Comparative Performance of AI vs Radiologists in Pre-Biopsy mpMRI Prostate Cancer Diagnosis: A Systematic Review and Meta-Analysis of Multi-Centre, Multi-Vendor Studies

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Introduction

- **PROMIS trial (2017)**
- Landmark study demonstrating **mpMRI superiority over TRUS for csPC**

- Prostate mpMRI is **standard** in diagnosing csPC
- AI-based tools offer support to **enhance mpMRI-based decision-making**

Objectives

- EAU recommendation: upfront implementation of **mpMRI in biopsy-naive patients**

- Systematic review of AI vs radiologists to diagnose prostate cancer from pre-biopsy prostate MRI in a **multi-centre, multi-vendor setting**

Results

Metric	AI Models	Radiologists
AUC	**0.837**	**0.75**
Sensitivity	**90.6%**	**91.2%**
Specificity	**67.1%**	**51.3%**

Pooled AUC, sensitivity, and specificity

Methods

Databases searched: MEDLINE, EMBASE, SCOPUS, COCHRANE

Timeframe: 2010 – present day

Records screened: 6389 → 137 full-text → 3 studies included

Inclusion: Multi-centre, multi-vendor studies comparing AI vs radiologist on pre-biopsy mpMRI

Meta-analysis using R with AUC as primary metric
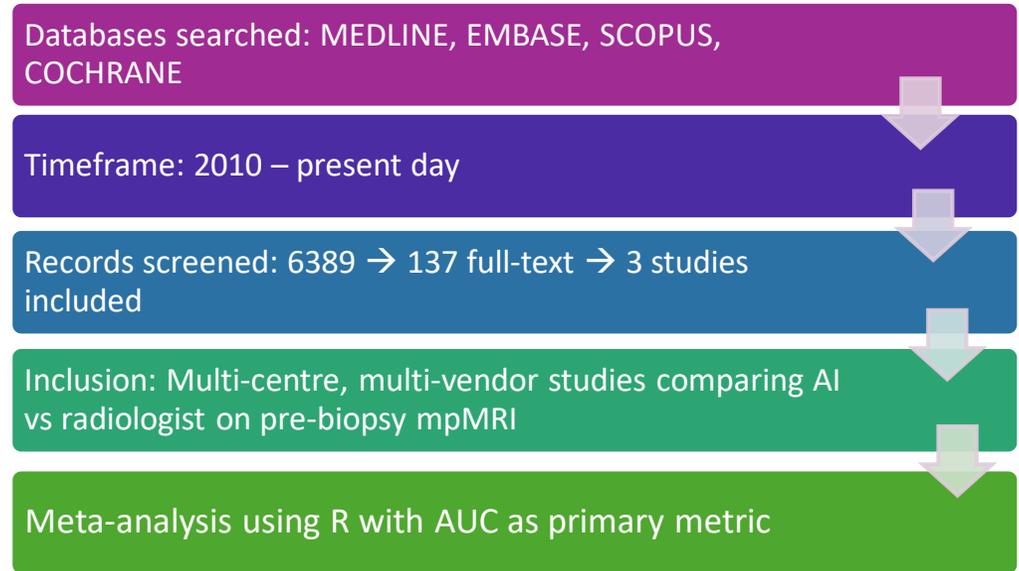
Study	AI System Used	Sensitivity	Specificity	AUC	Strengths	Weaknesses
Giganti et al.	Prostate Intelligence (Pi v2.4)	95%	67%	0.91	High sensitivity; Generalizable across multi-center, multi-vendor datasets; CE-marked clinical AI	Slightly lower specificity than radiologists; **Missed 14% of lesions**; Performance varies across sites
Jaouen et al.	**Radiomic-based CAD (Standalone & Second Reader)**	84%	83%	0.88	Improved performance when used as second reader; High diagnostic accuracy	Performance affected by lesion zone and reader experience
Castillo et al.	Radiomics model using **WORC**	88%	63%	0.75	Outperforms radiologists in multi-center setting; Good generalizability	**Performance drops significantly on external datasets**; High dependency on scanning protocols and delineation

Model 1 – Prostate intelligence: detected csPC against MDT-supported radiologists
Model 2 – radiomics-based, zone-specific ROI CAD aligned with PI-RADSv2
Model 3 – radiomics-based WORC using logistic regression, SVM, random forest, and naiive Bayes models

A meta-analysis including 552 pre-biopsy patients

Pooled sensitivity 0.884 (95% CI: 0.75-0.98)

Pooled specificity 0.681 (95% CI: 0.51 – 0.80)

AUC 0.837 (95% CI: 0.690 – 0.950)

Pooled analysis of 552 patients pre-biopsy → Model 1 and Model 2 comparable to radiologists.
Model 3 demonstrated superior performance to radiologists

Conclusions

MpMRI-directed prostate biopsy pathway increases clinically-significant prostate cancer detection

Decreased prostate cancer negative biopsy rates

Implies reduced labour-intensive radiology workforce pressure and time constraints

AI prostate cancer diagnostic accuracy is comparable to radiologists

References