SYSTEMATIC REVIEW: EFFECTIVENESS OF ARTIFICIAL INTELLIGENCE IN FETAL NEUROSONOGRAPHY FOR DETECTING BRAIN ANOMALIES

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BACKGROUND:

- We trust **fetal neurosonography** to guide some of the most critical prenatal decisions — yet it remains vulnerable to operator variability, fetal position, and scan quality.
- **MRI** can offer diagnostic clarity, but it's often costly, time-consuming, and not universally accessible.

Is artificial intelligence the **partner we need** — to make fetal brain imaging more reliable, equitable, and repeatable?

AIM / OBJECTIVES

Primary Objective:

To evaluate the impact of AI-powered tools on **diagnostic accuracy** in detecting fetal brain anomalies.

Secondary Objectives:

To explore AI's influence on **MRI referral rates**, clinical workflow **efficiency**, consistency, and its potential **return on investment** in prenatal neurosonography.

METHODS

- **Design:** PRISMA-compliant systematic review
- **Databases Searched:** PubMed, Cochrane Library, ClinicalTrials.gov
- **Timeframe:** January 2014 – March 2024

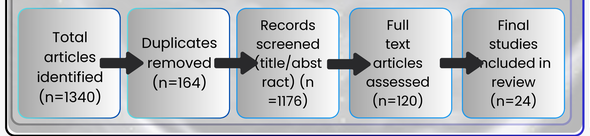
Inclusion Criteria:

✓ AI-based tools evaluating fetal brain anomalies via ultrasound
✓ Reported metrics: sensitivity, specificity, or AUC
✓ English language, human studies

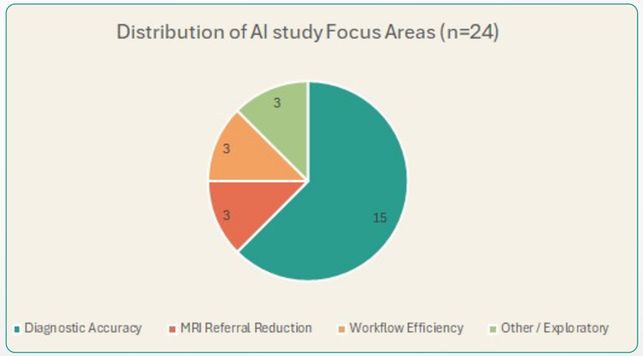
Exclusion Criteria:

✗ Non-neuro anomalies
✗ MRI-only studies
✗ No AI implementation

PRISMA FLOW CHART – STUDY SELECTION PROCESS

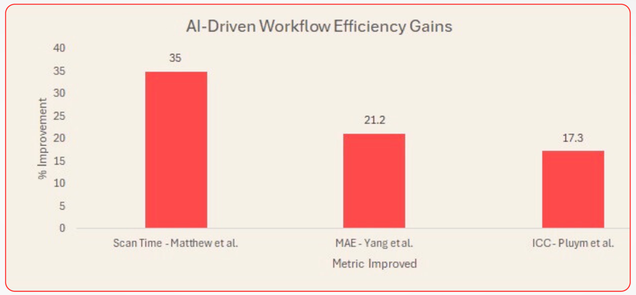


RESULTS



STUDY DISTRIBUTION CHART

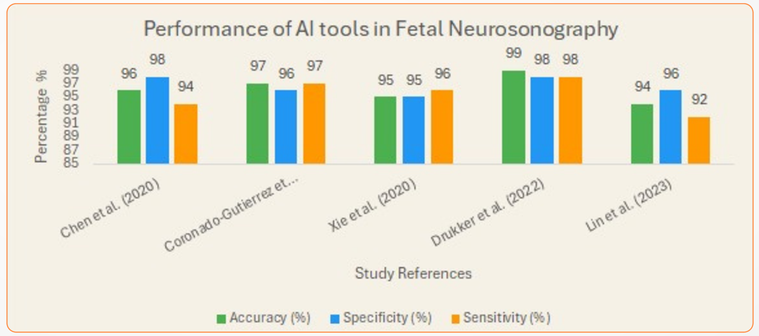
Of the 24 included studies, 15 reported diagnostic accuracy metrics, primarily using CNN-based classifiers. Models like PAICS, Sonio Expert, and RDHCformer achieved accuracy levels consistently above 95%.



WORKFLOW EFFICIENCY

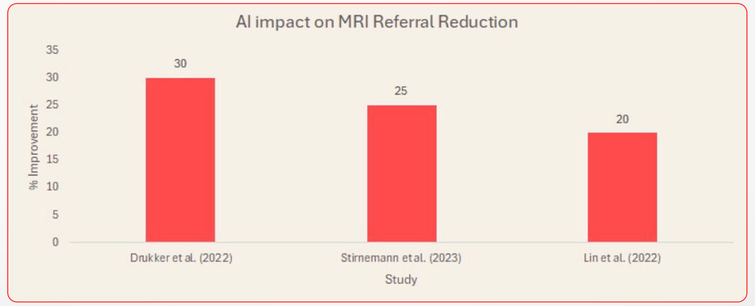
- Matthew et al. (2022): AI reduced scan time by 35%
- Yang et al. (2022): RDHCformer outperformed manual measurement with MAE of 1.97 mm
- Pluym et al. (2021): SonoCNS® showed high reproducibility (ICC = 0.80–0.88)

🔍 AI improves speed, reproducibility, and reduces operator dependence



PERFORMANCE OF AI TOOLS IN NEUROSONOGRAPHY

- Drukker et al. (2022): PAICS achieved expert-level accuracy (99%) in detecting intracranial anomalies
- Xie et al. (2020): AI improved sensitivity and specificity over manual interpretation
- Chen et al. (2020) & Coronado-Gutierrez et al. (2023): Consistently reported >95% accuracy using CNNs
- Lin et al. (2023): Performance dropped slightly, showing model dependency on dataset and training quality



AI'S IMPACT ON MRI REFERRALS

- Drukker et al. (2022): 30% fewer MRIs with AI support at scan stage
- Stirnemann et al. (2023): Sonio Expert reduced referrals by 25% in real time
- Lin et al. (2022): 20% reduction in a randomized clinical setting

💡 AI increases diagnostic certainty, reducing unnecessary second-line imaging

CONCLUSION:

- Yes — AI can become a **reliable partner** in fetal neurosonography by reducing interobserver variation, supporting consistent measurements, and enhancing diagnostic accuracy.
- It has demonstrated **potential to save** time, reduce MRI referrals, and increase confidence in real-time fetal brain assessment — even in suboptimal conditions.
- However, most studies are early-phase, and larger, **prospective trials are needed** to assess long-term clinical impact, generalizability, and economic value.
- Looking ahead, cloud-based AI platforms could enable centralised evaluations, connecting peripheral units with tertiary fetal medicine centres for expert-level review — **improving access, equity, and outcomes.**

🔍 *AI is not a replacement — it's a reinforcement.*
Smart, fast, and reproducible fetal neurosonography is within reach.

Key References:

Drukker et al. (2022) – Prenatal Diagnosis
Stirnemann et al. (2023) – Ultrasound Obstet Gynecol
Weichert & Scharf (2024) – Fetal Diagn Ther
Tsai et al. (2020) – IEEE Trans Med Imaging
Yang et al. (2022) – Medical Physics