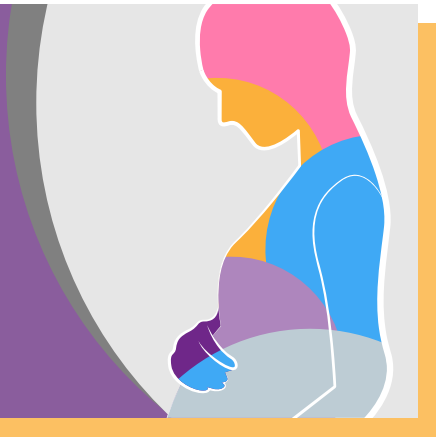
The George Institute for Global Health India

RESEARCH BRIEF

Cardiovascular Diseases (CVD) in Pregnancy

Findings of a scoping review of guidelines and policies with a focus on Low- and middle-income countries



Background

Cardiovascular diseases (CVD) is the largest cause of indirect maternal mortality and accounts for over 33% of pregnancy-related maternal deaths globally[1,2]. CVD during pregnancy is a significant cause of morbidity and mortality in both high- and low-income countries. However, cardiovascular conditions disproportionately affect women living in low-income countries. For example, women in Southern Asia and Sub-Saharan Africa have the highest CVD burden, specifically hypertensive heart disease[3,4]. It is estimated that while the hypertensive disorders of pregnancy (HDP) affects 2–8% of pregnancies globally, around one fourth of maternal deaths in Latin America and one tenth (10%) in Asia and Africa are due to HDP [5].

The frequency of cardiovascular diseases in women during pregnancy is yet to be established. It is also unknown whether there is an increased frequency of CVD among pregnant women in developed vis-à-vis low and middle-Income countries. What is known is that most pregnancies with cardiac disease could be treated if early detection and careful follow-up are a part of routine pregnancy care.

Given this understanding, the George Institute for Global Health, India, on behalf of the Taskforce on Women and Non-Communicable Diseases (NCDs), supported by the American Heart Association (AHA), conducted a scoping review to identify and map various clinical guidelines, and policies on CVD in pregnancy.

Methods

The review followed the Joanna Briggs Institute (JBI) methodology for scoping review [6]. Clinical guidelines and policies on CVD in pregnancy were searched. A search of key electronic databases of PubMed, EMBASE, CINAHL, The GIN international guideline library (EBSCO) and Google Scholar, along with individual websites of national and international professional organizations and associations, and Ministry of Health of Low- and Middle-Income Countries (LMIC) was conducted. Inclusion was based on clinical conditions including hypertensive Diseases of Pregnancy (HDP), primary cardiac conditions and stroke and cerebrovascular conditions with a focus on LMICs. Guidelines extracted were from the World Health Organization (WHO), international professional organizations, national professional organizations, and Ministry of Health in LMICs, and were published between 2011 and 2023. Selected guidelines were reviewed and shortlisted documents were extracted and analyzed.

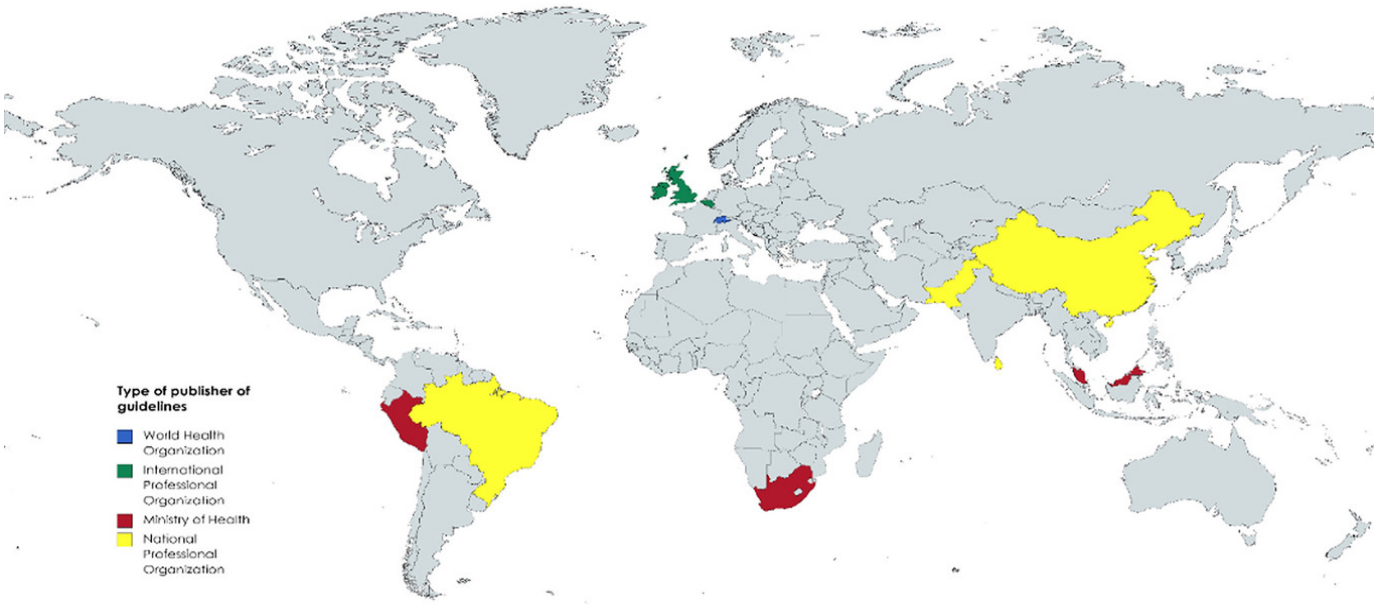
Results

A total of 17 clinical guidelines were included in the review. Of these guidelines, seven were from the WHO[7–13], three were from International Professional Organizations (IPO)[14–16], three were from the Ministry of Health (MoH)[17–19] and four were from National Professional Organizations (NPO)[20–23]. No policies on CVD in pregnancy were found.

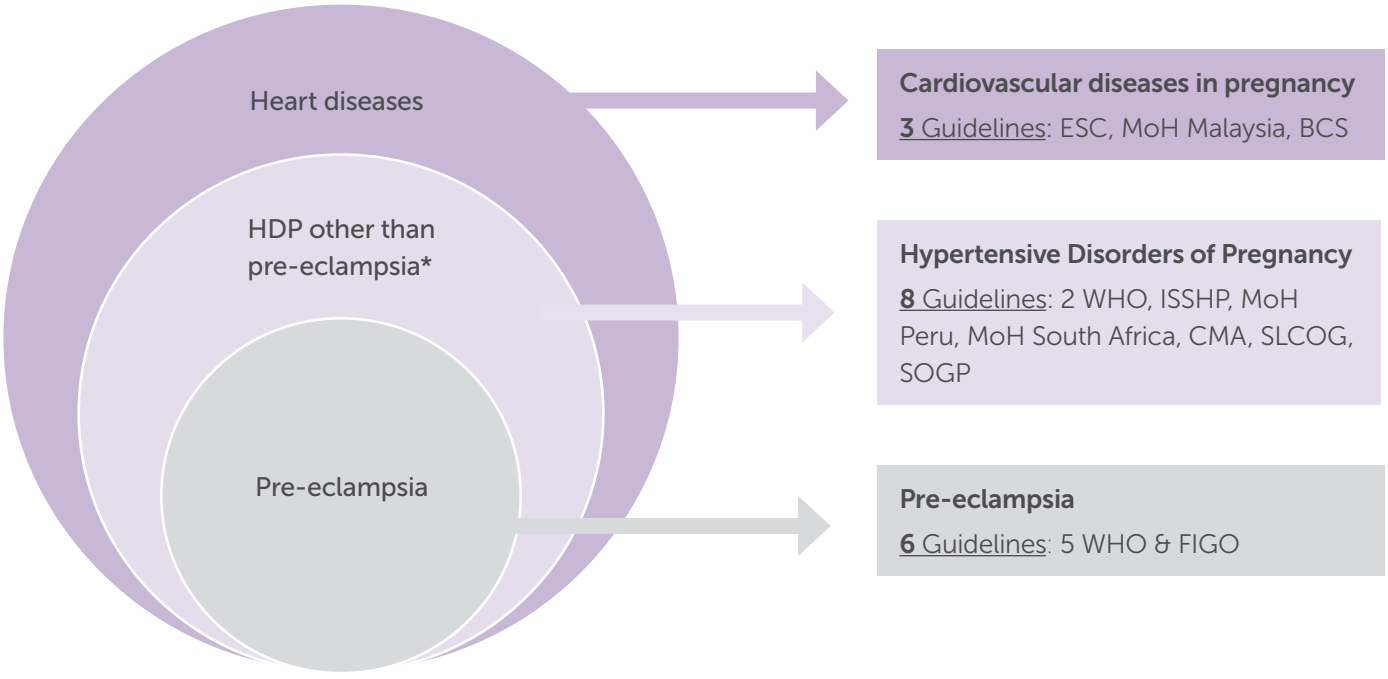
The review with the following research questions focused on low-and-middle income countries (LMICs):

1. What clinical guidelines and policies exist from World Health Organization, international professional organizations, national professional organizations, and the Ministry of Health in low-middle income countries to address the cardiovascular needs of pregnant women?
2. Where are the gaps concerning the objective of the guidelines /policy (prevention, screening, or management), timing (interventions aimed before/during/after pregnancy), and key clinical conditions?

Geographical distribution of guidelines on cardiovascular diseases in pregnancy



Representation of guidelines on CVD in pregnancy included in the review



*HDP other than pre-eclampsia : chronic hypertension, gestational hypertension and white-coat hypertension

(WHO- World Health Organization, ESC- European Society of Cardiology, FIGO- The International Federation of Gynecology and Obstetrics, ISSHP- International Society for the Study of Hypertension in Pregnancy, MoH- Ministry of Health, BCS-Brazilian Cardiology Society, CMA- Chinese Medical Association, SLCOG- Sri Lanka College of Obstetricians and Gynaecologists, SOGP- Society of Obstetricians and Gynaecologists Pakistan)

Focus areas of the selected guidelines

- **Fourteen** on hypertensive disorders of pregnancy (HDP)
  - » **Two** guidelines on management of pre-eclampsia
  - » **Four** guidelines on prevention and screening pre-eclampsia
  - » **Eight** guidelines on prevention, screening, and management of HDP
- **Three** guidelines on the comprehensive care (prevention, screening, management) of heart diseases in pregnancy

Components of guidelines

The guidelines on CVD in pregnancy mainly focused on the following two groups of CVD involving prevention, screening, and management

a. Hypertensive disorders of pregnancy (HDP)- gestational hypertension, essential hypertension, preeclampsia, HELLP (hemolysis, elevated liver enzymes, low platelet count) syndrome and eclampsia

b. Heart diseases in pregnancy – arrhythmia, aortic diseases, cardiomyopathy, congenital heart diseases (CHD), coronary artery disease (CAD), heart failure, pulmonary hypertension and valvular diseases

A. Recommendations for the care of hypertensive disorders of pregnancy (HDP)

Pre-conception care

- Pre-conception care recognized by eight guidelines (WHO, IPO- ESC and FIGO, MoH- Malaysia, NPO – BCS Brazil, CMA China, SLCOG Sri Lanka, SOGP Pakistan) as crucial for women at risk of HDP.
- Recommendations include dietary modifications (WHO, IPO- ESC, MoH- Malaysia, NPO – BCS Brazil, CMA China, SLCOG Sri Lanka, SOGP Pakistan), calcium and folic acid supplementation (WHO, IPO -ESC, MoH- Malaysia, NPO – BCS Brazil and SOGP Pakistan), lifestyle adjustments (MoH Malaysia and NPOs -BCS Brazil, SGOP Pakistan and CMA China), and behavioral changes like alcohol and smoking cessation (IPO – ESC, MoH Malaysia and NPO – BCS Brazil, SOGP Pakistan).
- Evaluations cover renal, cardiac, and obstetric aspects (IPO- ESC, MoH Malaysia, NPOs – BCS Brazil, SOGP Pakistan and SLCOG Sri Lanka), and risk counseling (IPO- ESC, MoH Malaysia, NPOs – BCS Brazil, CMA China, SLCOG Sri Lanka and SOGP Pakistan) provides detailed information on HDP risks, interventions, and expected pregnancy course.

Antenatal care

*i. **Screening and Risk Assessment***

Nine guidelines recommend screening and risk assessment for HDP. They include IPOs- ESC, FIGO, ISSHP, MoH- Malaysia and South Africa and NPO - BCS Brazil, CMA China SLCOG Sri Lanka, SOGP Pakistan.

- **Time of assessment:** Five guidelines (IPO- ISSHP and FIGO, MoH South Africa, NPOs- CMA China and SOGP Pakistan) recommend assessment at 20 weeks of gestation, while four guidelines (IPO- ESC and FIGO, MoH Malaysia and NPO- SLCOG Sri Lanka) recommend screening and risk stratification in the first trimester.
- Parameters of assessment:
  - » All nine guidelines recommend blood pressure measurement.
  - » IPO (ESC, FIGO, ISSHP), MOH (Malaysia, South Africa) and NPOs [CMA China and SOGP Pakistan]. recommend maternal history and risk assessment
  - » IPO (ESC and FIGO), MoH (Malaysia and South Africa) and NPO (SOGP Pakistan) guidelines recommend assessing BMI for risk assessment.
  - » IPO (ISSHP and ESC), MoH (South Africa) and NPO (CMA China, SLCOG Sri Lanka and SOGP Pakistan) recommend urinalysis for proteinuria
  - » Four guidelines IPO [ESC and FIGO] and NPO [CMA China and SLCOG Sri Lanka] recommend using PlGF and PAPP-A* tests for risk assessment of pre-eclampsia. But, IPO [ISSHP], MoH [South Africa] and NPO [SOGP Pakistan] recommend against PIGF tests because of its inconclusive predictive value.
  - » Only FIGO and SOGP Pakistan recommends using a digital tool, an online risk calculator, for HDP risk assessment

*ii. **Drugs to prevent/manage pre-eclampsia and eclampsia***

Administration of drugs are recommended by the guidelines to prevent (Aspirin and Calcium) or manage HDP (antihypertensive medications). **Eleven** guidelines such as the WHO, IPO (ESC, FIGO, ISSHP), MoH (Malaysia, Peru, South Africa), and NPO (BCS Brazil, CMA China, SLCOG Sri Lanka, SOGP Pakistan) recommend **aspirin**.

Nine guidelines such as- WHO, IPO- (ESC, FIGO, ISSHP), MoH- (Peru, South Africa) and NPO - (BCS Brazil, CMA China, SOGP Pakistan) recommend **Calcium.** **Twelve** guidelines by the WHO, IPO- (ESC, ISSHP), MoH (Malaysia, Peru, South Africa) and NPOs (BCS Brazil, CMA China, SLCOG Sri Lanka, SOGP Pakistan) recommend **antihypertensive medications**.

i. Aspirin administration for pre-eclampsia prevention:

Dosage

- 75 mg- WHO and MoH (Malaysia)
- 75-150 mg - NPO (SLCOG Sri Lanka and BCS Brazil)
- 100- 150 mg- IPO (ESC), MoH (Peru)
- 150 mg - IPO (FIGO, ISSHP) and NPO (CMA China, SOGP Pakistan)
- Up to 162 mg - MoH (South Africa)

Commencement time

- 12 weeks - MoH (Malaysia and South Africa) and NPO (SLCOG, Sri Lanka)
- 16 weeks - IPO (ISSHP) and NPO (SOGP, Pakistan)
- within 20 weeks of pregnancy or as soon as antenatal care starts- WHO

Cessation time

- after 36 weeks - IPO (ESC and FIGO) and NPO (SOGP Pakistan)
- time of delivery - IPO (ISSHP), MoH (Malaysia) and NPO (SLCOG Sri Lanka)
- five days before delivery - NPO (BCS Brazil)
- the WHO, and MoH (Peru and South Africa) do not recommend cessation time of aspirin

ii. Calcium Supplementation for pre-eclampsia prevention:

- Two guidelines (MoH Malaysia and SLCOG Sri Lanka) recommend against calcium administration
- Five guidelines (WHO, IPO -FIGO, ISSHP and ESC and NPO (BCS Brazil) recommend using dietary thresholds, two guidelines (MoH - Peru and NPO - SOGP Pakistan) recommend high-risk (for HDP) women, and one guideline (MoH South Africa) recommends universal supplementation.

Recommended dosage

- 0.5g - MoH (South Africa)
- 1g – NPO (CMA China, SOGP Pakistan)
- 1.5-2g - IPO (ESC and FIGO) and NPO (BCS Brazil)
- 2g - MoH (Peru)
- 1.2-2.5g - IPO (ISSHP)

iii. Antihypertensive Medication:

The recommended target BP to aim for hypertension control-

- 160/80-85 mm Hg - IPO (ISSHP)
- 160/110 mm Hg - MoH (South Africa)
- 150/80-110 mm Hg - MoH (Malaysia) and NPO (SLCOG Sri Lanka)
- 110-140/80-85 mmHg - NPO (BCS Brazil)
- 130/85 mm Hg - NPO (SOGP Pakistan)
- no target BP- IPO(ESC)

- One among the three antihypertensives - **Alpha-methyldopa** (WHO, IPO [ESC and ISSHP], MoH [Malaysia and South Africa] and NPO [BCS Brazil, SLCOG Sri Lanka and SOGP Pakistan]), **Labetalol** (WHO, IPOs (ESC and ISSHP), MoH (Malaysia and South Africa), and NPOs (BCS Brazil, CMA China. SGOP Pakistan, and SLCOG Sri Lanka)) and **Nifedipine** (IPOs (ISSHP and ESC), MoH (Malaysia), and NPOs (BCS Brazil, CMA China, SLCOG Sri Lanka and SOGP Pakistan)) is recommended with differing preferences.
- Labetalol specifically recommended as the first choice by SOGP Pakistan
- BCS Brazil recommends second-line oral medications (clonidine, hydralazine, thiazide diuretics).
- Recommendations vary on contraindicated drugs; thiazide diuretics are contraindicated in pregnancy by SOGP Pakistan and MoH Malaysia, while recommended cautiously by ESC, CMA China and BCS Brazil. Discrepancies in the recommendation for hydralazine and sodium nitroprusside use also.
- In emergencies (BP $\geq$ 160/110 mm Hg), rapid control with nifedipine is commonly advised.

iii. Maternal and Fetal monitoring for managing hypertensive disorders of pregnancy (HDP)

Eight guidelines recommend maternal monitoring in HDP. They include two IPO- (ESC, ISSHP), two MoH- (Malaysia, South Africa) and four NPO - (BCS Brazil, CMA China, SLCOG Sri Lanka, SOGP Pakistan).

- All guidelines emphasized on BP measurement regularly
- Seven guidelines (IPO- ESC and ISSHP, MoH- Malaysia and South Africa, and NPO - CMA China, SLCOG Sri Lanka, SOGP Pakistan) recommend additional assessments such as urinalysis for proteinuria assessment
- Other parameters for monitoring recommended were maternal history (IPO-ISSHP, MoH- Malaysia, and NPO (CMA China and SOGP Pakistan)), BMI (ISSHP, MoH Malaysia), and biochemical blood tests (IPO -ESC and ISSHP, MoH - Malaysia and NPOs - CMA China, SLCOG Sri Lanka and SOGP Pakistan)
- **Monitoring intervals:** SLCOG Sri Lanka and SOGP Pakistan recommend biweekly checks, CMA China recommends weekly, BCS Brazil recommends at every antenatal visit, ISSHP recommends at 28 and 34 weeks, and Malaysia tailors it to individual needs.

Intranatal care

i. Referral

- For severe hypertension/ preeclampsia, referral to higher centres is universally recommended by **10** guidelines- WHO, IPO (ESC and ISSHP), MoH (Malaysia, Peru and South Africa), and NPOs (BCS Brazil, CMA China, SLCOG Sri Lanka and SOGP Pakistan)
- Only ISSHP, ESC, BCS Brazil, and SOGP Pakistan recommend a BP threshold (170/110mmHg or >160/110mmHg) for referral.

ii. Timing of Delivery

- Recommended time of delivery for pregnant women with uncomplicated HDP ranges from 37 weeks (IPO - ISSHP and ESC, MoH – Malaysia and Peru, and NPOs - BCS Brazil, CMA China, SLCOG Sri Lanka and SOGP Pakistan), 38-39 weeks (SOGP Pakistan) and to a maximum of 40 weeks (MoH Malaysia and NPO (SOGP Pakistan)
- In severe case, the recommendations were 26 weeks (CMA China) to 34 weeks (MoH South Africa)
- All guidelines recommend immediate delivery for pregnant women with eclampsia

iii. Interventions and delivery methods

- Four guidelines published by the WHO, IPO (ISSHP), MoH (South Africa), and NPO (SOGP Pakistan) include recommendations regarding interventions and delivery methods in HDP.
- WHO and ISSHP recommend that pregnant women before 36 weeks of gestation with severe pre-eclampsia should be managed without induction of labor or interventions for delivery (expectant management)
- MoH South Africa and SOGP Pakistan recommend vaginal delivery in HDP unless obstetric complications necessitate a cesarean delivery.
- MoH South Africa also recommends shortening the second stage with forceps or vacuum delivery if hypertension is uncontrollable.

iv. Magnesium Sulfate Administration

Ten guidelines (WHO, IPO- ESC and ISSHP, MoH- Malaysia, Peru and South Africa, and NPO - BCS Brazil, CMA China, SLCOG Sri Lanka, SOGP Pakistan) recommend Magnesium Sulfate Administration in HDP to prevent convulsions due to eclampsia.

- Similar indications (severe hypertension (SBP/DBP > 160/110 mmHg) and preeclampsia with severe features (headache, chest or epigastric pain, visual disturbances)), dosage (loading dose of 4gm and infusion dose of 1 g/hour until delivery) and route of administration (intravenous injection (IVI)) of MgSO4 recommended among the guidelines
- MoH (Malaysia and South Africa) also recommend an intramuscular injection of MgSO4
- Additional doses of 2-4 g in 5 to 15 minutes in case of recurrent fits recommended by SLCOG Sri Lanka
- ISSHP recommended MgSO4 for all women with pre-eclampsia in low-resource settings. For high-income settings, MgSO4 is being recommended for high-risk cases.
- MoH (Malaysia) and NPO (BCS Brazil) recommend clinical monitoring to avoid magnesium toxicity

Postpartum care

Nine guidelines (WHO, IPO- ESC and ISSHP, MoH- Malaysia and South Africa, NPO - BCS Brazil, CMA China, SLCOG Sri Lanka and SOGP Pakistan) recommend postpartum care in HDP.

- Common recommendations include monitoring maternal clinical condition in an ICU/CCU/HDP for at least 48 hours post-delivery, with BP and pulse rate checked every four hours.
- ISSHP and SOGP Pakistan recommend more frequent monitoring for those with a history of preeclampsia. This include recording BP hourly for the first two hours and then every 6-8 hours till 48 hours after delivery.
- *Recommended antihypertensive medications postpartum:*
  - » WHO, IPO (ESC and ISSHP) and NPO (CMA China and SLCOG Sri Lanka) – Not specified.
  - » MoH (Malaysia) and NPO (BCS Brazil and SOGP Pakistan) - ACE-I (enalapril and captopril), beta-blockers (labetalol), metoprolol) and calcium channel blockers (nifedipine)
  - » NPO (CMA China) recommends avoiding ACE-I drugs.
  - » NPO (SOGP Pakistan) recommends a combination of nifedipine and labetalol if the BP is not controlled.
  - » Furthermore, the NPO (SOGP Pakistan) recommends using Atenolol for controlling blood pressure postpartum while the NPO (BCS Brazil recommends that it should be avoided
  - » IPO (ESC) and MoH (Malaysia) recommend avoiding methyldopa due to post-partum depression risk
- Recommended duration of hospital stay- at least three days (IPO -ISSHP, MoH - South Africa and NPO - SOGP Pakistan) and up to five days (ISSHP)
- Instead of the day of discharge, MoH Malaysia, CMA China and SOGP Pakistan recommend discharge only if certain criteria (BP within threshold, no proteinuria, signs and symptoms relieved and patient awareness and community support in self-care) are met
- *Post-discharge follow-up*
  - » The IPO - ISSHP recommends a review within one week and at three-month post-partum
  - » The MoH (Malaysia) recommends everyday review by the nurse and a biweekly review of a doctor till 6 weeks postpartum along with the nurse-led community follow-up
  - » NPO (SOGP Pakistan) recommends BP monitoring by a health worker in the community or a health facility and a hospital checkup in two weeks, at 6-8 weeks and 12 weeks after delivery.
  - » NPO (BCS Brazil) recommends a brief review at 1-2 weeks
  - » NPO (CMA China) recommends follow-up at six weeks postpartum, and additional check-up if BP is not normalized at 12 weeks postpartum

Long-term follow-up

- Only four guidelines (ESC, ISSHP, MoH South Africa and SOGP Pakistan) give recommendations for long term follow-up after the postpartum period for those who had HDP
- Frequency of follow-up- ISSHP, MoH South Africa and SOGP Pakistan recommend at 3 months postpartum while annual review recommended by ESC, ISSHP and SOGP Pakistan

B. Recommendations for the management of heart disease in pregnancy

Three guidelines- the IPO (ESC) 14, MoH (Malaysia) 17, and NPO (BCS Brazil) 20 contained recommendations for the care of cardiac diseases in pregnancy. They include recommendations for screening, prevention, and management of CVDs

Pre-conception care

- Pre-conception counseling aiming for informed decision-making, individualized planning, and addressing lifestyle factors like diet, weight, and substance use recommended by all three guidelines
- MoH (Malaysia) recommend starting counseling at puberty, at least 6 months before conception.
- All three guidelines recommend contraceptive counseling
- ESC recommends a holistic approach emphasizing emotional, cultural, psychological, and ethical aspects.
- Antenatal care

i. Maternal and Fetal Risk Estimation

- Baseline investigations include ECG and echocardiography recommended by all three guidelines.

- ESC additionally recommends using predictors like those from the CARPREG study
- Full maternal clinical examination recommended by MoH Malaysia and ESC
- ESC recommends exercise testing for all pregnant patients with cardiovascular diseases, while MoH Malaysia and BCS Brazil do not.

ii. Recommendations for thromboprophylaxis in pregnancy with CVD

- For anticoagulation during pregnancy in women with heart disease, low molecular weight heparin (LMWH) or unfractionated heparin (UFH) as prophylactic agents after 36 weeks, with a switch to IV unfractionated heparin 36 hours before a planned delivery is recommended by all three guidelines
- Risk assessment for venous thromboembolism recommended by ESC and MoH Malaysia but not by BCS Brazil
- *Thromboprophylactic LMWH*
  - » While NPO (BCS Brazil) recommends three LMWH (enoxaparin, tinzaparin and dalteparin), MoH (Malaysia) recommends the first two (enoxaparin and tinzaparin) only. The IPO (ESC) recommends only enoxaparin.
  - » IPO (ESC) and MoH (Malaysia) recommend weight-based dosage, while, the NPO (BCS Brazil) recommends it only for enoxaparin and recommends a fixed dose for the rest of the drugs
- Meticulous leg care, elastic support stockings, and early ambulation are recommended by all three guidelines to prevent thromboembolism.

iii. Antibiotic Use in pregnancy with cardiac disease

- All three guidelines recommend cautious antibiotic use for treating infectious conditions like infective endocarditis and rheumatic fever, but recommendations for prophylactic antibiotic use differ.
- ESC recommends against prophylactic antibiotics for all women with cardiovascular disease (CVD), regardless of the delivery mode while the other two recommend it with different indications.

iv. Cardiac interventions during pregnancy

- Similar recommendations regarding the indications (when medical or interventional approaches fail and the mother's life is at risk) and timing (2nd trimester) for cardiac interventions in pregnancy among all three guidelines

Intranatal care

- **Time of Delivery-** All three guidelines recommend multidisciplinary team consultation, led by an obstetrician and cardiologist, to assess the woman's cardiac condition and fetal well-being for deciding the time of delivery. Induction of delivery at 40 weeks of gestation is recommended, weighing risks and benefits. BCS Brazil recommends delivery from week 37 in patients under oral anticoagulation.
- **Route of Delivery-** Vaginal delivery is recommended for pregnant women with uncomplicated or non-severe cardiac conditions in all three guidelines and similar indications for cesarean section are outlined, including severe cardiac conditions
- **Maternal Monitoring during Delivery-** Specific parameters for maternal monitoring vary for different CVD with a consensus on monitoring maternal blood pressure, heart rate, ECG, and pulse oximetry during the intrapartum period. Additional recommendations include the use of arterial lines and right atrial pressure monitoring in severe and high-risk cases (ESC)

Postpartum care and long-term follow-up

- After delivery, all three guidelines (ESC, MoH Malaysia, BCS Brazil) recommend strict hemodynamic monitoring of women with heart disease in ICU/CCU/HDU.
- Monitoring duration varies, with ESC and BCS Brazil recommending 24-48 hours, while MoH Malaysia recommends 24-72 hours based on risk.
- All three guidelines recommend protocols for preventing complications (post-partum hemorrhage, heart failure, thrombosis) including oxytocin and misoprostol for PPH prevention and thromboprophylaxis using UFH/LMWH, leg care, and early ambulation.
- MoH Malaysia recommends hospital stays of 3-5 days (7-14 days for pulmonary hypertension) post-delivery, with follow-up plans, including customized home visits by health workers and cardiac review at 6 weeks postpartum.

Gaps and differences in recommendations among guidelines to manage CVD in pregnancy

Pre-conception care

- Lack of comprehensive pre-conception care recommendations in HDP
- Difference in recommendations regarding salt restriction in HDP

Antenatal care

- Differences in the timing, parameters and frequency of screening and risk assessment in HDP
- Conflict in the recommendation on use of exercise testing in all pregnant patients with CVDs (ESC is the only guideline to recommend).
- Incoherence in the recommendations regarding dosage (ranging from 75 mg to 162 mg), commencement time (varies between 12-20 weeks) and cessation time (ranges from 36 weeks to delivery or 5 days before delivery) of Aspirin administration for pre-eclampsia prevention
- Conflict in recommendations on calcium administration (two guidelines recommend against it) for pre-eclampsia prevention. The recommendations on indications and dosage of calcium also differ between the guidelines
- Differences in recommendations in terms of the first choice of the antihypertensive and its dosage
- Recommendations vary on antihypertensives contraindicated in pregnancy such as thiazide diuretics, hydralazine and sodium nitroprusside
- Differences in the recommendations on the interval of surveillance and parameters (such as assessment of history of symptoms of pre-eclampsia, assessment of BMI and, biochemical assessment of blood) for maternal monitoring in HDP
- The recommendations for the administration of thromboprophylactic drugs for the prevention of venous thromboembolism differ between the three guidelines on CVD in pregnancy in terms of the choice of drugs (LMWH and UFH) and their dosage
- Differences in the recommendations on antibiotic prophylaxis in CVD during pregnancy

Intranatal care

- Only four guidelines provide recommendations for referral in HDP in case of complications, which is a significant gap
- Recommendations vary in blood pressure (BP) thresholds in HDP for referral
- Another significant gap is the omission of detailed guidance on the symptoms and signs of pre-eclampsia that warrant diagnosis
- Differences in the recommended optimal time of delivery among guidelines
- Lack of detailed recommendations regarding obstetric interventions and delivery methods in HDP
- Lack of recommendations for dosage of MgSO4 to prevent eclampsia in four guidelines. There is also a lack of recommendations regarding the monitoring of magnesium toxicity (except for MoH (Malaysia) and NPO (BCS Brazil)). Furthermore, only ISSHP has a specific recommendation for low-resource settings

Postpartum care

- Recommended parameters of monitoring (such as platelet count, transaminases and serum creatinine) and the frequency of monitoring during postpartum period in HDP differ across guidelines
- Difference in the recommendations on the day of discharge, choice of antihypertensives and frequency and parameters of review (short term and long-term) in HDP
- Lack of recommendations on the discharge process (except IPO (ISSHP) and MoH South Africa) and post-partum community care in low-resource settings (except MoH (Malaysia) and (SOGP Pakistan)) in HDP
- For cardiovascular disease (CVD) care in pregnancy during postpartum care, the gaps include the absence of specific recommendations regarding monitoring parameters, both facility-based and community-based follow-up plans, and guidance for the postpartum period in two guidelines IPO (ESC) and NPO (BCS Brazil).

Discussion & recommendations

This review underscores the availability of comprehensive clinical guidelines for hypertensive disorders of pregnancy globally; however, significant variations exist in recommendations for care delivery among different guidelines. Notably, guidelines for other cardiovascular disorders during pregnancy are scarce, with only one international professional organization (European Society of Cardiology), one ministry of health (Malaysia) and one national professional organization (Brazilian Cardiology Society) offering guidance.

Importantly, there is a lack of health policies addressing the needs of women with cardiovascular disease (CVD) during pregnancy. Despite the existence of clinical guidelines, ensuring access to high-quality care for CVD in pregnancy requires attention to implementation considerations and broader health system components.

Collaboration among healthcare professionals is essential for delivering complex cardiac care, but guideline recommendations often overlook the role of primary care providers, hindering early identification and intervention.

Maternity care often excludes pre-conception and post-natal stages, creating a fragmented care continuum for women with CVD. Wide variations in medication regimens further complicate CVD care during pregnancy. Inconsistencies in guidelines underscore the need for harmonization and continuous medical education. Leadership, akin to successful campaigns for maternal health, is crucial for policy attention and investment in addressing CVD in pregnancy. Table 2 summarizes the gaps observed in the guidelines on CVD in pregnancy through a health system perspective and recommendations to address them as the way forward.

Table 2: Gaps observed in the guidelines on CVD in pregnancy and recommendations to address them

Health System Building Blocks	Gaps	Way Forward
Health workforce	• Existing recommendations not tailored for various categories of clinicians / health providers. • Focus on specialist care and absence of integration into primary care.	• Ensuring that the appropriate teams are available and accessible to women who are pregnant with CVD. • Enhance the capacity of all levels of health professionals to provide integrated and multidisciplinary care for CVD in pregnancy.
Access to essential medicines	• Inconsistencies among the guidelines regarding recommendations for medications.	• Global collaboration to review the existing guidelines and evidence to standardise recommendations on medication regimes and regularly update them.
Service delivery	• Inconsistencies among the recommendations of CVD care service delivery. • Fragmented care continuum for pregnant women with CVD.	• Harmonization of clinical guidelines based on current best evidence. • Ensure holistic, seamless, and integrated care for all pregnant women with CVD from pre-conception till postpartum stages.
Leadership and Governance	• Lack of policies on CVD in pregnancy. • Skewed focus on HDP (especially Preeclampsia).	• Ensure that comprehensive care of CVD in pregnancy receives investment and policy attention. • Enhance local capacity by strengthening community level service delivery

**The 'Financing' and 'Health Information Systems' building blocks are not included as they are outside the scope of the review of clinical guidelines on CVD in pregnancy.*

The review excluded non-English language guidelines (except Chinese, French, and Spanish) due to cost and complexity concerns in translation, potentially limiting findings, especially in low-income countries where guidelines might exist in local languages.

The consideration was limited to guidelines post-2011 for relevance, and the focus was on standalone cardiovascular guidelines during pregnancy, possibly overlooking recommendations in broader antenatal/ maternal care guidelines globally.

Additionally, the review may not account for unpublished policies or inaccessible guidelines, introducing a potential bias.

CVD care in pregnancy is very crucial for reducing maternal morbidity and mortality. This review has been able to identify and describe various guidelines for managing CVD in pregnancy in low-middle income countries (LMICs).

However, there is a need to address the gaps in terms of availability and access to the policies and guidelines in LMICs along with concerted efforts to ensure standardized and comprehensive care for CVD in pregnancy.

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