Cardiac Arrhythmias in Healthy Women During or Post-Pregnancy: A Scoping Review

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Abstract

Pregnant and postpartum women are at risk of developing cardiac arrhythmias. There is negligible published research on the development of peripartum and postpartum electrophysiological complications in previously healthy women. The purpose of this scoping review was to map existing evidence about cardiac arrhythmia development in previously healthy pregnant or postpartum women and provide an overview of prevalence and underlying mechanisms on this topic. Using JBI methodology, we completed systematic searches in CINAHL, Medline, and Healthstar databases, and a multi-step screening process; thirteen articles were included. Thematic analysis revealed three themes: 1) Electrocardiography and cardiac findings; 2) Hemodynamic, autonomic, and hormonal changes in pregnancy; and 3) Conflicting information on the effect of maternal age on cardiac arrhythmias. Nursing awareness of the risk for cardiac arrhythmias during pregnancy is imperative to ensure timely intervention. As well, qualitative exploration of previously healthy women's lived experiences with cardiac arrhythmias is warranted.

Keywords: electrophysiology, pregnancy, arrhythmia, women

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Key Highlights

- This scoping review revealed various arrhythmias reported in previously healthy pregnant or postpartum women.
- Development of cardiac arrhythmias may be attributed to age, as well as the hemodynamic, autonomic, and hormonal changes that occur during pregnancy.
- Nurses must be aware of previously healthy women's risk for, and identify and monitor, cardiac arrhythmias to ensure timely and optimal interventions.
- Further research, especially qualitative studies, are needed to explore lived experiences of healthy pregnant women with cardiac arrythmias.

Introduction

Pregnancy induces a time of various anatomical and physiological changes in a woman's body, which can have significant implications on the cardiac system (e.g., increased blood volume and cardiac output; Soma-Pillay et al., 2016). These unique hormonal and physiological changes are associated with a greater risk of cardiac arrhythmias, despite the absence of cardiovascular pathology prior to the pregnancy (Sanghavi & Rutherford, 2014).

The literature reports the incidence of cardiac arrhythmias to be a common symptom in pregnancy. During pregnancy, the heart rate progressively increases by 10% to 25% from pre-pregnancy values (Davis, 2022). Therefore, sinus tachycardia, especially in the third trimester, is not uncommon (Adamson & Nelson-Piercy, 2007; Safavi-Naeini et al., 2021). Li et al. (2008) found that maternal arrhythmias have an event rate of approximately 166/100,000. However, this statistic may underestimate the total prevalence, as it does not factor in the additional cases of arrhythmias that occur in the community that are under-reported. According to Gałczyński et al. (2013), the incidence of arrhythmias during pregnancy is estimated to be 1.2 per 1,000 pregnancies, with about half of these arrhythmic episodes being asymptomatic. Although more recent statistics have not been published, the incidence of arrhythmias during pregnancy has been increasing and becoming a growing concern in healthcare (Tamirisa et al., 2022).

While palpitations and arrhythmias during pregnancy are common, they are typically benign and subside within a brief period of time without treatment (Cleveland Clinic, 2024; Senarath et al., 2021). However, some arrhythmias during pregnancy can be concerning. For example, Coad and Frise (2021) reported that tachyarrhythmias during pregnancy are an urgent health issue that must be addressed with appropriate follow-up, as it may cause hemodynamic instability and consequent placental hypoperfusion, requiring immediate cardioversion. Moreover, sustained palpitations can occur secondary to ventricular arrhythmias, such

as idiopathic ventricular tachycardia (VT) or pathway-related supraventricular tachycardia (SVT; Senarath et al., 2021), which require immediate medical treatment. While SVT has been identified as the most prevalent form of arrhythmias in healthy women during pregnancy (Ramlakhan et al., 2022; Senarath et al., 2021; Uzakova et al., 2023), other types of arrhythmias, such as catecholaminergic polymorphic VT, Brugada syndrome, and arrhythmogenic right ventricular cardiomyopathy are less prevalent (Tamirisa et al., 2022).

Finally, cardiac arrhythmias during and/or post-pregnancy can increase the potential for sudden cardiac death (Conti et al., 2024).

Therefore, it is imperative for cardiovascular nurses to be aware of the risk of arrhythmias during pregnancy and the postpartum period. By being knowledgeable about the specific risks and presentations of cardiac arrhythmias in pregnancy, cardiovascular nurses can provide comprehensive care and collaborate with other healthcare providers to develop and implement appropriate treatment plans with patients and their families (Conti et al., 2024). This proactive approach not only safeguards maternal and fetal health, but also contributes to overall positive pregnancy experiences and outcomes (Conti et al., 2024).

There has been negligible research on the prevalence and development of peripartum and postpartum cardiomyopathy (Ramlakhan et al., 2022; Senarath et al., 2021). Moreover, research has seldomly focused on women who develop arrhythmias for the first time in their second or subsequent pregnancy or postpartum period (Hutchens et al., 2022). As no previous literature review could be located, a comprehensive review is essential to identify gaps in existing knowledge and establish the foundation for future studies in this area.

Aim

The aim of this scoping review was to identify the nature and extent of existing evidence on cardiac arrhythmias in women without any related significant medical history, who received a diagnosis of cardiac arrhythmia during pregnancy or in the immediate postpartum period. The following research questions were developed using the population, concepts, and context (PCC) framework (Pollock et al., 2021; Tricco et al., 2018). The population included women who developed cardiac arrhythmia during pregnancy or the postpartum period, with core concepts focusing on cardiac arrhythmia, pregnancy, postpartum, and multiple pregnancy, applicable in any geographical setting.

1. What is reported in the current literature on the development of cardiac arrhythmias among women during pregnancy or in the immediate postpartum period who did not have any prior related significant medical history?
2. What is reported in the current literature on the development of cardiac arrhythmias among women who are pregnant with their second or subsequent pregnancy or postpartum period?

Methods

The Joanna Briggs Institute (JBI) scoping review method (Aromataris & Munn, 2020) and the Preferred Reporting Items for Systematic Reviews and Meta-Analysis extension for Scoping Reviews (PRISMA-ScR) checklist (Tricco et al., 2018) guided this review. Although there are other frameworks that can be used to report scoping review findings, the JBI method is recommended as it was developed to improve quality and conduct of reporting such reviews (McGowan et al., 2020). The protocol for this scoping review has not been published.

Eligibility Criteria

Sources were considered for inclusion if they met the following criteria: 1) published in a peer-reviewed journal; 2) were full-text accessible; 3) included the population of pregnant or postpartum women; and 4) discussed the diagnosis of cardiac arrhythmias during pregnancy or in the postpartum period. This review was open to all sources. However, it was limited to studies published in English due to the time and financial constraints of translation. No time limitations were applied to thoroughly map the literature available on this topic.

Information Sources and Search

Systematic searches in CINAHL, Medline, and Healthstar databases were performed in May 2023 and repeated in September 2023. To ensure the search strategy yielded relevant results, the team consulted with a subject librarian. Medical subject headings (MeSH) 'Arrhythmia' OR 'Ventricular Arrhythmia' OR 'Sinus Arrhythmia' or 'Atrial arrhythmia' or 'Extrasystole' AND 'Pregnancy' OR 'Multiple Pregnancy' or 'Prolonged Pregnancy' or 'High-Risk Pregnancy' were used in the CINAHL database with Boolean operators OR/AND. Reference lists of included studies were also explored.

The search generated a total of 1,870 records. After removing 861 duplicates, 1,009 were screened by title and abstract, resulting in the exclusion of 955 articles at stage one. This resulted in 54 articles that proceeded to independent full-text review equating to 13 articles that met the inclusion criteria (see Figure 1: PRISMA flow chart).

Selection of Sources of Evidence

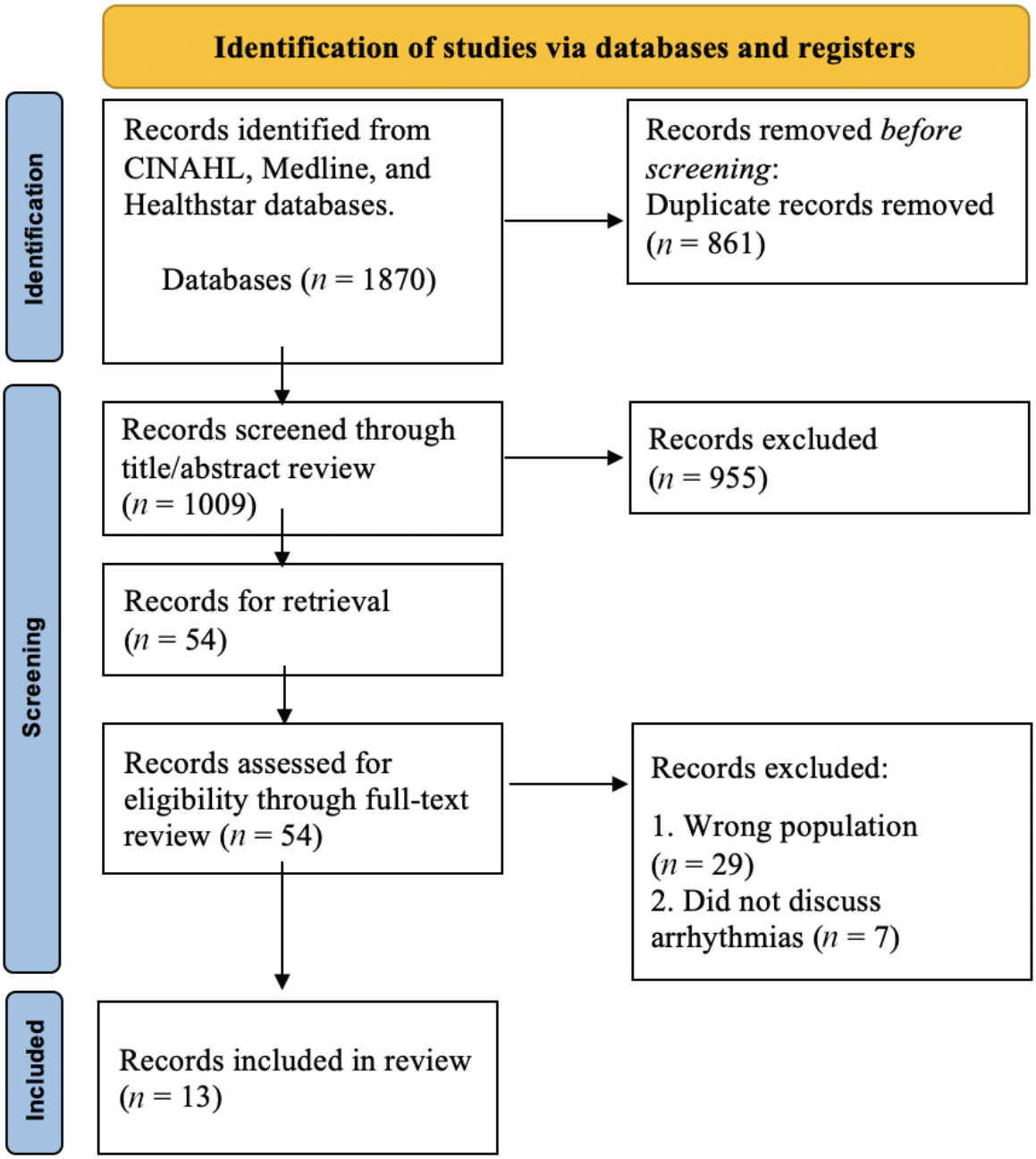
All articles retrieved from the search were reviewed by the first two authors (KM & SF) and two trained research assistants (KC & PK). A two-stage screening process was used. In the first stage, titles and abstracts were reviewed. If the article met the eligibility criteria or if it was not clear, the article was moved to stage two to undergo a full text review. Any disagreements were resolved with consultation with an additional reviewer (KC).

Data Charting Process and Data Items

Microsoft's Excel program was utilized to create data extraction tables where key data was organized. In the data charting process, the variables collected included author(s),

Figure 1

PRISMA-ScR Flow Chart



title, year, journal, study type, study purpose, setting, population of interest, sample size, procedures/ measures, findings, gaps, and conclusions (see Table 1).

Synthesis of Results

The narrative synthesis approach outlined by Popay et al. (2006) was an appropriate method to summarize findings from different studies of varying research designs and methodologies. This approach includes four elements and provided guidance on different tools that can be implemented to improve the rigour and trustworthiness of the synthesis (Popay et al., 2006).

Element 1: Selecting a Theoretical Framework

As this topic has not been extensively studied, the team did not select a specific theory to guide this review. As opposed to relying on a pre-existing theory, this review sought to identify concepts, themes, and factors that emerged from across the included literature.

Table 1

Extraction Table of Included Studies

Authors (Year)/ Setting	Study Design	Purpose	Main Findings
Altun et al. (2014) Türkiye	Quantitative/Cross-sectional Study (N = 30)	To evaluate atrial conduction abnormalities obtained by tissue Doppler imaging (TDI) and electrocardiogram analysis in pregnant subjects	Inter-atrial, intra-atrial, and intra-left atrial electromechanical coupling intervals were prolonged in the pregnant subjects compared to the age-matched controls. No relationship was detected between the atrial electromechanical coupling parameters and maternal age.
Choi et al. (2001) Seoul, Korea	Quantitative/Case series study/Cross-sectional (N = 261)	To investigate the incidence, severity/ time-course of dyspnea and palpitation among normal pregnant women	Arrhythmias documented in only 22% of patients having 24-hour Holter monitoring. A high incidence (11.5%) of gestational palpitation and increased while pregnancy approached to term.
Coad & Frise (2021) Various cities, UK	Discussion paper	To provide a robust approach to the investigation and management of a persistent tachycardia in pregnancy	Tachyarrhythmia in the presence of structural heart disease could rapidly result in haemodynamic instability and subsequent placental hypoperfusion.
Gonçalves et al. (2022) Angola	Quantitative/Cross-sectional community-based case study (N = 234)	To describe electrocardiographic findings in women with normal pregnancies, compared with a paired control group of non-pregnant women	Electrocardiographic changes found: Sinus tachycardia (4.4% vs. 2.5%), T-wave inversion (14.9% vs. 1.7%), minor ST segment depression (4.5% vs. 0%) and left ventricular hypertrophy (11.4% vs. 11.7%, $p = .726$).
Kandzia et al. (2022) Poland	Quantitative/ Prospective cohort/ Longitudinal (N = 160)	To determine the TpTe (Tpeak-Tend) interval in women in the first, second and third trimester of pregnancy and the post-partum period	Mean duration of TpTe interval during pregnancy (81.59 ± 5.92 ms) and in the whole study group (pregnancy + postpartum; 85.46 ± 6.45 ms) was significantly longer ($p < 0.001$) compared to the TpTe interval in the control group (74.06 ± 6.14 ms). During pregnancy and postpartum, the increase in the TpTe interval compared to the increase in the corrected QT interval (QTc) parameter (31.10% vs. 4.18%) was significantly higher ($p < 0.001$).
Köşüş et al. (2011) Türkiye	Quantitative/ Retrospective cohort study/Longitudinal (N = 34)	To examine the maternal and fetal effects of arrhythmias detected by ECG monitoring during labour in patients at term, without any known cardiovascular pathology	Sinus tachycardia was the most observed, with a frequency of 70.6%. The highest rate of arrhythmias was recorded for the active phase group (29 of 47 had arrhythmias), with sinus tachycardia being the most common type ($n = 10$). This group also had three patients with supraventricular tachycardia (8.8%) and two patients with T-negativity (5.8%). Sinus tachycardia was the most frequently observed arrhythmia in the latent phase group ($n = 5$).
Kugamoorthy & Spears (2020) Toronto, Canada	Discussion paper	To discuss the topic of management in tachyarrhythmia in pregnancy	Idiopathic ventricular arrhythmias occur in the absence of structural heart diseases.
Li et al. (2008) Washington, USA	Quantitative/ Retrospective study/ Longitudinal (N = 226)	To examine the occurrence and outcome of cardiac arrhythmias during pregnancy in one of the busiest obstetric services in the USA	Most common rhythm disturbances during pregnancy were sinus tachycardia (ST), sinus bradycardia (SB), or sinus arrhythmia (SA; 104 episodes/100,000 pregnancies). Paroxysmal supraventricular tachycardia (PSVT) and premature beats, with a frequency of 24/100,000 and 33/100,000, respectively.

continued…

Li et al. (2019) Beijing, China	Quantitative/ Retrospective study/ Longitudinal (N = 28)	To investigate the incidence of idiopathic sustained maternal arrhythmia	Among patients without history of tachyarrhythmia, 38.6% developed tachyarrhythmia in first trimester, 31.8% in second trimester, and 29.6% in third trimester.
Manolis et al. (2020) Canterbury, UK	Discussion paper	To discuss the management of cardiac arrhythmias in pregnancy for mother and fetus protection	While older studies had indicated supraventricular tachycardia as the most common tachyarrhythmia in pregnancy, more recent data indicate an increase in the frequency of arrhythmias, with atrial fibrillation (AF) emerging as the most frequent arrhythmia in pregnancy, attributed to an increase in maternal age, cardiovascular risk factors, and congenital heart defects (CHD) in pregnancy.
Nikoo et al. (2014) Shiraz, Iran	Quantitative/Cross-sectional study (N = 234)	To find any relationship between maternal age and ventricular arrhythmia risk with the use of QT dispersion (QTd) as an index	Although QTd was prolonged in all three age groups, no significant difference was observed among the three groups regarding QTd.
Shotan et al. (1997) Los Angeles, USA	Quantitative/Cross-sectional study (N = 110)	To assess prevalence of cardiac arrhythmias during gestation and their relation to subjective complaints of palpitations, dizziness, and syncope in healthy women, comparing two groups	Both groups had a high incidence of arrhythmias on Holter monitoring with atrial premature complexes (APCs) of 56% in the study group and 58% in the control group, >100 APCs in 7% and 4% of the patients, respectively, and isolated ventricular premature complexes (VPCs) in 59% and 50%, respectively. The number of isolated VPCs was higher and >50 VPCs/hour were seen in significantly more patients in the study group.
Romem et al. (2004) Tel-Aviv, Israel	Quantitative/ Retrospective/ Longitudinal (N = 30)	To assess the incidence and characteristics of maternal cardiac arrhythmias during labour	Tachycardia was recorded in all these women and bradycardia in 50%.

Element 2: Developing a Preliminary Synthesis

The preliminary synthesis involved extracting key information from all included studies. The tabulation technique was utilized to create extraction tables using Microsoft Excel.

Element 3: Exploring Relationships Within and Between All Included Studies

The research team used thematic analysis to identify recurring themes, patterns, or concepts across included studies. Braun and Clarke's (2006) six-phase framework was used to conduct thematic analysis, which was confirmed with all team members, to enhance the credibility and reliability of the findings.

Element 4: Assessing the Robustness of the Synthesis

To ensure robustness of this narrative synthesis, the team clearly defined the review questions and eligibility criteria that were developed using the PCC framework (Peters et al., 2015; Pollock et al., 2021). The team adhered to the PRISMA-ScR checklist and a clear audit trail was provided as articles excluded at each level of screening were numerically recorded in the PRISMA-ScR flowchart (see Figure 1).

Results

Thirteen articles met the eligibility criteria. No additional articles were located through reference list reviews of included articles (see Figure 1). All articles included in this review addressed the diagnosis of cardiac arrhythmias in previously healthy pregnant or postpartum women. Of the 13 studies included in the review, five were cross-sectional, quantitative in design (Altun et al., 2014; Choi et al., 2001; Gonçalves et al., 2022; Nikoo et al., 2014; Shotan et al., 1997). One was a case study (Choi et al., 2001). Five studies were longitudinal, quantitative in design (Kandzia et al., 2022; Köşüş et al., 2011; Li et al., 2008; Li et al., 2019; Romem et al., 2004). Among these, four were retrospective (Köşüş et al., 2011; Li et al., 2008; Li et al., 2019; Romem et al., 2004) and one was a prospective cohort study (Kandzia et al., 2022). The three other included articles were discussion papers (Coad & Frise, 2021; Kugamoorthy & Spears, 2020; Manolis et al., 2020).

The articles provided a global perspective, as they originated from United Kingdom ($n = 2$; Coad & Frise, 2021; Manolis et al., 2020), Türkiye ($n = 2$; Altun et al., 2014; Köşüş et al., 2011), the United States of America ($n = 2$; Li et al., 2008; Shotan et al., 1997), China ($n = 1$; Li et al., 2019), Iran ($n = 1$; Nikoo et al., 2014), Poland ($n = 1$; Kandzia et al., 2022), Angola ($n = 1$; Gonçalves et al., 2022), Korea ($n = 1$; Choi et al., 2001), Israel ($n = 1$; Romem et al., 2004), and Canada (n=1; Kugamoorthy & Spears, 2020; see Table 1). Eight articles reported specifically where the previously healthy

pregnant or postpartum women were receiving care. Four articles reported the pregnant women to be receiving care at a hospital (Choi et al., 2001; Li et al., 2008; Li et al., 2019; Romem et al., 2004), whereas four other articles reported they were receiving care at a clinic (Kandzia et al., 2022; Köşüş et al., 2011; Nikoo et al., 2014; Shotan et al., 1997).

Critical Appraisal of Evidence: Themes

Following the process of data analysis, three themes associated with the diagnosis of cardiac arrhythmias in previously healthy women who were pregnant or in the postpartum period were extracted from the data: 1) electrocardiography and cardiac findings; 2) hemodynamic, autonomic, and hormonal changes that occur in pregnancy; and 3) conflicting information available regarding the effect of maternal age on cardiac arrhythmia.

Theme One: Electrocardiography and Cardiac Findings

All included studies reported the onset of cardiac arrhythmias in some pregnant and/or postpartum women participants, despite having no explicit history of cardiac illness and who were previously healthy. Six articles reported on development of various tachyarrhythmias (Coad & Frise, 2021; Kandzia et al., 2022; Kugamoorthy & Spears, 2020; Li et al., 2019; Manolis et al., 2020; Romem et al., 2004). In a quantitative, cross-sectional study (N = 28 pregnant women; aged 21–37), Li et al. (2019) identified that 38.6% of women developed tachyarrhythmia in the first trimester, 31.8% in the second trimester, and 29.6% in the third trimester. In another quantitative cross-sectional study (N = 36 healthy pregnant women aged 18–36, in active labour), Romem et al. (2004) reported tachycardia in all participants. According to a discussion paper by Coad and Frise (2021), any tachyarrhythmia during pregnancy is an urgent health issue that requires appropriate follow-up, as it can cause hemodynamic instability and subsequent placental hypoperfusion.

Four articles reported specifically on the onset of SVT (Kugamoorthy & Spears, 2020; Lee et al., 1995; Li et al., 2008; Manolis et al., 2020). Li et al. (2008) conducted a quantitative, retrospective study that analyzed pregnancy related admissions to the obstetric unit between 1992 and 2000 (N = 136,422), 226 of which were related to cardiac arrhythmias (Li et al., 2008). The mean age of women with a cardiac arrhythmia was 24 years old; most (84%) were Hispanic/African American. The study found a high frequency of SVT occurrence (24/100,000; Li et al., 2008). In a quantitative, cross-sectional study Lee et al. (1995) analyzed 207 women with a mean age of 43 hospitalized for symptomatic SVT, most of whom (83.57%; $n = 173$) had been previously pregnant. Participants completed questionnaires with questions about onset and severity of symptoms, number of pregnancies and their age for each of these items. Episodes of SVT during pregnancy were significantly more symptomatic compared to episodes during the non-pregnant periods. Fourteen women with attacks of paroxysmal SVT had exacerbation of this condition during pregnancy and self-reported higher symptom scores of palpitations, fatigue, dyspnea, dizziness, blurred vision, and syncope (Lee et al., 1995). Both of these studies reported an SVT occurrence in 0.02%–0.5% of pregnancies (Lee et al., 1995; Li et al., 2008). Based on relatively recent reviews of the literature, Kugamoorthy and Spears (2020) and Manolis et al. (2020) also concluded SVT to be the most frequent sustained arrhythmia in this population.

Theme Two: Hemodynamic, Autonomic, and Hormonal Changes in Pregnancy

Three studies reported on the hemodynamic, autonomic, and hormonal changes that occur during pregnancy (Altun et al., 2014; Köşüş et al., 2011; Nikoo et al., 2014). Nikoo and colleagues (2014) conducted a cross-sectional study of women (N = 234) between 36–40 weeks pregnant, who were referred to two private obstetric clinics with reported QT prolongation in preg-nancy. Participants were divided into three groups based on age (Group 1: < 20 years; Group 2: 20–35 years; Group 3 >35 years). Although prolonged QT dispersion (QTd) in all groups was observed, there was no significant difference in QT prolongation based on age; this finding was attributed to the hemodynamic, autonomic, and hormonal changes that occur during pregnancy (Nikoo et al., 2014).

In a quantitative cross-sectional study Altun et al. (2014) analyzed atrial conduction abnormalities among 30 pregnant women with a mean age of 28 in the second trimester, between 18 and 23 weeks and 30 age-matched controls. Altun et al. found that atrial electromechanical coupling intervals and P-wave dispersion, which are predictors of atrial fibrillation, were significantly longer in pregnant patients. In particular, inter-atrial, intra-atrial, and intra-left atrial electromechanical coupling intervals were prolonged in the pregnant subjects compared to the age-matched controls (26.4 ± 4.0 versus 20.2 ± 3.6 ms, $p < 0.001$; 10.0 ± 2.0 versus 8.0 ± 2.6 ms, $p = 0.002$; 16.4 ± 3.3 versus 12.2 ± 3.0 ms, $p < 0.001$, respectively). This finding was attributed to the increases in blood volume, cardiac output, elevated levels of estrogen and β-human chorionic gonadotropin that occur during pregnancy (Altun et al., 2014).

Among a sample of 38 pregnant women with a mean age of 29 that were referred to an obstetric clinic in Ankara, Türkiye, Köşüş et al. (2011) reported the diagnosis of cardiac arrhythmia in 82.3 percent of patients in all stages of labour. Sinus tachycardia was found to be the most common arrhythmia (24 cases). However, other forms of cardiac arrhythmias were also observed that included: supraventricular tachycardia (three cases), T-wave inversion (two cases) and ventricular extrasystole (one case; Köşüş et al., 2011). These arrhythmias were attributed to the increase in adrenergic sensitivity that may modify the refractory period and conduction velocity in the re-entrant circuit (Köşüş et al., 2011). In summary, the changes that occur during pregnancy appear to make women more susceptible to arrhythmogenesis.

Theme Three: Conflicting Information on the Effect of Maternal Age on Cardiac Arrhythmias

Three studies reported on the impact of maternal age on the development of cardiac arrhythmias (Altun et al., 2014; Nikoo et al., 2014; Vaidya, et al., 2017). More specifically, two studies reported maternal age to have a non-significant impact on the incidence of cardiac arrhythmias (Altun et al., 2014; Nikoo et al., 2014), While Nikoo et al. (2014) reported QT prolongation in pregnancy, maternal age was found not to affect the heterogeneity of ventricular repolarization and propensity of ventricular arrhythmia. Similarly, Altun et al. (2014) found no relationship between maternal age and the probability of atrial fibrillations during gestation (Altun et al., 2014). Conversely, Vaidya et al. (2017) found that pregnant women aged between 41 and 50 reported an overall greater frequency of any arrhythmias (199 per 100,000 and 162% increase) compared to pregnant women aged 18 to 30 years of age (55 per 100,000 and 58% increase). Thus, the findings reported in the literature on the relationship between maternal age and the development of arrhythmias during pregnancy are inconsistent.

Synthesis of Evidence

This scoping review reported on the current literature on the development of cardiac arrhythmias among women during pregnancy or in the immediate postpartum period, who did not have any prior related significant medical history. The most common arrhythmia reported in the literature is related to different tachyarrhythmias, particularly the onset of SVT. The development of cardiac arrhythmias was reported during different stages of pregnancy. However, there was no literature that focused on women in their second or subsequent pregnancy experiencing this complication for the first time in the postpartum period.

Discussion

Based on the findings of our review, the three major themes identified were: 1) electrocardiography and cardiac findings; 2) hemodynamic, autonomic, and hormonal changes that occur in pregnancy; and 3) conflicting information regarding the effect of maternal age on cardiac arrhythmias. Included articles suggested the issue may be of global concern among healthy pregnant women of diverse ages.

The findings from this review indicate that previously healthy women may develop cardiac arrhythmias at various stages of gestation, although the evidence remains limited and inconsistent. Several discussion papers and studies reported specifically on the symptoms of SVT (Kugamoorthy & Spears, 2020; Li et al., 2008; Manolis et al., 2020). However, the prevalence of SVT among pregnant and postpartum women remains unclear. Moreover, the design, methods, and sample characteristics in the existing studies are inconsistent. There is also less focus on bradyarrythmias than tachyarrhythmias in this literature, which may be because sinus bradycardia is unusual in pregnant women. Therefore, future research should explore the prevalence, risk factors, and clinical implications of tachyarrythmias and bradyarrhythmias throughout the various stages of pregnancy.

Research to date supports the contention that hemodynamic, autonomic, and hormonal changes in pregnancy can be underlying mechanisms that lead to arrhythmia development. Substantial increases in maternal hormones like oestrogen and human chorionic gonadotropin (hCG) occur during pregnancy. Estrogen increases plasma catecholamine levels and adrenergic receptor sensitivity, both of which lead to an excessively activated sympathetic response (Hart et al., 2011; Holzman et al., 2009; Machuki et al., 2018). According to a review by Stavrakis et al. (2020), sympathetic hyperactivity raises the risk for ventricular arrhythmias and sudden death in pregnant women. However, the four sources included in this review contradicted the findings of Stavrakis et al. (2020) and found that these types of arrhythmias in normal pregnancy are idiopathic, showing a benign nature using an ECG monitor (Köşüş et al., 2011; Kugamoorthy & Spears, 2020; Li et al., 2008; Manolis et al., 2020). Moreover, only three available articles discussed the role of hormonal changes in pregnancy-related arrhythmias development. Therefore, further research related to hemodynamic, autonomic, and hormonal changes in pregnancy is needed.

This scoping review also revealed inconsistent findings and lack of evidence on the effects of maternal age on the development of cardiac arrhythmias during pregnancy in previously healthy women. Variations in study designs and sampling could have contributed to this, warranting the need for further exploration in this area. While the maternal age of mothers giving birth to their first child is increasing, this raises concerns regarding adverse complications during pregnancy that could affect both the mother and the fetus (Londero et al., 2019). Since numerous factors may affect the prevalence of arrhythmia in pregnancy, it is important to evaluate the possible effects of multiple factors. Further quantitative research is necessary to observe correlations between maternal age and the incidence of cardiac arrhythmia in pregnancy.

Limitations

Only 13 relevant articles that included the criteria for this review could be located; 10 were research based. As well, studies written in languages other than English may have been overlooked. However, as this is an emerging area of research, there is a high likelihood that this is representative of the number of studies that exist to date on this topic. Finally, although the interpretation of the literature deemed worthy of inclusion may have been subject to reviewer bias, this evaluation bias was minimized by four reviewers (KM, SF, KC, and PK) examining each of the articles.

Implications for Nursing

Pregnancy is associated with an increased risk for the development of arrhythmias (Conti et al., 2024; Soma-Pillay et al., 2016). Therefore, it is important for cardiovascular nurses to be aware of and assess pregnant women for this risk. Nurses providing care to pregnant women in different healthcare settings, including community, clinics and hospitals, must be aware of the potential risks of developing cardiac arrhythmias during pregnancy. This scoping review highlights various factors that can increase the likelihood of developing cardiac arrhythmias during pregnancy, including age, physiological changes during pregnancy, and hormonal fluctuations. Nurses must understand the risk assessment to ensure early detection and timely intervention. Education must be provided to ensure nurses caring for pregnant and postpartum women have the skills to assess their patients for possible cardiac arrhythmias. Patient care guidelines should include ongoing assessments of heart rate and rhythm during pregnancy and at postpartum care periods to ensure timely intervention and management (Conti et al., 2024).

This review highlights the prevalence of tachyarrhythmias in healthy pregnant women. In addition to the assessment of cardiac arrhythmias, nurses also play a crucial role in providing education to patients on the symptoms, risk factors, and when to seek medical attention. The management of cardiac arrhythmias during pregnancy and the postpartum period requires a collaborative approach, including nurses, physicians, pharmacists, electrophysiologists, and other healthcare professionals, to implement a comprehensive care plan, as well as further refine the existing practical guidelines to support this patient population. Nurses must facilitate effective communication among members of the interprofessional care team, as well as patients and their families, to ensure all healthcare professionals are well-informed and working toward providing patient-centred care for previously healthy pregnant or postpartum women with cardiac arrhythmias.

Our review highlights the importance of further research in this area. Future studies need to be mindful to include a detailed description of the demographic profiles of included participants to delineate any impact that sample diversity can have on arrhythmia development. As well, since this review determined that previous studies in this topic area utilized quantitative designs, more qualitative research should be conducted that explores participants' lived experiences of developing and living with cardiac arrhythmias.

Conclusion

The purpose of this scoping review was to to map existing evidence on cardiac arrhythmia development in previously healthy pregnant or postpartum women. Thirteen articles were included in this scoping review and revealed three themes. The literature reported on several different cardiac arrhythmias that were observed in previously healthy pregnant or postpartum women. Several studies attributed the development of arrhythmias to the hemodynamic, autonomic, and hormonal changes that occur during pregnancy. Nurses providing care to this population must be aware of this potential issue and ensure that regular assessments, as well as timely interventions, occur. Finally, inconsistent findings were reported on the relationship between maternal age and the risk of cardiac arrythmias. Therefore, future quantitative and qualitative research is needed to explore previously healthy women's lived experiences of a diagnosis of arrhythmias during pregnancy or the postpartum period.

REFERENCES

Adamson, D. L., & Nelson-Piercy, C. (2007). Managing palpitations and arrhythmias during pregnancy. *Heart (British Cardiac Society), 93*(12), 1630–1636. https://doi.org/10.1136/hrt.2006.098822

Altun, B., Gazi, E., Gungor, A. C., Uysal, A., Temiz, A., Barutcu, A., Colkesen, Y., Ozturk, U., Tasolar, H., Acar, G., & Akkoy, M. (2014). Atrial electromechanical coupling intervals in pregnant subjects: Cardiovascular topic. *Cardiovascular Journal of Africa, 25*(1), 15-20. https://doi.org/10.5830/cvja-2013-085

Aromataris, E., & Munn, Z. (2020). *Joanna Briggs Institute manual for evidence synthesis.* Joanna Briggs Institute. https://doi.org/10.1891/9780826152268.0012

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101.

Choi, H. S., Han, S. S., Choi, H. A., Kim, H. S., Lee, C. G., Kim, Y. Y., Hwang, J. J., Park, J. B., & Shin, H. H. (2001). Dyspnea and palpitation during pregnancy. *The Korean Journal of Internal Medicine, 16*(4), 247–249. https://doi.org/10.3904/kjim.2001.16.4.247

Cleveland Clinic. (2024). *Heart palpitations in pregnancy.* https://my.clevelandclinic.org/health/diseases/21941-heart-palpitations-in-pregnancy#:~:text=Most%20of%20the%20time%2C%20heart%20palpitations%20during%20pregnancy%20aren't,may%20be%20causing%20your%20symptoms

Coad, F., & Frise, C. (2021). Tachycardia in pregnancy: When to worry? *Clinical Medicine (London, England), 21*(5), e434–e437. https://doi.org/ 10.7861/clinmed.2021-0495

Conti, E., Cascio, N. D., Paluan, P., Racca, G., Longhitano, Y., Savioli, G., Tesauro, M., Leo, R., Racca, F., & Zanza, C. (2024). Pregnancy arrhythmias: Management in the emergency department and critical care. *Journal of Clinical Medicine, 13*(4), 1095.

Davis, M. (2022). *Arrhythmias in pregnancy.* https://www.acc.org/Latest-in-Cardiology/ten-points-to-remember/2022/01/20/17/59/Arrhythmias-in-Pregnancy

Gałczyński, K., Marciniak, B., Kudlicki, J., Kimber-Trojnar, Z., Leszczyńska-Gorzelak, B., & Oleszczukz, J. (2013). Electrical cardioversion in the treatment of cardiac arrhythmias during pregnancy–Case report and review of literature. *Ginekologia polska, 84*(10), 882–887. https://doi.org/10.17772/gp/1656

Gonçalves, M. A. A., Pedro, J. M., Silva, C., Magalhães, P., & Brito, M. (2022). Electrocardiographic findings in pregnant women in Angola. *Annals of Noninvasive Electrocardiology, 27*(5), e12980. https://doi.org/10.1111/anec.12980

Hart, E. C., Charkoudian, N., & Miller, V. M. (2011). Sex, hormones, and neuroeffector mechanisms. *Acta Physiologica, 203*(1), 155–165. https://doi.org/10.1111/j.1748-1716.2010.02192.x

Holzman, C., Senagore, P., Tian, Y., Bullen, B., Devos, E., Leece, C., Zanella, A., Fink, G., Rahbar, M. H., & Sapkal, A. (2009). Maternal catecholamine levels in midpregnancy and risk of preterm delivery. *American Journal of Epidemiology, 170*(8), 1014–1024. https://doi.org/10.1093/aje/kwp218

Hutchens, J., Frawley, J., & Sullivan, E. A. (2022). Cardiac disease in pregnancy and the first year postpartum: A story of mental health, identity and connection. *BioMed Central Pregnancy and Childbirth, 22*(1). https://doi.org/10.1186/s12884-022-04614-1

Kandzia, T., Markiewicz-Łoskot, G., & Binkiewicz, P. (2022). Tpeak-Tend interval during pregnancy and postpartum. *International Journal of Environmental Research and Public Health, 19*(19), 12638. https://doi.org/10.3390/ijerph191912638

Köşüş, A., Köşüş, N., Acikgoz, N., Yildirim, M., & Kafali, H. (2011). Maternal arrhythmias detected with electrocardiography during labour: Are they significant clinically? *Journal of Obstetrics and Gynaecology, 31*(5), 396–399. https://doi.org/10.3109/01443615.2011.563331

Kugamoorthy, P., & Spears, D. A. (2020). Management of tachyarrhythmias in pregnancy – A review. *Obstetric Medicine, 13*(4), 159–173. https://doi.org/10.1177/1753495X20913448

Lee, S. H., Chen, S. A., Wu, T. J., Chiang, C. E., Cheng, C. C., Tai, C. T., Chiou, C. W., Ueng, K. C., & Chang, M. S. (1995). Effects of pregnancy on first onset and symptoms of paroxysmal supraventricular tachycardia. *The American Journal of Cardiology, 76*(10), 675–678. https://doi.org/10.1016/s0002-9149(99)80195-7

Li, J.-M., Nguyen, C., Joglar, J. A., Hamdan, M. H., & Page, R. L. (2008). Frequency and outcome of arrhythmias complicating admission during pregnancy: Experience from a high-volume and ethnically-diverse obstetric service. *Clinical Cardiology, 31*(11), 538–541. https://doi.org/10.1002/clc.20326

Li, M., Sang, C. H., Jiang, C. X., Guo, X. Y., Li, S. N., Wang, W., Zhao, X., Tang, R. B., Long, D., Gao, H., Dong, J. Z., Du, X., & Ma, C. S. (2019). Maternal arrhythmia in structurally normal heart: Prevalence and feasibility of catheter ablation without fluoroscopy. *Pacing and Clinical Electrophysiology, 42*(12), 1566–1572.

Londero, A. P., Rossetti, E., Pittini, C., Cagnacci, A., & Driul, L. (2019). Maternal age and the risk of adverse pregnancy outcomes: A retrospective cohort study. *BioMed Central Pregnancy and Childbirth, 19*(1). https://doi.org/10.1186/s12884-019-2400-x

Machuki, J. O., Zhang, H. Y., Harding, S. E., & Sun, H. (2018). Molecular pathways of oestrogen receptors and β-adrenergic receptors in cardiac cells: Recognition of their similarities, interactions and therapeutic value. *Acta Physiologica, 222*(2), e12978. https://doi.org/10.1111/apha.12978

Manolis, T. A., Manolis, A. A., Apostolopoulos, E. J., Papatheou, D., Melita, H., & Manolis, A. S. (2020). Cardiac arrhythmias in pregnant women: Need for mother and offspring protection. *Current Medical Research and Opinion, 36*(7), 1225–1243.

McGowan, J., Straus, S., Moher, D., Langlois, E. V., O'Brien, K. K., Horsley, T., Aldcroft, A., Zarin, W., Garitty, C. M., Hempel, S., Lillie, E., Tunçalp, Ö., & Tricco, A. C. (2020). Reporting scoping reviews-PRISMA ScR extension. *Journal of Clinical Epidemiology, 123,* 177–179. https://doi.org/10.1016/j.jclinepi.2020.03.016

Nikoo, M. H., Khosropanah, S., Alborzi, S., & Aslani, A. (2014). QT dispersion in young, ideal, and old aged pregnancies. *International Cardiovascular Research Journal, 8*(1), 24–26.

Peters, M. D. J., Godfrey, C. M., Khalil, H., McInerney, P., Parker, D., & Soares, C. B. (2015). Guidance for conducting systematic scoping reviews. *International Journal of Evidence Based Healthcare, 13,* 141–146. https://doi.org/10.1097/XEB.0000000000000050

Pollock, D., Davies, E. L., Peters, M. D. J., Tricco, A. C., Alexander, L., McInerney, P., Godfrey, C. M., Khalil, H., & Munn, Z. (2021). Undertaking a scoping review: A practical guide for nursing and midwifery students, clinicians, researchers, and academics. *Journal of Advanced Nursing, 77*(4), 2102–2113. https://doi.org/10.1111/jan.14743

Ramlakhan, K. P., Kauling, R. M., Schenkelaars, N., Segers, D., Sing-Chien, Y., Post, M. C., Cornette, J., & Roos-Hesselink, J. (2022). Supraventricular arrhythmia in pregnancy. *Heart, 108*(21), 1674–1681. https://doi.org/10.1136/heartjnl-2021-320451

Romem, A., Romem, Y., Katz, M., & Battler, A. (2004). Incidence and characteristics of maternal cardiac arrhythmias during labor. *The American Journal of Cardiology, 93*(7), 931–933. https://doi.org/10.1016/j.amjcard.2003.12.042

Safavi-Naeini, P., Sorurbakhsh, N. Z., & Razavi, M. (2021). Cardiac arrhythmias during pregnancy. *Texas Heart Institute Journal, 48*(4), e217548. https://doi.org/10.14503/THIJ-21-7548

Sanghavi, M., & Rutherford, J. D. (2014). Cardiovascular physiology of pregnancy. *Circulation, 130*(12), 1003–1008. https://doi.org/10.1161/circulationaha.114.009029

Senarath, S., Nanayakkara, P., Beale, A. L., Watts, M., Kaye, D. M., & Nanayakkara, S. (2021). Diagnosis and management of arrhythmias in pregnancy. *Europace, 24*(7), 1041–1051. https://doi.org/10.1093/europace/euab297

Soma-Pillay, P., Nelson-Piercy, C., Tolppanen, H., & Mebazaa, A. (2016). Physiological changes in pregnancy. *Cardiovascular Journal of Africa, 27*(2), 89–94. https://doi.org/10.5830/cvja-2016-021

Shotan, A., Ostrzega, E., Mehra, A., Johnson, J. V., & Elkayam, U. (1997). Incidence of arrhythmias in normal pregnancy and relation to palpitations, dizziness, and syncope. *The American Journal of Cardiology, 79*(8), 1061–1064. https://doi.org/10.1016/S0002-9149(97)00047-7

Stavrakis, S., Kulkarni, K., Singh, J. P., Katritsis, D. G., & Armoundas, A. A. (2020). Autonomic modulation of cardiac arrhythmias: Methods to assess treatment and outcomes. *Journal of American College of Cardiology: Clinical Electrophysiology, 6*(5), 467–483. https://doi.org/10.1016/j.jacep.2020.02.014

Tamirisa, K. P., Elkayam, U., Briller, J. E., Mason, P. K., Pillarisetti, J., Merchant, F. M., Patel, H., Lakkireddy, D. R., Russo, A. M., Volgman, A. S., & Vaseghi, M. (2022). Arrhythmias in pregnancy. *Journal of American College of Cardiology: Clinical Electrophysiology, 8*(1), 120–135. https://doi.org/10.1016/j.jacep.2021.10.004

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D. J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M. G., Garrity, C., & Straus, S. E. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine, 169*(7), 467–473. https://doi.org/10.7326/m18-0850

Uzakova. M., Babajanova, G. S., & Uzokov, J. K. (2023). Prevalence and characteristics of arrhythmias during the pregnancy. *Europace (London, England), 25*(Suppl 1). https://doi.org/10.1093/europace/euad122.767

Vaidya, V. R., Arora, S., Patel, N., Badheka, A. O., Patel, N., Agnihotri, K., Billimoria, Z., Turakhia, M. P., Friedman, P. A., Madhavan, M., Kapa, S., Noseworthy, P. A., Cha, Y. M., Gersh, B., Asirvatham, S. J., & Deshmukh, A. J. (2017). Burden of arrhythmia in pregnancy. *Circulation, 135*(6), 619–621. https://doi.org/10.1161/CIRCULATIONAHA.116.026681