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Maternal Cardiac Risk Stratification in Contemporary Practice: External Validation of mWHO, CARPREG II, and ZAHARA in a 14-Year Tertiary Cohort

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Background

Pregnancy in women with cardiac disease carries substantial maternal risk. The modified WHO classification, CARPREG II, and ZAHARA are the three principal risk stratification tools in this setting. External validation in contemporary practice is essential to assess their performance in specialist programs.

Predicted versus observed cardiac complication rates and model discrimination.

Model	Predicted risk (%)	Observed risk (%)	O:E ratio	AUC CI 95%
CARPREG II	12.78%	4.18%	0.33	0.69 (0.53-0.83)
mWHO	8.30%	4.18%	0.50	0.69 (0.55-0.80)
ZAHARA	6.70%	4.18%	0.62	0.74 (0.61-0.85)

O:E ratio = observed events / expected events (ratio closer to 1.0 indicates better calibration). AUC = area under the receiver operating characteristic curve for cardiac complications within 1 year postpartum.

Methods

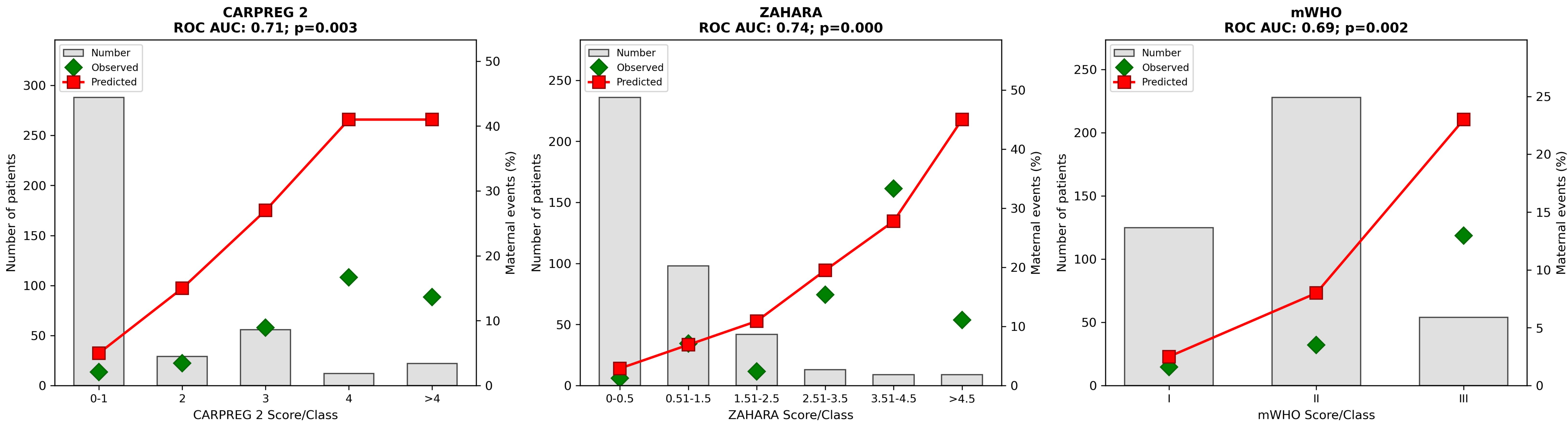
- Single-center retrospective cohort study
- All pregnancies in women with cardiac disease delivering > 24+0 gestational weeks
- 2009 and 2023.
- Among 85,473 deliveries, 407 pregnancies in 282 women were included.
- The primary outcome was maternal cardiac complication within 12 months postpartum
- The secondary outcome was obstetric complication during pregnancy or the postpartum period.
- Model accuracy was assessed by comparing the weighted average predicted risk with the observed number of cardiac events, using each scoring system’s original published definitions.
- Additional performance measures included observed-to-expected (O:E) ratios

Conclusion

Cardiac risk stratification scores might overestimate maternal cardiac risk in this contemporary specialist cohort, consistent with calibration drift, while preserving a clinically meaningful cardiac risk gradient.

These findings highlight the role of individualized assessment. While our findings provide useful preliminary insight, further evaluation in larger and more diverse cohorts is needed to refine risk prediction.

Figure 1. The distribution of lesion types among the mWHO classes. ASD, atrial septal defect; CHD, congenital heart disease; MV; mitral valve; mWHO, modified World Health Organization; LVOT, left ventricular outflow tract; PDA, patent ductus arteriosus; PFO, patent foramen ovale; PV, pulmonary valve; TGA, transposition of the great arteries; TOF, tetralogy of fallot; TV, tricuspid valve; VSD, ventricular septal defect



Distribution of Patients and Predicted vs Observed Cardiac Complications Across CARPREG II, ZAHARA, and mWHO Risk Categories

