# Evaluating an AI Tool for Fetal Heart Rate Measurement in First-Trimester Emergency Ultrasound: Interim Results

Madeleine Mason BS[1], Dr. Peter Alsharif MD[1,2], Dr. Matthew Riscinti MD[1,2]

1: University of Colorado School of Medicine, 2: Department of Emergency Medicine, Denver Health Medical Center

## Background

- First trimester pregnancy complications are frequent in the emergency department (ED), with over 1/3 of patients presenting at least once during pregnancy
- Ultrasound (US) evaluation of the first trimester fetus is a core skill for ED physicians
- Fetal bradycardia (heart rate <100 BPM), is a predictor of early pregnancy loss
- The American College of Obstetricians and Gynecologists (ACOG) recommend measurement of fetal heart rate (FHR) to identify pregnancies at high risk for early pregnancy loss
- Measuring FHR can be difficult for novice sonographers

## Objectives

- To validate the use of an Artificial Intelligence (AI) instrument to accurately measure FHR in first trimester pregnancies when compared to the gold standard of M-mode analysis

## Methods

Consent obtained from eligible patients, n=50

Image Acquisition

APP/Resident (novice) measures FHR with AI and M-mode

US expert captures M-mode tracings

Images and covariates securely stored for data analysis

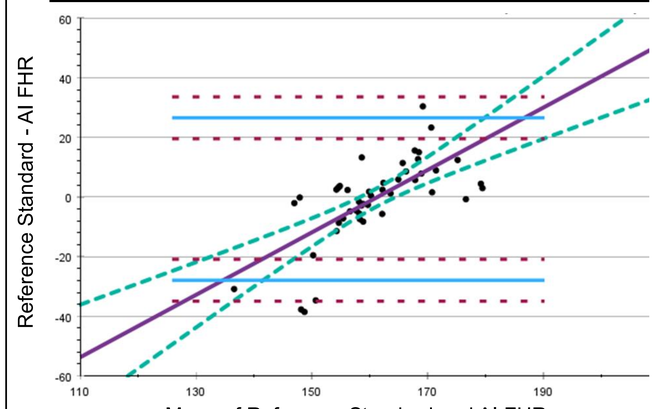
Novice AI and M-mode FHRs compared to reference standard: FHR, measured by PI from expert tracings

Bland-Altman graphs and ANOVAs were utilized to analyze agreement and statistical difference

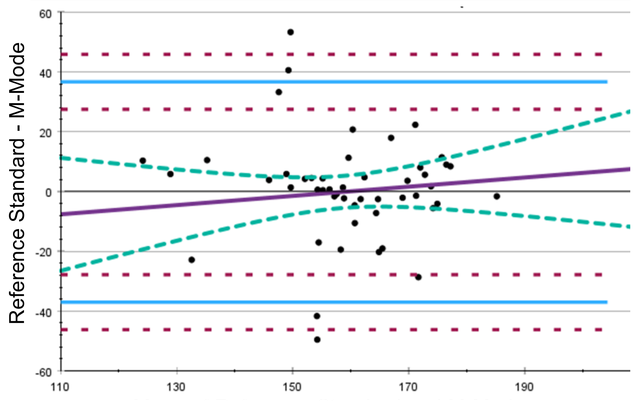
BMI and gestational age were analyzed as covariates via multinomial logistic regressions

## Results

Bland-Altman Plot of Differences: Reference Standard versus AI FHR



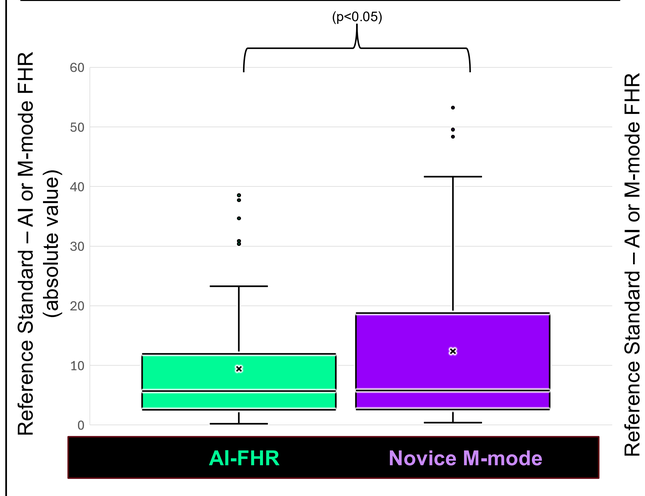

Bland-Altman Plot of Differences: Reference Standard versus Novice M-mode



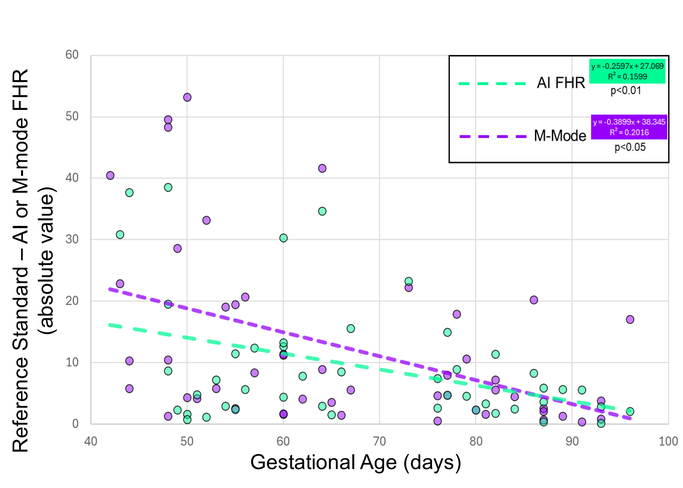

95% Agreement Limit | 95% Confidence Interval of Agreement Limit

Mean Difference Trendline | 95% Confidence Interval of Mean Difference Trend

Absolute Mean Level of Agreement Between Reference Standard and AI FHR vs. Novice M-mode




AI FHR and M-mode: Level of Agreement (Absolute Value) vs. Gestational Age




## Conclusions

- AI FHR tool has a strong agreement with expert calculated rates, suggesting good preliminary accuracy of the AI tool, but tended to slightly over-estimate low heart rates and vice versa
- Novice M-mode measurements had wider limits of agreement with the expert reference standard, indicating greater variability and technical difficulty
- Both the AI tool and M-mode measurements were more accurate with increasing gestational
- These early findings may suggest that the AI FHR tool could improve consistency and efficiency, particularly for less experienced users
- Improving FHR measurement in the emergency setting may facilitate earlier recognition of high-risk pregnancies, helping to optimize emergency care for patients presenting with first trimester complications

## Future Directions

- Data collection and analysis are on going to confirm these preliminary trends and further evaluate performance
- Future studies should evaluate the clinical workflow impact and potential time savings of AI integration in Emergency Ultrasound

## Acknowledgements & Disclosures

Thank you to Peter Alsharif MD and Matthew Riscinti MD for the opportunity to be part of this project and immersed in emergency ultrasound research

## References

1. Beals T, Naraghi L, Grossestreuer A, Schafer J, Balk D, Hoffmann B. Point of care ultrasound is associated with decreased ED length of stay for symptomatic early pregnancy. Am J Emerg Med. 2019;37(6):1165-8.
2. Doubilet PM , Benson CB , Chow JS . Long-term prognosis of pregnancies complicated by slow embryonic heart rates in the early first trimester . J Ultrasound Med 1999 ; 18 : 537 – 41 . (Level II-3)
3. Guidelines for diagnostic imaging during pregnancy and lactation. Committee Opinion No. 723. American College of Obstetricians and Gynecologists.
4. Malik, S., Kothari, C., MacCallum, C., Liepman, M., Tareen, S., & Rhodes, K. V. (2017).Emergency department use in the perinatal period: An opportunity for early intervention. Annals of Emergency Medicine, 70(6), 835–839. https://doi.org/10.1016/j.annemergmed.2017.06.020
5. Matenchuk, B. A., Rosychuk, R. J., Rowe, B. H., Metcalfe, A., Chari, R., Crawford, S., Jelinski, S., Serrano-Lomelin, J., & Ospina, M. B. (2023). Emergency department visits during pregnancy. Annals of Emergency Medicine, 70(6), 835–839. https://doi.org/10.1016/j.annemergmed.2017.06.020
6. Prager S, Dalton V, Allen RH, Early pregnancy loss. ACOG Practice Bulletin No. 200. American College of Obstetricians and Gynecologists. Obstet Gynecol 2018;132:e197–207.
7. Saul T, Lewiss RE, Rivera Mdel R. Accuracy of emergency physician performed bedside ultrasound in determining gestational age in first trimester pregnancy. Crit Ultrasound J. 2012;4(1):22.
8. Ultrasound Guidelines: Emergency, Point-of-Care and Clinical Ultrasound Guidelines in Medicine. *Ann Emerg Med*. 2017;69(5):e27-e54. doi:10.1016/j.annemergmed.2016.08.457