CARDIO OB SCORING

TABLE 2 ZAHARA Risk Prediction Model Derived From Patients With Congenital Heart Disease

ZAHARA Predictors	Points
Prior arrhythmia	1.5
Cardiac medications before pregnancy	1.5
NYHA functional class ≥II	0.75
Left heart obstruction	2.5
Moderate or severe mitral regurgitation	0.75
Moderate or severe tricuspid regurgitation	0.75
Mechanical valve	4.25
Cyanotic heart disease (corrected or uncorrected)	1
ZAHARA Score	**Predicted Risk, %**
0-0.5	2.9
0.51-1.50	7.5
1.51-2.50	17.5
2.51-3.50	43.1
>3.50	70.0

NYHA = New York Heart Association; ZAHARA = Zwangerschap bij Aangeboren HARtAfwijking (Pregnancy in Women With Congenital Heart Disease) study.

TABLE 1 CARPREG II Risk Prediction Model

CARPREG II Predictors	Points
Prior cardiac event or arrhythmia	3
Baseline NYHA functional class III to IV or cyanosis	3
Mechanical valve	3
Ventricular dysfunction	2
High-risk left-sided valve disease/LVOT obstruction	2
Pulmonary hypertension	2
Coronary artery disease	2
High-risk aortopathy	2
No prior cardiac intervention	1
Late pregnancy assessment	1
CARPREG II Score	**Predicted Risk, %**
0 to 1	5
2	10
3	15
4	22
>4	41

CARPREG = Cardiac Disease in Pregnancy Study; LVOT = left ventricular outflow tract; NYHA = New York Heart Association.

TABLE 3 Modified WHO Risk Stratification Model

Modified WHO Class	Conditions	Predicted Risk, %
I—No higher risk than the general population	Uncomplicated, small or mild lesions including pulmonary stenosis, VSD, PDA, and mitral valve prolapse with no more than trivial mitral regurgitation Successfully repaired simple lesions including ostium secundum ASD, VSD, PDA, and TAPVD Isolated PVCs and PACs	2.5-5
II—Small increased risk of maternal morbidity and mortality	Unoperated ASD Repaired tetralogy of Fallot Most arrhythmias Coarctation of the aorta without significant gradient or aneurysm (repaired or unrepaired) Long QT syndrome	5.7-10.5
II to III	Mild LV impairment Hypertrophic cardiomyopathy Marfan syndrome without aortic dilation Heart transplant Native or tissue valve disease not considered WHO class IV Bicuspid aortic valve without aortic dilatation	10-19
III—Significant risk of maternal morbidity and mortality	Mechanical valve Systemic RV Post-Fontan operation Cyanotic heart disease Other complex congenital heart repair Aortic dilation without known fibrinogen disease Coarctation of the aorta with residual gradient or aneurysm (repaired or unrepaired) Marfan syndrome with aortic root dilation <45 mm or following aortic replacement Bicuspid aortic valve with aortic root dilation 45 to 50 mm	19-27
IV—Pregnancy contraindicated	Pulmonary arterial hypertension of any cause Severe left ventricular dysfunction (LVEF <30% or NYHA functional class III to IV) Previous peripartum cardiomyopathy with any residual impairment of LV function Severe left heart obstruction (AVA <1 cm^2 or peak gradient >50 mm Hg; MVA <1.5 cm^2) Marfan syndrome with aortic dilation >45 mm Bicuspid aortic valve with aortic dilation >50 mm	40-100

ASD = atrial septal defect; AVA = aortic valve area; LV = left ventricular; LVEF = left ventricular ejection fraction; MVA = mitral valve area; NYHA = New York Heart Association; PAC = premature atrial contraction; PDA = patent ductus arteriosus; PVC = premature ventricular contraction; RV = right ventricle; TAPVD = total anomalous

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MANAGEMENT

	mWHO I	mWHO II	mWHO II–III	mWHO III	mWHO IV
Care during pregnancy	Local hospital	Local hospital	Referral hospital	Expert centre for pregnancy and cardiac disease	Expert centre for pregnancy and cardiac disease
Minimal follow-up visits during pregnancy	Once or twice	Once per trimester	Bimonthly	Monthly or bimonthly	Monthly
Location of delivery	Local hospital	Local hospital	Referral hospital	Expert centre for pregnancy and cardiac disease	Expert centre for pregnancy and cardiac disease

- Echocardiography is the modality of choice recommended for all valvular management, evaluation at baseline, evaluation for aorta.
- Any change in cv signs or symptoms should lead to echocardiogram as first line management
- Adding Pro-BNP (usually stable through the duration of pregnancy)
- Based on WHO class echoes are often every trimester to every month

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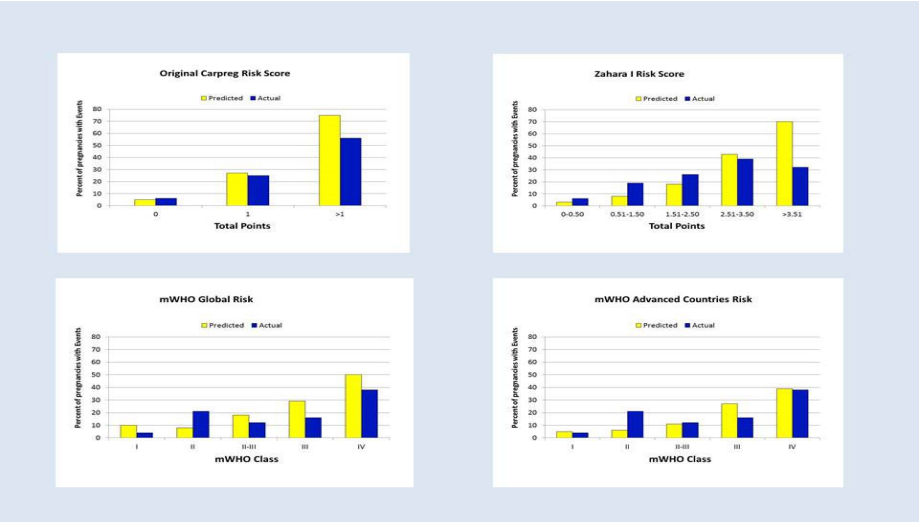
ACTUAL VS PREDICTED RISK



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WHO Category and Fetal Outcome

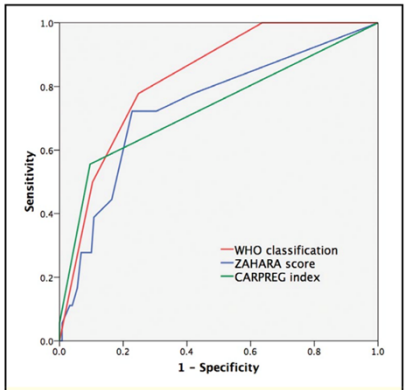
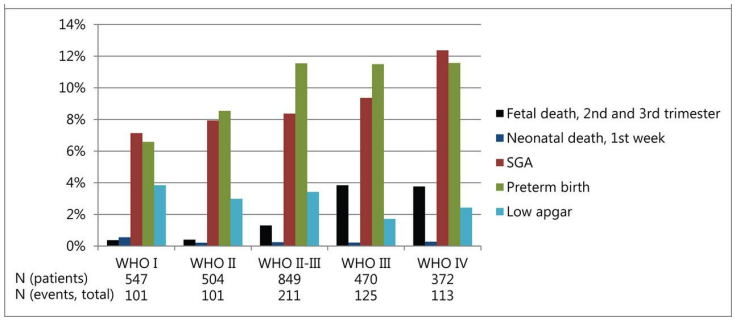


Figure 2. Receiver-operating characteristic curves of 3 risk estimation methods of predicting maternal cardiac events. WHO, World Health Organization.



Comparison of 3 Risk Estimation methods for predicting cardiac outcomes in pregnant women with CHD Circ J. 2015 Jun 25;79(7):1609-17. Lu et all

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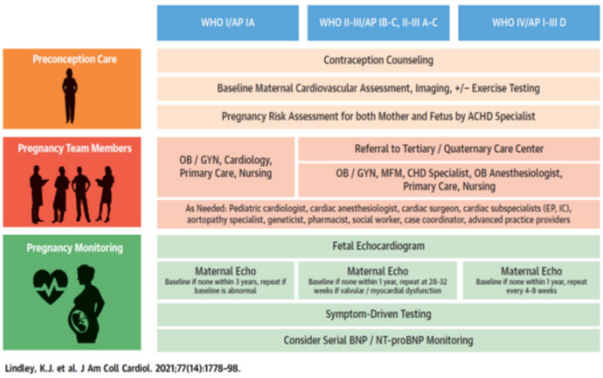
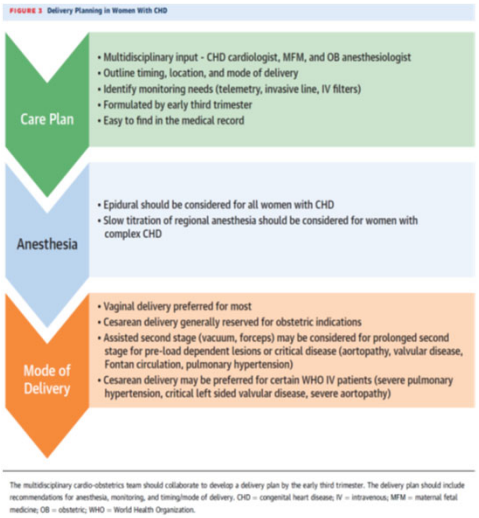
MULTIDISCIPLINARY MANAGEMENT PREGNANCY: CONGENITAL AND VALVE DISEASE



Lindley, K.J. et al. J Am Coll Cardiol. 2021;77(14):1778-98.



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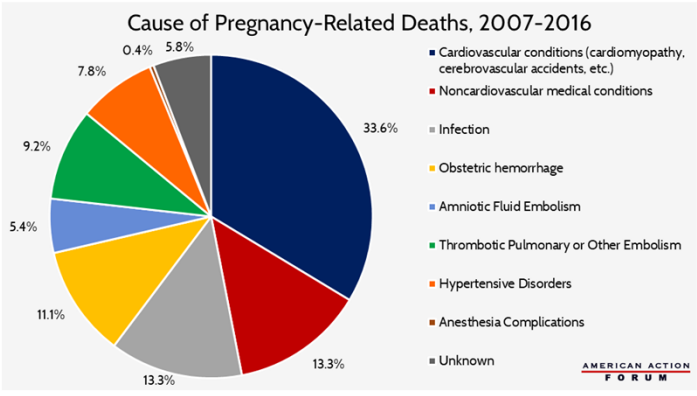
MATERNAL MORTALITY



- ♥ the most common causes of pregnancy-related deaths were cardiovascular conditions:
  - ♥ congenital heart disease,
  - ♥ ischemic heart disease
  - ♥ cardiac valvular disease
  - ♥ hypertensive heart disease,
  - ♥ congestive heart failure

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TABLE 1 A Stepwise Approach to Developing a Niche in Cardio-Obstetrics

Area of Intervention	Focused Intervention for FITs/ECPs, Institutions and Professional Science Organizations, and Competency Management Committees
Understanding the disease spectrum	• Understanding the social determinants of health and poor pregnancy outcomes • Improving knowledge on APOs and long-term CV risks • Incorporating detailed pregnancy history in routine encounters • Understanding physiology of pregnancy and its effects on CV system • Learning pharmacotherapeutics in pregnancy
Developing a pregnancy heart team	• Need for short- and long-term follow-up of women with APOs • Developing multidisciplinary team-based care for high-risk women • Preconception CV risk assessment and pregnancy planning • Implement quality improvement projects and hospital protocols • Volunteering on hospital and state maternal mortality review committees
Improving research and registry data	• Studying subclinical and overt CV dysfunction in APOs and acquired heart disease in pregnancy • Pregnancy outcomes in women with congenital heart disease and peripartum cardiomyopathy • Large, multicenter phenomic and proteomic investigations of APOs • Understanding the role of placental ischemia and antiangiogenic proteins in the etiology of APOs • Population data research associations of APOs and long-term CV risks • Outcomes research on healthy lifestyle interventions in women with CVD risk enhancers
Improving training and education	• Designing and implementing curricula in fellowship • Increasing collaborative sessions on CVD in pregnancy at national societal meetings • Developing multidisciplinary grand rounds • Revising COCATS to incorporate modules on CVD in pregnancy

APO = adverse pregnancy outcome; COCATS = Core Cardiovascular Training Statement; CV = cardiovascular; CVD = cardiovascular disease; ECP = early career professional; FIT = fellow-in-training.

TABLE 2 Key Team Members Focused on a Multidisciplinary Approach to the Care of the Cardio-Obstetric Patient

Physicians and surgeons	Allied health professionals and cardiovascular team members
Cardiologist (and cardiac subspecialists)	Mental health specialist
Obstetrician/maternal fetal medicine specialist	Nurse specialist/physician assistant
Cardiac anesthesiologist	Pharmacist
Cardiothoracic surgeon	Geneticist
Pediatric cardiologist	
Neonatologist	
Pulmonary hypertension specialist	
Family medicine/internist	

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CONCLUSION

- Maternal Mortality in the US continues to Rise
- CVD is now the number one cause of maternal M and M
- Cardio Obstetrics teams, with risk assessment, delivery planning decrease maternal M and M
- Pregnancy and post partum symptoms = CV symptoms and should be assessed
- Policy, Research and Education changes are needed to impact our woeful mortality rates

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