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Predicting birth weight at booking

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Model for birth weight shows promise in prediction of infants who are small or large for gestational age

Imagine being able to predict an infant's birth weight for a given gestation before the first ultrasound appointment. It sounds implausible, but Allotey and colleagues have published a model for predicting birth weight at any gestation based solely on clinical characteristics and demographic data that would normally be collected at the first antenatal or booking appointment.[1] Their model is the result of a meta-analysis of individual patients incorporating data from over 230 000 pregnancies across four countries (Australia, Norway, UK, and USA) with a relatively ethnically diverse population (17% Hispanic, 22% black, and 50% white). This meta-analysis was systematically and robustly undertaken with internal and external cross validation and transparent reporting. The model has the potential to identify women who are at risk of abnormal fetal growth that may lead to infants being born either small or large for gestational age. The model was deemed to have good calibration (calibration slope 0.99 (95% confidence interval (CI) 0.88 to 1.10); calibration-in-the-large 44.5 g (−18.4 to 107.3)) with an observed versus expected average birth weight ratio of 1.02 (95% CI 0.97 to 1.07). Traditionally, small for gestational age is defined as being born with a birth weight less than the 10th centile relative to the reference population and large for gestational age with a birth weight over the 90th centile.[2] Observational and epidemiological evidence has shown that infants who are small or large for gestational age, but in particular small for gestational age, are at increased risk of perinatal morbidity and mortality;[3 4] however, identification of these infants early in utero remains challenging. The clinical usefulness of Allotey's model is therefore impressive in terms of its ability to identify which women are at risk of abnormal fetal growth from the end of the first trimester.

Reducing perinatal morbidity and mortality

Early identification of pregnant women at risk allows obstetricians to implement monitoring strategies and helps to inform decisions around timing and place of delivery. For pregnant women with infants at risk of severe growth restriction, tertiary or higher level of care might be needed from the second trimester onwards.[5] The ability to identify infants at risk of growth restriction from the first antenatal appointment is important because this condition may only be identified as a result of stillbirth or after delivery, which misses the crucial window for surveillance and earlier delivery.

Although abnormal fetal growth has no treatment, timing of delivery has been shown to have the biggest affect on perinatal outcomes[6]; one study, which included over 800 000 women with singleton pregnancies in Australia, showed that the optimal time for delivery for infants with a birth weight of less than a third centile is at 37 weeks to 37 weeks plus six days gestation, and for those with a predicted birth weight between the third and 10th centile and >90th centile, optimal delivery is at 38 weeks to 38 weeks plus six days.

Generally, estimations of birth weight are on the basis of ultrasound scan biometry data.[7 8] Obstetric ultrasound is user dependent, with access limited or non-existent in resource poor settings. Even in countries with established antenatal screening programmes, guidance does not routinely recommend further scans beyond 20 weeks gestation for women who are at otherwise low risk.[9] Hence, Allotey and colleagues' model has the potential to identify infants with growth restriction who might have otherwise been missed with routine care.

The ability to predict birth weight from 11 or 12 weeks gestation does, however, raise the possibility of increasing both maternal and paternal anxiety without any apparent treatment beyond increased monitoring and earlier delivery. Anxiety of course, may worsen conditions such as hypertension, which can contribute to further restrict growth in pregnancy.[10] Furthermore, additional scans have not been shown to reduce maternal anxiety.[11] Therefore, if this prediction model is rolled out into clinical practice, sufficient thought must be put into how birth weight predictions are communicated to women and their families.

One of the real strengths of Allotey and colleagues' work is the very large population studied (over 230 000 women) from four different countries. The sample is ethnically diverse, however, all four countries are relatively similar in terms of their resources, demographics, populations, and healthcare provision. As such, this model will need testing in different populations and settings prior to wide scale use. Another strength is the inclusion of clinical predictors, which were identified through a Delphi process, and then incorporated into the model.

The true clinical value of any prediction tool relies on the predictions from the model to distinguish between those with and without the outcome of interest, in this case adverse perinatal outcomes arising from fetal growth restriction. The cohorts included in the model were mostly comprised of healthy women who were at low risk. Low rates of adverse predictive factors and perinatal mortality and morbidity were reported. External validation in a

cohort at high risk would increase the clinical usefulness of this model.

Further assessment in large, cluster randomised controlled trials will also be needed to show improved perinatal outcomes if this model is to be rolled out more widely. Any such trial will need to be relatively large because of the infrequency of the studied outcomes (eg, stillbirth and neonatal morbidity and mortality). In terms of widespread application to clinical practice, healthcare professionals might be able to use the continuous output of birth weight from the model in conjunction with the current recommended growth chart in their unit (eg, GROW, Intergrowth, World Health Organization, etc), to increase tailoring to their population.

In the UK, several maternity enquiries (eg, Morecambe Bay and East Kent)[12 13] have highlighted the danger in not reclassifying risk when complications in pregnancy arise and the clinical situation changes. A potential danger with a predictive model that classifies women so early in their pregnancy is the risk of no escalation if their clinical condition changes. Therefore, staff would need to be educated to use this model and the need to continually reassess the status of mother and baby at every appointment would need to be emphasised.

Allotey and colleagues' birth weight prediction model has the promise to have clinical usefulness at a population level and with careful further evaluation, implementation, and assessment, the potential to improve perinatal outcomes. The model could be another tool for obstetricians to use alongside existing screening and surveillance strategies to identify women at risk of abnormal growth and mitigate their risks.

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