Biparametric versus Multiparametric Prostate MRI for the Detection of Prostate Cancer in Treatment-Naive Patients: A Diagnostic Test Accuracy Systematic Review and Meta-Analysis

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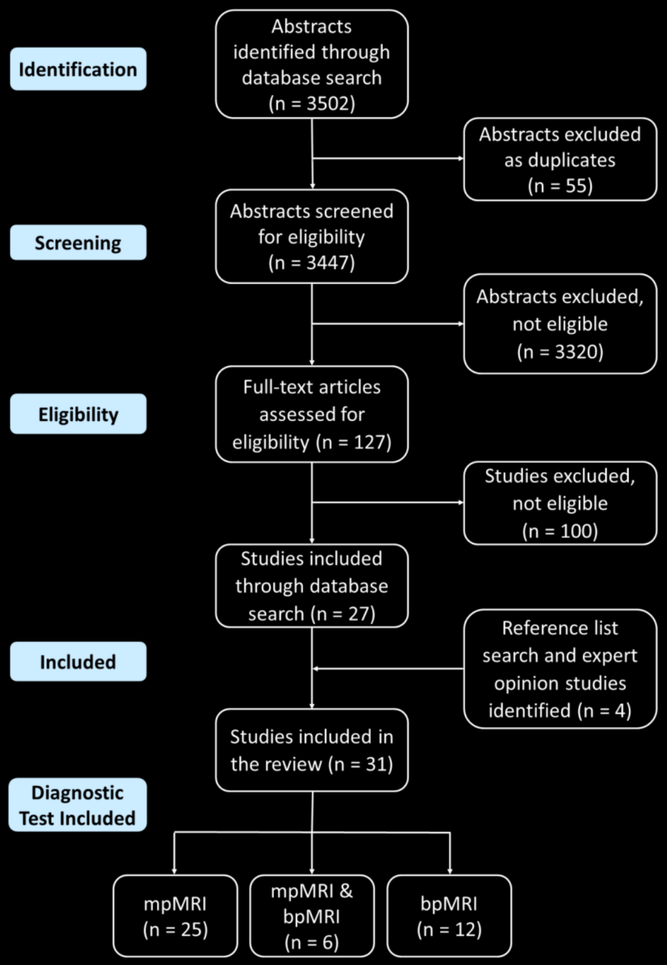
Disclosures

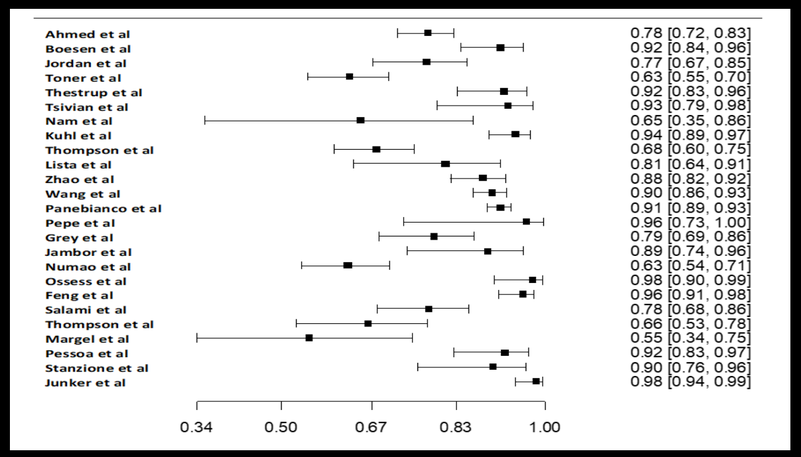
The authors have no relevant conflicts of interest to disclose.

Highlights

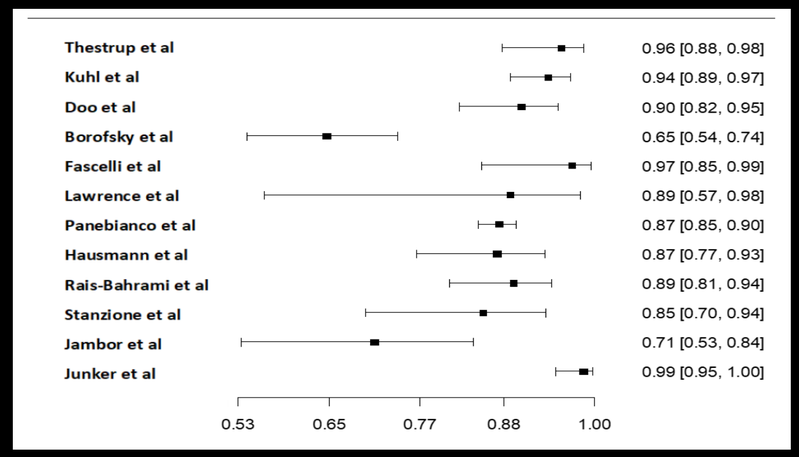
- bpMRI non-inferior to mpMRI for prostate cancer detection in treatment-naïve patients



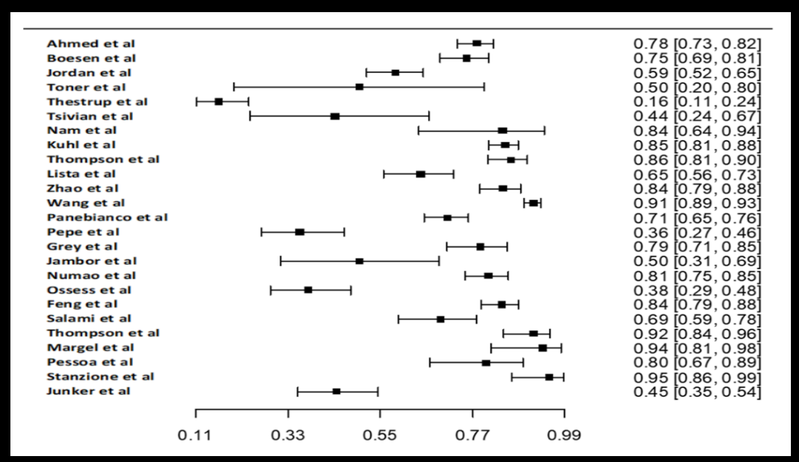
31 studies included



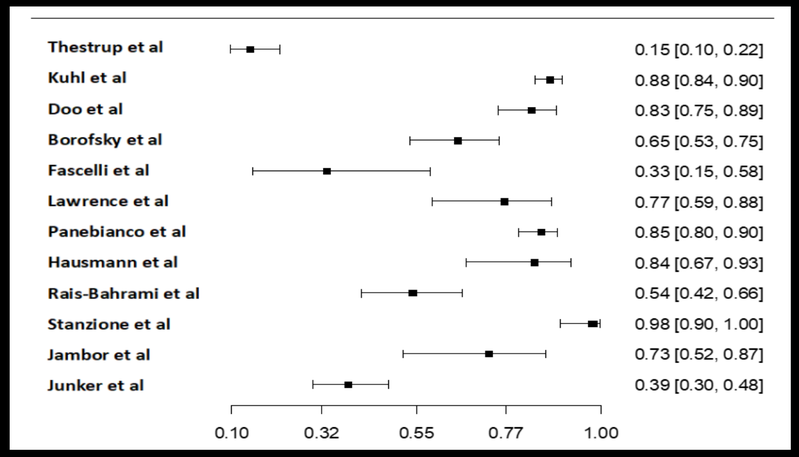
mpMRI Sensitivity: 86% (95%-CI 81-90)



bpMRI Sensitivity: 90% (95%-CI 83-94)



mpMRI Specificity: 73% (95%-CI 64-81)



bpMRI Specificity: 70% (95%-CI 42-83)

Abbreviations

DRE: Digital rectal examination

PSA: Prostate specific antigen

T2WI: T2-weighted imaging

DWI: Diffusion-weighted imaging

DCE: Dynamic contrast enhanced

mpMRI: Multiparametric MRI

bpMRI: Biparametric MRI

QUADAS: Quality Assessment of Diagnostic Accuracy Studies

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Background

- Prostate cancer is the second most common cancer affecting men
- Targeted screening with DRE and PSA levels reduces mortality
- Prostate biopsies are the gold standard for diagnosis

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Background

- MRI is now commonly used for prostate cancer assessment and local staging
- Standard protocol includes: T2WI, DWI, and DCE sequences
- DCE is helpful if T2WI and DWI sequences are non-diagnostic
- DCE requires the use of gadolinium and a longer scan time

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Purpose

Our objective was to perform a diagnostic test accuracy systematic review and meta-analysis to compare mpMRI (T2WI, DWI and DCE) versus bpMRI (TWI and DWI) in diagnosing clinically significant prostate cancer in treatment-naive patients.

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Methods

- Registration a priori (PROSPERO CRD 42017079756)
- MEDLINE and Embase searched for studies published after first PIRADS guidelines (January 1, 2012)
- Studies reporting on per-patient diagnostic accuracy data of mpMRI or bpMRI included
- Studies with patients who were treated prior to imaging excluded
- Reference standard: histopathology (biopsy or prostatectomy)

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Methods

- Title, abstract, and full text screening performed
- Methodologic and diagnostic accuracy data extracted
- Risk of bias assessed using the QUADAS-2 tool
- Accuracy metrics pooled using bivariate random-effects meta-analysis
- Subgroup analysis performed to assess for sources of heterogeneity

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RESULTS

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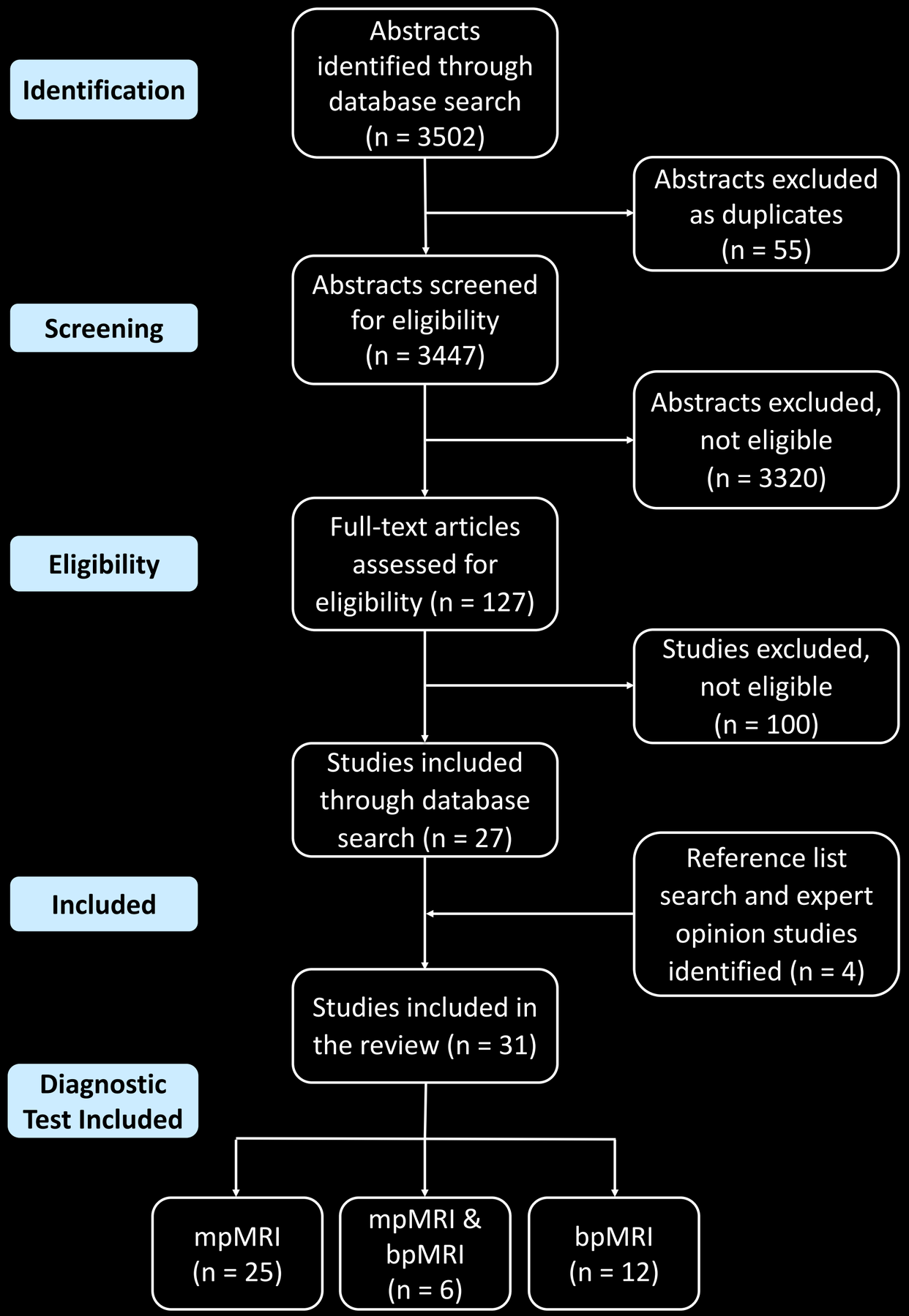
Study Flow Diagram



Results

- Total patients included: 9244 (4161 with prostate cancer)
- mpMRI: 6764 patients (2819 with prostate cancer)
- bpMRI: 2480 patients (1342 with prostate cancer)

- Risk of bias:
  - Low risk (4)
  - Unclear risk (18)
  - At risk (7)

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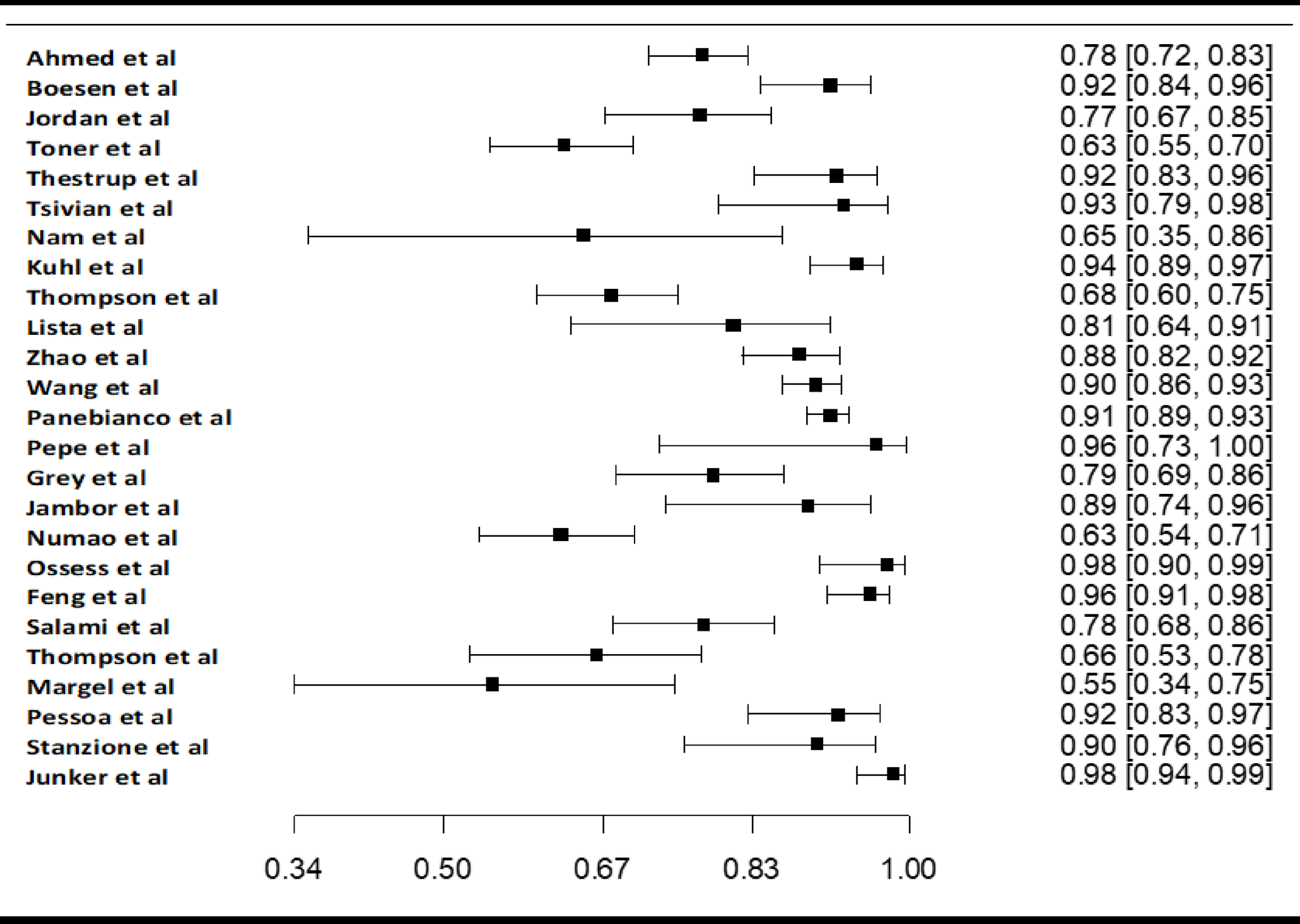
mpMRI Sensitivity: 86% (95%-CI 81-90)



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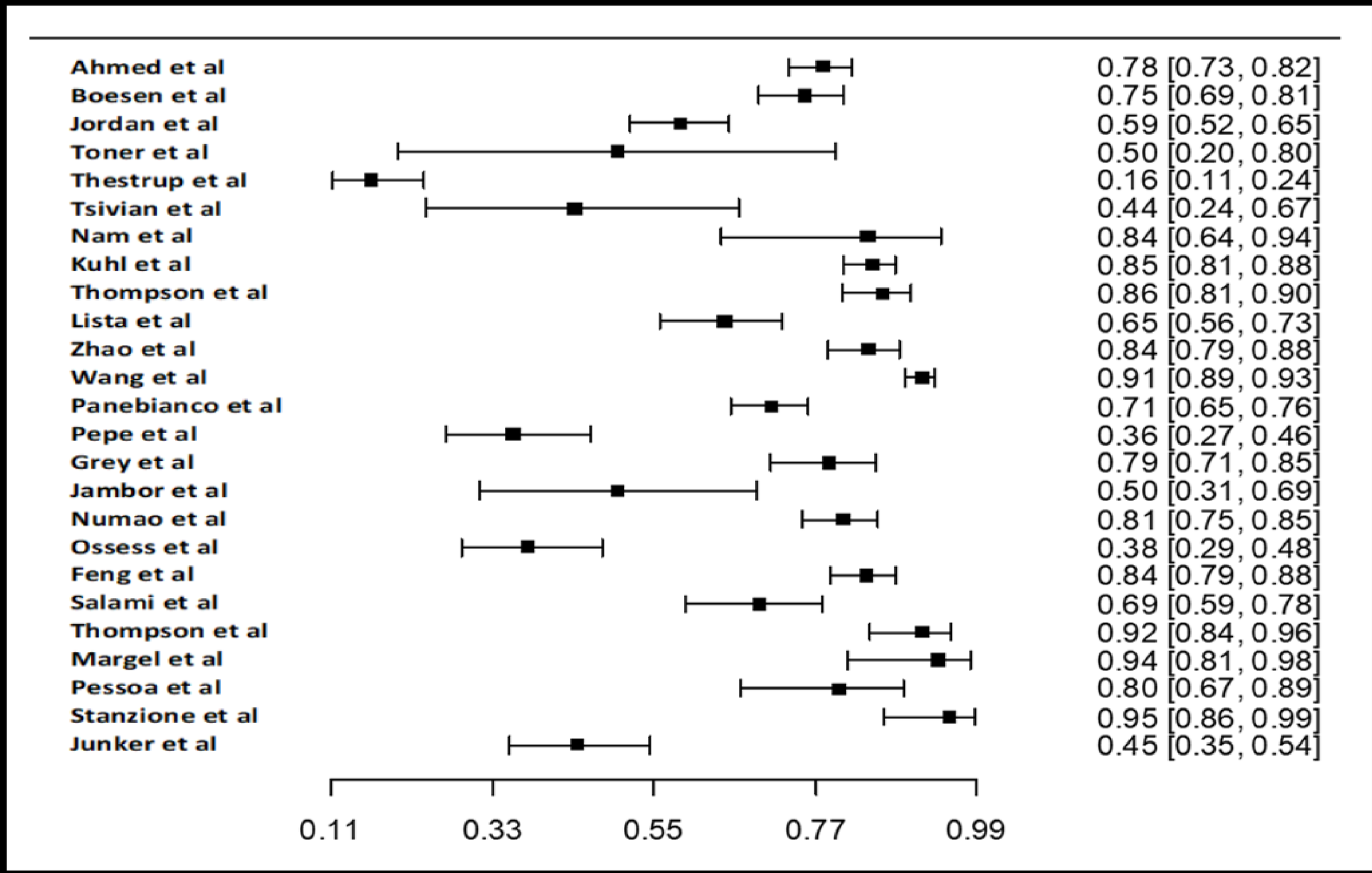

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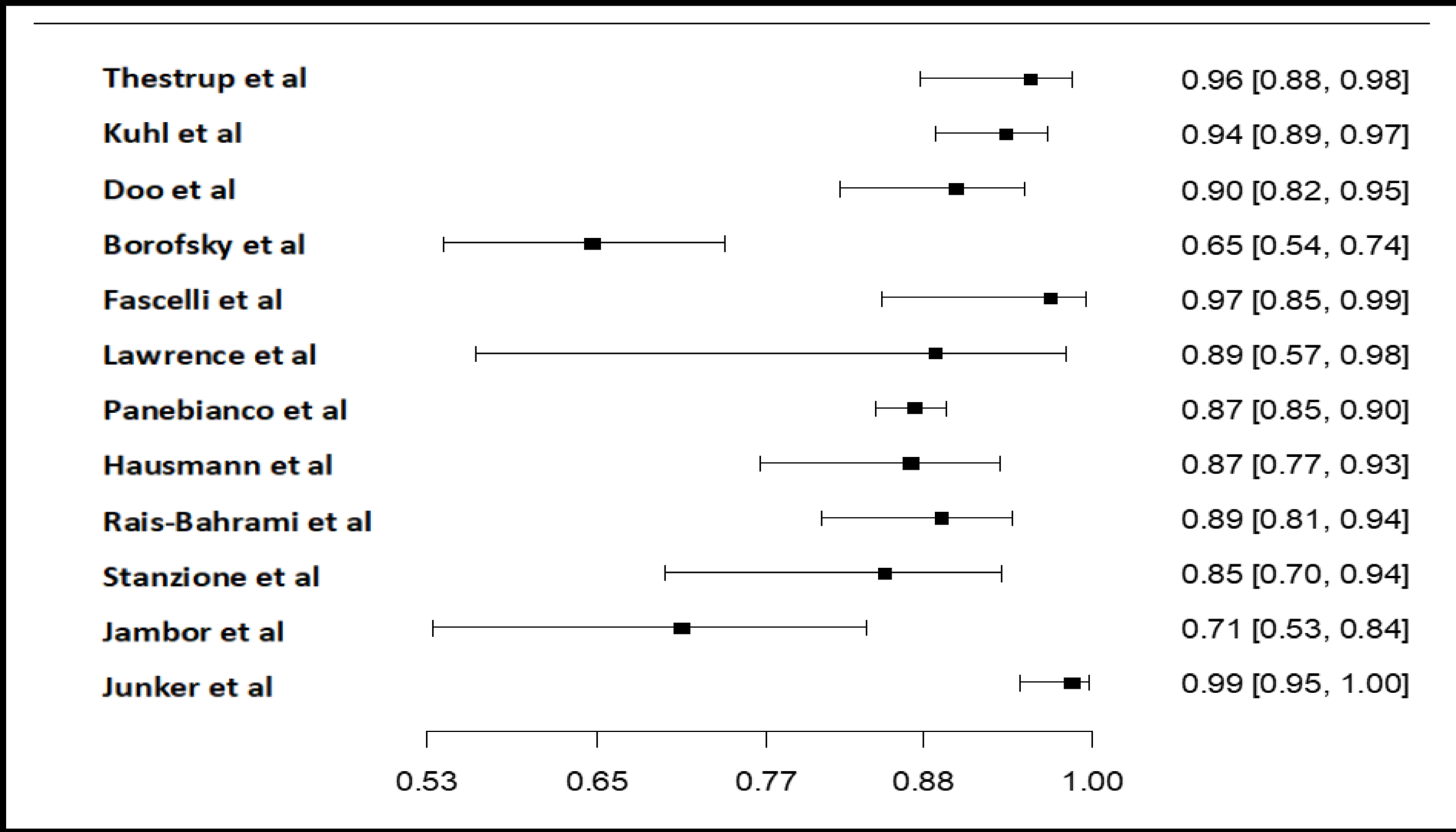

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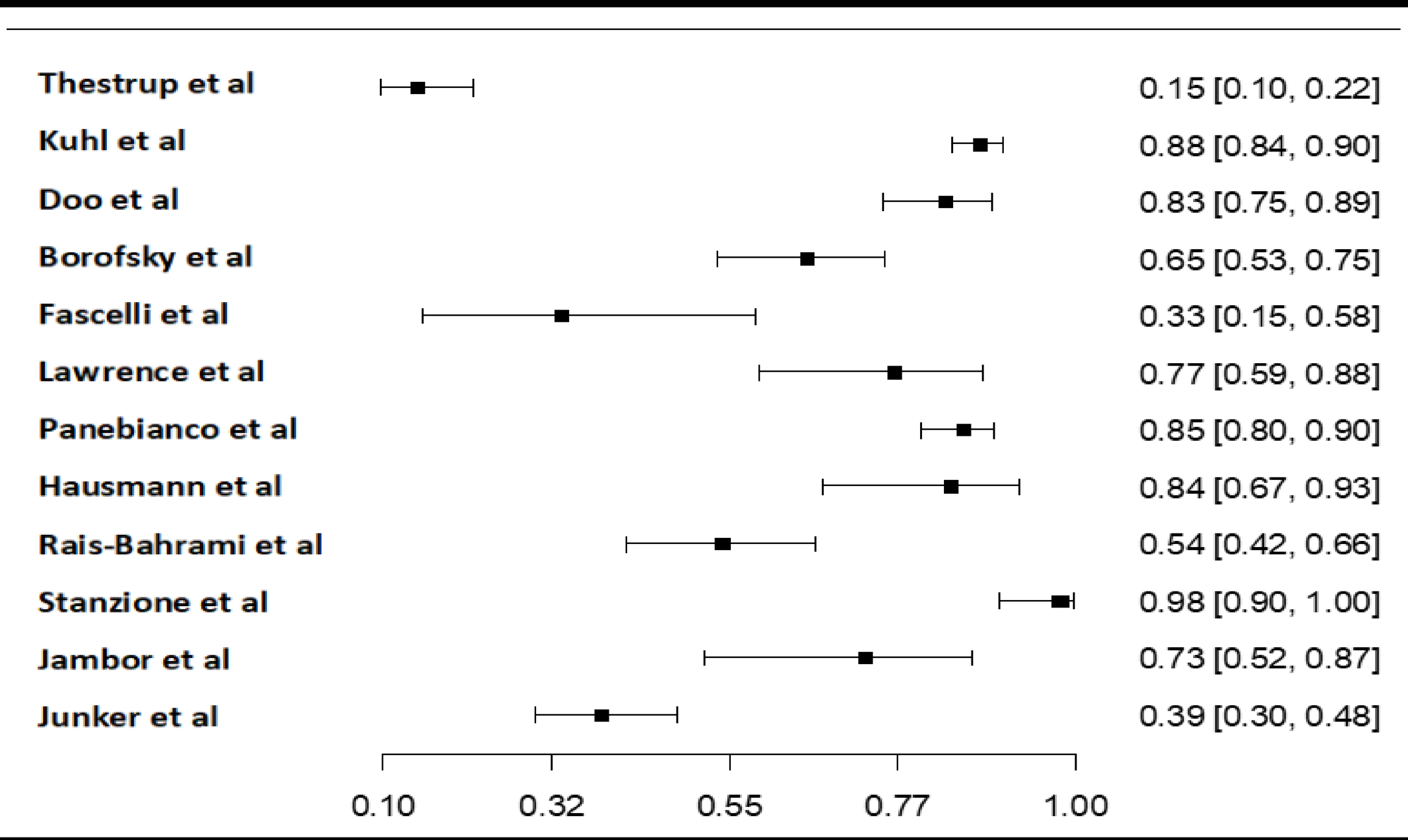
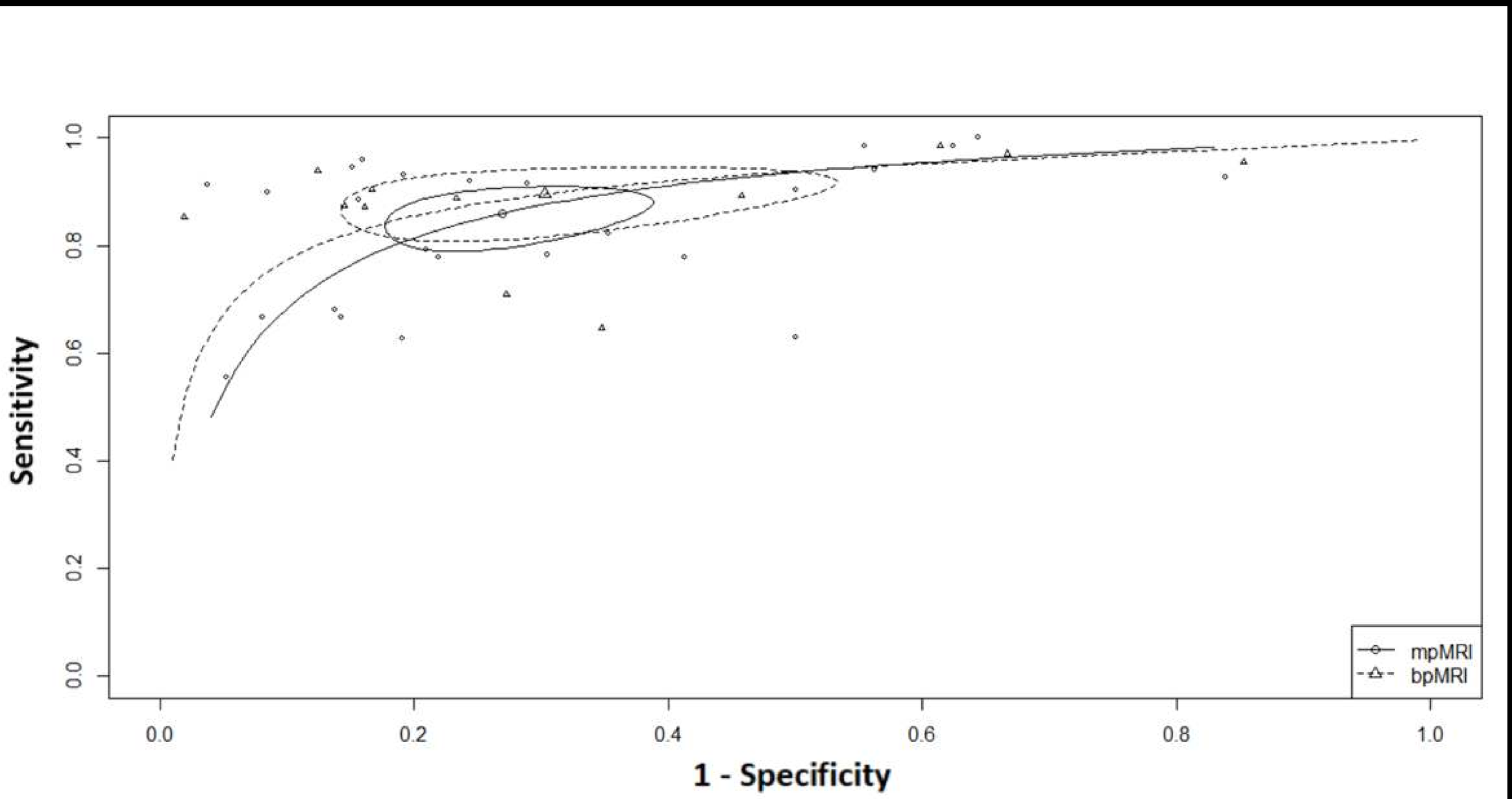


Comparative Summary ROC Curves



Pooled Diagnostic Accuracy and Subgroup Analyses

	mpMRI			bpMRI		
Category	Number of studies	Sensitivity (95% CI)	Specificity (95% CI)	Number of studies	Sensitivity (95% CI)	Specificity (95% CI)
All	25	0.86 (0.81-0.90)	0.73 (0.64-0.81)	12	0.90 (0.83-0.94)	0.70 (0.42-0.83)
Direct Study Comparison	6	**0.92 (0.91-0.94)**	0.65 (0.33-0.87)	6	0.91 (0.82-0.96)	0.73 (0.37-0.92)
Indirect Study Comparison	19	**0.83 (0.76-0.88)**	0.76 (0.67-0.83)	6	0.87 (0.76-0.93)	0.69 (0.52-0.81)
Clinically Significant Prostate Cancer	16	0.83 (0.74-0.89)	0.74 (0.62-0.83)	6	0.91 (0.79-0.96)	0.62 (0.34-0.84)
Any PC	9	0.91 (0.86-0.95)	0.73 (0.56-0.85)	6	0.89 (0.79-0.94)	0.76 (0.54-0.89)
PIRADS ≥ 4	21	**0.83 (0.77-0.88)**	**0.75 (0.64-0.83)**	–	–	–
PIRADS ≥ 3	18	**0.95 (0.92-0.97)**	**0.45 (0.32-0.58)**	–	–	–
Low or Uncertain Risk of Bias	18	0.87 (0.81-0.92)	0.73 (0.60-0.82)	11	0.90 (0.82-0.94)	0.68 (0.48-0.83)
High Risk of Bias	7	0.83 (0.72-0.90)	0.74 (0.58-0.85)	1	–	–
Prospective Study	16	0.84 (0.77-0.89)	0.79 (0.71-0.85)	4	0.87 (0.76-0.93)	**0.85 (0.79-0.89)**
Retrospective Study	9	0.90 (0.80-0.96)	0.59 (0.39-0.76)	8	0.91 (0.82-0.96)	**0.57 (0.36-0.75)**
3.0 Tesla MRI	15	**0.90 (0.86-0.93)**	0.67 (0.54-0.79)	7	0.89 (0.83-0.93)	0.80 (0.54-0.93)
1.5 Tesla MRI	6	**0.77 (0.66-0.85)**	0.82 (0.72-0.89)	–	–	–
All Non-3.0 Tesla MRI	10	0.78(0.65-0.87)	0.81 (0.70-0.88	5	0.91 (0.70-0.98)	0.54 (0.40-0.67)

Results

- No difference in diagnostic accuracy of mpMRI and bpMRI
- mpMRI: PIRADS ≥ 3 “positive cut-off” more sensitive than PIRADS ≥ 4
- mpMRI: PIRADS ≥ 4 “positive cut-off” more specific than PIRADS ≥ 3
- mpMRI: 3.0 T MRI more sensitive than 1.5 T MRI
- bpMRI: prospective studies more specific than retrospective studies

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Discussion

- bpMRI non-inferior to mpMRI for prostate cancer detection in treatment-naïve patients
- bpMRI may be considered as potential first-line imaging
- Addition of DCE sequence post-hoc on “as needed” basis

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Discussion

- Alternatively, baseline mpMRI with bpMRI used as follow-up exam
- bpMRI may serve as a safer, faster, cheaper examination due to the non-utilization of Gadolinium contrast
- bpMRI may be considered for screening purposes

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Limitations

- Study heterogeneity warrants cautious interpretation of results
- Standardized “positive” and “negative” test cut-offs warranted
- High frequency of studies at risk or unclear risk of bias
- Grey literature was not assessed

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Conclusion

- bpMRI non-inferior to mpMRI for prostate cancer detection in treatment-naïve patients
- Study heterogeneity warrants cautious interpretation of results
- bpMRI may serve as a faster, cheaper, gadolinium-free alternative

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Conclusion

- An approach involving a baseline mpMRI with bpMRI used for follow-up and active surveillance imaging can be considered
- bpMRI may serve as a feasible first-line screening imaging test

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