

isuog2026.19d0667

AI-based assessment of gestational age & fetal biometry from blind sweep obstetric ultrasound in variable scanning environments

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Introduction

- Accurate estimation of gestational age (GA) and fetal biometry is central to obstetric care.
- Conventional ultrasound assessment relies on acquisition of standardized imaging planes by trained sonographers, limiting accessibility in some settings.
- Blind sweep ultrasound simplifies acquisition while preserving clinically relevant information for fetal assessment.

Objective: To evaluate the performance of an AI-based system for estimating GA and fetal biometry directly from blind sweep obstetric ultrasound examinations.

Data Collection & Methods

- Clinical validation data consisted of paired blind sweep and standard-of-care (SOC) ultrasound examinations.
- Blind sweep examinations [1] served as AI inputs, while SOC examinations were used to establish reference standards for gestational age and fetal biometry.

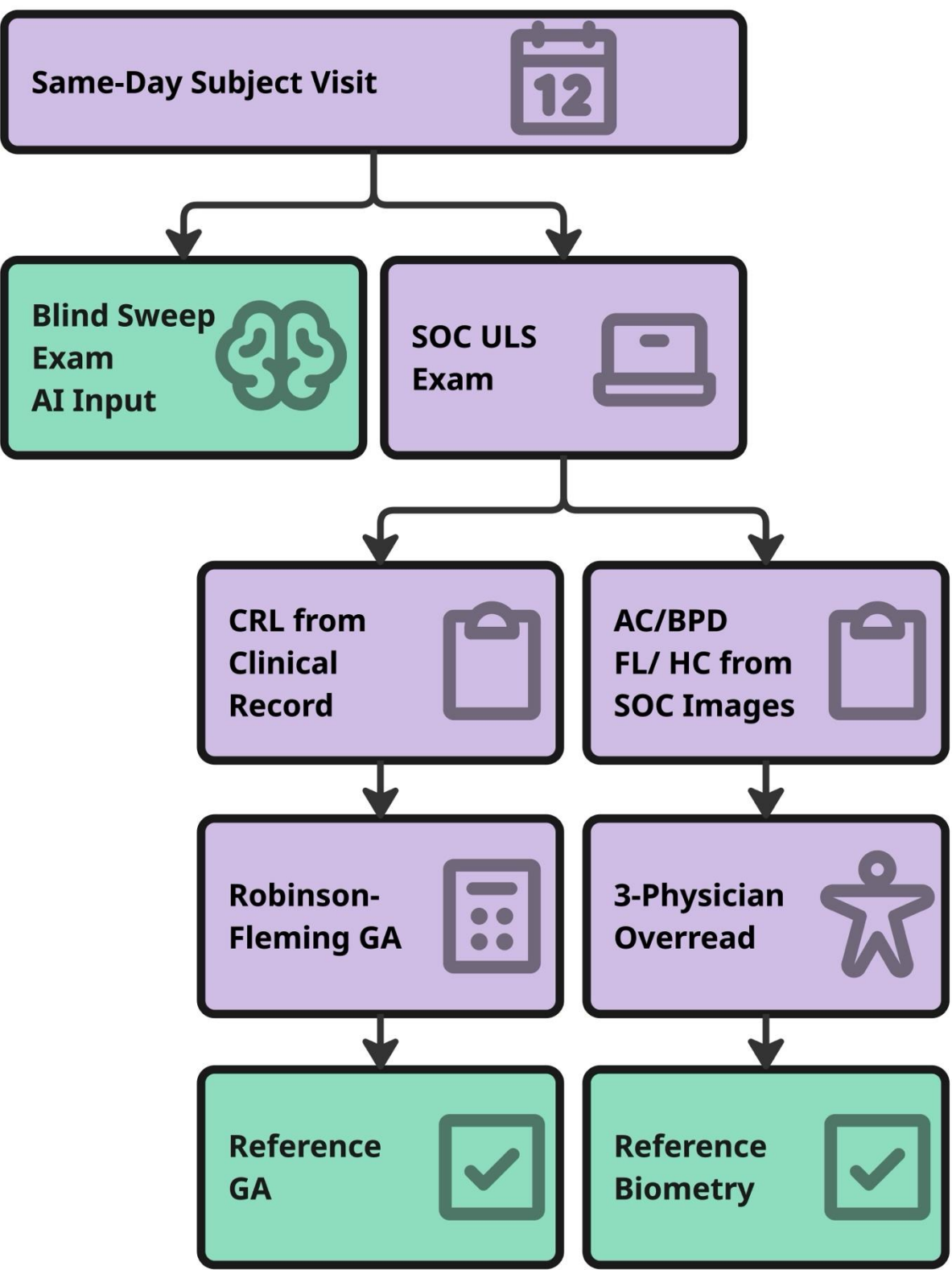


Figure: Reference standard generation. Reference GA was derived from first-trimester CRL. Reference fetal biometry was established through review by 3 physicians.

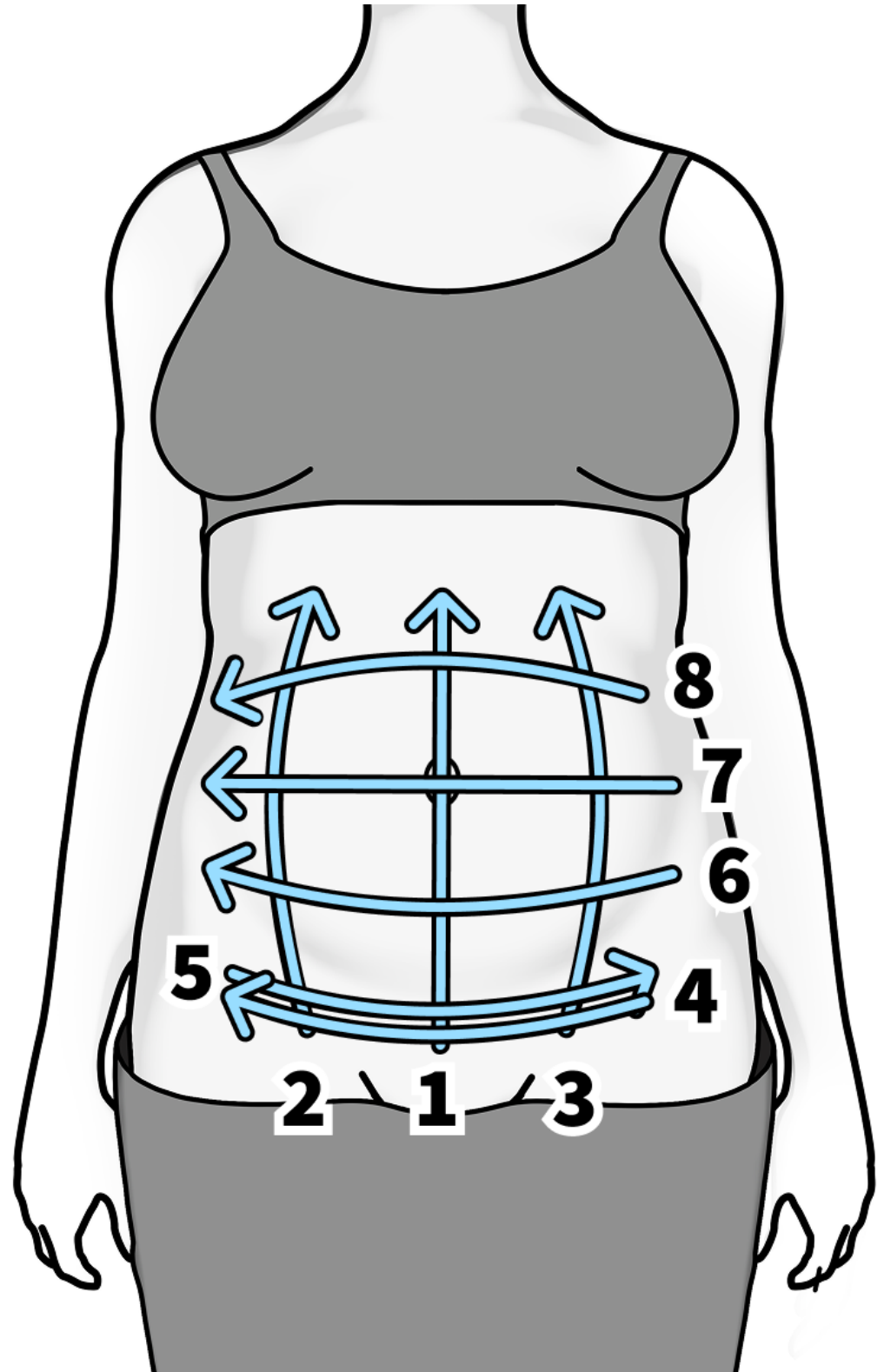


Figure: 8 sweep acquisition protocol. Eight standardized abdominal sweeps [1] acquired using the VScan Air CL probe

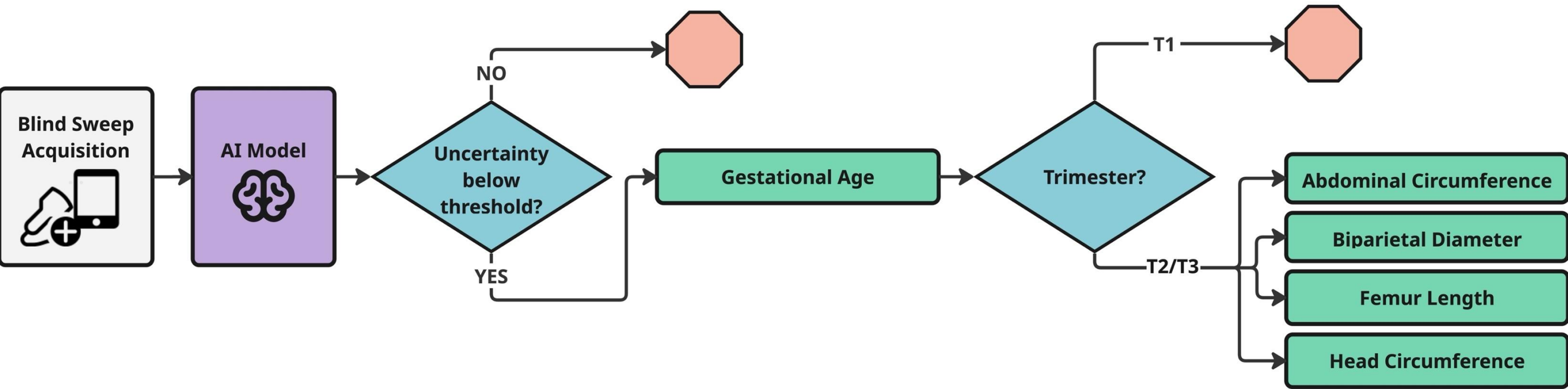
Acknowledgements & References

1. Toscano et al. *J Women's Health (Larchmt)*. 2024. Diagnosis of pregnancy complications using blind ultrasound sweeps performed by individuals without prior formal ultrasound training.
2. Fetal Age Machine Learning Initiative (FAMLI), a Gates Foundation-funded study.



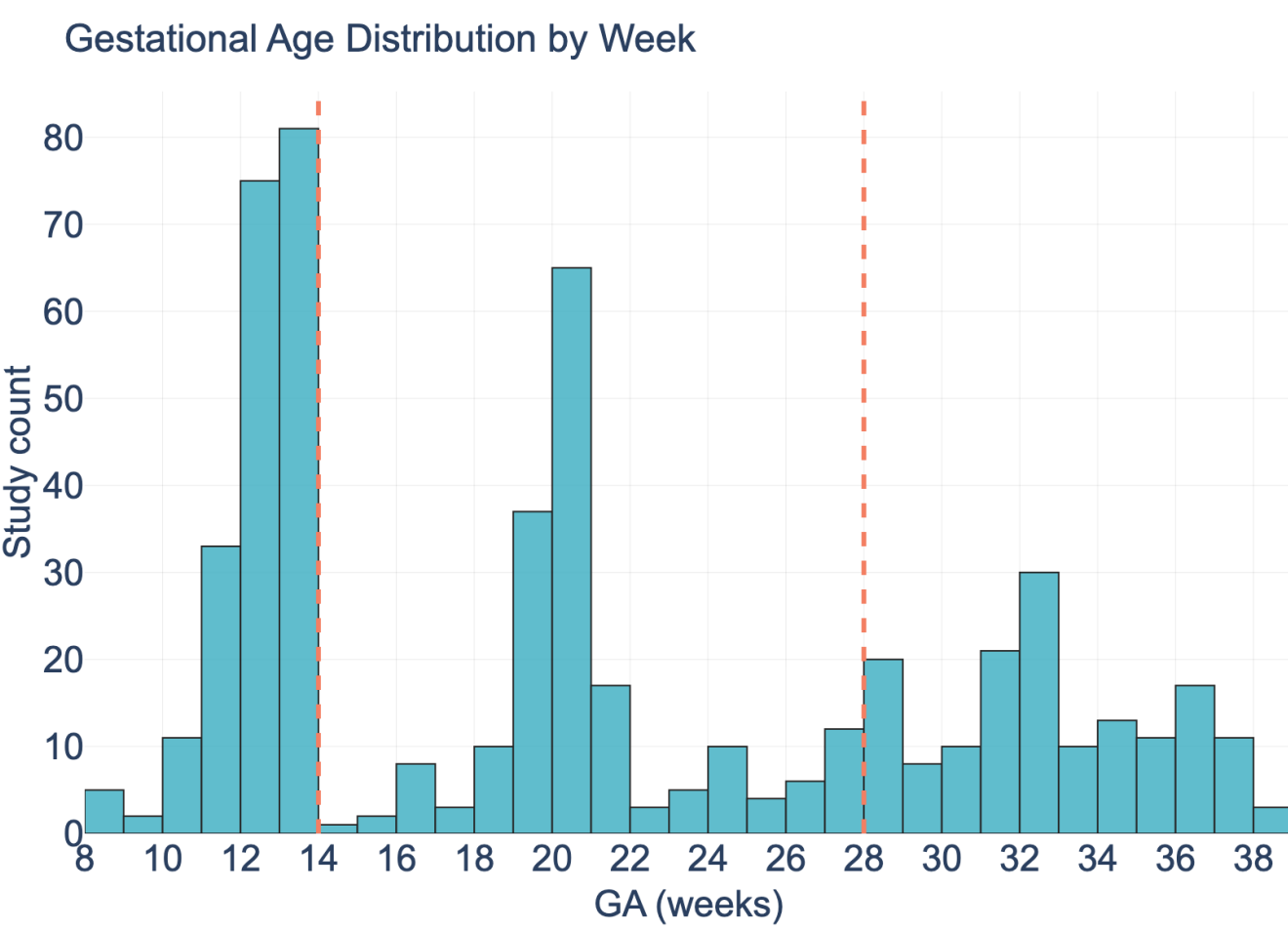
This work is funded by the
Gates Foundation

AI System & Workflow



- **Training.** AI model was trained using FAMLI [2], a large, geographically diverse blind sweep dataset collected across multiple countries, sites, and devices. The final model was fine-tuned for Vscan Air CL.
- **Inference.** Blind sweep cine loops are sampled and standardized before AI inference. Inference completes in less than 15 seconds on a Samsung Galaxy S9.
- **Uncertainty Estimation.** AI model outputs a learned standard deviation representing model uncertainty which is used to gate outputs from high-uncertainty acquisitions.

Independent Evaluation Dataset



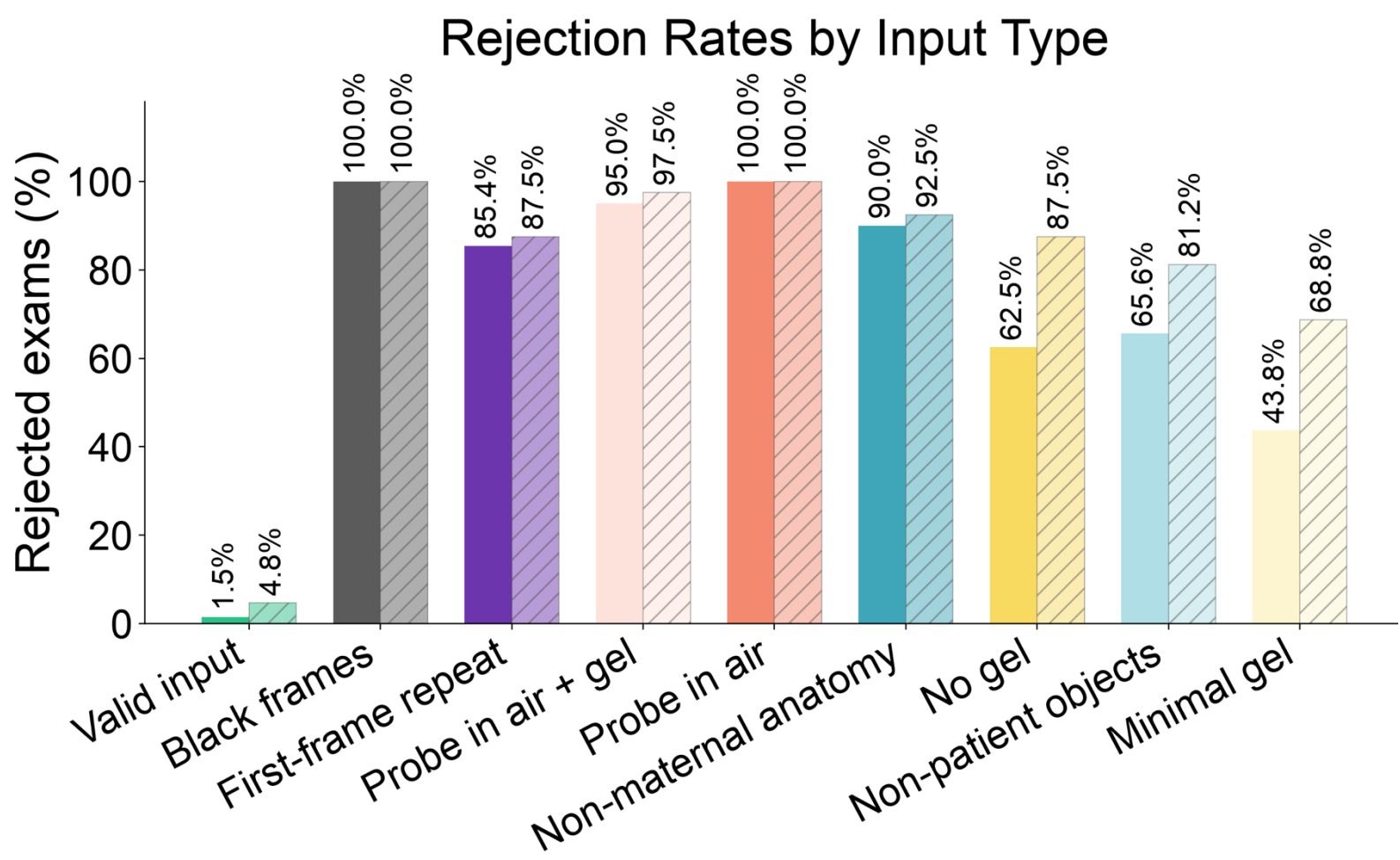
- Broad representation across trimester, maternal BMI, maternal age and acquisition site:
- ✓ N = 545 examinations
 - ✓ 7 clinical sites
 - ✓ 4 countries
 - ✓ 8 – 39 weeks gestation

Figure (left): GA distribution by week.

Uncertainty Gating of Poor-Quality Inputs

Can model uncertainty identify invalid inputs?

- Gating was evaluated on synthetic and sonographer-collected poor-quality exams.
- Invalid and off-protocol inputs produced higher uncertainty and correspondingly high rejection rates, than valid studies.



Results: Estimated Gestational Age & Fetal Biometry



Trimester	N	MAE (95% CI), days	Bias, days	LoA, days
GA T1	205	2.60 (2.25-2.98)	-0.03	-7.4 to 7.3
GA T2	183	2.96 (2.63-3.27)	-0.15	-7.5 to 7.2
GA T3	148	6.67 (5.81-7.62)	-3.12	-18.9 to 12.7



Measurement	N	Rel MAE (95% CI), %	Bias, %	LoA, %
AC	290	3.58 (3.25-3.88)	-1.73	-9.9 to 6.5
BPD	290	2.84 (2.60-3.09)	-0.84	-7.6 to 5.9
FL	290	4.30 (3.80-4.82)	0.79	-11.2 to 12.8
HC	290	2.62 (2.41-2.84)	0.07	-6.4 to 6.5

Conclusion

- Accurate GA estimation was achieved across all trimesters from blind sweeps.
- Fetal biometry measurements demonstrated low relative.
- Performance was consistent across clinical sites, maternal BMI and maternal age.
- Elevated uncertainty was observed for poor-quality inputs.
- Largest errors occurred in a small number of challenging exams, including cases with elevated BMI, prior cesarean scarring, severe growth restriction (<1%).
- AI-based blind sweep ultrasound may enable scalable fetal assessment without standard-plane acquisition.