years of experiences in CXR AI/CAD for TB programs

Speaking Topic – CXR CAD Operations Manual

HIV/TB Agency, Information and Services Activity

Chest X-ray Augmented with Computer-Aided Detection (CXR-CAD) Operations Manual

Dr. Kyaw Zin Thann

Program Manager (TB/HIV), PATH

28.2.2023 (Tuesday)

USAID
FROM THE AMERICAN PEOPLE

HIV/TB Agency, Information and Services Activity

Background

Benefits of CXR

- Highly sensitive tool for detecting TB disease
- Improve TB case detection
- Cost efficiency

Challenges of CXR

- Limited Specificity
- Significant inter-and intra-reader variability
- Lack of Reproducibility
- Lack of adequately trained radiologists

CXR-CAD as a solution

- Automating and standardizing X-ray interpretation
- Supplementing existing human health workers
- Can be extended to hard-to-reach key populations

Objectives

General Objectives

To support in accelerating TB case detection

Specific Objectives

To standardize implementation of CXR-CAD as a tool for systematic screening for TB, integrating it into existing mobile CXR and networked CXR centers

To support in overcoming the obstacles during the implementation process of CXR-CAD

Target Audiences

Health care providers of AIS partner organizations in implementing CXR-CAD in their respective implementation areas for TB screening

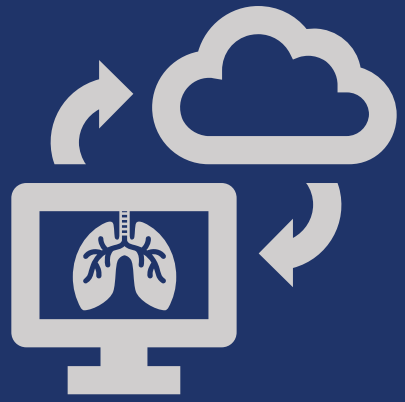
Target Beneficiaries

From the community and following attendees of the clinics at the project areas

a. People with presumptive TB symptoms
b. Household and close contacts of index TB case
c. Clients of Mobile TB ACF team

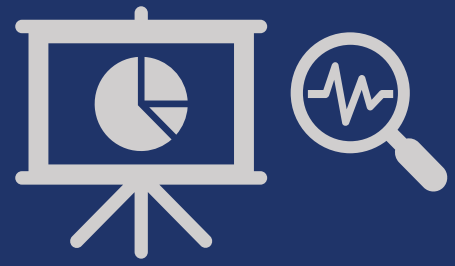
Main Components in CXR-CAD Operations Manual

Technical Background of CXR-CAD



Product Consideration

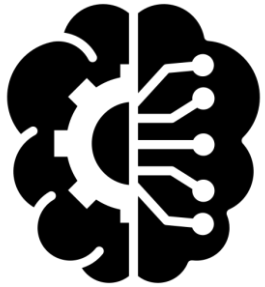
Implementation Consideration



Monitoring and Evaluation

Technical Background of CXR-CAD

Basic concept of Artificial intelligence used in CXR-CAD software



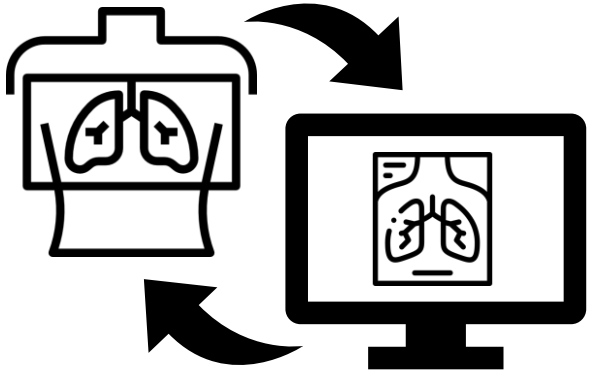
Deep Learning Neural Networks

The way nerve cells distribute signals within the brain

Learns to perform a particular task through training

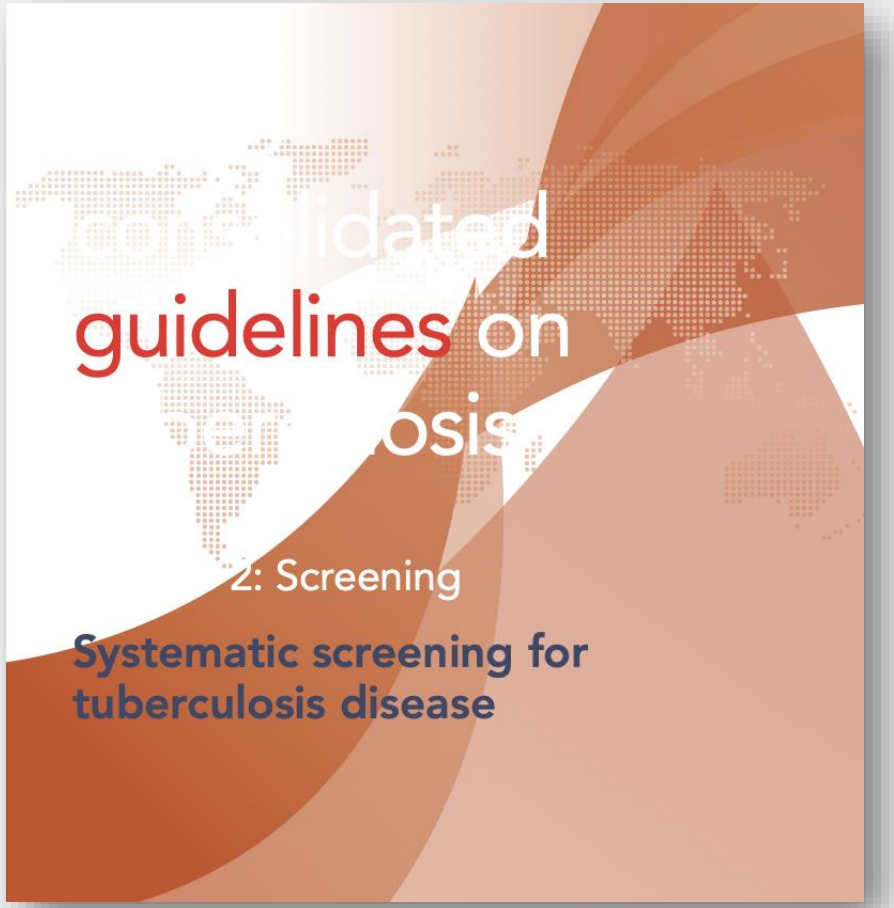
Millions of iterations of Training

Using Large Training datasets



Reduces the difference between its prediction and ground truth

Accurate Model



CXR-CAD Global Policy and WHO Recommendation (March 2021)

In place of human readers for the interpretation of digital CXR in **Screening and Triage** for TB disease.

Interpretation of **Antero-posterior** or **Postero-anterior views** of digital plane CXR for pulmonary TB. Age: **15 years or more**

Cannot be relied CXR CAD – alone – as a diagnostic tool

CXR-CAD Global Policy and WHO Recommendation (March 2021)

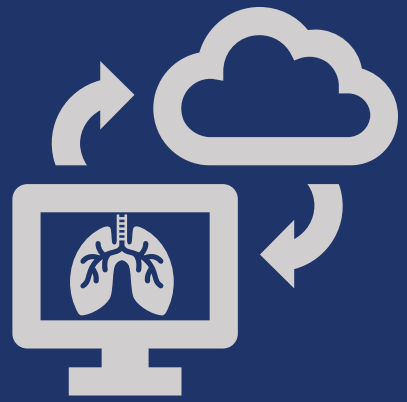
Sensitivity and specificity ranges of CAD software and human readers interpreting digital chest radiographs for detection of bacteriologically confirmed TB across three software programmes, from three independent evaluations of the software in a range of populations and settings.

Type of case and Type of reader	Accuracy estimate range	
	Sensitivity	Specificity
WHO target product file	>0.90	>0.70
Screening use case		
CAD software	0.90 - 0.92	0.23 - 0.66
CXR with human reader	0.82 - 0.93	0.14 - 0.63
Triage use case		
CAD software	0.90 - 0.91	0.25 - 0.79
CXR with human reader	0.89 - 0.96	0.36 - 0.63

Myanmar Edition of CXR CAD Deployment in TB REACH WAVE 7

Total (n = 2389) Mean age – 37.6 M:F= 1:1.3	Household contacts of TB patients (Group 1)	TB presumptive referred by clinician (Group 2)
Overall agreement (qXR vs radiologist)	91.3% (95% CI)	82.9% (95% CI)
Cohen's kappa	0.55	0.66

When a survey was conducted among the twenty-one GPs, **95% clinicians** claimed that the use of qXR within their facilities for TB screening has been has been **beneficial for patients** and **would strengthen TB case finding**



Product Consideration

CXR-CAD products

Product	Lunit - Lunit INSIGHT CXR	Qure.ai - qXR	Delft Imaging - CAD4TB
Features	Lunit	qure.ai	DELFT IMAGING
Company HQ	Lunit INSIGHT CXR Version 3.1.3.2 Seoul, Republic of Korea	qXR Version 3.0 Mumbai, India	CAD4TB Version 7 's-Hertogenbosch, The Netherlands
Certification	CE-marked Class I, Korea MFDS	CE-marked	CE 0344 marked Class IIb
Development Stage	On the market	On the market	On the market. Technology readiness level 9
Deployment	Online & offline	Online & offline	Online & offline

CAD4TB
Certification: CE-marked Class IIb
Development Stage: On the market
Intended Age Group: 4+ years

RADIFY
Certification: FDA (pending), CE (pending), SAHPRA Class A (certified)
Development Stage: On the market
Intended Age Group: 2+ years

InferRead DR Chest
Certification: CE-marked Class IIa
Development Stage: On the market
Intended Age Group: 12+ years

JLD-02K (JVIEWER-X)
Certification: CE-marked Class I, Australia TGA, Others
Development Stage: On the market
Intended Age Group: 10+ years

INSIGHT CXR
Certification: CE-marked Class I, Korea MFDS
Development Stage: On the market
Intended Age Group: 6+ years

ChestLink, ChestEye
Certification: ChestEye: CE Class IIa, ChestLink: CE Class II (pending)
Development Stage: On the market
Intended Age Group: 18+ years

qXR
Certification: CE-marked
Development Stage: On the market
Intended Age Group: 6+ years

AXIR
Certification: CE-marked
Development Stage: On the market
Intended Age Group: 16+ years

VUNO Med-Chest X-ray, Pro
Certification: VUNO Med-Chest X-ray: MFDS (K-FDA), CE; Pro: MFDS
Development Stage: VUNO Med-Chest X-ray: On the market; Pro: under development
Intended Age Group: 19+ years

Product characteristics for qXR (CAD software)

Suitable population

Target Population – CXR AP/PA view of age range 6 and above

Input

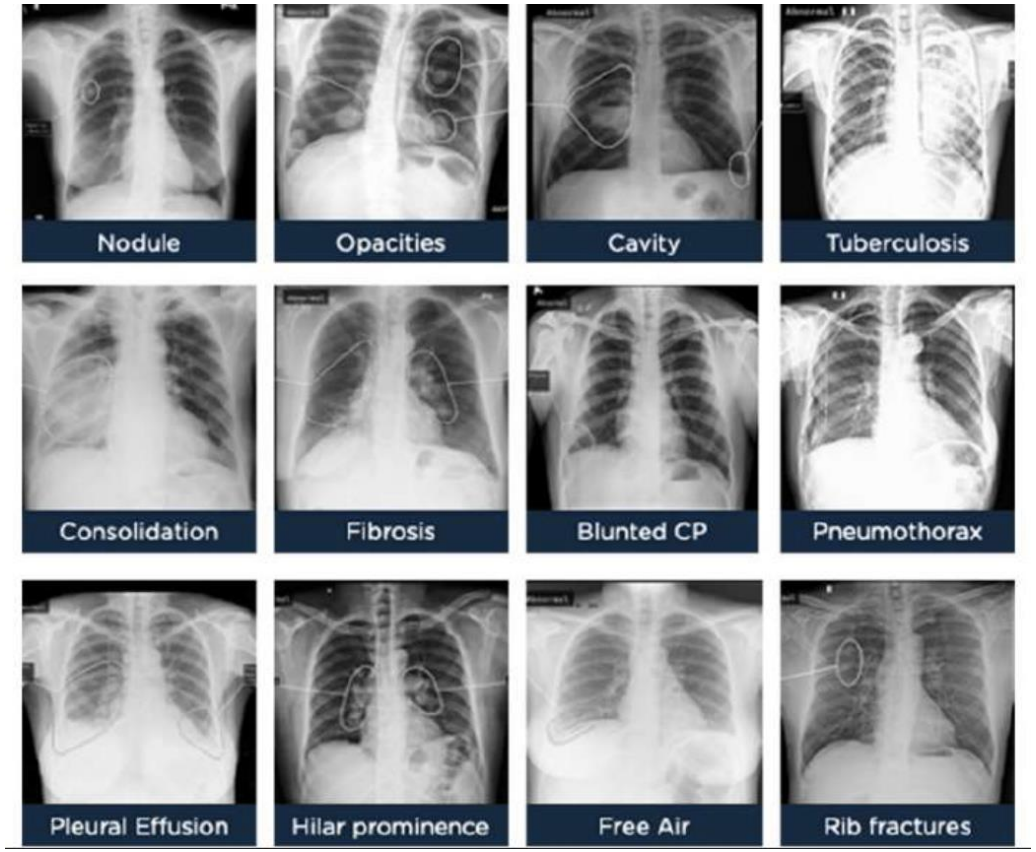
Only DICOM format will be used under AIS implementation sites.

Output

a) A heatmap indicating the area of the chest where an abnormality is present
b) A numerical abnormality score, ranging from zero to one (or 0-100)
c) A dichotomized (binary) classification (TB presumptive or no TB) based on the abnormality score described above
d) An automatically generated standard radiology report

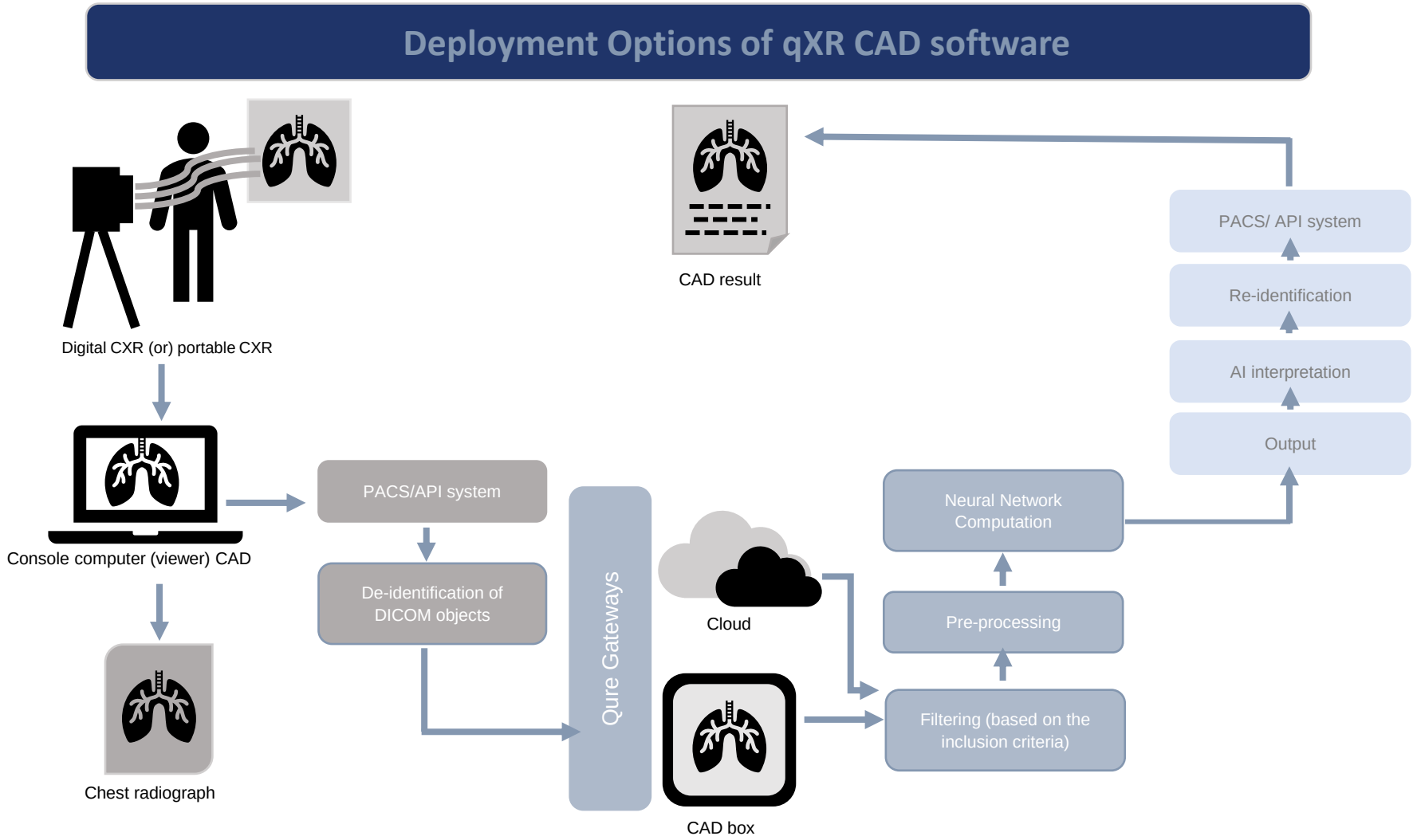
Product characteristics for Qure.ai qXR CAD software

Capability of qXR CXR CAD capability



qXR was unable to detect and localize lymphadenopathy and mass

Product characteristics for qXR (CAD software)



Product characteristics for qXR (CAD software)

Client Readiness of Deployment Options for qXR

Hybrid (On premise)

Technical Specification	Compulsory
Operating System	Ubuntu 18.04 (Preferred)
CPU's	No pref
Number of Cores	16/ 24 vCPUs
RAM	64 GB RAM
Hard Disk Space	1TB
Hardware needed	Monitor, Keyboard, Mouse
Additional Site Related Requirements	System should be connected to the same system as PACS

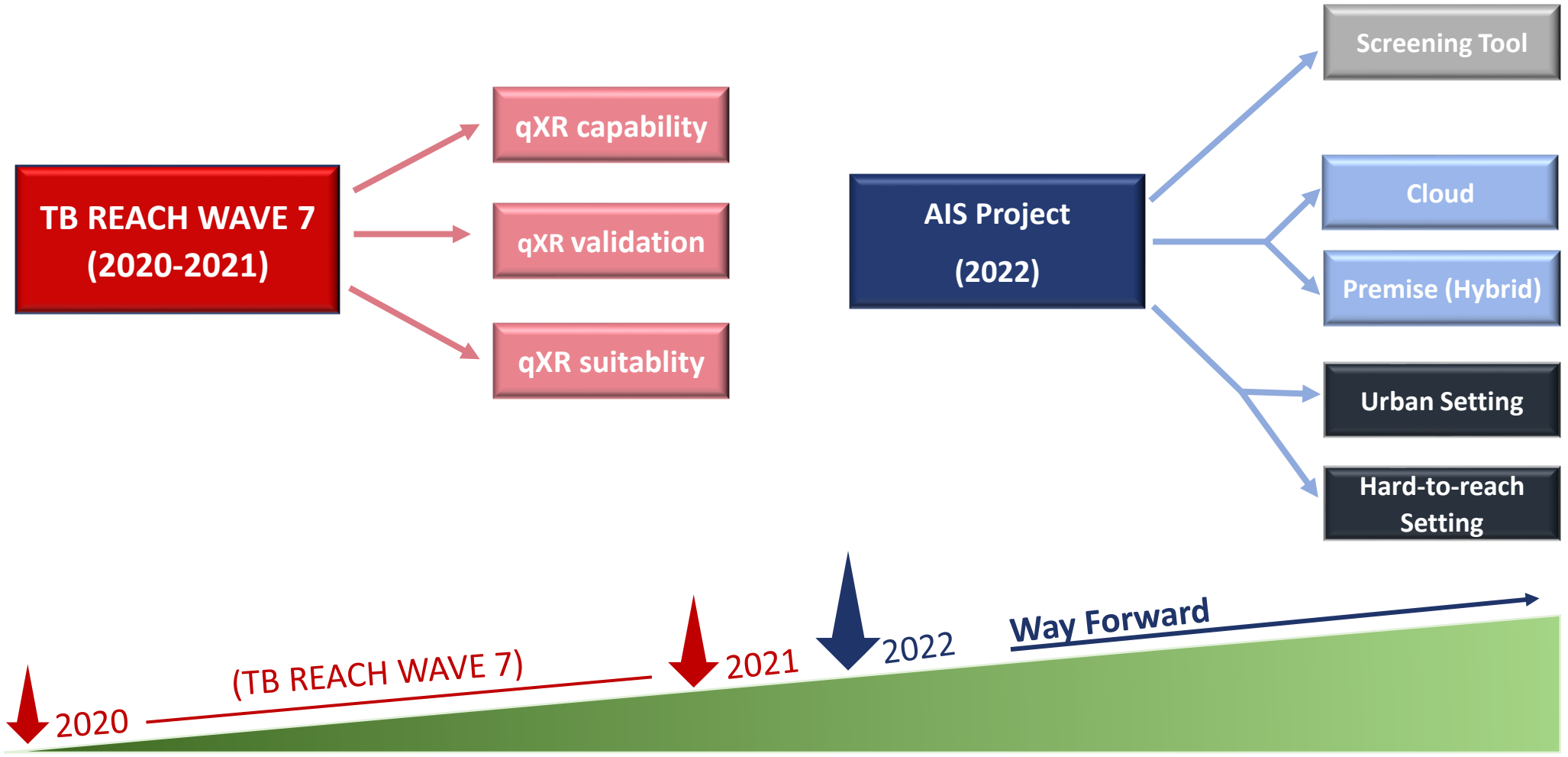
Cloud

Technical Specification	Minimum Requirement
Operating System	Ubuntu 18.04 or higher
RAM	8 GB RAM (required for running Gateway as a background service)
Internet Speed	8 MBPS (for seamless upload of the DICOMS to Cloud, minimum 4 Mbps upload speed required)
Hard Disk Space	500 GB (to ensure there is sufficient space for DICOM storage, since the gateway has a PACs running)

Valid DICOM file must satisfy the following inclusion criteria	
Modality	CR/ DR/ portal CXR
Body Part Examined	Chest
View	PA/ AP
Patient Position	Erect/ Supine

Implementation Consideration

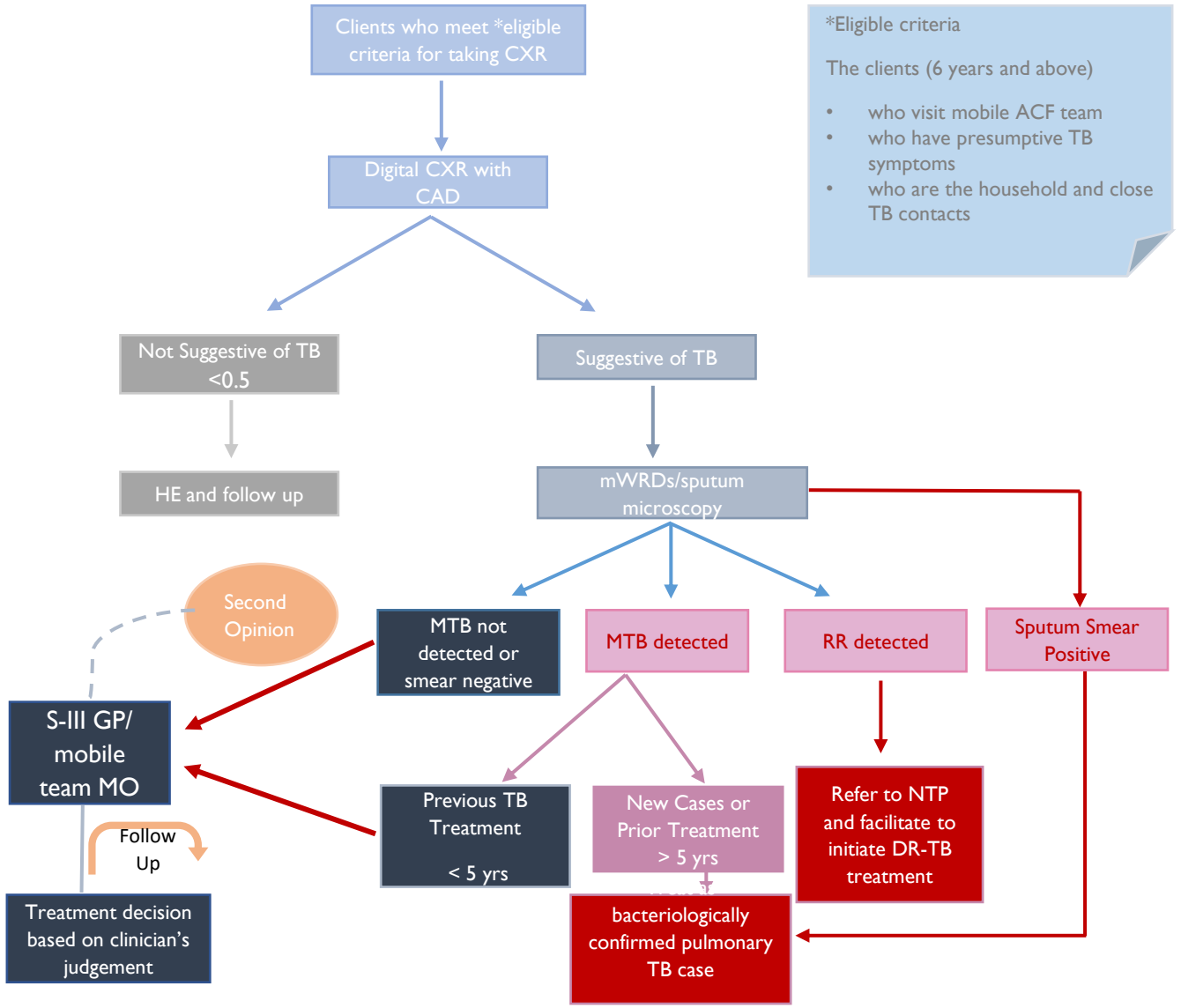
Position of CXR CAD under AIS Project



Geographical Coverage of CXR-CAD by AIS partners

No	Deployed	Deployment Options	Number of Deployment Sites	Implementation Areas
1	Mobile ACF at Hard-to-reach Setting	On premise (Hybrid)	4 sites	• Sagaing • Kachin
2	Stationary at Urban Setting	Cloud	9 sites	12 townships in Yangon

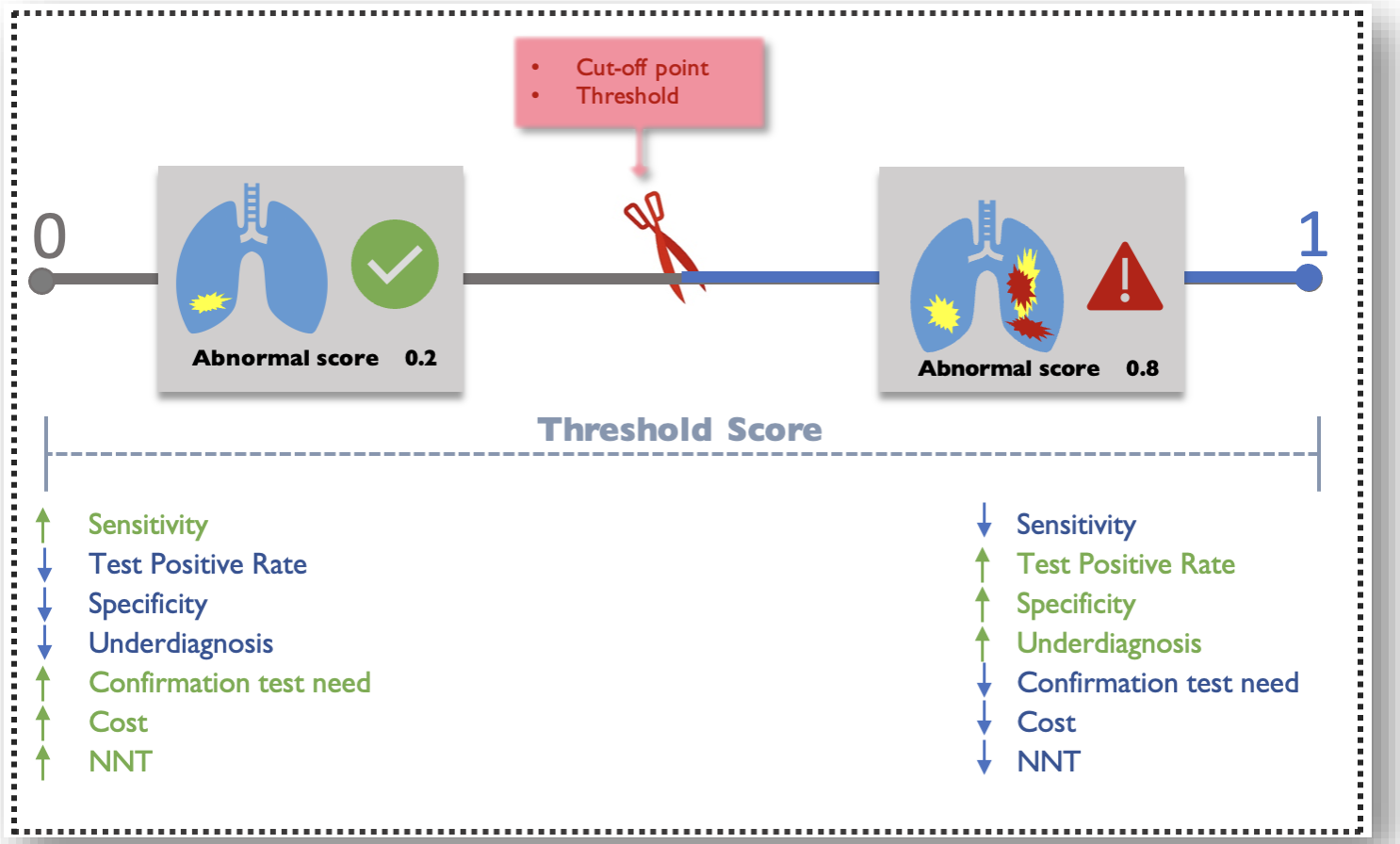
CXR-CAD Algorithm under AIS



Monitoring and Evaluation

Internal Quality Assurance

CXR-CAD Threshold Score

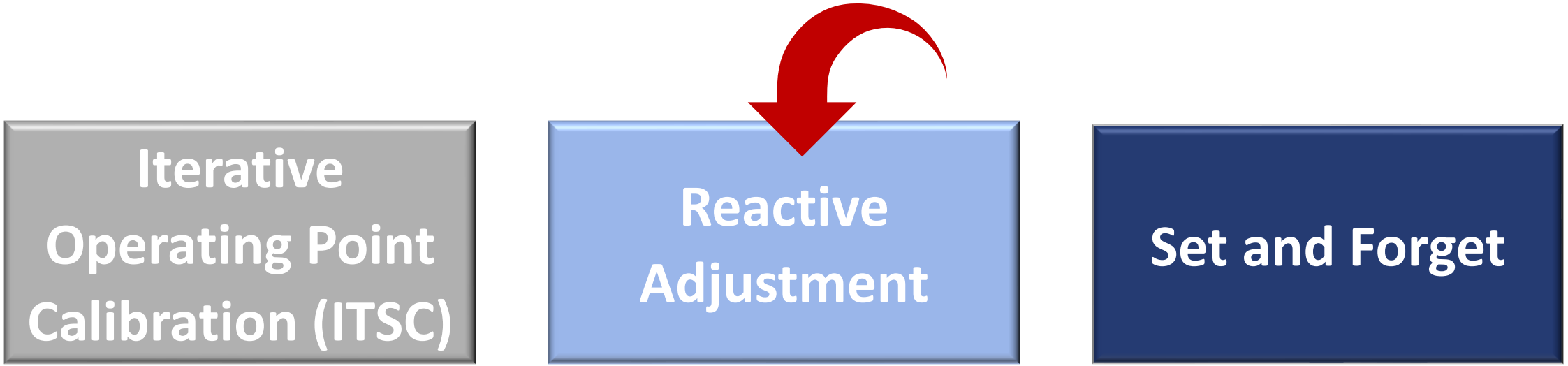


Under AIS, **0.5** was chosen as Threshold Score based on previous TB REACH wave 7 experience and series of discussion of Technical Working Group

Process indicators

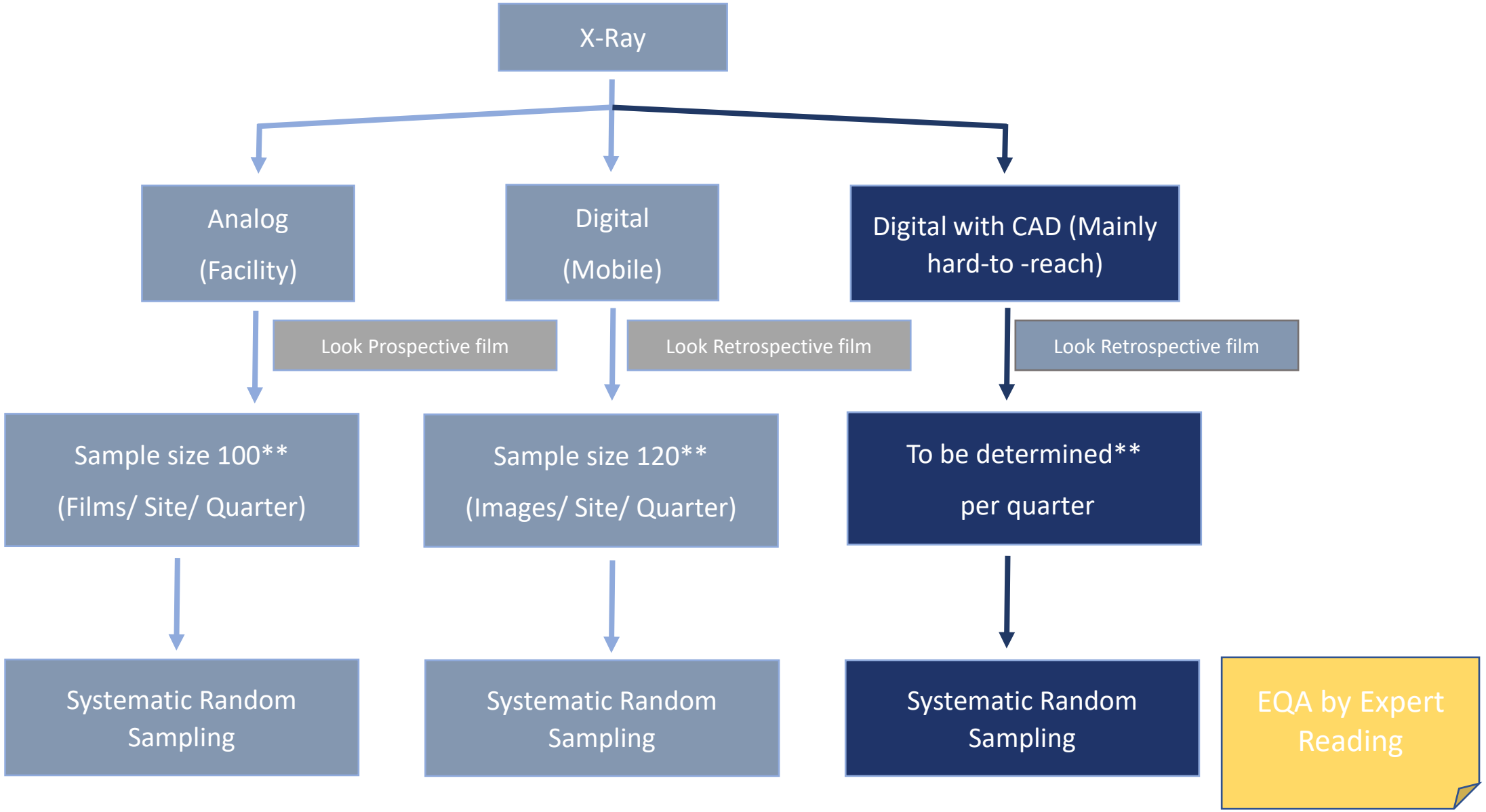
- Number of people screened by CXR CAD
- Number of people resulted with "Presumptive TB" by CXR CAD
- Number of people with CXR CAD resulted presumptive TB and/or abnormalities who undergo sputum investigation (Microscopy, GeneXPert, TrueNat)
- Number of people with CXR CAD resulted presumptive TB and/or abnormalities who is clinically confirmed TB or bacteriological confirmed TB (all forms of TB)
- Number of people with CXR CAD resulted presumptive TB and/or abnormalities who is bacteriologically confirmed TB

Calibration Exercise



Monitoring and Evaluation

External Quality Assurance


X-Ray
Analog
(Facility)
Digital
(Mobile)
Digital with CAD (Mainly hard-to -reach)
Look Prospective film
Look Retrospective film
Look Retrospective film
Sample size 100**
(Films/ Site/ Quarter)
Sample size 120**
(Images/ Site/ Quarter)
To be determined**
per quarter
Systematic Random Sampling
Systematic Random Sampling
Systematic Random Sampling
EQA by Expert Reading

Review and Studies

Routine Meetings

- CXR-CAD monthly Check-in
- AIS TB Technical Support Group Meeting
- Partners Coordination Meeting

CXR CAD Review Workshop

Study

- Role of CXR-CAD in TB detection in children and young adolescents

HIV/TB Agency, Information and Services Activity

THANK YOU.