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IUC24413-79 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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Background: Multiparametric MRI (mpMRI) is the cornerstone for diagnosing clinically significant prostate cancer (csPC), that is, International Society of Urological Pathology (ISUP) Grade ≥ 2 . The European Association of Urology (EAU) recommends its upfront implementation in biopsy-naïve patients to guide prostate biopsy decision making (PMID 38614820). However, significant inter- and intra-observer reporting variability affects patient outcomes. Our objective was to systematically review and evaluate the comparative performance of AI vs radiologists in diagnosing prostate cancer from pre-biopsy prostate mpMRI.

Methods: Our systematic review [PROSPERO ID: CRD420251037432] included MEDLINE, PMC, EMBASE, SCOPUS, and COCHRANE databases. Searching primary research published in 2010 and beyond yielded 6,389 records. After screening 3,747 articles, 137 underwent full-text review, with 3 meeting inclusion criteria—2 from database searches and 1 from grey literature. A meta-analysis using R assessed the diagnostic performance of the AI models, with area under the curve (AUC) as the primary outcome.

Results: Three multi-center, multi-vendor intervention studies on prostate mpMRI compared AI characterization of csPC vs standard of care (SOC), that is, ≥ 2 radiologists performing Prostate Imaging-Reporting and Data Systems (PI-RADS) version ≥ 2 scoring. A meta-analysis, including 552 pre-biopsy patients, yielded pooled sensitivity 0.884 (95% CI, 0.75–0.98), specificity 0.681 (95% CI, 0.51–0.80), and AUC 0.837 (95% CI, 0.690–0.950) for the AI—principally supervised machine learning (ML) models.

Model 1 (PMID 40016318) had a 95% sensitivity, 67% specificity and was non-inferior to SOC (AUC 0.91 vs 0.95; $P = .044$). Model 2 (PMID 37345961) reported 86%–91% sensitivity, 64%–75% specificity and was also non-inferior to SOC (comparable AUCs 0.82–0.86). Model 3 (PMID 33671533) showed 89% sensitivity and superiority over SOC (AUC 0.75 vs 0.47). Models 1 and 2 exhibited strong generalizability, with Model 2 aligning closely with PI-RADSv2 lesion characterization.

Conclusions: The mpMRI-directed prostate biopsy pathway increases csPC detection and decreases PC negative biopsy rates. Adopting this implies a significant time and labor-intensive radiology workforce pressure. Our meta-analysis demonstrates how AI PC diagnostic accuracy is comparable to radiologists. This aids standardization, reduces diagnostic variability and radiologist workload.