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Maternal Health

The Heart of the Matter



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With the exception of COVID-19, rarely has an area of medicine brought together a confluence of factors such as science, education, advocacy, and health policy, as well as social, legal, and operational issues, that have so profoundly influenced how we practice as has the rapid evolution of cardio-obstetrics and the focus on maternal cardiovascular (CV) health.

Maternal mortality has been steadily increasing for the past 2 decades, driven by increasing maternal age, obesity, diabetes, hypertension, and lack of access to adequate prenatal care.¹ During the COVID-19 pandemic, all-cause mortality during pregnancy has increased 33%, likely as a result of unmasking health disparities.² Risk of pregnancy-related death is 3.4 times higher among non-Hispanic Black women as compared to non-Hispanic White women.³

Mortality is also geographically dependent, varying state by state, potentially related to underlying social determinants of health, Medicaid expansion, and state laws regulating reproductive health. Based on published state health statistics, California has the lowest rate (4.0 per 100,000 live births) and Louisiana the highest (58.1 per 100,000 live births).

The majority of maternal mortality occurs preterm or at delivery, although >20% of events may not occur until 6 weeks postpartum or later. Maternal mortality and morbidity increase with age of the mother, rising sharply after age 30.⁴ The rate of maternal mortality collectively in the United States (17.4 per 100,000 live births) is twice that of the developed country with the next highest rate (France, 8.7 per 100,000 live births).⁵

Cardiovascular events are the most common cause of maternal mortality, accounting for more than one-quarter of all pregnancy-related deaths.³ Cardiac mortality and morbidity may result from congenital or heritable anomalies, newly acquired CV illnesses, or exacerbation of underlying CV disease during pregnancy.^{6,7} Maternal congenital heart disease predisposing to mortality includes corrected or uncorrected cyanotic congenital abnormalities, aortopathies, congenital valvular disease, and single-ventricle physiology. Examples of CV problems developing during pregnancy include eclampsia/pre-eclampsia, peripartum cardiomyopathy, myocardial infarction, venous thromboembolism (VTE), atrial and ventricular arrhythmias, as well as coronary and aortic dissections.

Physiologically, pregnancy places even the normal CV system under great stress due to expanded blood volume, increased cardiac output, reduced systemic vascular resistance, vena caval obstruction, anemia, and variations in blood pressure. Accordingly, under such physiologic stress, women who become pregnant and who have preexisting pulmonary hypertension, atherosclerotic CV disease, essential hypertension, cardiomyopathy, or arrhythmias may experience complications as a result of worsening or exacerbation of their underlying CV disease.

A number of risk assessment tools have been developed and validated to both screen and triage women who may become or who are pregnant, including the CARPREG II (Cardiac Disease in Pregnancy Study), ZAHARA (Zwangerschap bij Aangeboren Hartafwijking), and modified WHO (World

Health Organization) classification system.⁸ These tools combine “lesion” or disease-specific information with patient-specific data to facilitate preconception counseling, prenatal management, preparation for delivery, referral to cardio-obstetric centers of excellence, and counseling related to pregnancy avoidance/contraception or, in circumstances where the life or long-term health of the mother is significantly at risk, termination of pregnancy. Risk assessment tools capture the presence and severity of underlying heart disease, hemodynamics, left ventricular function, arrhythmias, medications, and past pregnancy-related complications. Biomarkers, including N-terminal pro-B-type natriuretic peptide, may predict adverse outcomes in pregnant women at risk for CV complications.⁹

Despite a greater prevalence, increased awareness, and rising frequency of risk factors for pregnancy-related CV disease, until recently, resources and structures to manage these complex patients have been limited and not well organized. Fortunately, there has been a growing trend toward developing multidisciplinary teams focused on the care of women who are at risk for CV complications, or who have preexisting demonstrable CV disease, or who develop CV problems during pregnancy. Such teams, analogous to those focused on advanced heart failure or valvular heart disease, are the essential element of the growing cardio-obstetrics subspecialty in cardiology.¹⁰

Cardio-obstetric programs and teams are built around the patient and comprise cardiology and maternal-fetal medicine specialists, high-risk obstetricians, primary care providers, CV pharmacists, social workers, nurses, anesthesiologists, and patient counselors. Outcomes of women with known CV disease, predominantly congenital heart disease, compared in 2 Canadian referral centers suggested that care at a dedicated cardiac-pregnancy center, increased use of appropriate CV medications, and earlier referral were associated with a lower rate of CV complications.¹¹ The CHAP (Chronic Hypertension and Pregnancy) trial, presented at the American College of Cardiology’s (ACC) 2022 Annual Scientific Session (ACC.22) demonstrated that a pragmatic, protocol-driven strategy of hypertension control during pregnancy led to significant improvement in both maternal and fetal outcomes.¹²

In addition to CV risk factors impacting both maternal and fetal mortality and morbidity in the short term, development of cardiovascular complications

during pregnancy is associated with long-term CV events including myocardial infarction, stroke, heart failure, and valvular heart disease. Such late-pregnancy-related risk is independent of traditional CV risk factors.¹³ Pregnancy-related left ventricular remodeling and hypertrophy, inflammation, endothelial dysfunction, antiangiogenic antibody induction, and abnormalities resulting from placental dysfunction may have long-term consequences in terms of CV risks later in life.

As an emerging field, many trainees and practicing cardiologists have little or no formal training in cardio-obstetrics. The 2015 Core Cardiovascular Training Statement (COCATS-4) does suggest that trainees have experience in “an OB clinic visited by pregnant patients with heart disease, optimally in the context of a multi-disciplinary approach to high-risk pregnancy” and that fellows have training in treating hypertension during pregnancy.¹⁴ Nonetheless, most trainees do not have access to established cardio-obstetric programs within their institutions nor formal training in the assessment and management of pregnancy-related cardiac conditions.

Currently, however, in the absence of formalized training in cardio-obstetrics, resources do exist for those caring for patients with or at risk for CV complications related to pregnancy, including the 5-part JACC Focus Seminar: Cardio-Obstetrics, published in the April 13, 2021 issue. In addition, the ACC has produced multiple webinars available on ACC.org that provide didactic and practical guidance on topics like building a cardio-obstetrics program and how to care for women with CV disease who become pregnant.

The ACC Cardiovascular Disease in Women Committee and Cardio-Obstetrics Work Group have published 13 papers in the past 18 months; developed a virtual “Cardio-Obstetrics Essentials” course in conjunction with the College’s Lifelong Learning Oversight Committee that will debut November 18; supported a cardio-obstetrics journal club; hosted 5 educational webinars; and collaborated with ACC state chapters and/or partner medical societies such as the American College of Obstetricians and Gynecologists, the Society for Cardiovascular Angiography and Interventions, and the American Heart Association to create educational content as well as to provide a clinical community and opportunity for engagement of interested clinicians.

On June 24, 2022, with the U.S. Supreme Court *Dobbs v Jackson* decision overturning the nearly 50-year-old precedent of federal protection of access to

abortion services, the field of cardio-obstetrics was thrown into the spotlight. Although ACC does not have a policy on abortion, a position statement was released articulating support for shared clinical decision making, the primacy of the physician-patient relationship, promotion of access to all treatment options to protect the life and health of the mother, and to reiterate that cardiovascular professionals are the content experts when evaluating and treating patients with pregnancy-related CV issues. ACC's position takes into account the latest science, clinical evidence, considerations of social determinants of health and health equity, as well as the patient's personal beliefs and goals.¹⁵

The result of the Supreme Court decision was to return the authority to individual states to enact their own laws regulating access to abortion. Accordingly, this *de facto* created a 50-state local advocacy effort to educate legislators and to preserve access to reproductive rights and care to reduce maternal mortality and morbidity. To operationalize and

coordinate this challenging advocacy effort, the ACC Board of Governors, in collaboration with the ACC's Health Affairs Committee and Advocacy Team, developed a "toolkit" or set of guiding principles relevant to maternal CV care to provide a standard core message that could be tailored to individual state circumstances.¹⁶

The measure of success in advocating for protection of women's access to reproductive care in order to reduce maternal CV-related mortality and morbidity will play out across state legislatures and courts for months and years to come. In the meantime, CV clinicians will continue to focus on the key reversible and treatable causes of maternal mortality, namely CV risks and disease. That is the heart of the matter.

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