Machine learning methods to predict foetal growth restriction and small for gestational age: a systematic and critical review

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DOI: 10.36129/jog.2024.S117

Objective. This systematic review aims to evaluate the methodological rigor and adherence to standardized definitions and methodological guidelines in studies employing machine learning (ML) algorithms for predicting foetal growth restriction (FGR) or small for gestational age (SGA).

Methods. A systematic search was conducted in MEDLINE and Scopus following PRISMA 2020 guidelines. Studies were included if they reported ML prediction algorithms for FGR/SGA with performance metrics such as Area Under the Receiver Operating Curve (AUROC) or accuracy. Adherence to TRIPOD+AI statement was assessed for each study using a 4-point Likert scale, and sample size adequacy was evaluated using recent published guidelines.

Results. Out of 272 identified records, 31 studies were included. A significant variation in outcome definitions was observed, with only one third of studies adhering to the Delphi consensus on FGR. Sample size requirements were met in less than a quarter of studies, revealing systematic under-power. Adherence to TRIPOD+AI guidelines varied, with consistent shortcomings in addressing model fairness, heterogeneity and calibration, raising concerns about the generalizability of the findings.

Conclusions. The review highlights the need for standardized outcome definitions and improved methodological rigor in ML studies on FGR. Addressing these issues is essential for enhancing the reliability, generalizability, and clinical applicability of predictive models in prenatal and postnatal care.