

Cardiac Conditions in Obstetric Care

Tennessee Initiative for Perinatal Quality Care

Inter-Institutional Quality Improvement Project

In Association with The American College of Obstetricians and Gynecologists' (ACOG)

Alliance for Innovation in Maternal Health (AIM)

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Project Pilot Teams

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Introduction: *What are we trying to accomplish?*

a. Problem

Cardiovascular disease (CVD) is the leading cause of maternal mortality in the United States, accounting for over one-third of all pregnancy-related deaths and is often associated with failure to provide timely risk-appropriate care [1]. According to the most recent Tennessee MMR, the leading cause of pregnancy related deaths was cardiovascular and coronary disease [2]. Data from the California pregnancy associated mortality review (CA-PAMR) supports this finding and noted factors that contributed to CVD related mortality including delayed or inadequate response to warning signs (61%), ineffective or inappropriate treatment (39%), misdiagnosis (37.5%), and failure to refer or consult (30%). From the patient perspective the CA-PAMR found pre-existing medical conditions to be a factor in 64% of deaths. Other contributing factors included obesity (31%), delays in seeking care (31%), and lack of recognition of CVD symptoms (22%) [3]. With these findings in mind, it was suggested that quality improvement opportunities started with screening and recognition of signs and symptoms of CVD in pregnancy such as shortness of breath, fatigue, tachycardia, and low oxygen saturation.

Cardiac conditions also disproportionately affect non-Hispanic Black women. More work is also needed to reduce difference in outcomes in care across the US and in Tennessee specifically. The TN state MMR Committee determined in 2020, differences in outcomes contributed to 1 in 3 (33%) of pregnancy-related deaths and 23% (n=23) of all pregnancy-associated deaths [2]. Cardiovascular conditions, cardiomyopathy and other medical conditions are the leading indirect cause of all US maternal mortality, particularly in non-Hispanic Black and Hispanic birthing people [3]. Across all age groups and all causality, non-Hispanic Black women have a higher prevalence of pregnancy-related mortality than others [4]. Recent national data on maternal mortality confirms a statistically significant increase in deaths per 100,000 live births each year from 2018 to 2020. Furthermore, the rates are highest among non-Hispanic Black populations and women over the age of 40. A California analysis of maternal deaths due to CVD found that the majority occurred in the postpartum period [5].

b. Project Description (*What*)

TIPQC will implement the Alliance for Innovation on Maternal Health (AIM), Cardiac Conditions in Obstetrical Care (CCOC) patient safety bundle, to address Tennessee's rising mortality from cardiovascular disease, the leading cause of death in the State of Tennessee. The goal of this project will be to implement cardiac screening in pregnancy in 90% of hospitals that provide obstetrical care by June 2026.

Objectives include:

1. Readiness: Implementation of standard processes for optimal care of cardiac conditions in pregnancy and postpartum.
2. Recognition & Prevention: Screening and early diagnosis of cardiac conditions in pregnancy and post-partum.
3. Response: Care management for every pregnant or postpartum woman with cardiac conditions in pregnancy and post-partum.
4. Reporting/System Learning: Foster a culture of safety and improvement for care of women with cardiac conditions in pregnancy and post-partum.

5. Respectful and Supportive Care: Including the patient as part of the multidisciplinary care team.

The Cardiac Conditions in Obstetric Care (CCOC) project was selected by stakeholders at the 2023 TIPQC Annual Meeting. Project development occurred in Q3 and Q4 2023. The pilot phase of the project was Q1 2024. The start of the statewide roll-out of the project is planned for March 2024. The project is proposed to end in Summer of 2026.

TIPQC agrees to the following:

- Provide this toolkit and other resources to participating teams.
- Offer monthly huddles, quarterly learning sessions, and annual statewide meetings.
- Facilitate the sharing between participating teams, allowing them to learn from each other.
- Facilitate the capture of data metrics and provide reports to participating teams which show their progress towards improvement.
- Provide guidance and feedback to participating teams, facilitating their achievement of the project aim.

Participating teams will agree to the following:

- Hold regular, at least monthly, team meetings.
- Regularly review and revise your goals, current system, opportunities for improvement, and barriers.
- Plan and conduct tests of the recommended changes detailed in this toolkit.
- After successful testing and adaptation, implement the changes in your facility.
- Attend and actively participate in the monthly huddles, quarterly learning session, and annual statewide meetings.
- Capture and submit the defined project data as required (with minimal to no data lag).
- Submit a monthly report that includes data as well as information on changes being tested and/or implemented.
- Strive to achieve the project aim and the project's process and structure measure goals:
 - At least 90% compliance on all defined process measures.
 - Have all structures (defined by the structure measures) in place by the end of the project.

c. Rationale (*Why*)

Diagnosis of cardiovascular disease (CVD) is challenging during pregnancy due to the overlap of symptoms of normal pregnancy. Therefore, delays in recognition and response remain the primary drivers of adverse maternal outcomes related to cardiovascular disease.

Adoption of the cardiac screening tool will improve the ability for providers to identify and treat pregnant and postpartum women appropriately and will improve outcomes for women in the state of TN.

d. Expected Outcomes and Benefits

If successful, this project will identify women with CVD through a screening process. Identification will allow for an appropriate plan of care and timely follow up through a pregnancy heart network established by each hospital system. By recognizing and responding appropriately, patient care is optimized leading to less emergency preterm deliveries and cesarean sections and ultimately reducing maternal mortality related to CVD in the state of Tennessee.

e. Aim Statement

The aim of this state-wide quality improvement (QI) project is:

Global AIM: Decrease Severe Maternal Morbidity Among Pregnant and Postpartum Women with Cardiac Conditions & Decrease Pregnancy-Related Deaths Due to Cardiac Conditions (utilizing state surveillance monitoring) by 10% across the state by Summer 2026.


Statewide AIM:

Improve care of patients with cardiac conditions in all participating hospitals and/or urgent or emergency care hospital settings by increasing screening and appropriate referrals for at least 90% of all pregnant and postpartum women thereby reducing NTSV C-sections & reduce preterm rates by 10% by June 2026.

Evidence, Contraindications, & Special Circumstances

● Summary of Evidence

Cardiac conditions are the leading cause of pregnancy-related deaths and disproportionately affect non-Hispanic Black women [6]. Nationally, multidisciplinary maternal mortality review committees have found that women who died from cardiac conditions during pregnancy and postpartum were not diagnosed with a cardiovascular disease prior to death. These committees also found that more than 80% of all pregnancy-related deaths were preventable, regardless of cause. Obstetric complications such as preeclampsia and gestational diabetes are associated with future cardiovascular disease (CVD) risk. Studies show that those with cardiac risk factors and those with congenital and acquired heart disease require specialized care during pregnancy and postpartum to minimize risk of preventable morbidity and mortality [6]. Common risk factors for CVD-related mortality include race and ethnicity, age, hypertension during pregnancy, and obesity [7].

 Tennessee (TN), from 2017 to 2021, 455 Tennessee women have died during pregnancy or within a year of pregnancy [2]. Over the past five years, Black women in Tennessee were 2.4x as likely to die from pregnancy-related causes as White women. Tennessee's maternal mortality review (MMR) noted race-specific causes of death such as, Black women were more represented in pregnancy-related cardiovascular deaths. For Black women, 91% of pregnancy related deaths were determined to be preventable. The main causes of pregnancy-related deaths among Black women were preeclampsia, eclampsia, cardiovascular conditions, embolism, and homicide. Just over 1 in 3 (36%) deaths were pregnancy-related and over half of pregnancy-associated deaths (57%) occurred between 43-365 days postpartum. Among all pregnancy-associated deaths, about 3 in 4 deaths (77%) could have been prevented with the appropriate resources and/or interventions [2].

References:

- Hameed, Afshan B et al. "Alliance for Innovation on Maternal Health: Consensus Bundle on Cardiac Conditions in Obstetric Care." *Obstetrics and gynecology* vol. 141,2 (2023): 253-263. doi:10.1097/AOG.0000000000005048

- American College of Obstetricians and Gynecologists' Presidential Task Force on Pregnancy and Heart Disease and Committee on Practice Bulletins—Obstetrics. "ACOG Practice Bulletin No. 212: Pregnancy and Heart Disease." *Obstetrics and gynecology* vol. 133,5 (2019): e320-e356. doi:10.1097/AOG.0000000000003243
- Tennessee Department of Health. (2023). 2021 Maternal Mortality Review (MMR). <https://www.tn.gov/content/dam/tn/health/program-areas/maternal-mortality/Racial-Inequities-Providers-2021.pdf>

a. Contraindications

There are almost no contraindications.

b. Special Circumstances

Cardiac conditions during pregnancy include hypertensive disorders, hypercholesterolemia, myocardial infarction, cardiomyopathies, arrhythmias, valvular disease, maternal congenital heart disease, pulmonary hypertension, thromboembolic disease, aortic disease, and cerebrovascular diseases [8].

● How to Use This Toolkit

This toolkit focuses on providing support and resources to facilitate the implementation of Maternal Cardiac Screening, referral, and treatment in all birthing hospitals in Tennessee.

Included in this toolkit are:

- The rationale for Maternal Cardiac screening, referral, and treatment.
- An overview of quality improvement (QI),
- The details regarding the data measures to collect and monitor to see the impact of your changes,
- The guidelines and best practices.

We recommend that you review the entire toolkit. We then suggest focusing on the change ideas and potentially better practices listed in the Key Driver Diagram. It is recommended that all the change ideas and best practices be implemented by the end of the project.

Research your current system and identify the opportunities for improvement. From this, we suggest creating a draft 30-60-90-day plan, which will help your team decide where to start and identify what you want to accomplish in the next 3 months. Thus, allowing your team to determine your first PDSA cycles.

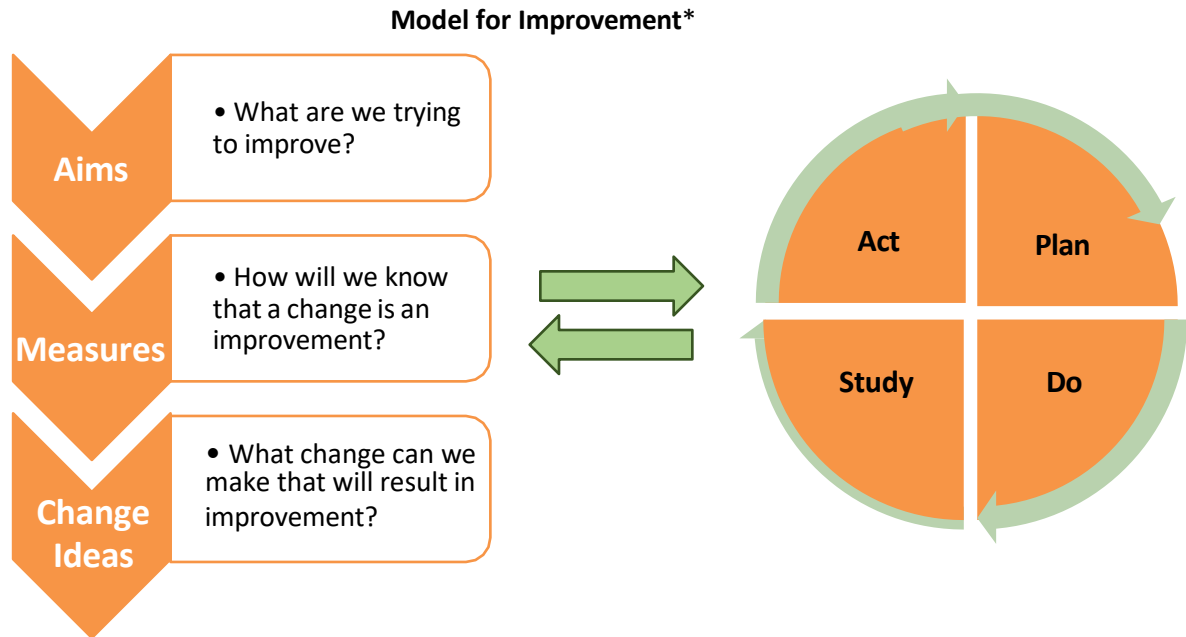
The order of the change ideas on the Key Driver Diagram is the order we suggest (from top to bottom). As you conduct tests of change and accomplish individual change ideas, return to the Key Driver Diagram for your "roadmap" of which change idea to work on next.

This toolkit is intended for application in conjunction with the learning opportunities and webinars offered and facilitated by TIPQC.

Any success realized from this toolkit is in part due to the generosity and collaborative spirit of the team that developed this toolkit, the practices that participated in the TIPQC pilot projects, and from California and Georgia PQC's who provided ideas and direction.

● **QI Overview: The Journey to CCOC**

All TIPQC inter-institutional QI projects are designed based on the IHI Model for Improvement, which provides the framework for developing, testing, and implementing changes that lead to improvement.



For more information, see <https://tipqc.org/jit-pdsa/>. *Used by permission and adapted from: Langley, Nolan, Nolan, Norman, Provost. *The Improvement Guide*. San Francisco: Jossey-Bass Publishers; 1996.⁷

The following sections provide a more general overview of quality improvement – placed in the context of achieving the best care for the CVD patient, and all pregnant women at your facility.

a. Phase 1: Define the Problem

Where are we now? And how did we get here?

It is important to understand your local data and to consider it in the context of regional, national, and international standards observing any changes over recent years. To achieve this, your team should understand how to look at your local data, what questions to ask and where to access benchmarking data such as the Maternal Mortality Report in Tennessee. This report lists cardiovascular disease as one of the three leading causes of pregnancy-related deaths in 2021. National, state and disaggregate data can be found at the national Center for Health Statistics, Center for Disease Control. This report lists in 2021 the maternal mortality rate for non-Hispanic Black (subsequently, Black) women was 69.9 deaths per 100,000 live births, 2.6 times the rate for non-Hispanic White (subsequently, White) women (26.6). [2]. Due to the increases from 2020 to 2021 for all race and Hispanic-origin groups this is a national concern for all women. Using data at the state and national level, and the ability to convey these data to the wider team clearly and concisely will facilitate a stronger commitment to the implementation of quality improvement interventions.

Questions to ask:

Understanding barriers and enablers and finding solutions

We suggest solutions that have worked elsewhere but encourage your hospital team to find solutions which are appropriate for your setting, as a solution which works for one team may not be successful for another.

In general, barriers fall into one of these categories:

1. Lack of awareness of benefits
2. Resistance to change
3. Concerns for lack of resources and referral capacity to address the problem at hand
4. Concerns for increased patient anxiety
5. Logistical concerns and human factors in carrying out a large project

Use some of these improvement tools to survey barriers and enablers in your own service:

1. **Forcefield analysis**- this tool balances the positive and negative drivers, with scores assigned to describe the strength of each force. Study, plan, and act to strengthen the weaker positive forces and diminish the resisting forces (Figure 3). Resource: <https://tipqc.org/jit-force-field/>
2. **Pareto Chart**- in categorizing the underlying problem, a Pareto chart gives a visual depiction of the frequency of problems in graphical form, allowing you to target the areas that offer the greatest potential for improvement. Resource: <https://tipqc.org/jit-pareto-chart/>
3. **Fishbone diagram**- cause and effect analysis tool. This is a useful tool for categorizing factors which influence the ability to deliver optimal cord management (Figure 4). Resource: <https://tipqc.org/jit-cause-effect/>
4. **Case review** – take the last 10-20 cases and use a structured review tool to identify any common themes. The BAPM Toolkit has an example case review tool here: [https://hubble-live-assets.s3.amazonaws.com/bapm/redactor2_assets/files/831/OCM Toolkit Full For Launch.pdf](https://hubble-live-assets.s3.amazonaws.com/bapm/redactor2_assets/files/831/OCM_Toolkit_Full_For_Launch.pdf) (pages 46-48). Consider reviewing 10 cases and identify strengths as well.
5. **Process mapping** – walk through the journey that a patient may experience and think about the factors within the process and the environment that may contribute to the patient care you provide . Resource: <https://tipqc.org/jit-flowcharts/>

Figure 3: Example force field analysis for CCOC [8]

Adverse Neonatal Outcomes Associated with Maternal Heart Failure

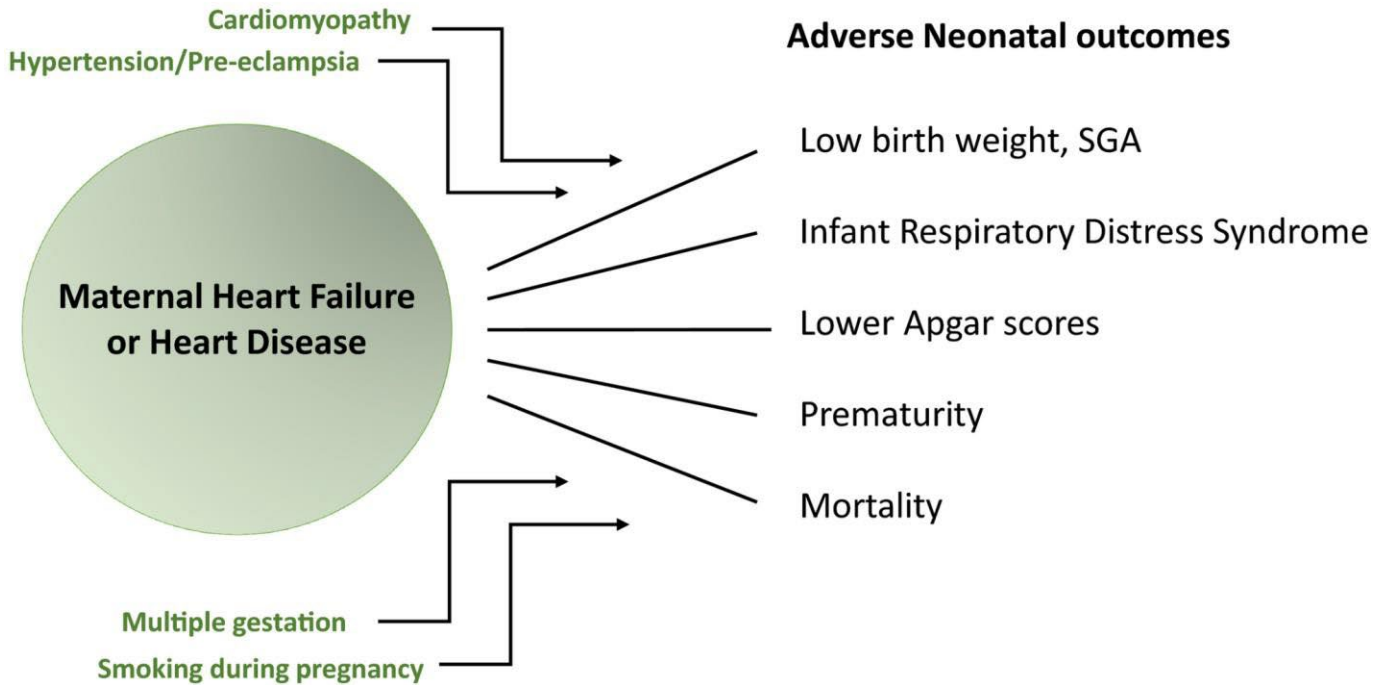


Figure 4: Example fishbone diagram [10]

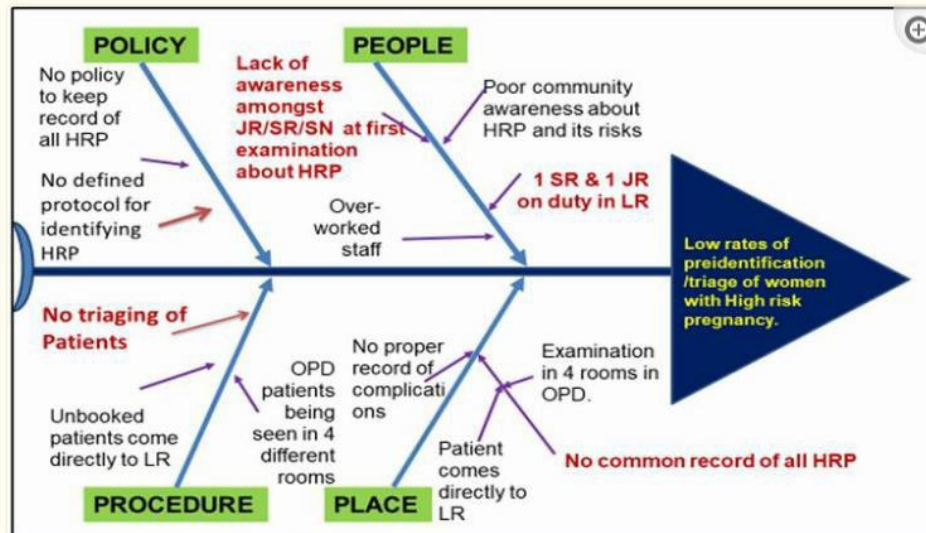


Figure 1

Fishbone analysis of the problem. HRP, high-risk pregnancy; JR, junior resident; LR, labour room; OPD, outpatient department; SN, staff nurse.

Phase 2: Develop a Shared Purpose

The evolution of the perinatal team. Obstetric and neonatal teams all have an important role to play in the safe delivery of care for women in labor and the subsequent care of their baby. This care at times may be delivered in professional silos which has the potential to lead to poor communication and missed opportunities for antenatal interventions which may lead to suboptimal outcomes. Developing a strong perinatal team within your workplace will help facilitate communication, understanding and collaboration across departments and allow more cohesive implementation and embedding of antenatal interventions. Having shared goals, a shared vision and sharing experience ensures your project has momentum and that barriers and enablers can be best appreciated and tackled.

One key component to any successful project is having a team that is engaged, resilient, enthusiastic, and committed to working together to create the right culture for change. Teams should ideally be around 5-8 members. Suggested team composition includes:

- Project champion
- Physician champion
- Nursing champion
- Unit medical director
- Unit nursing management
- Front line nursing
- Nursing educators
- Nurse practitioners
- Midwives
- Physicians (Cardiology, Critical Care/ICU, Internal Medicine, Emergency Medicine, Anesthesiology)
- Patient/family members
- Patient safety officer
- Quality improvement office
- IT/EMR implementation experts

When forming your team consider:

- **Who** are the most influential people within the maternity/cardiology/anesthesia/emergency medicine/critical care team? These may not be the most senior staff members. Consider inviting those who are unsure or oppositional to understand perspective and secure buy in from the outset.
- **Where** are the areas likely to be affected by any changes? Consider staff in these areas.
- **Why** should people want to be involved in your project? Not everyone understands the benefits of CCOC, so take the time to educate the staff. Consider how you are going to engage people and maintain their commitment.
- **What** are your expectations of team members? What will they be required to do in terms of time and effort? How will you manage team members who do not deliver on tasks/actions?
- **When** are people available and are the project's time commitments realistic?
- **How** often are you going to meet? Keep up momentum for change, short but frequent meetings.

- **What else** is going on? Are there existing workstreams with overlapping agendas that could be pulled together to prevent duplication? Are there other QI projects which take priority?

Find out if your facility has a central quality improvement team who can facilitate projects and provide valuable skills and knowledge in designing and implementing improvement work. Local data analysts are valuable in helping to collect, analyze, and display data.

Stakeholder engagement

Who else needs to be involved? Start by brainstorming the groups of people likely to be affected by the proposed change. Within the topic of cardiac conditions in obstetrical care, they are likely to include:

- Obstetrical nurses
- Obstetricians
- Advance practice nurses – practitioners, midwives, CRNAs
- Parent groups
- Anesthesiologists
- Cardiologists
- Emergency Medicine
- Critical Care providers (ICU)

Resources:

<https://tipqc.org/jit-teams/>

Phase 3: Plan and Implement Changes

Project Charter

The quality improvement project charter provides a rationale for the team's work. It can help to clarify the team's thinking about what needs to be done and why. The charter helps the team keep the focus on a specific problem. The charter also identifies members of the project's team. An example charter and template can be found here:

<http://www.ihl.org/resources/Pages/Tools/QI-Project-Charter.aspx>
[Cardiac Conditions in Obstetrical Care Change Package](#)

Formulate, prioritize, and test solutions

As mentioned, all TIPQC inter-institutional QI projects are designed based on the IHI Model for Improvement, which provides the framework for developing, testing, and implementing changes that lead to improvement.

Model for Improvement*

The Model for Improvement

The IHI Model for Improvement consists of the 3 questions and the Plan-Do-Study-Act (PDSA) cycle. With PDSA cycles, the main idea is a mindset of continuous monitoring and testing of change ideas over time.

Plan

Which intervention(s) will you try first? This may be the intervention most likely to make an impact, the easiest to implement or the one that will best win hearts and minds. How will this intervention be introduced into clinical practice? Who and what will be required to make this happen? Predict what you think the change might be?

Do

When and how will this plan be carried out? A timescale is important. Document problems and unexpected observations.

Study

Use established tools to analyze your data (see Phase 4). Has your change idea resulted in improvement? Is this a real improvement? Does your data suggest your change idea needs to be modified? Why might this be so? Compare your data to your predictions.

Act

Identify and carry out any modifications needed to this change idea to make it more effective, using further PDSA cycles as needed i.e., Adapt, Adopt or Abandon, Repeat. Start with rapid testing your change on a small scale, for example small numbers of patients or a specific subgroup of patients. If effective, increase the numbers or widen to include other groups of patients. Test and repeat with increasing scale until you can show effectiveness throughout your patient group.

Resources:

<https://tipqc.org/jit-model-for-improvement/>
[How to Improve: Model for Improvement](#)

Phase 4: Test and Measure Improvement

In this phase, improvements are tested, reviewed, and re-tested (using PDSA cycles) to find a solution.

Measures

Measuring for improvement is different from the data collected for research or to prove whether clinical interventions work or not. This type of measurement asks the questions “How do we make it work in our context?” and “How do we know that a change is an improvement?” It is important that you collect the right data for your project.

Groups of measures collected include:

- Outcome measures
 - Reflect the impact on the patient. This may include things like: Percent of NTSV cesarean birth rate

among women with cardiac conditions or the preterm birth rate among women with cardiac conditions.

- Process measures

- The way systems and processes work to deliver the desired outcome, e.g., using a standardized pregnancy risk assessment tool for women with cardiac conditions, implementing a multidisciplinary care plan for pregnant women with cardiac conditions, and providing education to providers and nursing staff to improve the care of women with cardiac conditions.

- Balancing measures

- This is what may be happening elsewhere in the system because of the change. The project may bring an increase in the volume of referrals to the Cardiology/MFM which may lead to delays in patient care while waiting for a referral. Screening may increase patient anxiety. These unintended consequences are not able to be measured in a way that is meaningful to the project. To that end, many times when a screen is positive, while it may not be related to CVD, it could uncover other diagnoses that are important to the pregnancy.
- The measures defined for this TIPQC CCOC Project are detailed in the “Measures: How will we know that a change is an improvement?” section.

Data analysis and display

How will any change be measured, assessed, and displayed in your unit or network? Common tools to present and analyze your data include run charts and statistical process control (SPC) charts. All require a level of knowledge and skill to collate and interpret correctly. Importantly, measurement should not be a ‘before and after’ audit which is unreliable in measuring true change, but a continuous process over time during which your changes can be evaluated and modified.

Note that you may choose a different type of chart to be understood by your audience. Run charts and statistical process control charts should always be used by the QI project team in understanding data and assessing change, while other charts and tools may be used to prepare your data in a format which is best understood by frontline staff. You may need an easy-to-read key to explain your chart or provide a summary interpretation.

Resources:

<http://www.ihl.org/resources/Pages/Measures/default.aspx>

<https://tipqc.org/jit-types-of-measures/>

<https://tipqc.org/jit-run-charts/>

<https://tipqc.org/jit-control-charts/>

[Tools | Institute for Healthcare Improvement](#)

[Publications | Institute for Healthcare Improvement](#)

Phase 5: Implement, Embed, and Sustain

This phase involves the wider implementation of improvements so that change becomes embedded in routine practice throughout the system.

Spread

This can involve formal methods such as *dissemination* that includes presentations, publications, leaflets, learning boards, social media, or informal methods of *diffusion* where word of mouth, champions, and opinion leaders can accelerate your message. Consider carefully what is required for the embedding of changes within your system. It is also important to consider how to disseminate this information to non-participating centers. This could be done through local and regional conferences and at professional organization meetings.

Exception reporting

We recommend that birthing units undertake a case review when cardiac screening, referral, care plan, or treatment is not achieved using the facility's risk reporting mechanisms. A case review or audit tool can be used or adapted for this purpose. In this project we propose that appropriate recognition and treatment will improve maternal stabilization, thereby reducing the need for cesarean section by decreasing the risk of emergent delivery. This would also ideally decrease the preterm birth rates.

Sustainability

The ability of a service to implement and sustain change is dependent on various strengths and weaknesses of any one project. These can be assessed and addressed from the outset of a project and be reviewed regularly throughout the time course to improve the likelihood of sustaining improvement beyond its lifespan. A useful tool to guide sustainment efforts is available through the IHI at: [Tools | Institute for Healthcare Improvement](#).

Barriers and loss of motivation

It is not unusual to find the size of a previous improvement decreases over time. It is important to understand why, so that solutions can be tailored to the problem. Different approaches will be effective for different people and different situations. The following activities may be useful: talk to key individuals, observe clinical practice in action, use a questionnaire to survey staff, and/or brainstorm with a focus group. Education is a key element of overcoming barriers particularly within an interactive forum; using opinion leaders to influence others within your staffing structure; reminder systems to prompt clinicians; and ensuring feedback of data to staff in a format that they find useful; and proper use of parent stories. All these can help to reinvigorate and embed your changes for improvement.

Resources:

[White Papers | Institute for Healthcare Improvement](#)

[Tools | Institute for Healthcare Improvement](#)

<https://tipqc.org/jit-spread/>

<https://tipqc.org/jit-holding-gains/>

Measures: How will we know that a change is an improvement?

Target population

All women in Tennessee hospitals and urgent/emergent care departments within the hospital setting

Measurement Statement: For the purpose of this bundle, cardiac conditions refer to disorders of the cardiovascular system which may impact maternal health. Such disorders may include congenital heart disease, cardiac valve disorders, cardiomyopathies, arrhythmias, coronary artery disease, pulmonary hypertension, and aortic dissection. An ICD-10 codes list of cardiac conditions will be used when calculating outcome and **state surveillance data**.

Outcome measure

Outcome Measures as defined by AIM - *frequency of collection & reporting: monthly*

1. Percent of NTSV Cesarean Birth Rate Among Women with Cardiac Conditions

Report N/D - Disaggregate by race/ ethnicity and payor status

Denominator: Among women with cardiac conditions, those with live births who have their first birth ≥ 37 completed weeks gestation and have a singleton in vertex (Cephalic) position

Numerator: Among the denominator, those with a cesarean birth

- *Nulliparous = first delivery/birth or Para Zero*
- *Term = ≥ 37 weeks gestation*
- *Singleton = no twins or beyond*
- *Vertex position = cephalic position; no breech or transverse position*

2. Percent of Preterm Birth Rate Among Women with Cardiac Conditions

Report N/D - Disaggregate by race/ ethnicity and payor status

Denominator: Singleton live births among women with cardiac conditions

Numerator: Among the denominator, preterm live births (<37 completed weeks gestation)

These metrics are not necessarily a reflection of quality of care, but a reflection of provider comfort because of a comprehensive, team-based approach to providing care to pregnant and postpartum women with cardiac conditions.

Potential differences in outcomes across Structural and Social Determinants of Health (SSDOH):

Participating hospitals will be asked to capture the “overall” numerator and denominator counts for each outcome measure as well as counts disaggregated by (1) mother’s race/ethnicity and (2) payor type.

Balancing measures

- There are no measurable balancing measures for this project nor were any developed by AIM.

This project may bring an increase in the volume of referrals to the Cardiology/MFM which may lead to delays in patient care while waiting for referral. Screening may increase patient anxiety. These unintended consequences are not able to be measured in a way that is meaningful to the project. To that end, many times when a screen is positive, while it may not be related to CVD, it could uncover other diagnoses that are important to the pregnancy.

Process measures

Process Measures as defined by AIM - *Frequency of collection & reporting*: monthly and quarterly

Process Measure #1, #2 and #3 should be reported monthly (data entered into the SimpleQI platform).

1. Standardized Pregnancy Risk Assessments for Women with Cardiac Conditions

- Utilize a standardized pregnancy risk assessment tool.

Report N/D - Disaggregate data by race/ethnicity and payor status

Denominator: Women with cardiac conditions diagnosed prior to birth admission

Numerator: Among the denominator, those who received a pregnancy risk classification using a standardized cardiac risk assessment tool by time of birth admission.

2. Cardiovascular Disease (CVD) Assessment among Pregnant and Postpartum Women

- Utilize a CVD assessment tool for all birthing admissions.

Report N/D - Disaggregate data by race/ethnicity and payor status

Denominator: All birth admissions

Numerator: Among the denominator, those with documentation of a cardiovascular disease assessment using a standardized tool

3. Multidisciplinary Care Plan for Pregnant Women with Cardiac Conditions

- Patients with cardiac disease who had a multidisciplinary care plan for birth established by time of birth admission.

Report N/D - Disaggregate data by race/ethnicity and payor status.

Denominator: Women with cardiac conditions diagnosed prior to birth admission

Numerator: Among the denominator, those who had a multidisciplinary care plan for birth established by time of birth admission

Process Measure #4 - #6 should be reported quarterly (data entered into the SimpleQI platform).

4. OB Provider and Nursing Education – Cardiac Conditions
 - Cumulative proportion of delivering physicians and midwives who have completed an education program on cardiac conditions in pregnant and postpartum women.
 - Report estimates in 10% increments (0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%)
5. OB Provider and Nursing Education – Respectful and Equitable Care
 - Cumulative proportion of delivering physicians and midwives who have completed an education program on Respectful and Equitable Care
 - Report estimates in 10% increments (0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%)
6. ED Provider and Nursing Education – Cardiac Conditions
 - Cumulative proportion of ED providers and mid-level providers who have completed an education program on cardiac conditions in pregnant and postpartum women.
 - Report estimates in 10% increments (0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%)

Structure measures

Structure Measures as defined by AIM - *Frequency of collection & reporting*: quarterly.

1. Multidisciplinary Pregnancy Heart Team (PHT)
 - Does your hospital have a multidisciplinary Pregnancy Heart team appropriate to the Maternal Level of Care to coordinate clinical pathways for women experiencing cardiac conditions in pregnancy and the post-partum period including as applicable cardiologist, anesthesiologist, maternal fetal medicine (MFM), obstetrics, obstetric anesthesia, cardiac anesthesia, pharmacy, emergency medicine, intensive care, cardiac surgeons, interventional cardiologists, electrophysiologists, HF Specialists, nursing, and social workers. [11]
 - Establish a multidisciplinary Pregnancy Heart Team
 - Each Quarter, report what the level of “completion” is for each structure measure on a 3-point Likert Scale. (1=Not Started, 3= Started, 5= Fully in Place)
2. ED Screening for Current or Recent Pregnancy
 - Integrate standardized verbal screening for current or recent pregnancy in the past year as part of the ED triage process.
 - Each Quarter, report what the level of “completion” is for each structure measure on a 3-point Likert Scale. (1=Not Started, 3= Started, 5= Fully in Place)
3. Patient Education Materials on Urgent Postpartum Warning Signs
 - Has your hospital integrated patient education on urgent postpartum warning signs that align with culturally and linguistically appropriate standards into discharge teaching (or other times)?
 - Do these education materials provided to parents encourage discussion with providers?
 - Each Quarter, report what the level of “completion” is for each structure measure on a 3-point Likert Scale. (1=Not Started, 3= Started, 5= Fully in Place)

4. Multidisciplinary Case Reviews for CCOC Bundle

- Care providers should establish a process and perform multidisciplinary case reviews of specific cases, including:
 - Critical care/ICU admissions for other than observation
 - Those at the highest levels of risk, such as maternal WHO risk levels III and IV
 - Each Quarter, report what the level of “completion” is for each structure measure on a 3-point Likert Scale. (1=Not Started, 3= Started, 5= Fully in Place)

5. Patient Event Debriefs

- Has your hospital developed and implemented a standardized process to conduct debriefs with patients after a severe event (include patient support networks during patient event debriefs, as requested; severe events may include the TJC sentinel event definition severe maternal morbidity, or fetal death).
 - Each Quarter, report what the level of “completion” is for each structure measure on a 3-point Likert Scale. (1=Not Started, 3= Started, 5= Fully in Place)

6. Patient/Family Partner

- Hospital has a patient/family partner who engaged in appropriate education, e.g., Momma’s Voices’ Training, and is actively participating on the improvement team.
 - Each Quarter, report what the level of “completion” is for each structure measure on a 3-point Likert Scale. (1=Not Started, 3= Started, 5= Fully in Place)

Data Collection

Your team should determine the process in which they will collect and capture the outcome, process, and structure measures for this project.

Each participating team will enter monthly and quarterly data into the Simple QI platform. All data and graphs will be available to teams for viewing and downloading at the time of data entry. A detailed Data Collection Plan and EMR Guide are provided for this project.

Change Ideas: *What changes can we make that will result in an improvement?*

All improvement requires change. And while there are many kinds of changes that will lead to improvement, the specific changes are developed from a limited number of change concepts. As described in the IHI Model for Improvement, “A change concept is a general notion or approach to change that has been found to be useful in developing specific ideas for changes that lead to improvement.” These change concepts are used to design and run tests of change (i.e., Plan-Do-Study-Act (PDSA) cycles) to see if they result in improvement.

A similar idea to change concepts is Potentially Better Practices (PBP’s), which are a set of clinical practices that have the potential to improve the outcomes of care. They are labeled ‘potentially better’ rather than ‘better’ or ‘best’ because until the practices are evaluated, customized, and tested in your own institution, you will not know whether the practices are truly ‘better’ or ‘best’ (or ‘worse’). Depending on the circumstances in your facility, you may have to implement other practices or modify existing ones to successfully improve outcomes. The PBP’s in this collection are not necessarily the only ones required to achieve the improved outcomes targeted. Thus, this list of PBP’s is not exhaustive, exclusive, or all inclusive. Changes in practice,

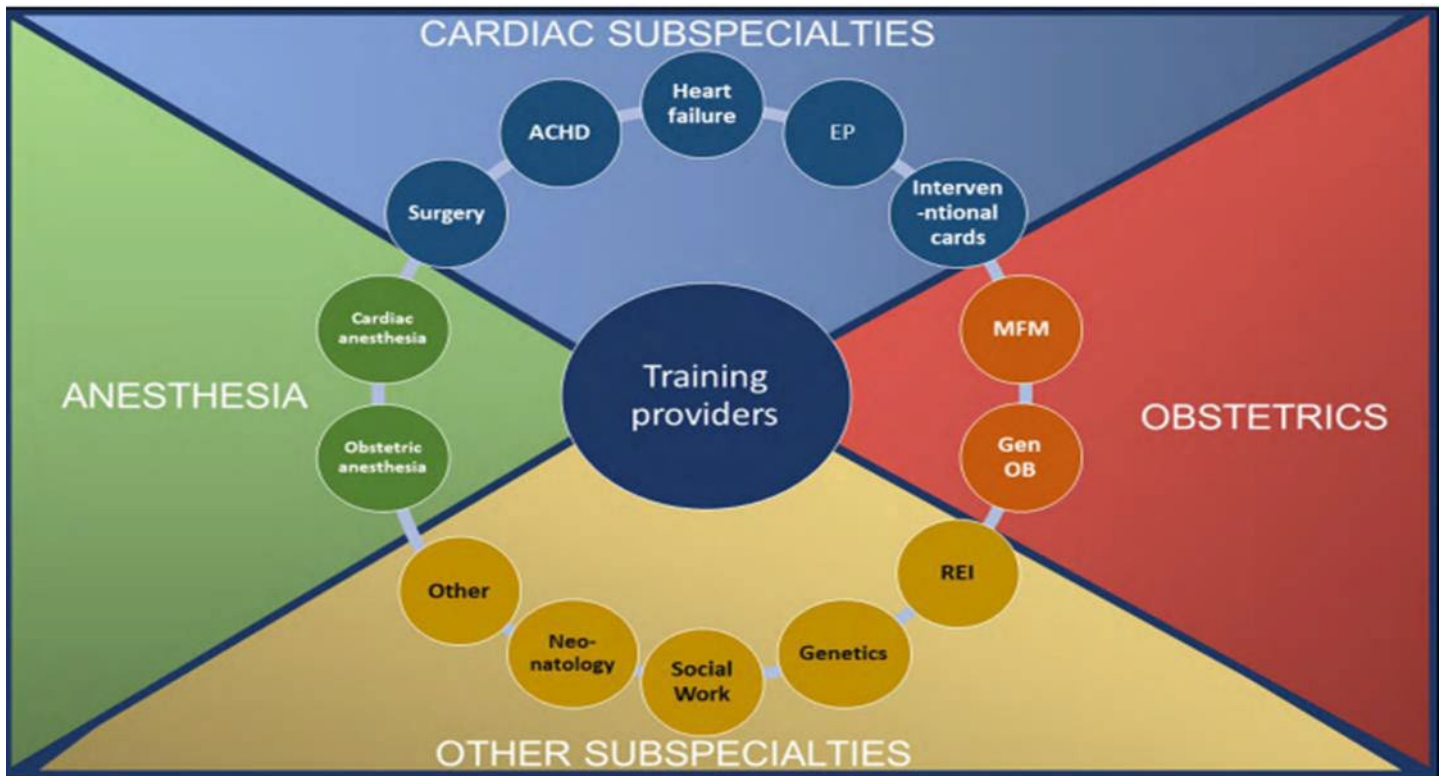
guided by these PBPs, will require testing and adaptation to your circumstances and context to achieve measured improvements in outcomes.

The following core strategies provide a framework that is best designed to improve **identification, care, and a resource for obstetrics, primary care, and emergency medicine providers who interact with women during prenatal care or the postpartum period**. Each of these core strategies should be reviewed to identify how to achieve best practice. The toolkit includes an overview of clinical assessment and comprehensive management strategies for cardiovascular disease based on risk factors and presenting symptoms.

Improve the culture of Care, Awareness, & Education: **READINESS-EVERY UNIT**

The following core strategies provide a framework that is best designed to improve identification and care for the CVD pregnant & postpartum patient. Each of these core strategies should be reviewed to identify how to achieve best practice [12-18]

- a. Train all providers in contact with pregnant and postpartum women (OB, ED, OB Triage) to perform a basic Cardiac Conditions Screen
- b. Establish a protocol for rapid identification of potential pregnancy-related cardiac conditions in all practice settings into which pregnant and postpartum women may present
- c. Develop a patient education plan based on the pregnant and postpartum women's risk of cardiac conditions
- d. Establish a multidisciplinary "Pregnancy Heart Team" (PHT) or consultants appropriate to their facilities' designated Maternal Level of Care to design coordinated clinical pathways women experiencing cardiac conditions in pregnancy and the postpartum period
- e. Establish coordination of appropriate consultation, co-management, and/or transfer to appropriate level of maternal or newborn care. This coordination should include protocols for work up, easy referral network within and outside of the facility, and a designated OB and Cardiology champion.
- f. Develop trauma-informed protocols in training to enhance quality of care
- g. Develop and maintain a set of referral resources and communications pathways between obstetric providers, community-based organizations, and state and public health agencies to enhance quality of care [19]



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- Pregnancy in congenital heart disease: risk prediction and counseling. BMJ, 2020
- In cardio-obstetrics, clinicians must think 'outside the box' on CV issues in pregnancy. Cardiology Today, 2020
- Improving Health Care Response to Cardiovascular Disease in Pregnancy and Postpartum Toolkit CMQCC, 2017
- Addressing maternal mortality: the pregnant cardiac patient. Am J Obstet Gynecol. 2019 Feb;220(2):167.e1-167.e8. doi: 10.1016/j.ajog.2018.09.035. Epub 2018 Sep 29. PMID: 30278179.
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RECOGNITION & PREVENTION: Every Patient

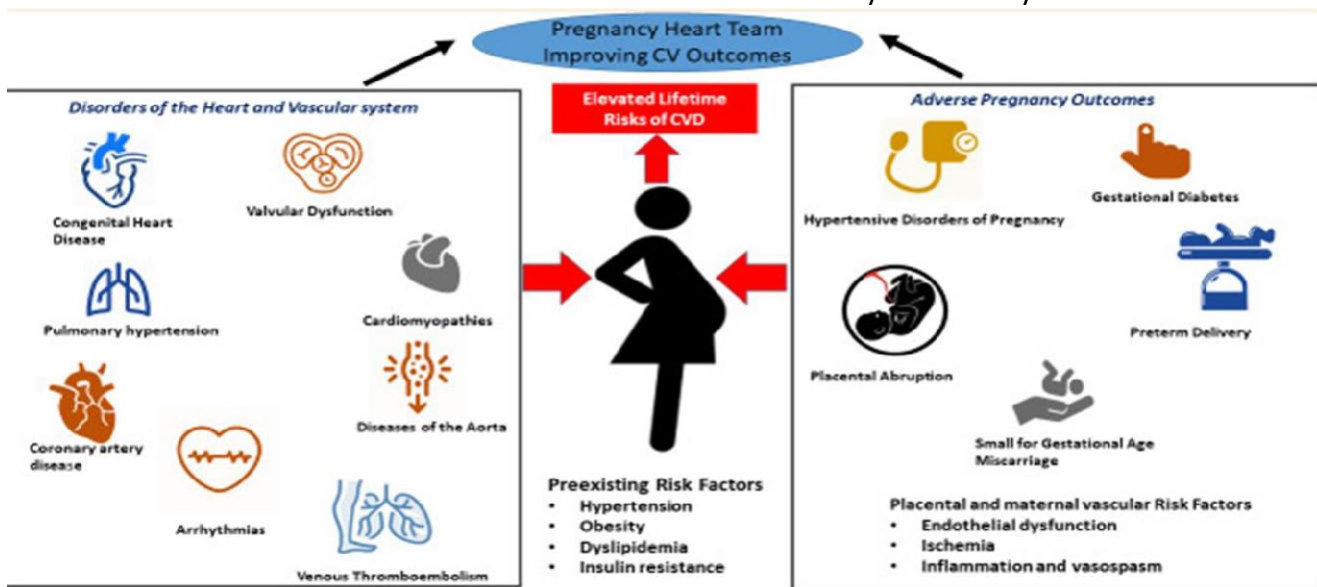
Hypertensive disorders affect ~6-10% of all pregnancies. In 2014, the American Heart Association declared that a history of preeclampsia should be considered a failed stress test. All women with a history of preeclampsia should be regularly evaluated and treated for cardiovascular risk factors such as high blood pressure, obesity, smoking, and high cholesterol. Screening for risk factors should start within one year after delivery [20].

Recent data has suggested that this subset of women is at increased risk for long term cardiovascular complications such as heart failure and stroke. Other population studies have denoted that early preeclampsia (34 weeks or less) is associated with long term CVD mortality [21].

Other pregnancy complications including growth restriction, gestational diabetes, placental abruption, and preterm labor are also associated with an increased risk of CVD.

Recommendations are as follows:

- A targeted history for all patients of childbearing age which documents a history of hypertensive disorders
- Target family history including history of stroke, hypertension, diabetes, and cardiac disease
- Improved communication between obstetricians and primary care providers
- Increase awareness through education
- Encourage yearly follow up with cardiology or primary care provider in this population
- In all care environments, assess and document if a patient presenting is pregnant or has been pregnant within the past year
- Assess if escalating warning signs for a potential imminent cardiac event are present
- Utilize standardized cardiac risk assessment tools to identify and stratify risk

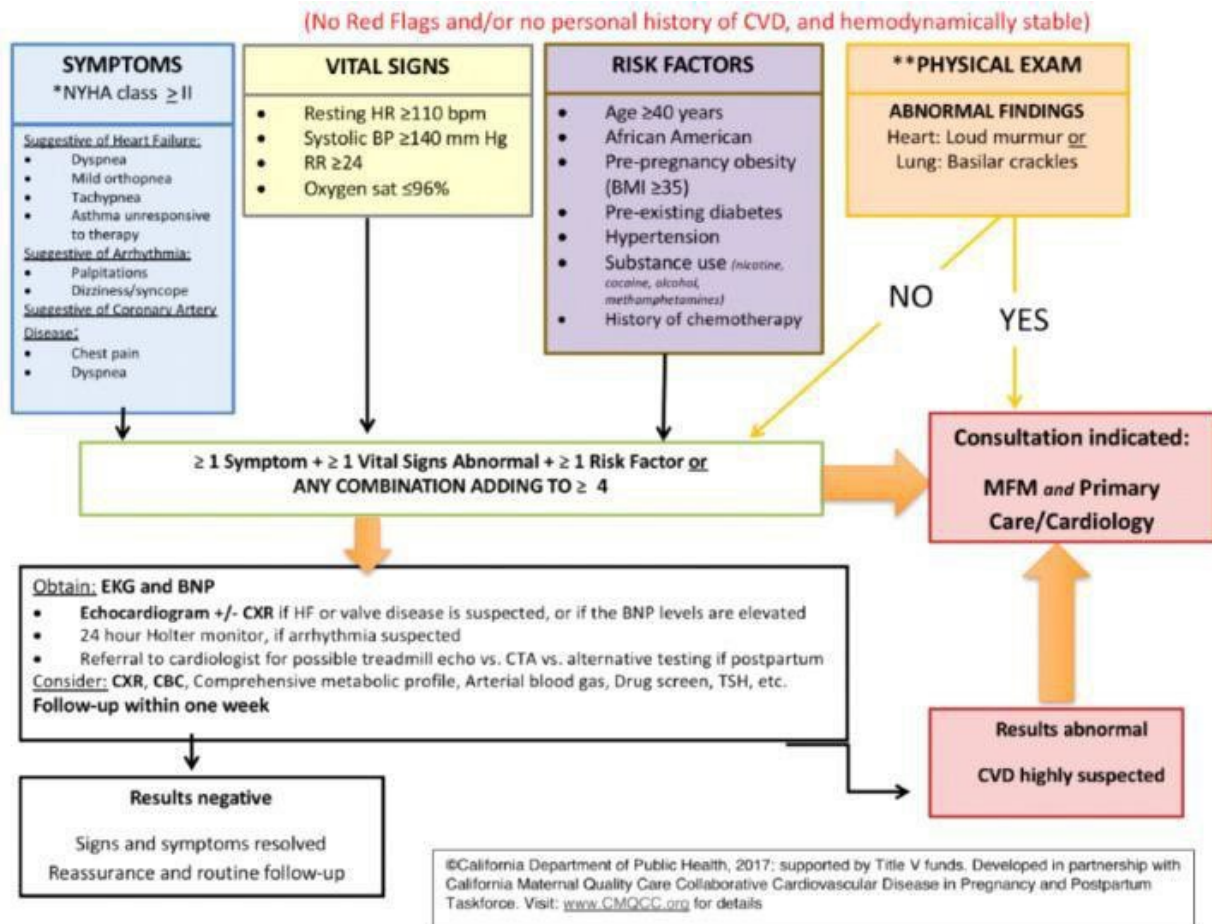


[22]

Early detection and risk stratification of CVD among pregnant and postpartum women is essential, as most pregnant/postpartum patients who died of CVD did not carry a prior diagnosis of cardiac disease.

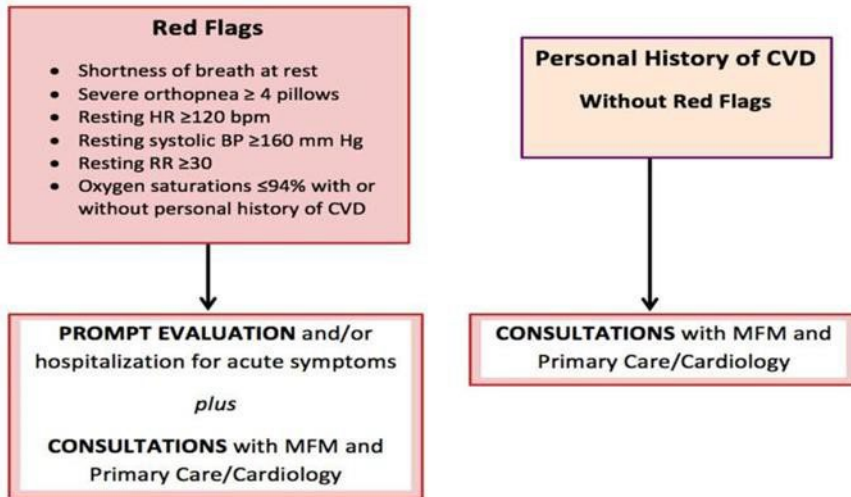
- Implementation of the CVD screening tool in all care settings including the emergency room.
- Tool should be used in all pregnant women and up to six weeks postpartum.

- c. Conduct a risk-appropriate workup for cardiac conditions to establish diagnosis and implement the initial management plan.
- d. Screen each person for condition-associated risk factors and provide linkages to community services and resources



[23]

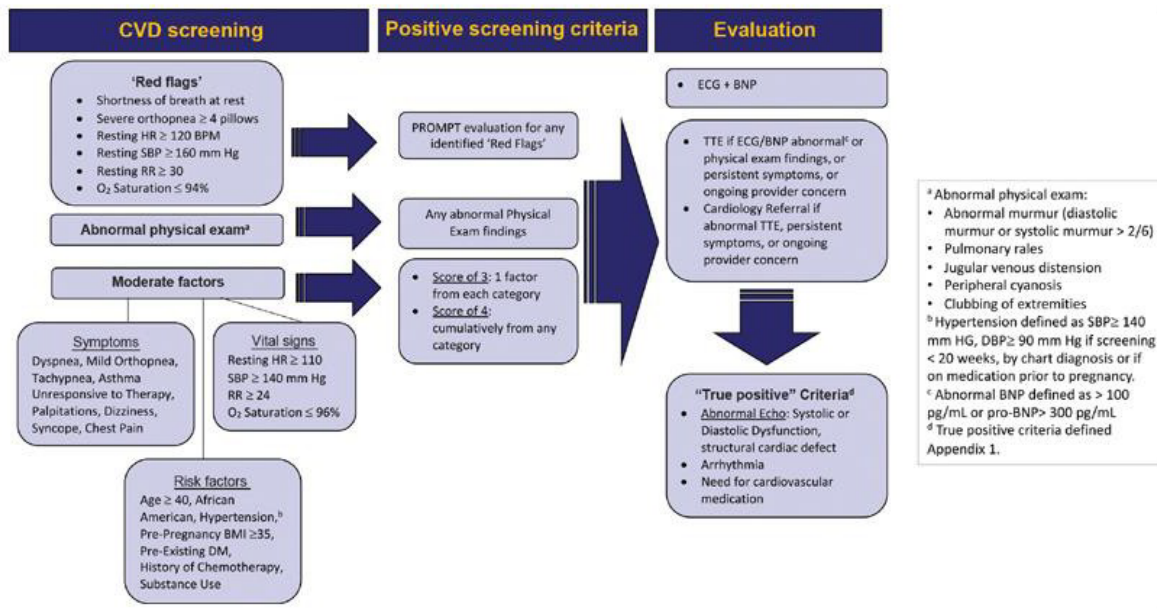
Pregnant women with CVD may be stratified into three groups. Compared to women with preexisting CVD entering their pregnancy with a known diagnosis of CVD (group 1; people with undiagnosed unknown CVD but have chronic symptoms (group 2) and patients for whom CVD is unmasked by pregnancy (group 3)



Cardiovascular disease assessment in women presenting with red flags (severe signs and symptoms or personal history of CVD). (Adapted from CMQCC.com, with permission.) [23]

- 1) Assess patients for immediate care using the RED FLAG signs and symptoms of disease
- 2) Develop initial evaluation and triage including stabilization and moving a higher level of care
- 3) Develop a simulation around the treatment of cardiac arrhythmias for providers

Fig. 1



CVD screening, evaluation, and initial management Toolkit. BNP, brain natriuretic peptide; CVD, cardiovascular disease; DBP, diastolic blood pressure; DM, diabetes mellitus; ECG, echocardiogram; HR, heart rate; RR, respiratory rate; SBP, systolic blood pressure; TTE, transthoracic echocardiogram.

[24]

One of the barriers to CVD-related care is lack of knowledge at the healthcare provider and the patient level. Therefore, a key step in preventing maternal death can be reduced by addressing provider awareness and education surrounding CVD in pregnancy.

1. Develop a presentation on OB physiology for providers including cardiologist, hospitalist, emergency room provider, family practice providers and other providers who care for OB patients.
2. Implement a community education campaign for patients and their advocates to spread the word regarding CVD signs and symptoms in pregnancy.

California Cardiovascular Screening Tool Blumenthal et al. [24]

California Cardiovascular Screening Tool Blumenthal et al.

Supplementary Table S1 Criteria used for diagnosis of "true positive" cardiac abnormalities

Abnormality	Parameters for diagnosis ^a
Systolic or diastolic dysfunction	
Systolic dysfunction ¹	EF < 54% Estimated based on 2D Simpson's and/or 3D LVEF (except when not possible due to poor window or other technical reasons, in which case visual estimation used)
Diastolic dysfunction ²	Diastolic dysfunction determined based on estimation of filling pressures per ASE 2016 guidelines ² reported as mild (grade 1), moderate (grade 2), severe (grade 3)
Ventricular dilation or hypertrophy	
Ventricular hypertrophy ¹	LV mass by 2D method (g) Mild: 151–171 Moderate: 172–193 Severe: >193
Ventricular dilatation ¹	LV diastolic diameter (cm), LV diastolic volume (mL) Mild: 5.3–5.6, 107–120 Moderate: 5.7–6.1, 121–130 Severe: >6.1, >130
Valvular abnormality	
Mitral regurgitation ³	Cases described as "mild to moderate" dysfunction were included; "trace to mild" was not considered abnormal. Mild: EROA, 2D PISA < 0.20 cm ² , RVol < 30 mL, RF < 30% Moderate: EROA, 2D PISA 0.20–0.39 cm ² , RVol 30–59 mL, RF = 30–49% Severe: EROA, 2D PISA > 0.39 cm ² , RVol > 59 mL, RF > 49%
Aortic regurgitation ³	Mild: EROA < 0.10 cm ² , RVol < 30 mL/beat, RF < 30% Moderate: EROA 0.10–0.29 cm ² , RVol 30–59 mL/beat, RF 30–49% Severe: EROA > 0.39 cm ² , RVol > 59 mL/beat, RF > 49%
Tricuspid regurgitation ³	Cases described as "mild to moderate" dysfunction were included; "trace to mild" was not considered abnormal. Mild: EROA < 0.20 cm ² , RVol (2D PISA) < 30 mL Moderate: EROA 0.20–0.39 cm ² , RVol (2D PISA) 30–44 mL Severe: EROA > 0.39 cm ² , RVol (2D PISA) > 44 mL
Pulmonary regurgitation ³	Mild: RF < 20% Moderate: RF 20–40% Severe: RF > 40%
Aortic stenosis ⁴	Mild: EROA < 0.10 cm ² , RVol < 30 mL/beat, RF < 30% Moderate: EROA 0.10–0.29 cm ² , RVol 30–59 mL/beat, RF 30–49% Severe: EROA > 0.39 cm ² , RVol > 59 mL/beat, RF > 49%
Mitral stenosis ⁴	Mild: MVA > 1.5 cm ² , mean gradient < 5 mm Hg, PAP < 30 mm Hg Moderate: MVA 1–1.5 cm ² , mean gradient 5–10 mm Hg, PAP = 30–50 mm Hg Severe: MVA < 1 cm ² , mean gradient > 10 mm Hg, PAP > 50 mm Hg
Pulmonary stenosis ⁴	Mild: peak velocity < 3 m/s, peak gradient < 36 mm Hg Moderate: peak velocity 3–4 m/s, peak gradient 36–64 mm Hg Severe: peak velocity > 4 m/s, peak gradient > 64 mm Hg
Pulmonary hypertension ⁵	Assessment of intermediate or high probability of pulmonary hypertension based on ASE criteria
Pathologic arrhythmia	A sustained arrhythmia identified by Holter or telemetry that required treatment

Abbreviations: 2D, two-dimensional; ASE, American Society of Echocardiography; AVA, aortic valve area; EROA, effective regurgitant orifice area; LA, left atrium; MVA, mitral valve area; PAP, pulmonary artery pressure; PISA, proximal isovelocity surface area; RVol, regurgitant volume; RF, regurgitant fraction; TR, tricuspid regurgitation.

^aEchocardiogram parameters based on the American Society of Echocardiography (ASE) guidelines (see references below for individual documents).

RESPONSE: Every time

1. Facilities and providers should establish system-wide standard protocols, standard checklists, and escalation of care policies for management of cardiac symptoms [25]
2. Facilities and providers should establish system-wide standard protocols, standard checklists, and escalation of care policies for management of women with known or suspected cardiac conditions.
3. Facilities and providers should coordinate transitions of care including higher level or continuing care. This should include discharge from the birthing facility to home and transition from the postpartum care to ongoing primary and specialty care.
4. Facilities and providers should offer family planning discussions and resources, including access to a full range of contraceptive options in accordance with safe regimens.
5. Facilities and providers should provide patient education focused on general life-threatening pregnancy and postpartum cardiac-related complications and early warning signs, including instructions of who to notify if they have concerns.

Response To Do List:

- Cardiac Assessment Checklist for Providers
 - Timing: Any admission
 - Outpatient: new OB visit, Postpartum visits, Preconception
 - Target Audience: OB Providers
- Cardiac Assessment Checklist for Patient
 - “Checklist for a Mother’s Heart”
 - Timing: Preconception, Early Pregnancy, prior to delivery discharge, 1-week postpartum visit, 6-week postpartum visit (*Termination time)
- Create an algorithm of Awareness
 - Includes current referral networks
- Marketing Campaign
 - “HEARTS” (Magnets, Lapel Pins, Badge buddy, etc.)
 - § High Blood Pressure
 - § Extra Fluid
 - § Achy Chest or Abnormal Chest Pain
 - § Rapid Heartbeat or Breathing
 - § Tiredness
 - § Short of Breath
- Request Campaign advertised in anything pregnancy-related (ex. Hospital newsletters, mommy groups, advocacy websites, etc.)
- Education and Awareness for non-OB providers
 - Webinars
 - Brainstorming Kickoff
 - Speakers Bureau Tour
- Create an Algorithm of Action
 - Establishment of referral systems
 - Include Telehealth and other remote resources
 - A website and sign up (Georgia example)
- Establishment of the multidisciplinary team
 - Statewide Collaborative Team

Reporting & Systems Learning: Every Unit

For pregnant and postpartum women at high-risk for a cardiac event, establish a culture of multidisciplinary planning, admission huddles, and post event debriefs [25].

1. Have formal review following serious cardiac events to assess alignment with standard policies and procedures (with appropriate updates) and to identify opportunities for improvement (including identification of discriminatory practices).
 - Establish standardized briefing documentation to capture successes and determine actionable follow-up.
 - Maintain awareness of how disparaging labels like “frequent flyer,” “non-compliant,” etc. can undermine care and trust in the system.
 - Identify improvement champions in each setting
2. Archive debriefing documentation for OB cardiac conditions events and review systematically with unit-specific and QI leadership teams Establish unit-specific and QI leadership teams to review and address quality and safety issues
 - Establish unit-specific and QI leadership teams to review and address quality and safety issues
3. Conduct huddles in conjunction with stage-based algorithm to be responsive to evolving clinical scenarios
 - Include patients and families in bedside huddles if they want to participate
4. Have immediate post-event debrief (with equity lens) for support and learning
 - Establish standardized briefing documentation to capture successes and determine actionable follow-up
5. Have more formal after-action review with designated leader and standardized content
 - Reflect on equity in case as part of review
6. Include assessment of transfers to higher levels of care and multidisciplinary planning and treatment as part of review
 - Emphasize excellence in transferring patients and collaborating cross teams to help remove stigma for referral and transfer

Obstetric Team Debriefing Form

[SMI Obstetric Team Debriefing Form](#)

Premier Perinatal Safety Initiative Intervention Timeline [26]

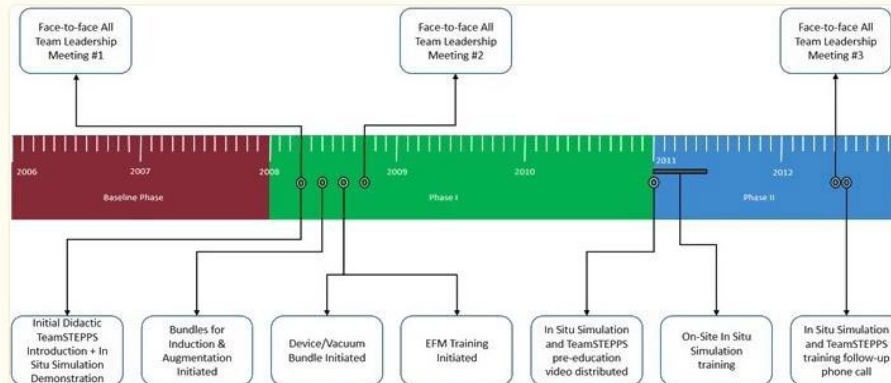


Figure 1

Premier Perinatal Safety Initiative Intervention Timeline

Notes. The timeline depicts the dates of meetings and intervention implementation that occurred during the 7-year project. On-site *in situ* simulation training occurred from January to June 2011.

[TeamSTEPPS Pocket Guide \(ahrq.gov\)](http://ahrq.gov)

b. Perform multidisciplinary reviews of serious complications (e.g., intensive care unit (ICU) admissions for reasons other than observation) to identify systems issues.

1. Have formal review following care of those at highest risk (e.g., mWHO III or IV) and those who experienced complications to assess alignment with standard policies and procedures (with appropriate updates) and to identify opportunities for improvement (including identification of discriminatory practices)

- Include Race, Ethnicity and Language (REAL) data to identify barriers to care

- Use reporting pathways to communicate and document consistent issues

2. Include involved providers (specialists and generalists) in review process with focus on ways to improve care

- Include near-misses and establish system for reporting near-misses and unexpected outcomes

3. Identify key processes and outcomes for quality improvement data collection; include staff training metrics among run charts [Data for Maternal Morbidity Prevention | AIM](#)

- Align quality improvement data collection with a perinatal quality collaborative and with hospital quality committee/officer

c. Monitor outcomes and process data related to cardiac conditions, with disaggregation by maternal characteristics due to known differences in outcomes in rates of cardiac conditions experienced by Black and Indigenous

pregnant and postpartum women. [REPORT FROM MATERNAL MORTALITY REVIEW COMMITTEES: A VIEW INTO THEIR CRITICAL ROLE](#) [27]

1. Collaborate with health information technology (HIT) or appropriate staff to modify EHR and automate data collection and reporting
2. Set specific goals for closing identified differences in outcomes using the SMARTIE format (strategic, measurable, ambitious, realistic, timebound, inclusive, and equitable)
3. Collect and analyze data
 - Hold staff training on importance of data and respectful collection
4. Review all process and outcome data disaggregated with unit-specific and QI leadership teams
 - Engage leaders in messaging about destigmatizing discussion and identification of differences in care to move toward action
 - Identify alternative strategies to integrate respectful care into reporting and systems learning in settings where use of disaggregated data may cause potential patient identifiability or unstable data
5. Assess quality of data and develop processes for improved data collection
 - Identify a champion

Respectful and Supportive Care: Every unit, provider, team member

Pacific Islanders, Native American and Alaskan Islanders (AN/AI) have an increased risk of maternal mortality when compared to non-Hispanic white women [28]. In fact, since 1999, AN/AI have had the largest increase in maternal mortality. Cardiomyopathy accounted for 14.5% of all deaths in the population presenting as a greater proportionate cause of death than any racial group [29]. Black women, Indigenous women, and women of color are more likely to have perinatal complications that confer a higher risk of cardiovascular complications, despite comparable social drivers that result in differences in care and outcome. Implicit bias of providers and perceived discrimination from patients impact trust in the healthcare system, resulting in delayed encounters for screening and reservations about research enrollment. These differences can be largely attributed to structural and institutional racism which have resulted in social structures and barriers to care rather than biological factors [30].

a. Screen for structural and social drivers of health that might impact clinical recommendations for treatment plans and provide linkage to resources that align with the pregnant or postpartum woman's health literacy, cultural needs, and language proficiency

b. Engage in open, transparent, and empathetic communication which clarify goals and values for pregnancy that are essential to include in a patient's treatment plan

◊ Refusal of Medically Recommended Treatment During 23 Cardiac Conditions in Obstetrical Care Change Package pregnant and postpartum women and their identified support networks to understand diagnoses, options, and treatment plans [31]

c. Include each pregnant or postpartum woman and their identified support network as respected members of and contributors to the multidisciplinary care team.

Key Driver Diagram

A driver diagram is a visual display of a QI collaborative's (or team's) theory of what "drives," or contributes to, the achievement of the project aim – that is, the project's "theory of change." The far-right column of the driver diagram lists the specific change ideas to test using PDSA cycles.

Tennessee Initiative for Perinatal Quality Care Cardiac Conditions in Obstetrical Care (CCOC)



Key Driver Diagram (KDD)



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