

BACKGROUND

- Improved selective screening performance of fetal growth ultrasound to detect the Small-for-Gestational-Age (SGA) fetus create affords opportunity to lower antepartum stillbirth for nonanomalous pregnancy.
- A sonographic strategy to improve selective screening performance of fetal growth ultrasound may be to *relax the biometric threshold* used to antenatally categorise SGA.
- It is plausible that higher thresholds for EFW are associated with adversity but evidence from a large multicentre selective screening program is lacking.

AIM

- To determine the selective screening performance of adjusted biometric criteria for antenatally suspected SGA with and without abnormal umbilical doppler indices to predict current definitions for SGA at birth and SGA at the next scan.

METHODS

- A prospective observational study of complete ultrasound data obtained during the DESiGN trial which recruited women from 13 maternity units across England to evaluate the impact of the Growth Assessment Protocol on antenatal detection of SGA (Vieira MC et al. PLoS Med Jun 2022 19(6):e1004004).
- Exposures included percentiles between the 10<sup>th</sup> and 30<sup>th</sup> for EFW (Hadlock) at 5% increments at the last scan with and without abnormal umbilical doppler indices as defined by any of: UA PI > 95%, IAEDF, AEDF, REDE.
- The outcome reported was birthweight < 10<sup>th</sup> percentile by UK population standards (Cole TJ et al. Stat Med 1998; 17(4):407–29).
- Test performance characteristics with 95% confidence intervals were reported by different gestational age of scan categories and scan to birth intervals within and beyond 4 weeks.
- Repeat analysis was performed on all scans beyond 24 weeks that were not the last scan to inform the value of the same exposures to predict EFW < 10<sup>th</sup> (Hadlock) at the next scan.

RESULTS

- Complete data analysis was performed on 94, 925 women from the DESiGN trial who had at least 1 growth scan after 24 weeks
- Higher thresholds for EFW demonstrated superior sensitivity and negative predictive value but inferior specificity and positive predictive value to predict SGA at birth particularly when the scan was performed after 34 weeks gestation.
- Umbilical doppler indices alone and with adjusted EFW captured fewer cases but sharpened the precision of a positive test.
- For all combination of exposures, the same trends were observed but performance was superior overall when used to predict SGA at the next scan. Neither exposure at either scan performed well beyond 4 weeks.

Table 1:The performance of EFW 10-30 at the last scan between 34 and 37+6 to predict SGA at birth within 4 weeks

| EFW | Sensitivity      |       |       | Specificity      |       |       | PPV              |       |       | NPV              |       |       |
|-----|------------------|-------|-------|------------------|-------|-------|------------------|-------|-------|------------------|-------|-------|
|     | (Mean and 95%CI) |       |       | (Mean and 95%CI) |       |       | (Mean and 95%CI) |       |       | (Mean and 95%CI) |       |       |
| 10  | 32.64            | 32.25 | 33.03 | 98.61            | 98.26 | 98.96 | 63.63            | 63.24 | 64.02 | 95.17            | 94.99 | 95.35 |
| 15  | 44.49            | 44.08 | 44.90 | 96.61            | 96.06 | 97.16 | 49.39            | 48.98 | 49.80 | 95.9             | 95.74 | 96.06 |
| 20  | 56.48            | 56.07 | 56.89 | 93.55            | 92.81 | 94.29 | 39.41            | 39.00 | 39.82 | 96.66            | 96.50 | 96.82 |
| 25  | 66.36            | 65.97 | 66.75 | 89.35            | 88.41 | 90.29 | 31.65            | 31.26 | 32.04 | 97.28            | 97.14 | 97.42 |
| 30  | 73.74            | 73.39 | 74.09 | 84.56            | 83.46 | 85.66 | 26.2             | 25.81 | 26.59 | 97.74            | 97.60 | 97.88 |

Table 2: The performance of EFW 10-30 between 34 and 37+6 to predict SGA at the next scan within 4 weeks

| EFW | Sensitivity      |       |       | Specificity      |       |       | PPV              |       |       | NPV              |       |       |
|-----|------------------|-------|-------|------------------|-------|-------|------------------|-------|-------|------------------|-------|-------|
|     | (Mean and 95%CI) |       |       | (Mean and 95%CI) |       |       | (Mean and 95%CI) |       |       | (Mean and 95%CI) |       |       |
| 10  | 56.93            | 56.13 | 57.73 | 96.55            | 95.65 | 97.45 | 64.02            | 63.26 | 64.78 | 95.41            | 95.01 | 95.74 |
| 15  | 75.44            | 74.75 | 76.13 | 91.4             | 90.03 | 92.77 | 48.62            | 47.80 | 49.44 | 97.18            | 96.91 | 97.45 |
| 20  | 85.45            | 84.88 | 86.02 | 85.91            | 84.20 | 87.62 | 39.54            | 38.70 | 40.38 | 98.21            | 97.97 | 98.45 |
| 25  | 91.18            | 90.73 | 91.63 | 80.34            | 78.38 | 82.30 | 33.34            | 32.50 | 34.18 | 98.83            | 98.63 | 99.03 |
| 30  | 94.65            | 94.28 | 95.02 | 74.52            | 72.38 | 76.66 | 28.61            | 27.77 | 29.45 | 99.23            | 99.07 | 99.39 |

Table 3: The performance of EFW 10-30 and umbilical doppler at the last scan between 34 and 37+6 to predict SGA at birth within 4 weeks

| EFW | Sensitivity      |       |       | Specificity      |       |       | PPV              |       |       | NPV              |       |       |
|-----|------------------|-------|-------|------------------|-------|-------|------------------|-------|-------|------------------|-------|-------|
|     | (Mean and 95%CI) |       |       | (Mean and 95%CI) |       |       | (Mean and 95%CI) |       |       | (Mean and 95%CI) |       |       |
| 10  | 13.18            | 12.91 | 13.45 | 99.64            | 99.46 | 99.82 | 72.93            | 72.58 | 73.28 | 93.92            | 93.72 | 94.12 |
| 15  | 15.79            | 15.50 | 16.08 | 99.27            | 99.02 | 99.52 | 61.57            | 61.18 | 61.96 | 94.07            | 93.87 | 94.27 |
| 20  | 18.68            | 18.37 | 18.99 | 98.77            | 98.44 | 99.10 | 52.96            | 52.57 | 53.35 | 94.23            | 94.03 | 94.43 |
| 25  | 20.66            | 20.33 | 20.99 | 98.05            | 97.64 | 98.46 | 44.1             | 43.71 | 44.49 | 94.33            | 94.13 | 94.53 |
| 30  | 22.17            | 21.84 | 22.50 | 97.25            | 96.76 | 97.74 | 37.51            | 37.12 | 37.90 | 94.39            | 94.19 | 94.59 |

DISCUSSION AND FUTURE WORK

- Higher thresholds can more effectively rule out disease and unmask a subgroup who can then be exposed to a subsequent test
- Adjusted criteria for SGA may be of greater value to the accuracy of antenatal suspicion rather than the accuracy of birthweight estimation
- Debate around what is an acceptable false positive rate at different gestational age windows is important before implementation of a dynamic biometric threshold for SGA.
- There is scope to develop a predictive model for a selective cohort that allows interplay between biometry and doppler with time

Figure 1: Population Flow Diagram

