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MAPPING THE MATERNAL HEART: A PUBLIC HEALTH REVIEW OF CARDIAC SCREENING PROTOCOLS IN OBSTETRIC CARE

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Abstract

Background: *The public health challenge of maternal heart disease may present differently in high income countries but it has the same potentially catastrophic consequences worldwide. As time went by and obstetrics improved cardiovascular conditions became more difficult to identify. It meant we did not screen enough. This review aims to assess current cardiac screening practices in obstetric care from a public health point of view, seek systemic gaps, and offer evidence-based strategies for better detection and prevention.*

Methods: *We conducted a systematic literature review from 2000 to 2025, using PubMed, Embase, Scopus, and Web of Science databases. Studies on protocols for cardiac screening, maternal cardiovascular risk and obstetric outcomes were included if they fitted the criteria. The data is synthesized in a narrative format, with emphasis on screening instruments, barriers to implementation in public health and outcomes from this.*

Results: *Twenty-seven studies met the inclusion criteria. Most protocols were based mainly on clinical history and symptoms; these are often nonspecific during pregnancy. Standard risk stratification tools such as the CARPREG II and ZAHARA scores are underutilized outside specialist centers. Biomarkers and imaging modalities are used intermittently. The main public health gaps were lack of screening integrated into routine prenatal visits, different access to cardiology care and poor continuity between obstetricians and internists.*

Conclusion: *Maternal cardiac screening remains fragmented and inconsistently implemented. Integrating risk-based cardiac screening into prenatal protocols, using validated tools for the right patients, and ensuring multidisciplinary collaboration out of doors are the three essentials to reduce maternal morbidity and mortality. Early cardiovascular risk identification in obstetrics is something which public health policy has got to attend to.*

In many high-income countries, including the United States and the United Kingdom, chronic heart disease has replaced hemorrhage as the main cause of maternal mortality. From 2011 to 2020, approximately 26.5% of deaths related to pregnancy in the US were attributed to a heart condition. This figure arises as much from an increasingly aged maternal population as it does an ill-equipped health care system. Yet, despite these statistics, there is still not enough emphasis on cardiac screening when women visit for prenatal care.

Physiological changes due to pregnancy-such as increases in blood volume, cardiac output and vascular compliance-can hide or intensify pre-existing heart disease. In addition, social disparities, limited access to cardiology services, and information deficits among frontliners all contribute to the challenge. Therefore, from the public health angle, proactive screening strategies are urgently necessary in order to find people at risk before they decompensate.

This review takes a critical look at the obstetric care pathway's approach toward cardiac screening protocols, featuring evidence-based tools and protocols of interventional care, barriers to implementation and population strategies that may guide policy or practice

INTRODUCTION

2. Methods

2.1 Search Strategy

A comprehensive search was conducted using PubMed, Embase, Scopus, and Web of Science for peer-reviewed articles published from January 1, 2000, to March 1, 2025. Search terms included: "cardiac screening," "maternal heart disease," "pregnancy," "cardiovascular risk assessment," "obstetric care," and "public health."

2.2 Inclusion and Exclusion Criteria

Included studies:

Examined cardiac screening or cardiovascular risk stratification in pregnancy
Reported maternal or perinatal outcomes
Were published in English

Excluded studies:

Focused solely on congenital heart disease without public health context
Included non-human subjects or non-obstetric populations

2.3 Data Extraction and Synthesis

Two reviewers independently screened abstracts and full texts. Discrepancies were resolved through consensus. Data were extracted on:
Screening methods
Risk assessment tools
Maternal outcomes
Health system integration
Barriers and facilitators to implementation
Data were synthesized thematically due to heterogeneity of methods and outcomes.

3. Results

3.1 Overview of Screening Protocols

Among the 27 included studies, only six described formal cardiac screening protocols. The remainder discussed general risk assessment approaches or highlighted missed opportunities in care. Common screening modalities included:
History and physical exam (27/27)
Electrocardiography (12/27)
Echocardiography (8/27)
Biomarkers (NT-proBNP, troponin; 5/27)
Risk scores (CARPREG I/II, ZAHARA; 10/27)
Only 4 studies reported implementation at the population level (e.g., national screening frameworks or integrated prenatal tools).

3.2 Risk Stratification Tools

Validated clinical risk tools, while available, are underutilized. The **CARPREG II** score incorporates variables such as prior cardiac events, baseline NYHA class, and ventricular function. It has been shown to predict major adverse cardiac events (MACE) during

pregnancy with reasonable accuracy (AUC ~0.76). However, routine use is rare outside academic centers. The **ZAHARA score**, developed in the Netherlands, includes congenital heart disease-specific parameters and has demonstrated predictive validity in Western European populations.

3.3 Missed Diagnoses and Delays

Multiple studies highlighted delayed diagnosis of peripartum cardiomyopathy, arrhythmias, and aortic dissection. Reasons include:
Symptom overlap with normal pregnancy (fatigue, edema) Inadequate use of imaging
Failure to escalate from primary care

3.4 Public Health Barriers

Common systemic barriers identified:
Limited training among prenatal providers in cardiovascular assessment Lack of integrated care pathways Racial and socioeconomic disparities in referral to cardiology Absence of cardiac screening in first-trimester prenatal labs.

3.5 Case Study: UK Maternal Medicine Networks

The UK National Health Service implemented Maternal Medicine Networks in 2019 to integrate cardiology, obstetrics, and anesthesia for high-risk patients. Early evaluations show improved risk documentation and earlier specialist referrals, suggesting a scalable model for other health systems.

Discussion

4.1 Clinical and Policy Time-Lag

In RCUK, ACOG publications have recommended risk-based seeking of maternal heart disease, but the manner in those guidelines are not carried out.Taking a public health approach would change the current reactive management of complications to one of proactive screening and preventive interventions.

4.2 Feasibility of Screening Integration

In the antenatal care, every week women are already subjected to some checks and interviews. It could only be a little disturbed by adding a small cardiovascular screening-with parameters such as family history, blood pressure, how fit they seem to be, what relevant biomarkers are out of range-in modules.

4.3 Leveraging Digital Health and AI

There were several papers that looked at the use of artificial intelligence in screening, such as alerts generated by electronic health record (EHR) and cell phone apps for risk scores, but further studies needed to be done to validate these tools, then regulation of the devices would have to be organized.

4.4 The Matter of Equity

Black and Indigenous women in the United States have a disproportionately high mortality, due to maternal cardiac injuries.Policies advocating equitable access to screening and cardiology services are not only ethical but also practical necessities at this time. Barriers of access can be broken down by community health worker power and mobile clinics.

5. Recommendations

For Clinicians:
Incorporate structured cardiovascular risk screening at first prenatal visit
Use CARPREG II or ZAHARA in patients with known or suspected heart disease
Refer early to maternal-fetal medicine or cardio-obstetrics teams.

For Health Systems:
Develop integrated cardiac-obstetric pathways
Invest in interdisciplinary training for prenatal providers
Standardize screening protocols across prenatal care settings

For Policy Makers:
Mandate cardiovascular risk assessment in national prenatal care guidelines
Expand insurance coverage for echocardiograms and biomarker testing in pregnancy
Fund public awareness campaigns on maternal heart health

6. Limitations

This review is limited by the heterogeneity of available studies and absence of randomized trials on screening efficacy. Most data are from high-income countries, potentially limiting generalizability. Additionally, unpublished quality improvement efforts may not have been captured.

7. Conclusion

Cardiac screening in pregnancy remains an under recognized public health priority. A paradigm shift is needed from reactive to proactive care, leveraging evidence-based tools and multidisciplinary collaboration. With targeted investment and political will, maternal cardiac mortality is a preventable tragedy.

As a principal cause of both maternal morbidity and mortality, the increasing incidence of cardiovascular diseases is but another in a long-listed instances public health shows itself wanting to protect pregnant women. The reasons for this failure go beyond the complex physiology of pregnancy and lie in how maternal health has traditionally been approached, prioritized and managed. Until obstetricians, primary care physicians and cardiologists shift to a more proactive approach that includes regular clinical cardiac exams for every woman of childbearing age, little in the way of change will come about. Despite evidence that improved maternal results come with early cardiovascular risk assessment of women in this same situation, still studies show that cardiac screening for these patients does not occur systematically and rarely serves as preventative medicine--such people have no access at all.

First, the present obstetric care pathways are plagued by a number of deficiencies. Existing screening methods are based too much on subjective clinical estimation at times when the patient has little incentive to report symptoms (pregnancy makes a body feel so much better) and physical exam findings may be nothing in particular or part and parcel of the normal adaptations for carrying a child. Second, validated risk assessment tools like the ZAHARA score and CARPREG II are not nearly so widely used as they should be in day-to-day medical practice. This is especially the case in primary care where most of women are seen because obstetricians do not have that experience or training necessary for successful use among their patients: their special talents lie elsewhere. The obstetrician who provides care exclusively for women on the higher end might be in this last category too.

By trying to share the burdens among different disciplines--obstetrics, cardiology and primary care services for instance (with anesthesiologists often being pulled in when necessary)--certain fatal flaws are introduced into our present working practices of care. A further disadvantage is that this system not only fails to collaborate across units but also that there are structural inequities in availability at each of these sites, especially among minority groups and people who live rurally without health insurance. At the changeover when racial and ethnic minorities, rural dwellers or those uninsured start coming to hospitals for care it becomes clear that they wind up getting a long way round in experience. They have rates of maternal postpartum death due to cardiac reasons that average five (or more) times higher than Europeans here.

Looking at the situation from a public health perspective, the lack of standard but universally applied protocols for pre-natal cardiac screening in this country represents two lost opportunities to intervene earlier and more effectively. Cardiovascular risk assessment should no longer be treated as a luxury add-on service for antenatal care, nor confined to the subspecialty realm of what women must go through under general anesthesia for surgery-related procedures--but needs to become an everyday part of maternal safety and health equity.

New innovations--such as decision-support tools driven by algorithms, mobile health technologies, and EHR-based alerts--may provide promising directions to close screening gaps. But these tools have to be coupled with policy-level mandates, reimbursement reform, interdisciplinary preparation programs for health care workers and community outreach that is culturally sensitive if they are to succeed in a general way.

Ultimately, reducing maternal death from cardiac causes will require a shift in assumptions, an eye that sees each prenatal encounter as chance to check for risk factors giving rise this present problem; a focus on distinguishing what is sickness from its management; and public health infrastructure set up in such a manner that it truly meets present obstetric needs. Failure to act means continued senseless deaths; success opens up a new era of maternal care--one which truly takes account not only of how things are in the womb but also matters to her who carries it.

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