Incorporating AI-Enabled Obstetric Ultrasound into HIV Prevention Research

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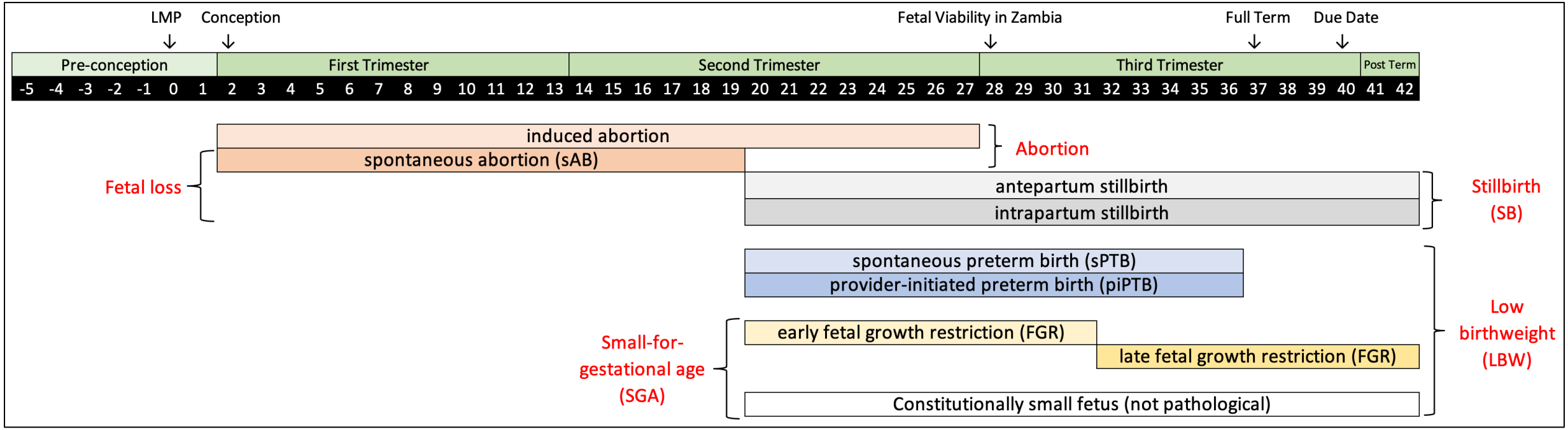
HPTN Annual Meeting

Disclosures

- No conflicts to disclose

Birth Outcomes and their Relationship to Gestational Age (GA)



Preterm Birth in ZAPPS Cohort, Lusaka (LMP vs. Ultrasound)

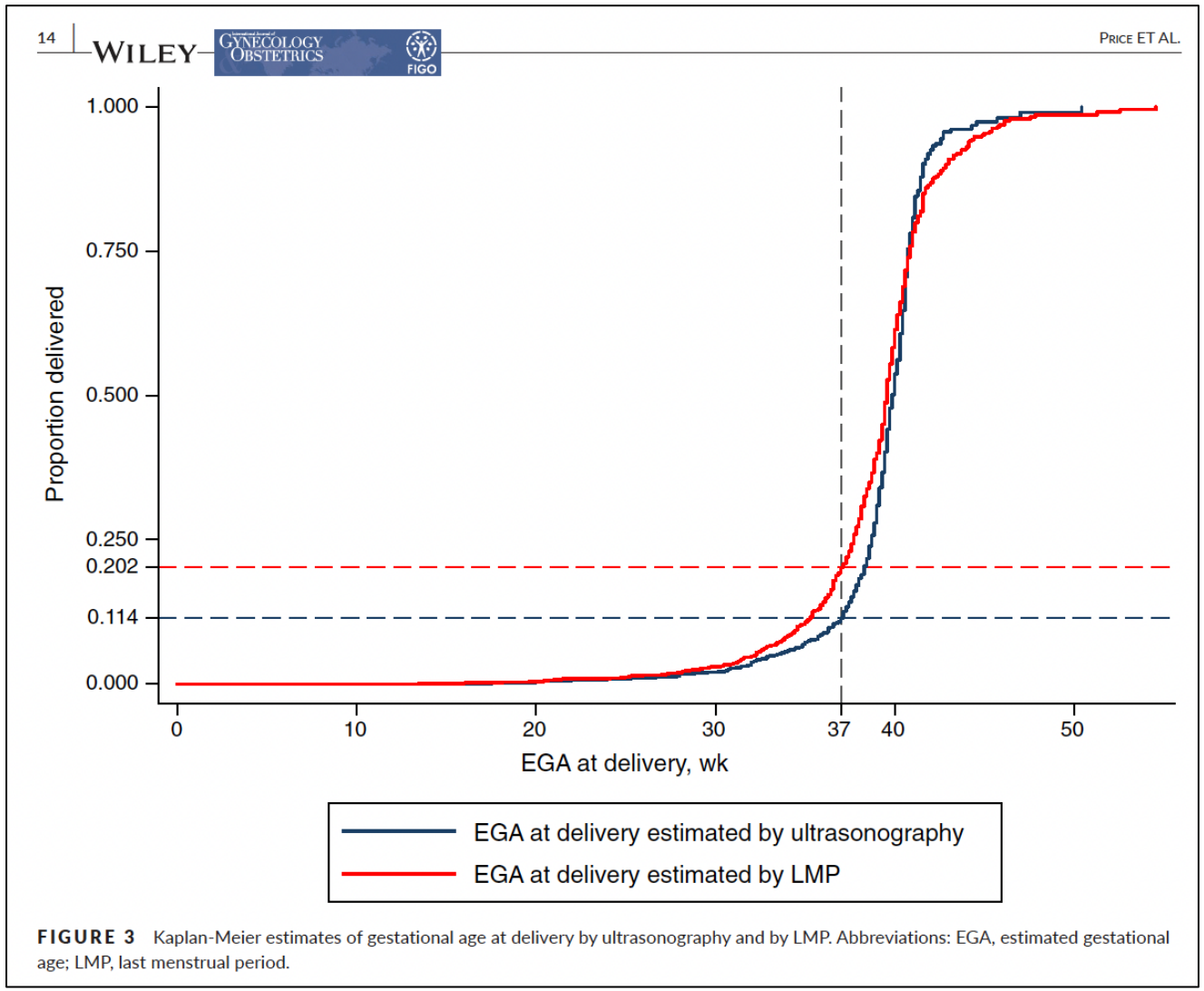
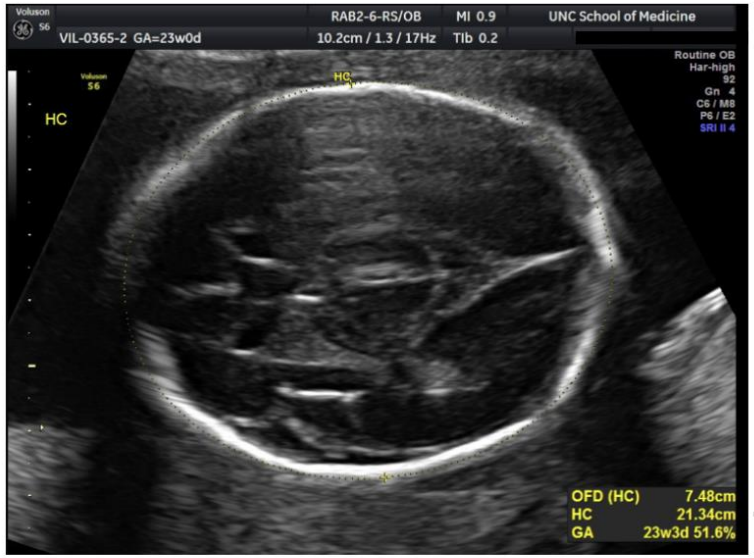


FIGURE 3 Kaplan-Meier estimates of gestational age at delivery by ultrasonography and by LMP. Abbreviations: EGA, estimated gestational age; LMP, last menstrual period.

Price et al. Int J Gynecol Obstet 2019; 144: 9–15

How We Measure GA (traditionally)



$$\log_e(GA) = 0.03243 * (\log_e(HC))^2 + 0.001644 * FL * \log_e(HC) + 3.813$$

Intergrowth 21st (2016)

Not enough ultrasounds

Not enough sonographers

Solution to “not enough ultrasounds”

Philips
Lumify
$7000

Echonous Kosmos
$7000

Butterfly IQ+
cMUT
$2200

Clarius
$5000

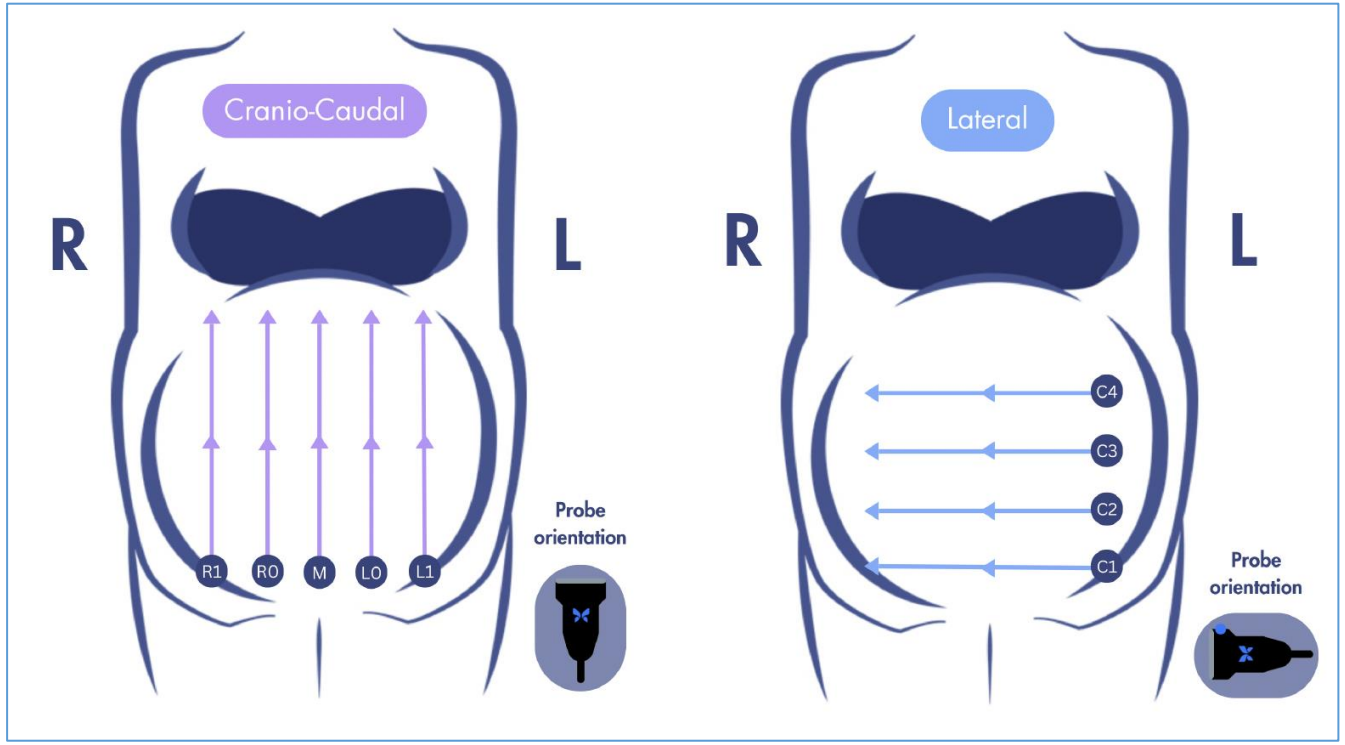
GE Vscan Air
$4500

Konted (China)
<$1000

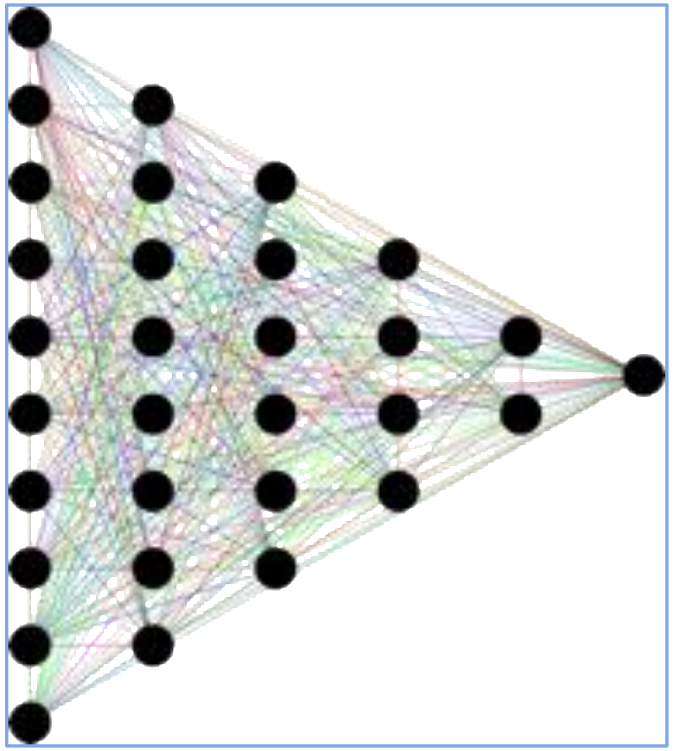
EXO
pMUT
$3500

Solutions to “Not Enough Sonographers”

Blind Sweeps



Deep Learning (AI)



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ORIGINAL ARTICLE

AI Estimation of Gestational Age from Blind Ultrasound Sweeps in Low-Resource Settings

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Abstract

BACKGROUND Ultrasound is indispensable to gestational age estimation and thus to quality obstetrical care, yet high equipment cost and the need for trained sonographers limit its use in low-resource settings.

METHODS From September 2018 through June 2021, we recruited 4695 pregnant volunteers in North Carolina and Zambia and obtained blind ultrasound sweeps (cineloop videos) of the gravid abdomen alongside standard fetal biometry. We trained a neural network to estimate gestational age from the sweeps and, in three test data sets, assessed the performance of the artificial intelligence (AI) model and biometry against previously established gestational age.

RESULTS In our main test set, the mean absolute error (MAE) (±SE) was 3.9±0.12 days for the model versus 4.7±0.15 days for biometry (difference, −0.8 days; 95% confidence interval [CI], −1.1 to −0.5; P<0.001). The results were similar in North Carolina (difference, −0.6 days; 95% CI, −0.9 to −0.2) and Zambia (−1.0 days; 95% CI, −1.5 to −0.5). Findings were supported in the test set of women who conceived by in vitro fertilization (MAE of 2.8±0.28 vs. 3.6±0.53 days for the model vs. biometry; difference, −0.8 days; 95% CI, −1.7 to 0.2) and in the set of women from whom sweeps were collected by untrained users with low-cost, battery-powered devices (MAE of 4.9±0.29 vs. 5.4±0.28 days for the model vs. biometry; difference, −0.6; 95% CI, −1.3 to 0.1).

CONCLUSIONS When provided blindly obtained ultrasound sweeps of the gravid abdomen, our AI model estimated gestational age with accuracy similar to that of trained sonographers conducting standard fetal biometry. Model performance appears to extend to blind sweeps collected by untrained providers in Zambia using low-cost devices. (Funded by the Bill and Melinda Gates Foundation.)

Drs. Pokaprakarn and Prieto contributed equally to this work. The author affiliations are listed at the end of the article.

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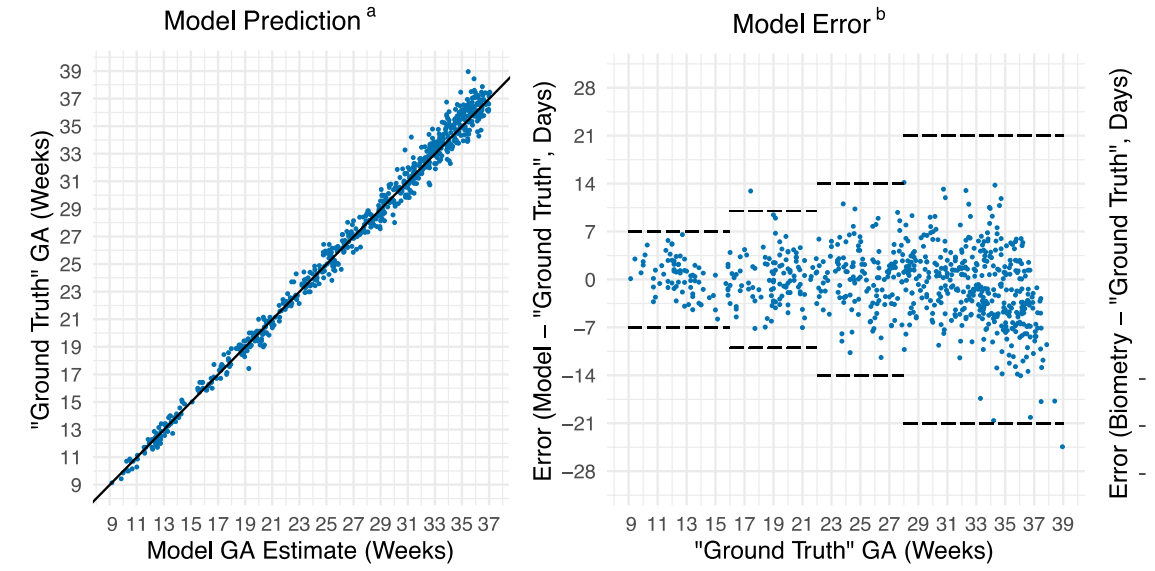
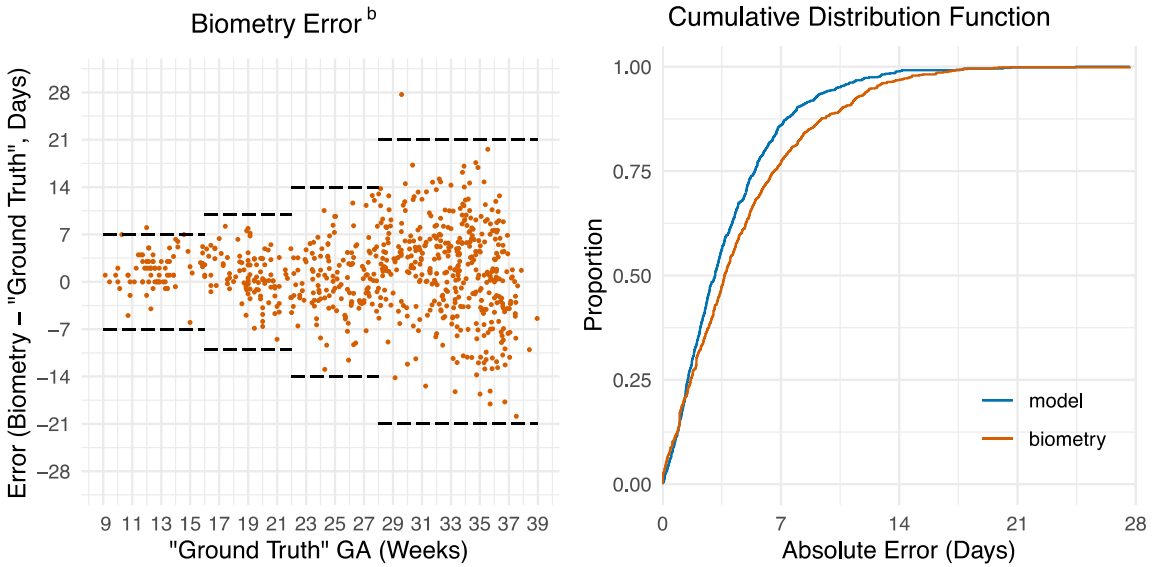
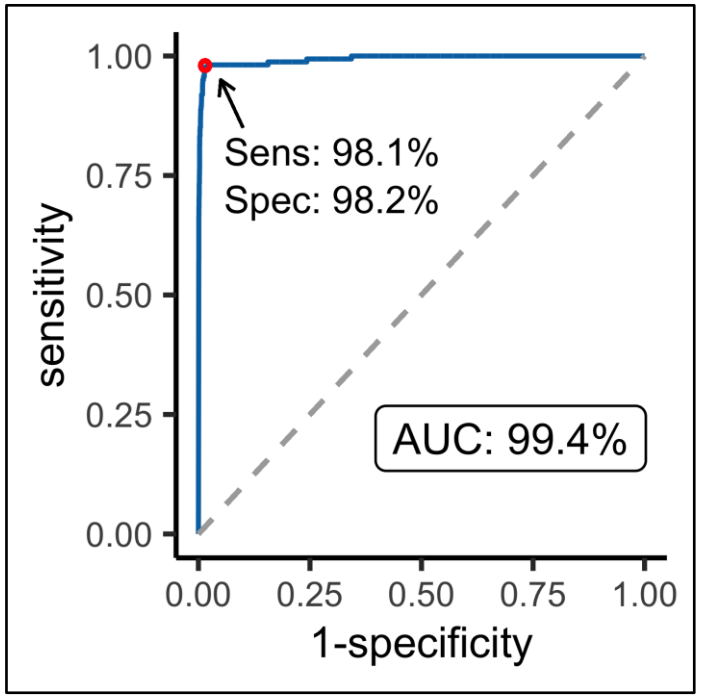


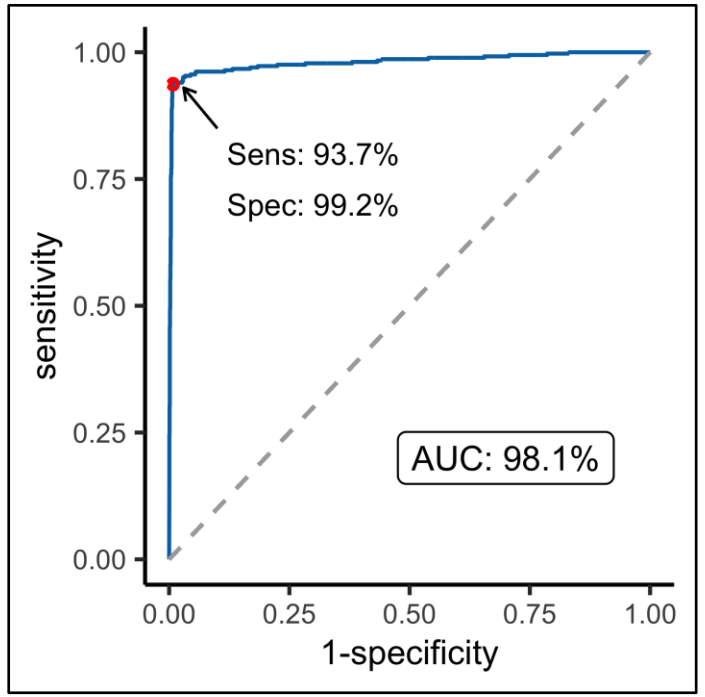


Other Diagnoses

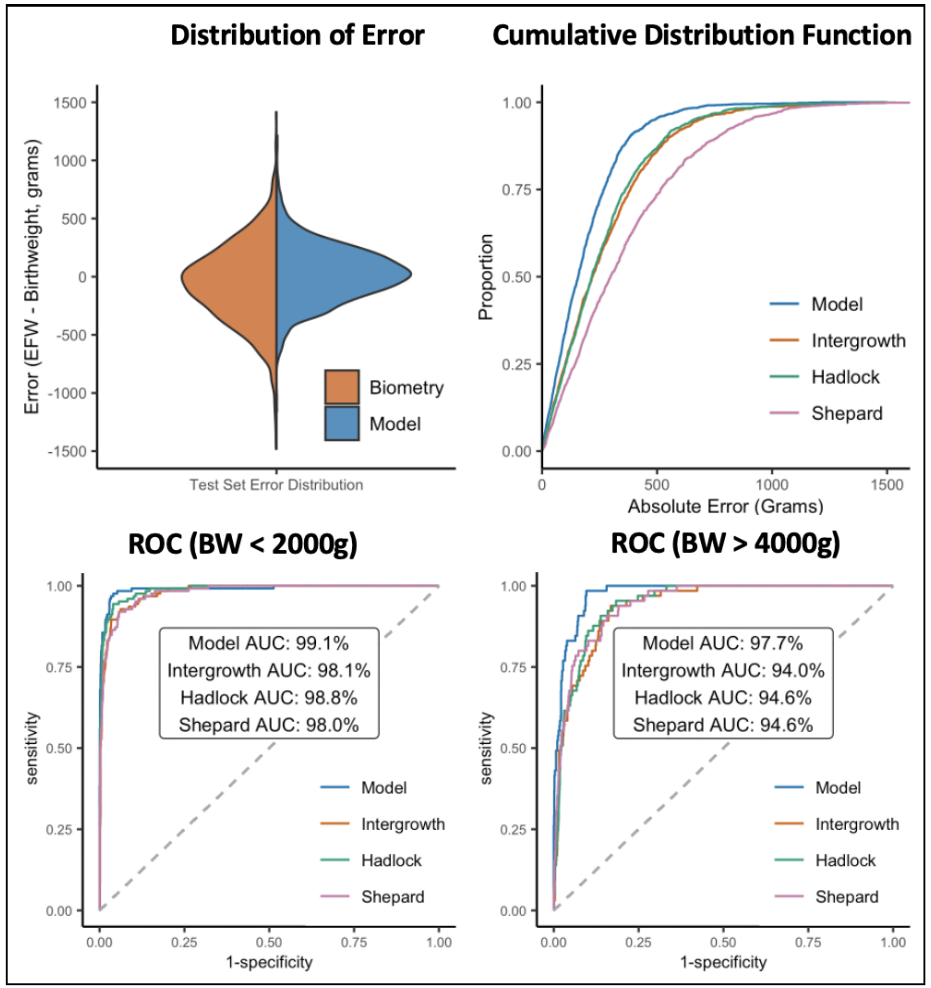
Twins



Malpresentation



Fetal Weight




Forgot your password?
Forgot your username?
Log In
Don't have an account? Sign Up
tab
delete
caps lock
done
shift
shift
.?123
.?123

Key Takeaways

1. Accurate assessment of gestational age (GA) is required for birth outcomes research
2. Low-cost ultrasound probes + AI allow accurate GA measurement anywhere
3. Almost any site can now incorporate ultrasound into its research with pregnant people

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- *Butterfly* and *Philips* have donated ultrasound probes

END

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HPTN
HIV Prevention Trials Network