Fetal strain and strain rate measured with 2D-speckle tracking echocardiography in maternal diabetes: a systematic review
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Objective
Systematic review on fetal cardiac function, assessed with two-dimensional speckle tracking echocardiography (2D-STE) in fetuses of women with maternal diabetes in comparison to those of women without maternal diabetes.

Methods
Embase, MEDLINE and CENTRAL were searched for observational studies on 2D-STE fetal left ventricular (LV) and right ventricular (RV) global longitudinal strain (GLS) and strain rate (GLSR) that included singleton, non-anomalous pregnancies complicated by pregestational diabetes mellitus (PDM) or gestational diabetes mellitus (GDM) compared to uncomplicated pregnancies.

Results
Thirteen studies met the criteria. A cross-sectional study design was used in all but one study where a longitudinal study design was applied. The gestational age (GA) of the fetuses, type of diabetes, ultrasound machine and 2D-STE software varied between the studies. Glycemic control and type of treatment were often not reported. In fetuses of women with PDM compared to those of women without maternal diabetes, LV-GLS values were significantly increased (1 study). In fetuses of women with GDM compared to those of women without maternal diabetes, LV-GLS values were significantly increased (4 studies) or not significantly different (3 studies) and LV-GLSR values were significantly increased (2 studies). RV-GLS values were significantly increased (five studies). In fetuses of women with maternal diabetes (without subgroups for PDM and GDM) compared to fetuses of women without maternal diabetes, LV-GLS values were significantly increased (1 study), significantly decreased (1 study) or not significantly different (3 studies) and LV-GLSR values were significantly increased (1 study), significantly decreased (1 study) or not significantly different (2 studies). RV-GLS values were significantly increased (1 study), significantly decreased (1 study) or not significantly different (1 study).

Conclusion
There is a trend of increased strain values, indicating systolic dysfunction, visible in fetuses of diabetic mothers. This effect is more visible in the RV than the LV. Contradictory results are probably due to suboptimal study designs and variation in GA, diabetes severity, image acquisition and software. Large prospective longitudinal studies are needed to assess fetal myocardial function with 2D-STE in PDM type 1 and 2 and GDM pregnancies. Influence of glycemic control and treatment should ideally be evaluated. Standardization of image acquisition and software is needed for fetal 2D-STE.