

Exploration of Non-Linear Hazard Risk Associations of Major Predictors of Adverse Pregnancy Outcomes



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Background

- Stillbirth remains common even in high income countries.
- Risk prediction models that incorporate ultrasound and pregnancy data could allow for more earlier intervention.
- One problem is the non-linear relationship of some major continuous variables to the risk of adverse pregnancy outcomes.
- This study aimed to explore non-linearity via spline and polynomial modelling.

Methods

- 25220 pregnancies from 2016 – 2023 from the Oxford NHS Trust that included complete data and had an adverse outcome (defined as iatrogenic preterm birth <33 weeks or still birth) to fit the data to restricted cubic splines and polynomial models (cubic, sinusoidal, and quadratic) combined with Cox models to determine trends in non-linear relationships. Best model fit was identified via lowest AIC score

Results

- After Lasso regularization, six continuous variables demonstrated non-linear contributions to risk.
- The RCS visualization determined that the upper and lower extreme bounds of major continuous variables such as uterine pulsatility index and estimated fetal weight contributed disproportionately
- The polynomial modelling determined that cubic polynomial modelling was the best fit based on the lowest AIC values for all six variables.

Conclusion

Overall, major clinical variables such as estimated fetal weight and uterine artery pulsatility index demonstrated non-linear risk contributions of adverse pregnancy outcomes,

It is important for future models to account for that non-linearity rather than use a linear assumption when accounting for time-to-event data.

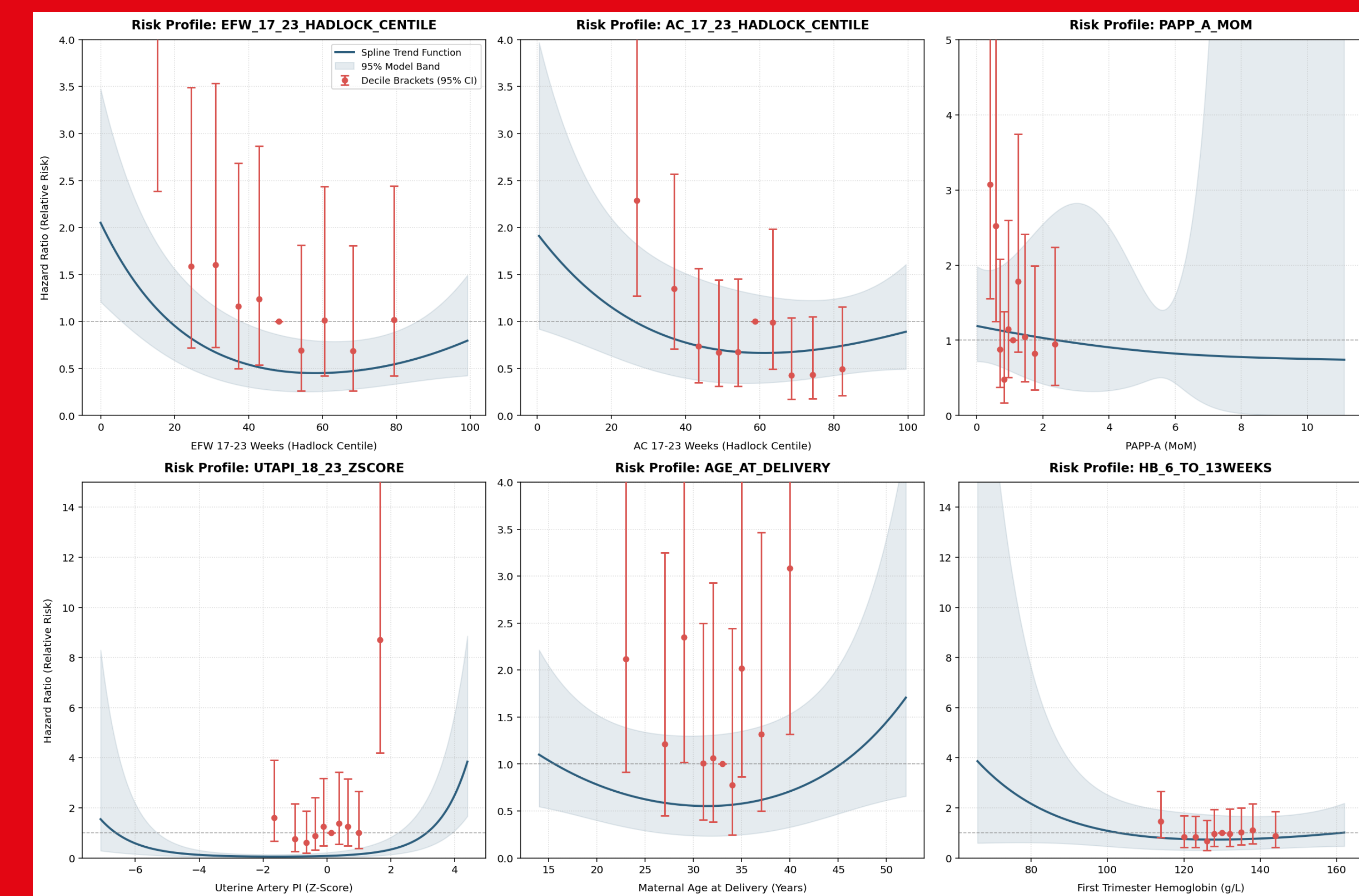


Figure 1. Restricted Cubic Spline Modelling of Contribution to Risk of Adverse Pregnancy Outcomes

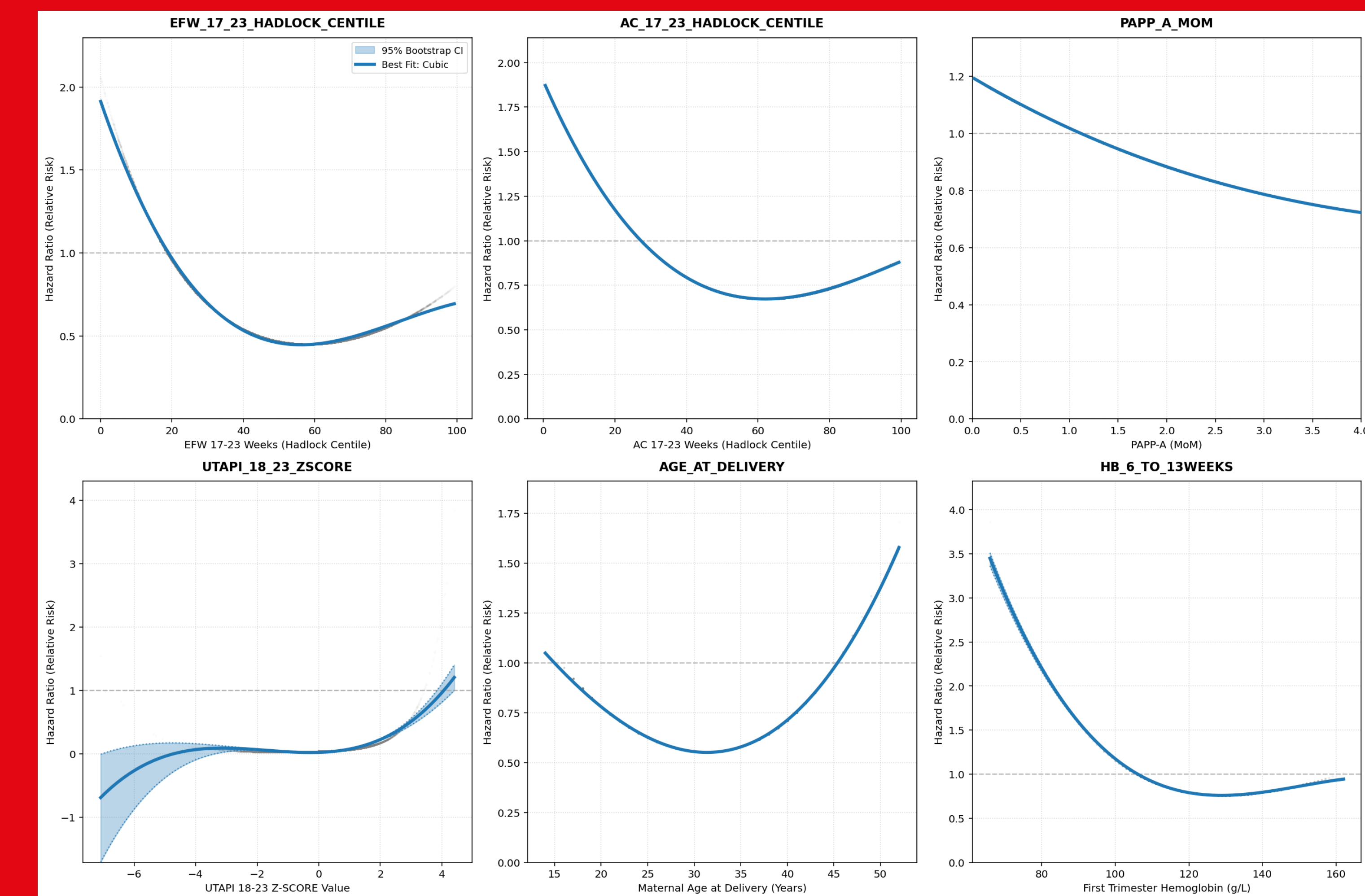


Figure 2. Cubic Polynomial Modelling of Contribution to Risk of Adverse Pregnancy Outcomes by Continuous Variables