Addressing postpartum contraception practices utilizing a multidisciplinary Pregnancy Heart Team approach

Hayley E. Miller, MD; Samantha C. Do, MD; Giovanna Cruz, PhD; Danielle M. Panelli, MD; Stephanie A. Leonard, PhD; Anna Girsen, MD, PhD; Christine J. Lee, RN, BSN; Abha Khandelwal, MD, MS; Kate A. Shaw, MD, MS; Katherine Bianco, MD

BACKGROUND: Cardiovascular disease has emerged as the leading cause of maternal morbidity and mortality, making planned pregnancy, and thereby reliable contraception among people with cardiovascular disease, vital.

OBJECTIVE: This study aimed to compare postpartum contraceptive practices among people with cardiovascular disease (cardiac cohort) cared for by a Pregnancy Heart Team to people with other chronic comorbidities (high-risk cohort), and people without comorbidities (low-risk cohort). We hypothesized that the Pregnancy Heart Team influenced baseline contraception counseling and practices among those with cardiovascular disease.

STUDY DESIGN: This was a retrospective cohort study comparing postpartum contraceptive practices between a cardiac cohort who received care by a multidisciplinary team between 2012 and 2020 and high-risk and low-risk cohorts delivering at a single academic center between 2016 and 2019. We investigated presence of a contraceptive plan (at birthing admission, discharge, and postpartum visit) and uptake of reliable contraception by 8 weeks postpartum.

RESULTS: We included 1464 people: 189 with cardiovascular disease, 197 with other chronic comorbidities, and 1078 low-risk people. At birth hospitalization admission, reliable contraception was planned among 42% of the cardiac cohort, 40% of the high-risk cohort, and 31% of the low-risk cohort, with similar distributions at the time of discharge and at 8 weeks postpartum. Compared with the cardiac cohort, by 8 weeks postpartum, the high-risk cohort had similar odds of using highly reliable forms of contraception (39% vs 36%; adjusted odds ratio, 0.78; 95% confidence interval, 0.50–1.21) and similar odds of having a plan to use the most reliable forms of contraception (intrauterine device, implant, bilateral tubal ligation) at the time of birthing admission (42% vs 40%; adjusted odds ratio, 0.78; 95% confidence interval, 0.50–1.22), discharge (47% vs 45%; adjusted odds ratio, 0.95; 95% confidence interval, 0.61–1.48), and postpartum visit (35% vs 29%; adjusted odds ratio, 0.76; 95% confidence interval, 0.49–1.17). The low-risk cohort had lower odds of using a reliable form of contraception (39% vs 27%; adjusted odds ratio, 0.53; 95% confidence interval, 0.37–0.75) and was less likely to have a plan for reliable contraception at the time of birthing admission (42% vs 31%; adjusted odds ratio, 0.54; 95% confidence interval, 0.38–0.76), discharge (47% vs 33%; adjusted odds ratio, 0.58; 95% confidence interval, 0.4–0.82), and postpartum visit (35% vs 21%; adjusted odds ratio, 0.50; 95% confidence interval, 0.35–0.71).

CONCLUSION: People with cardiovascular disease cared for by a Pregnancy Heart Team had higher odds of reliable postpartum contraception planning and uptake compared with a low-risk cohort and similar odds compared with a high-risk cohort. Pregnancy could serve as a critical period for contraception counseling and family planning among people with cardiovascular disease. A multidisciplinary team should be used to address postpartum contraception as a modifiable risk factor to reduce maternal morbidity and mortality among those with cardiovascular disease.

Key words: cardiovascular disease, long-acting reversible contraception, maternal morbidity, postpartum care, postpartum contraception

From the Division of Maternal-Fetal Medicine and Obstetrics, Department of Obstetrics and Gynecology, Stanford University, Palo Alto, (Drs Miller, Do, Panelli, Leonard, and Girsen, Ms Lee, and Dr Bianco) CA; Division of Cardiology, Department of Medicine, Stanford University, Palo Alto, (Dr Khandelwal) CA; Complex Family Planning Services and Research, Division of Gynecology, Department of Obstetrics and Gynecology, Stanford University, Palo Alto, (Dr Shaw) CA

The authors report no conflict of interest and no relationships with industry.

The authors report no funding received for this study.

This study was presented as a poster at the 40th annual meeting of the Society for Maternal-Fetal Medicine, Grapevine, TX, February 3–8, 2020.

Patient consent was not required because no personal information or details were included.

Cite this article as: Miller HE, Do SC, Cruz G, et al. Addressing postpartum contraception practices utilizing a multidisciplinary Pregnancy Heart Team approach. Am J Obstet Gynecol Glob Rep 2022;2:100100.

Corresponding author: Hayley E. Miller, MD Hayleym@stanford.edu

2666-5778/$36.00

© 2022 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/)

http://dx.doi.org/10.1016/j.xagr.2022.100100

November 2022 AJOG Global Reports 1
Introduction

In the United States, cardiovascular disease (CVD) is the leading cause of maternal morbidity and mortality, contributing to 1 in 3 of all pregnancy-related deaths.1,2 Optimizing cardiac status before pregnancy is essential in reducing maternal morbidity and mortality.3-4,10 However, gaps exist in reproductive healthcare for this cohort of people.3 Among people with CVD, unintended pregnancy rates range between 25% and 54%, and short-interval pregnancies (<18 months from delivery to subsequent conception) occur in 33% of cases.3,5 Reliable contraception can help prevent unintended pregnancy. The increasing prevalence of CVD among reproductive-age individuals should motivate clinicians of various specialties to prioritize contraceptive management among people with CVD to avoid unintended pregnancies and optimize preconception cardiac health.9 Pregnancy offers a unique time for people with CVD to be cared for by a multidisciplinary team and could serve as a critical period for contraception counseling and future family planning.

Previous literature has shown that a multidisciplinary Pregnancy Heart Team approach to pregnant individuals with CVD can improve obstetrical outcomes.3,4,10 The multidisciplinary team can offer early cardiac risk assessment,10 diagnostic evaluation, safe delivery, and postpartum planning. The nature of the multidisciplinary team can also provide an opportunity for clinicians in various subspecialties to provide comprehensive contraception counseling both antenatally and postpartum at their respective visits.2,3,4,10-13 However, little is known about the Pregnancy Heart Team impact on contraception practices. Given this knowledge gap, we sought to understand contraceptive practices among people with CVD cared for by a multidisciplinary team by comparing their contraceptive plan and uptake with those of people with chronic comorbidities (high-risk cohort) and low-risk pregnancies (low-risk cohort) at a single institution. This study has implications for clinicians in both the United States and internationally who are seeking optimal ways to care for people with CVD, given the high rates of mortality among this cohort globally. We sought to examine the use of the most reliable forms of contraception, including long-acting reversible contraception (LARC) and sterilization. These options have the lowest failure rates and are most likely to reduce unintended and short interpregnancy intervals and thus provide more time for preconception cardiac optimization.2,3,5,6,14,15

We hypothesized that the cardiac cohort compared with both high-risk and low-risk cohorts would be more likely to have a plan for reliable contraception at birthing admission, discharge, and the postpartum visit, and more likely to have contraception uptake postpartum.

Materials and Methods

Study population

This was a retrospective cohort study of pregnant people who delivered at a single institution. We included a cohort of individuals (cardiac cohort) with congenital or acquired CVD cared for by a multidisciplinary Pregnancy Heart Team who gave birth between 2012 and 2020. Acquired CVD diagnoses included arrhythmias, valvular disease, ischemic disease, and cardiomyopathy. The Pregnancy Heart Team was initiated in 2012, and birth data were collected among this cohort between 2012 and 2020; however, most of the cardiac cohort gave birth between 2015 and 2020. Two comparison groups (high-risk and low-risk cohorts) were drawn from a previous contraception study conducted at the same institution among people who gave birth between 2016 and 2019.16 These cohorts were selected to match the cardiac cohort study time period at the same institution (Figure 1). The high-risk comparison group included people with chronic comorbidities followed by maternal-fetal medicine (MFM) specialists, and the low-risk comparison group included those receiving routine prenatal care from general obstetrician–gynecologists (OB-GYNs) and advanced practice providers. Individuals with CVD were not included in high-risk or low-risk cohorts. Pregnancies resulting in live births at ≥24 weeks 0 days of gestation were included. The most recent pregnancies among people with multiple pregnancies during the study period were included in all cohorts. The Stanford University Research Compliance Office reviewed this study and provided ethics approval before its initiation.

The cardiac, high-risk, and low-risk cohorts varied by type of comorbidity and type of care team. At our institution, people with CVD in pregnancy

Why was this study conducted?

Cardiovascular disease (CVD) is the leading cause of maternal morbidity and mortality in the United States. Unintended short interval pregnancy is a modifiable risk factor among those with CVD, and can be influenced by providing contraception in the postpartum period. This study was conducted to understand postpartum contraceptive practices among people with CVD cared for by a multidisciplinary Pregnancy Heart Team.

Key findings

People with CVD cared for by a multidisciplinary team had high odds of reliable postpartum contraception planning and uptake compared with a low-risk cohort, and similar odds compared with a high-risk cohort.

What does this add to what is known?

A Pregnancy Heart Team improves perinatal outcomes and can prioritize contraception counseling in a multidisciplinary approach to improve pregnancy planning and preconception cardiac optimization for people with CVD.

AJOG Global Reports at a Glance

Why was this study conducted?

Cardiovascular disease (CVD) is the leading cause of maternal morbidity and mortality in the United States. Unintended short interval pregnancy is a modifiable risk factor among those with CVD, and can be influenced by providing contraception in the postpartum period. This study was conducted to understand postpartum contraceptive practices among people with CVD cared for by a multidisciplinary Pregnancy Heart Team.

Key findings

People with CVD cared for by a multidisciplinary team had high odds of reliable postpartum contraception planning and uptake compared with a low-risk cohort, and similar odds compared with a high-risk cohort.

What does this add to what is known?

A Pregnancy Heart Team improves perinatal outcomes and can prioritize contraception counseling in a multidisciplinary approach to improve pregnancy planning and preconception cardiac optimization for people with CVD.
receive prenatal care by a multidisciplinary team, described in literature as a Pregnancy Heart Team, including MFM and obstetrics, cardiology (women’s heart health, adult congenital heart disease [CHD], electrophysiology, heart failure), obstetrical and cardiac anesthesiology, and cardiothoracic surgery.2,5,9

The standard for contraception counseling throughout the study time period included contraception counseling performed by the MFM specialist, typically starting at 28 weeks’ gestation, similar to high-risk and low-risk cohorts, followed by a formal review of the contraception plan at a multidisciplinary team meeting (Supplemental Figure). Monthly multidisciplinary meetings are held for treatment planning for antepartum, intrapartum, and postpartum care, including a plan for postpartum contraception. Throughout the duration of the study period, all providers at our institution use a standardized contraception handout, which organizes contraception options by the contraceptive method effectiveness. The standard is to initiate contraception counseling at 28 weeks’ gestation and continue to address if the individual remains uncertain until delivery hospitalization. MFM providers routinely counsel the high-risk and cardiac cohorts on implications of unplanned and short-interval pregnancies; thus, we expected a focus on reliable forms of contraception among the high-risk and cardiac cohorts. Providers use the US Medical Eligibility Criteria (MEC) for Contraceptive Use to appropriately classify medical conditions affecting eligibility for the use of various contraceptive methods.17 The goal of these recommendations is to remove unnecessary medical barriers to accessing and using contraception by providing clinicians reassurance that most contraceptive methods can be safely used by most people, even those with complex medical conditions.

Data collection
The cardiac cohort was identified using a REDCap (Vanderbilt University, Nashville, TN) database where individuals are prospectively recorded directly from monthly multidisciplinary team meeting lists.18

We selected the high-risk cohort as a comparison group to compare variability of contraception practices of medically complex people between patients receiving care by a single MFM provider and those treated by a multidisciplinary team. We identified chronic comorbidities using the Society for Maternal-Fetal Medicine (SMFM) index and included hypertension, diabetes mellitus, uncontrolled asthma, seizure disorder, autoimmune disease, hepatitis B or C, HIV, renal disease, coagulopathy or thrombophilia, and history of deep vein thrombosis or pulmonary embolism.19

Investigators abstracted data from the electronic medical record of previously identified charts. Contraception plans
were recorded within a standardized prenatal checklist in all charts.

Methods of contraception were categorized by tiers based on the World Health Organization (WHO) model. Tier 1 includes bilateral tubal ligation (BTL) and LARC (intrauterine device [IUD], and implant); Tier 2 includes oral contraceptive pills, injection, patch, and ring; Tier 3 includes condoms; and no contraception plan includes vasectomy, no show, lost to follow-up, undecided, or declined. Vasectomy was categorized as Tier 3 for the study’s purpose because vasectomy for the male partner cannot prevent future pregnancies with a separate future partner. The primary outcome was reliable contraception (Tier 1) uptake by 8 weeks postpartum. Eight weeks was used as the endpoint because California public insurance coverage ended 60 days after delivery during the study period. The secondary outcomes were overall contraception plan (Tier 1, 2, or 3) and reliable contraception plan (Tier 1) during birthing admission, discharge, and at the postpartum visit. Tier 1 is considered reliable contraception because of the typical-use 1-year failure rate of <1%. The study’s primary outcome focused on Tier 1 plan and uptake of contraception on the basis of the American College of Obstetricians and Gynecologists (ACOG) and SMFM guidance to offer Tier 1 contraception to the most high-risk pregnancies given the low failure rate. However, it is important to note that Tier 2 and 3 methods are safe and reliable methods, with typical-use 1-year failure rate ranging from 6% to 28% depending on the method. This study included cardiovascular conditions with contraindications to estrogen-containing contraception and a heterogeneous group of providers with different levels of training in complex contraception counseling; therefore, we did not include Tier 2 methods uptake within the primary outcome.

Sensitivity analysis

Starting in 2015, our institution initiated the option of immediate postpartum IUD and implant insertion as the standard of care. In this study, the cardiac cohort included people before this change; however, the comparison cohorts included people after the initiation of immediate postpartum contraception as the standard of care (years 2016–2019). Because of the limited sample size of the cardiac cohort, we included all people within the 2012 to 2014 time period in our final analysis. We conducted a sensitivity analysis restricted to individuals in the cardiac cohort who delivered after 2016 to match the time period of delivery of both comparison cohorts and investigate any potential effect of temporal trends. We then analyzed temporal trends of reliable contraception. We compared reliable contraception uptake between the periods from 2012 to 2014 and 2015 to 2020 in the cardiac cohort to investigate potential bias in the study’s selected time period. On the basis of previous literature, we hypothesized that rates of LARC uptake by 8 weeks postpartum would increase after the initiation of immediate postpartum LARC placement.

Statistical analyses

Demographics and delivery characteristics were compared between the cardiac cohort and the comparison cohorts. Cardiac disease characteristics, including history of surgery and modified WHO score, were summarized for people in the cardiac disease cohort. Bivariate analysis was performed using chi-square, Fisher exact, or t-tests where appropriate. A similar analysis was conducted to assess the differences between plan and uptake of contraception between people with CVD and the comparison cohorts. Covariates including maternal age, race/ethnicity, parity, insurance status, and gestational age were selected a priori for inclusion in a multivariable model. Multivariable logistic regression was used to estimate odds ratios and 95% confidence intervals (CIs) for the association between each cohort and the contraception outcomes. P values <.05 were considered statistically significant. Analyses were conducted in Stata, version 14.2 (StataCorp LLC, College Station, TX).

Results

We identified 189 people with CVD, 197 with chronic comorbidities, and 1078 low-risk people eligible for inclusion from 2012 to 2020 (Figure 1). The baseline characteristics are summarized in Table 1, and the cardiac characteristics of the cardiac cohort are summarized in Supplementary Table 1.

When compared with the high-risk cohort, the cardiac cohort had similar rates of any contraceptive plan (Tier 1, 2, or 3) at all 3 time points in the study (admission: P=.666; discharge: P=.644; postpartum: P=.397) (Figure 2). In addition, the cardiac and high-risk cohorts had similar odds for a plan using reliable contraception (IUD, implant, BTL) at the time of birthing admission (42% vs 40%; adjusted odds ratio [aOR], 0.78; 95% CI, 0.50–1.22), discharge (47% vs 45%; aOR, 0.95; 95% CI, 0.61–1.48), and postpartum visit (35% vs 29%; aOR, 0.76; 95% CI, 0.49–1.17) (Table 2). Uptake of Tier 1 contraception was similar between both cohorts (39% vs 36%; aOR, 0.78; 95% CI, 0.50–1.21) (Table 2).

Compared with the cardiac cohort, the low-risk cohort was less likely to have a plan for reliable contraception at the time of birthing admission (42% vs 31%; aOR, 0.54; 95% CI, 0.38–0.76), discharge (47% vs 33%; aOR, 0.58; 95% CI, 0.4–0.82), and postpartum visit (35% vs 21%; aOR, 0.50; 95% CI, 0.35–0.71) (Figure 2 and Table 2). The low-risk cohort had lower odds of uptake of reliable contraception by 8 weeks postpartum (39% vs 27%; aOR, 0.53; 95% CI, 0.37–0.75) (Table 2). In addition, the cardiac cohort had higher rates of any contraception plan (Tier 1, 2, or 3) at all 3 study time points compared with the low-risk cohort (admission: P=.022; discharge: P<.01; postpartum: P<.01) (Figure 2).

The cardiac cohort had higher rates of plans for reliable contraception at the time of birth hospitalization admission than at the 8-week visit (42% vs 35%), with a 35% loss-to-follow-up rate by 8 weeks postpartum (Figure 2). After restricting analyses to individuals in the cardiac cohort who delivered after 2016 to match the time period of
delivery of both control cohorts, the contraceptive outcomes were similar to findings for the entire study period (Supplementary Table 2).

Initiation of immediate LARC placement significantly affected the rates of uptake of reliable contraception by 8 weeks postpartum among those with CVD; 25% of people in the 2012 to 2014 study time period received reliable contraception by 8 weeks postpartum among those with other chronic comorbidities, and higher odds compared with those without comorbidities. Pregnancy could serve as a critical window for contraception counseling and planning among people with CVD. Our results highlight an opportunity for the multidisciplinary team to use the pregnancy window to better establish contraceptive planning and reduce the risk of unintended and short-interval pregnancies and subsequent poor perinatal outcomes.

### Results

Although the impact of a Pregnancy Heart Team on perinatal outcomes is known, there are minimal data about its impact on contraceptive practices.\(^{3,4,10}\) This study demonstrated that such a team has the opportunity to provide comprehensive contraception counseling both antenatally and postpartum by various subspecialties to prevent future unintended short-interval pregnancies, thus addressing one of the most modifiable risk factors for those with CVD. In this retrospective study, when compared with people with CVD managed by a multidisciplinary team, individuals with other chronic comorbidities had similar outcomes of reliable contraceptive planning and uptake; however, people with low-risk pregnancies were significantly less likely to have a plan for and uptake of reliable contraception by 8 weeks postpartum. The multidisciplinary team approach did not improve contraception uptake among people with CVD compared with high-risk pregnant people. This draws attention to the need for improved contraception counseling among people with CVD to improve pregnancy outcomes given that CVD is a driver of maternal mortality.

### Clinical implications

There is an acute need to improve perinatal outcomes among people with CVD. Cardiac optimization before pregnancy is an important step in achieving that goal. The burden of maternal heart disease is expected to increase because of improved survival of individuals with CHD.\(^{9,25}\) The highest complication rates remain among people with pulmonary hypertension, a contraindication for pregnancy with a reported 5% maternal mortality rate in recent studies.\(^{26,27}\) People who had Fontan procedures surviving into adulthood are now common, and pregnancy-related hospitalizations with arrhythmias have increased by 58%.\(^{28,29,30}\) These individuals experience serious complications in pregnancy, including heart

### Discussion

#### Principal findings

People with CVD cared for by a Pregnancy Heart Team had similar odds of reliable postpartum contraception planning and uptake compared with people with other chronic comorbidities, and higher odds compared with those without comorbidities. Pregnancy could serve as a critical window for contraception counseling and planning among people with CVD. Our results highlight an opportunity for the multidisciplinary team to use the pregnancy window to better establish contraceptive planning

&&&
failure, life-threatening arrhythmias, postpartum hemorrhage, and fetal prematurity.\textsuperscript{28,29}

According to ACOG and SMFM, among people with CVD, the use of highly effective contraception in a correct and consistent manner is the best way to reduce unplanned pregnancy.\textsuperscript{2,3,22} The US MEC includes a list of 21 health conditions, including several CVD conditions, that pose an increased risk for adverse health events as a result of pregnancy and encourages LARC methods as the preferred option for individuals with these conditions.\textsuperscript{17} Despite these recommendations, contraceptive practices among people with CVD remain variable. In one study, 25% of people with CHD reported no use of contraception, and a separate study found that most people who had an unplanned pregnancy were using methods with low to moderate effectiveness according to typical-use 1-year failure rate.\textsuperscript{7,8,11} In this study, we found that individuals with CVD had slightly higher rates of plans for reliable contraception compared with high-risk and low-risk pregnant people.

### TABLE 2

| Tier 1 contraception outcome\textsuperscript{a} | Cardiac cohort 189 | High-risk cohort 197 | Low-risk cohort 1078 |
|-----------------------------------------------|---------------------|----------------------|---------------------|
| Planned at delivery admission                | 79 (42.3)           | 92 (0.61–1.37)       | 78 (0.50–1.22)      | 61 (0.45–0.85)       | 54 (0.38–0.76) |
| Planned at discharge from delivery           | 89 (47.1)           | 1.10 (0.70–1.58)     | 95 (0.61–1.48)      | 66 (0.48–0.90)       | 58 (0.41–0.82) |
| Planned at postpartum visit                  | 66 (35.1)           | 0.75 (0.49–1.16)     | 76 (0.49–1.17)      | 50 (0.35–0.70)       | 50 (0.35–0.71) |
| Uptake by 8 wk postpartum                    | 73 (38.8)           | 0.87 (0.57–1.31)     | 78 (0.50–1.21)      | 57 (0.41–0.79)       | 53 (0.37–0.75) |

Data are presented as number (percentage).

\textsuperscript{a} Tier 1 defined by the World Health Organization includes long-acting reversible contraception and bilateral tubal ligation.\textsuperscript{18}

\textsuperscript{b}Tier 1 defined by the World Health Organization includes long-acting reversible contraception and bilateral tubal ligation.\textsuperscript{18}

Miller. Postpartum contraception practices among people with cardiovascular disease. Am J Obstet Gynecol Glob Rep 2022.
postpartum contraception (47% vs 35% –40%) and higher rates of immediate postpartum LARC uptake (36% vs <15%) when compared with rates reported in previously published literature.7,8,11

At our institution, the Pregnancy Heart Team reviews each individual’s antenatal contraception plan in monthly multidisciplinary meetings. According to previous literature, OB-GYN providers and patients may be more motivated to ensure immediate postpartum contraception if there is a preexisting plan for reliable contraception at the time of admission.14,23 ACOG supports establishing a contraception plan, including immediate postpartum placement of LARC, among people with CVD before hospital discharge to minimize the risk of short-interval recurrent pregnancy.7 In addition, this study showed that implementation of immediate LARC placement led to increased reliable contraception uptake by 8 weeks postpartum among the cardiac cohort (Table 3). Immediate LARC placement can improve contraception uptake at institutions that care for pregnant people with high-risk comorbidities. In addition to LARC planning, establishing a plan for sterilization before birth hospital admission is particularly important for people with CVD because delaying surgery beyond the postpartum window poses risks including additional anesthesia and need for coordination of appropriate cardiac anesthesia.2,20

This study offers a solution to address barriers to postpartum contraception by proposing a new standard of care, whereby the Pregnancy Heart Team offers postpartum contraception counseling antenatally by all the multidisciplinary clinicians. Implementation and continuous review of a multidisciplinary action item list (Supplementary Figure 1) including contraception should be implemented to better prioritize contraception counseling antenatally.

However, it is important for all providers to counsel all people on contraceptive effectiveness and the full spectrum of contraceptive options, and with patient-centered care.31 Our study’s results demonstrate a higher incidence of overall contraceptive use among those with comorbidities than among those without, despite using similar contraceptive counseling tools at similar gestational ages. We hypothesize that providers caring for people with comorbidities may emphasize the most effective contraceptives because of ACOG and SMFM recommendations for reliable contraception among high-risk people. However, providers should counsel all individuals while factoring in their values, preferences, and lived experiences.31

**Research implications**
The potential benefit of postpartum contraception counseling for people with CVD is tremendous. Literature shows that those who are counseled both antenatally and postpartum have 2.3-fold increased odds of using more effective contraception, and those who are counseled postpartum have 1.6-fold increased odds of using contraception postpartum when compared with individuals not receiving any contraception counseling.22 However, there are challenges to improving the provision of postpartum contraception, including the perception that contraception planning should only be delivered by a specialized provider, timing of contraception counseling, disruption of insurance, and lack of postpartum follow-up. Additional research is warranted to better understand how the integration of cardiology and obstetrics can best address postpartum contraception planning before birthing hospitalization and potential loss to follow-up postpartum.

**Strengths and limitations**
A strength of this study is that the results are patient-level rather than population-based and provide granularity in exposures and outcomes. We were able to examine contraception uptake in a cohort of pregnancies complicated by CVD and compare it with that of a large diverse cohort of low-risk pregnancies and high-risk non-CVD pregnancies, which contributes to the generalizability of the results. We were also able to describe a multidisciplinary care approach among pregnancies complicated by CVD and compare it with a similar cohort of people being cared for by the same MFM providers during the same time period. Furthermore, the primary outcome focused on uptake of reliable contraception, a measurable outcome, as opposed to patient-reported use, which is a less verifiable outcome. We were also able to ascertain

**TABLE 3**
A comparison of reliable (Tier 1) postpartum contraception uptake between periods from 2012 to 2014 and 2015 to 2020 among people with cardiovascular disease (N=189) to assess uptake of reliable contraception based on availability of immediate postpartum long-acting reversible contraception

| Tier 1 contraception outcome | 2012–2014 N=31 | 2015–2020 N=157 |
|-----------------------------|----------------|----------------|
| LNG IUD                     | 2 (6.5)        | 17 (10.8)      |
| Copper IUD                  | 0              | 6 (3.8)        |
| Implant                     | 0              | 13 (8.3)       |
| Tubal ligation              | 6 (19.4)       | 13 (8.3)       |
| Other/declines              | 23 (74.2)      | 108 (68.8)     |
| Missing                     | 1 (3.2)        |                |

Data are presented as number (percentage).

IUD, intrauterine device; LNG, levonorgestrel.
not only planned postpartum contraception, but also follow most people up to 8 weeks postpartum to document implemented contraception.

Limitations include those inherent to retrospective studies, which may introduce ascertainment bias and other unmeasured confounding factors. Although the sample size limited the ability to investigate rare outcomes, it mirrored the incidence in the general maternal population and was therefore robust enough to examine our hypothesis. We recognize that the generalizability of the CVD cohort is limited because it is primarily in the lower-risk WHO class, with ethnic diversity that is not reflective of the primary population at risk of severe morbidity and mortality. Despite including pregnancies in people with CVD up to 3 years before immediate postpartum LARC implementation, reliable contraception uptake remained higher among the cardiac group. We performed a sensitivity analysis to control for the difference in time periods of delivery and changes in institutional contraceptive practices.

In addition, we recognize that both provider variation and patient preferences may influence contraception practices. The retrospective nature of the study limited our ability to examine these potential biases among a varied set of providers and patients. Although our institution uses a standardized handout to provide contraception counseling for all patients, providers may differ in their counseling practice, which may influence contraception provision. Family planning goals and contraceptive practices may vary across a cohort of people with various pregnancy risk profiles. It is important to note that individual factors contributing to contraception practices remain important to consider, and for our study’s purpose we did not explore individual experiences that may have influenced contraceptive practices.

Conclusions

A Pregnancy Heart Team approach to prenatal care had higher rates of reliable contraception uptake and influenced timing of counseling among people with CVD in comparison with routine prenatal care of people with low-risk pregnancies. However, reliable contraception planning was similar between people with CVD and those with other comorbidities. Prioritizing contraception counseling within a Pregnancy Heart Team approach may not only improve perinatal outcomes, but can also serve as a method to optimize pregnancy planning and timing for people with CVD.

ACKNOWLEDGMENTS

We acknowledge Lillian Sie, MPH for her work on statistical analysis and Elizabeth B. Sherwin, MPH candidate, for chart abstraction. Lillian Sie works at Stanford University School of Medicine and has no conflict of interest or financial disclosures. Elizabeth Sherwin is a student at University of California, Berkeley and has no conflict of interest or financial disclosures.

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.xagr.2022.100100.0.

REFERENCES

1. California Maternal Quality Care Collaborative. Cardiovascular disease in pregnancy & postpartum. Available at: https://www.cmqcc.org/resources-toolkits/toolkits/improving-health-care-response-cardiovascular-disease-pregnancy-and. Accessed April 18, 2020.
2. Moussa HH, Rajapreyar I. ACOG Practice Bulletin No. 212: pregnancy and heart disease. Obstet Gynecol 2019;134:881–2.
3. Lindley KJ, Bairey Merz CN, Davis MB, et al. Contraception and reproductive planning for women with cardiovascular disease: JACC Focus Seminar 5/5. J Am Coll Cardiol 2021;77:1823–34.
4. Easter SR, Valente AM, Economy KE. Creating a multidisciplinary pregnancy heart team. Curr Treat Options Cardiovasc Med 2020;22:3.
5. Teal SB. Postpartum contraception: optimizing interpregnancy intervals. Contraception 2014;89:487–8.
6. White K, Teal SB, Potter JE. Contraception after delivery and short interpregnancy intervals among women in the United States. Obstet Gynecol 2015;125:1471–7.
7. Miler PD, Canobbio MM, Pearson DD, et al. Contraceptive practices of women with complex congenital heart disease. Am J Cardiol 2017;119:911–5.
8. Lindley KJ, Madden T, Cahill AG, Ludbrook PA, Billiello JJ. Contraceptive use and unintended pregnancy in women with congenital heart disease. Obstet Gynecol 2015;126:363–9.
9. Allen, Rebecca H., and Carrie A. Cwiak, eds. Contraception for the medically challenging patient. Springer, 2014.
10. Silversides CK, Grewal J, Mason J, et al. Pregnancy outcomes in women with heart disease: the CARPREG II study. J Am Coll Cardiol 2018;71:2419–30.
11. Sobhani NC, Schultz H, Kheiwa A, et al. Contraceptive choices in the immediate postpartum period in women with cardiac disease. Am J Cardiol 2019;123:1364–9.
12. Grodzinsky A, Florio K, Spurtas JA, et al. Importance of the cardio-obstetric teams. Curr Treat Options Cardiovasc Med 2019;21:84.
13. Henry D, Gonzalez JM, Harris IS, et al. Maternal arrhythmia and perinatal outcomes. J Perinatol 2016;36:823–7.
14. Committee on Practice Bulletins-Gynecology. Long-Acting Reversible Contraception Work Group. Practice Bulletin No. 186: long-acting reversible contraception: implants and intrauterine devices. Obstet Gynecol 2017;130: e251–69.
15. ACOG Practice Bulletin No. 208 Summary: benefits and risks of sterilization. Obstet Gynecol 2019;133:592–4.
16. Miller HE, Henrik A, Leonard SA, et al. The impact of the COVID-19 pandemic on postpartum contraception planning. Am J Obstet Gynecol MFM 2021;3:100412.
17. Curtis KM, Tepper NK, Jattouli TC, et al. U.S. Medical eligibility criteria for contraceptive use, 2016. MMWR Recomm Rep 2016;65:1–103.
18. The Stanford REDCap platform. Available at: http://redcap.stanford.edu. Developed and operated by Stanford Medicine Research IT team. RedCap platform services at Stanford are subsidized by Stanford School of Medicine Research Office, and the National Center for Research Resources, the National Center for Advancing Translational Sciences, National Institutes of Health, through grant UL1 TR001085.
19. Society for Maternal-Fetal Medicine. What is Maternal-Fetal Medicine?. Available at: https://www.smfm.org/watwedo. Accessed 2021.
20. World Health Organization/Department of Reproductive Health and Research. Johns Hopkins Bloomberg School of Public Health (JHSPH)/Center for Communication Programs (CCP). Family planning: a global handbook for providers. Baltimore, MD: Center for Creative Photography; 2007.
21. Department of Health Care Services. Full scope Medi-Cal coverage and affordability and benefit program for low income pregnant women and newly qualified immigrants. 2019. Available at: https://www.dhcs.ca.gov/services/medi-cal/Pages/Affordability-and-Benefit-Program.aspx. Accessed April 18, 2020.
22. Electronic address Society for Maternal-Fetal Medicine (SMFM)/Vricella LK, Gawron
LM, Louis JM. Society for Maternal-Fetal Medicine (SMFM) Consult Series# 48: immediate postpartum long-acting reversible contraception for women at high risk for medical complications. Am J Obstet Gynecol 2019;220:B2–12.

23. Zapata LB, Murtaza S, Whiteman MK, et al. Contraceptive counseling and postpartum contraceptive use. Am J Obstet Gynecol 2015;212. 171.e1–8.

24. California Maternal Quality Care Collaborative. Modified World Health Organization (WHO) classification of maternal cardiovascular risk: application. Cardiovascular disease in pregnancy and postpartum toolkit; 2017. Available at: https://www.cmqcc.org/system/files/Modiﬁed_World%20Health%20Organization%20Classiﬁcation%20of%20Maternal%20Cardiovascular%20Risk-%20Application.pdf. Accessed June 24, 2021.

25. Roos-Hesselink JW, Baris L, Johnson M, et al. Pregnancy outcomes in women with cardiovascular disease: evolving trends over 10 years in the ESC Registry of Pregnancy and Cardiac disease (ROPAC). Eur Heart J 2019;40:3848–55.

26. Ladouceur M, Benoit L, Radojevic J, et al. Pregnancy outcomes in patients with pulmonary arterial hypertension associated with congenital heart disease. Heart 2017;103:287–92.

27. Luo J, Shi H, Xu L, Su W, Li J. Pregnancy outcomes in patients with pulmonary arterial hypertension: a retrospective study. Medicine (Baltimore) 2020;99:e20285.

28. Garcia Ropero A, Baskar S, Roos Hesselink JW, et al. Pregnancy in women with a Fontan circulation: a systematic review of the literature. Circ Cardiovasc Qual Outcomes 2018;11:e004575.

29. Vaidya VR, Arora S, Patel N, et al. Burden of arrhythmia in pregnancy. Circulation 2017; 135:619–21.

30. Fried M, Kriska Z, Danzig V. Does the laparoscopic approach significantly affect cardiac functions in laparoscopic surgery? Pilot study in non-obese and morbidly obese patients. Obes Surg 2001;11:293–6.

31. American College of Obstetricians and Gynecologists’ Committee on Health Care for Underserved Women. Contraceptive Equity Expert Work Group, and Committee on Ethics. Patient-centered contraceptive counseling: ACOG Committee Statement Number 1. Obstet Gynecol 2022;139:350–3.