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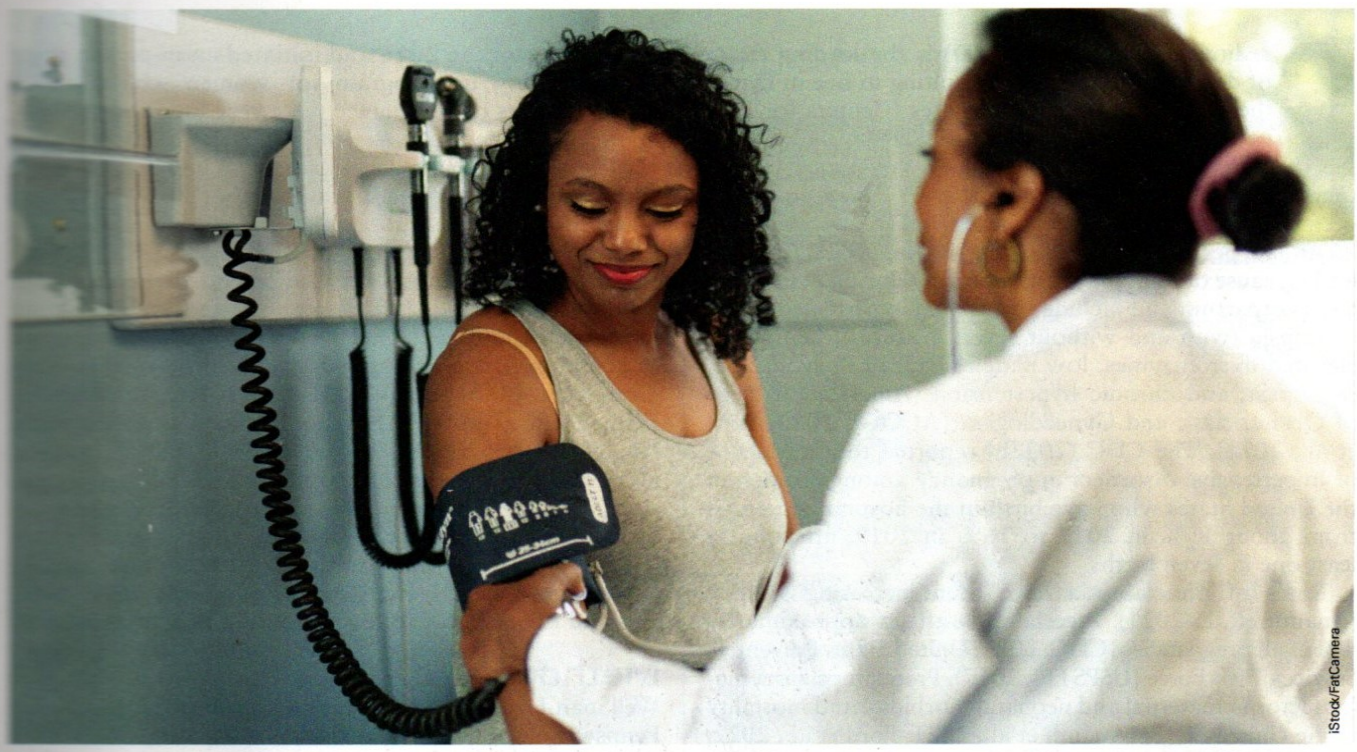
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IMPROVING CARDIOVASCULAR FOLLOW-UP AFTER DIAGNOSIS OF A HYPERTENSIVE DISORDER OF PREGNANCY USING THE ELECTRONIC HEALTH RECORD

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Abstract

Background: Cardiovascular disease is the leading cause of death among women. Sex-specific risk factors for cardiovascular disease include history of a hypertensive disorder of pregnancy.

Problem: After diagnosis of a hypertensive disorder of pregnancy, professional societies recommend follow-up with a primary care provider for preventative care. There are gaps in patient and health care provider knowledge of the association between a hypertensive disorder of pregnancy and cardiovascular disease. That gap has a negative effect on patients receiving recommended follow-up.

Methods: An electronic registry was created to identify those who gave birth in our health system and had a diagnosis of hypertensive disorder of pregnancy. From this, information outreach was sent electronically to the patient and their primary care provider.

Interventions: Communication in the outreach included education on the association between hypertensive disorders of pregnancy and cardiovascular disease, the importance of follow-up, cardiopreventative strategies, and biochemical assessment. Medical records were audited at approximately 6 months postpartum to determine if patients completed a visit with their primary care provider to discuss cardiovascular risks.

Results: Between May 2021 and June 2022, 15% ($n = 1,131$) of patients who gave birth in our health system had a diagnosis of hypertensive disorder of pregnancy. Ninety percent of those patients who received outreach communication viewed the letter. At baseline, 16% of patients during postpartum with a hypertensive disorder of pregnancy saw their primary care provider to discuss cardiopreventative strategies. After implementation of our program, 26% of those with a hypertensive disorder of pregnancy saw their primary care provider for follow-up and discussed cardiopreventative strategies.

Clinical Implications: Nurses should ensure that women during postpartum and their primary care providers are educated about the association of hypertensive disorders of pregnancy and long-term cardiovascular risk. The electronic health record may be an optimal way to ensure education is provided and follow-up scheduled.

Key words: Cardiovascular disease; Hypertension; Preeclampsia; Pregnancy-induced; Primary health care; Primary prevention.

Cardiovascular disease (CVD) is the leading cause of death among women, resulting in one in five of their deaths in the United States (Centers for Disease Control and Prevention [CDC], 2022a). Sex-specific risk factors for CVD include pregnancy factors such as gestational diabetes, preterm birth, gestational hypertension, preeclampsia, and eclampsia (Agarwala et al., 2020). Hypertensive disorders of pregnancy (HDP) are a leading cause of morbidity and mortality during pregnancy and postpartum and include gestational hypertension, preeclampsia (with and without severe features), hemolysis, elevated liver enzymes, low platelets (HELLP) syndrome, eclampsia, and chronic hypertension (American College of Obstetricians and Gynecologists [ACOG], 2020; Ford et al., 2022). The CDC (2022b) reported the prevalence of hypertensive disorders in pregnancy among women in the United States who gave birth in the hospital increased from about 13% in 2017 to 16% in 2019, affecting at least one in seven births.

Rates of preeclampsia have been increasing steadily (Ananth et al., 2021). Preeclampsia affects approximately 4% of all pregnancies (CDC, 2021; United States Preventive Services Task Force [USPSTF], 2017). Preeclampsia is a major factor in maternal and neonatal morbidity and mortality in the United States (Ananth et al., 2021; Ford et al., 2022; USPSTF, 2017) and although much work has been done to improve the safety and quality of care during pregnancy for preeclampsia, there continues to be a gap in addressing the associated long-term cardiovascular risk (Seely et al., 2021). Women affected by preeclampsia have been shown to have "twice the rate of CVD events, a 2.2-fold increased rate of chronic hypertension" and "30% increased rate of elevated cholesterol compared to women with normotensive pregnancies" (Seeley et al., 2021, p. 306). Therefore, pregnancy has been called a stress test that provides a window into a woman's future health, providing opportunity to implement preventative strategies earlier in the life course. Although the American Heart Association first listed history of preeclampsia as a moderate risk factor for CVD in 2011, many women and their health care providers have knowledge gaps about the association between history of preeclampsia and increased cardiovascular risk (Burgess & Feliu, 2019; Dijkhuis et al., 2020; Mosca et al., 2011).

Professional societies have varying recommendations on appropriate cardiovascular follow-up after HDP (Benschop et al., 2019). The American Stroke Association (Bushnell et al., 2014) recommends follow-up with a primary care provider (PCP) 6 months to 1 year postpartum and recommends that the visit includes annual blood pressure screening, assessment of lipids, and cardiopreventative education including education on weight management, smoking cessation, and the DASH diet (Bushnell et al., 2014). ACOG (2018) has similar recommendations on cardiovascular follow-up as they recommend cardiovascular risk factor reduction and lifestyle modification, however, do not clearly state a recommended timing for when women should follow up postpartum with a PCP.

There are few postpartum programs that promote care coordination for cardiovascular follow-up after HDP. We began this work in 2016 and initiated an in-person postpartum follow-up program for women with a HDP; however, rates of attendance were very low, and the program was discontinued. Berks et al. (2019) and Chan et al. (2021) outlined their development of in-person follow-up programs that offered cardiometabolic risk counseling sessions for postpartum patients with pregnancy-specific cardiovascular risk factors. Chan et al. (2021) reported that only half of those enrolled attended the clinic for follow-up and Berks (2019) reported that only 23% attended. These studies cited lack of time and inconvenience as common barriers to attendance at clinic visits for cardiovascular follow-up after HDP. To overcome these barriers, Chan et al. (2021) recommended that programs aimed at encouraging cardiovascular follow-up after HDP should improve collaboration with PCPs and consider use of telemedicine. We outline the design and implementation of a postpartum follow-up program that leverages the electronic health record (EHR) to improve awareness of cardiovascular risk and preventative strategies and the need for follow-up with a PCP after HDP.

Methods

WellSpan Health is a large health system in South Central Pennsylvania that includes five birthing hospitals with a combined annual birth volume of over 6,000 births. With an understanding of the association between HDP and the increased risk for CVD, we designed the Postpartum Hypertension Follow up Program. The program has four aims: 1) increase the number of women with HDP who give birth in our health system who receive education on their cardiovascular risk, their need for follow up with a PCP soon after birth, and the importance of implementing cardiovascular risk reduction strategies early in the life course, 2) ensure history of HDP is clearly documented in the medical history of the EHR as appropriate, 3) increase the percentage of those with HDP who receive follow-up with a PCP within 6 months postpartum, and 4) ensure PCPs are aware of a patient's history of HDP, its impact on cardiovascular risk, and professional societies recommendations for follow-up including blood pressure and biochemical assessments after a pregnancy complicated by HDP.

Preimplementation

A multidisciplinary team of experts was convened to design the Postpartum Hypertension Follow up Program based on the evidence and professional recommendations for cardiovascular follow-up after HDP. The team included nurses from maternity and cardiology specialties, physicians from maternal fetal medicine and cardiology, administrative leaders from the Heart and Vascular and Women and Children service line, a nurse informaticist, and an EHR analyst. The team worked to build a registry to identify all patients with a diagnosis of a HDP who gave birth in our health system, create outreach messages for patients and providers, outline a workflow in the EHR to send bulk outreach informational emails to patients on the registry and their PCP, and create a preeclampsia lab panel to make it easier for PCPs to order recommended labs after

TABLE 1. SUMMARY OF BIRTHS, DIAGNOSES OF A HYPERTENSIVE DISORDER OF PREGNANCY, AND PATIENTS ON THE ELECTRONIC HEALTH RECORD REGISTRY

Birth Month 2021–2022	Births at WellSpan Health	Patients with Diagnosis of Hypertensive Disorder of Pregnancy and on the Registry	Patients on the Registry Contacted via MyWellSpan	PCPs Contacted of Those on the Registry	Patients on the Registry without a PCP
	N	% (*n*)	% (*n*)	% (*n*)	% (*n*)
May	530	14.9% (79)	92.4% (73)	82.3% (65)	17.7% (14)
June	559	16.1% (90)	87.8% (79)	62.2% (56)	23.3% (21)
July	694	11.8% (82)	97.6% (80)	53.7% (44)	13.4% (11)
August	608	13.8% (84)	95.2% (80)	73.8% (62)	15.5% (13)
September	561	13.5% (76)	89.5% (68)	65.8% (50)	23.7% (18)
October	581	13.4% (78)	92.3% (72)	70.5% (55)	20.5% (16)
November	504	13.3% (67)	77.6% (52)	80.6% (54)	17.9% (12)
December	533	13.7% (73)	91.8% (67)	78.1% (57)	19.2% (14)
January	505	15.4% (78)	95% (74)	78.2% (61)	21.8% (17)
February	472	21% (99)	96% (95)	84.9% (84)	15.1% (15)
March	524	14.9% (78)	98.7% (77)	88.5% (69)	10.3% (8)
April	514	16.5% (85)	94.1% (80)	77.7% (66)	22.3% (19)
May	562	13.5% (76)	89.5% (68)	79% (60)	18.4% (14)
June	498	17.3% (86)	96.5% (83)	83.7% (72)	16.3% (14)
July	589	18.5% (109)	90.8% (99)	78.9% (86)	19.3% (21)

PCP = primary care provider

HDP including a cholesterol and lipid panel, fasting glucose, and urine protein assessment.

To increase engagement and awareness of the program, prior to implementation, education on cardiovascular risk after HDP, programmatic workflow, and provider expectations was provided to PCPs through grand rounds and outreach at medical and site directors meetings in the Primary Care Service line. Education about the initiative was spread to obstetric providers and outpatient obstetricians' office nurses through Women and Children Service Line system wide outpatient operation and quality improvement meetings. In May 2021, we initiated the program.

Postpartum Hypertension Follow-Up Program

The program has four main components, managing the registry, updating the patients' medical history, sending electronic outreach to patients and PCPs, and assessing the impact of the program.

Registry

A registered nurse with the Heart and Vascular Service Line serves as the program coordinator and manages the registry. They were selected to manage the registry due to their extensive experience managing cardiovascular risk reduction programs and to promote collaboration between the Women's and Children's and Heart and Vascular service lines. The registry is housed in the EHR and generates a list of those who gave birth at WellSpan Health and had a diagnosis code for a HDP. The program coordinator reviews the registry weekly and filters the report to look for those who gave birth in the 3 weeks prior. This time frame for outreach was chosen strategically since by this time postpartum, most patients will not have had their postpartum follow-up appointment with their obstetric provider, and yet enough time has passed since birth allowing the patient time to focus on issues outside of those relevant to the immediate postpartum period. Providing education on cardiovascular risk and need for lifelong follow-up prior to the postpartum visit allows patients the opportunity to have discussions about the recommendations and cardiovascular risks associated with HDP with their obstetric provider during the postpartum visit and allows the obstetric provider the opportunity to reinforce the recommendations.

Updating Medical History

Once identified via the registry, the program coordinator reviews the patients' EHR and confirms that their HDP is documented in their past medical history. If only documented on the patient's problem list and not their medical history, the program coordinator adds the diagnosis to their medical history as "history of" to make it a permanent part of their medical history. As nonobstetric providers do not often review a patient's obstetric history, or problems that have been resolved on the problem list in the EHR, this can lead to gaps in identifying those who require follow-up for obstetric complications known to impact cardiometabolic health. Confirming that a patient's HDP is documented in their medical history ensures that a patient's obstetric history, namely complications which could potentially affect their long-term cardiovascular

health and require active monitoring, are visible to their PCP and other nonobstetric providers.

Outreach Messaging

Three outreach messages were developed and made into a dot phrase in Epic our EHR, one which is sent to the patient's PCP, one which may be sent to patient's obstetric care provider, and one is a letter sent to the patient via their personal EHR. All messages sent to the patient and providers are visible in the EHR. They are viewable by any member of the patients care team who accesses their EHR.

Patient Outreach. For patients, outreach messages are sent via their personal EHR, MyWellSpan. These messages were also translated into Spanish for use when appropriate. The patient outreach message outlines their risk of heart disease and stroke later in life due to their HDP, and importance of implementing cardiovascular risk reduction strategies and following up with a PCP.

Primary Care Provider Outreach. For PCPs, an in-basket message in the EHR is sent by the Program Coordinator explaining that their patient had an HDP, the cardiovascular risk associated, and recommendations for follow-up. Letters for PCPs, not employed by WellSpan Health get faxed to them through the EHR.

Obstetric Outreach. After our initial implementation of the program, we identified that some patients on the registry did not have a PCP. Initially, in this instance, we only contacted the patient. However, to promote patients connecting with a PCP, we have begun to contact the patients obstetric care provider asking them to reinforce the importance of following up with a PCP and to support the patient in finding a PCP using our internal provider referral line while at their postpartum appointment.

Medical Record Audit

To assess the impact of our program, medical records are audited, and data analyzed monthly. However, outcome data related to follow-up with a PCP is assessed approximately 6 months after the patient gave birth. This allows us to determine if the patient saw their PCP within the time frame recommended by the American Stroke Association (Bushnell et al., 2014), discussed cardiovascular risk and preventative strategies, and if appropriate lab work was ordered.

Program Evaluation

The study was reviewed by the Institutional Review Board at the study site and the project was deemed to be not research. The Standards for Quality Improvement Reporting Excellence (2020) guidelines were followed for reporting. Data are abstracted from Epic Slicer Dicer, which is a self-service cohort query tool that allows users to quickly view data on specific patient populations. Program data are tracked on a dashboard to allow the team to monitor trends over time. To highlight the significance of HDP within our health system, each month, we monitor the number of patients who give birth in our health system diagnosed with HDP and determine the percentage of these diagnoses among our overall birth volume. To evaluate the impact of our program, we assess the number of patients identified on the registry which have MyWellSpan our personal EHR, and of those who receive our educational outreach via MyWellSpan, the percentage who read the outreach message sent. We count the number of those on the registry with a PCP listed in their EHR, and of those, the program coordinator completes a medical record review to determine the number who completed a follow-up visit with their PCP within 6 months postpartum to discuss cardiovascular risk and preventative strategies and the number with orders for the recommended follow-up lab work.

Results

Between May 2021 and July 31, 2022, 1,240 patients or 15% of all patients who gave birth within our system had an HDP diagnosis and were captured on our registry (Table 1). Of those on the registry, 92% (n = 1,147) had an active MyWellSpan personal EHR and received outreach from our program to include education on cardiovascular risk after an HDP, importance of preventative strategies, and need for follow-up with a PCP. Recent updates to the EHR have allowed us to evaluate the percentage of patients who read the outreach message sent. On average, 90% of patients who receive our outreach messaging through their personal EHR read the message.

Outreach to Primary Care Provider

Of those on the registry, we have been able to contact 76% (n = 941) of their PCPs. Of those whom we could not contact their PCP (n = 299), 227 (76%) had no PCP on file in our EHR, representing 18.3% of those on the registry. To address this gap, at the end of January 2022, we began to contact the obstetric care provider of patients without a PCP listed and since that time have contacted 71 obstetric care providers to encourage them to educate the patient about the importance of connecting with a PCP and following up about their cardiovascular risk.

Primary Care Provider Follow-Up Visits

Prior to implementing the program, we completed a retrospective medical record review to assess the number of women with an HDP who followed up with their PCP to discuss cardiovascular risk, blood pressure, and cardiopreventative strategies. At that time, 16% had documentation of this type of visit. After implementation, between May 2021 and January 2022, approximately 26% (n = 185) of those on our registry saw their PCP for follow-up and discussed their cardiovascular risk, blood pressure, and cardiopreventative strategies (Table 2). Of those who saw their PCP, 70% (n = 129) had recommended labs ordered. An additional 290 patients on the registry saw their PCP during that period yet did not have documentation that cardiovascular risk, blood pressure, or cardiopreventative strategies were discussed.

Discussion

Our program leveraged the patients' personal EHR to improve care for women who gave birth in our health

system and had an HDP diagnosis. This resulted in 90% of women who gave birth at our health system who had an HDP receiving and reviewing education on cardiovascular risk, prevention, and recommended follow-up after a diagnosis of an HDP. Burgess and Feliu (2019) studied knowledge of cardiovascular risk after preeclampsia in a survey of 241 women recruited on social media. They found 37% of respondents were unaware of the association and of those who had heard of the association, more reported hearing of the association via social media (51%) than from their health care provider (39%). Knowledge about the association between cardiovascular risk after preeclampsia is limited among women and providers, which could lead to lack of counseling and follow-up (Dijkhuis et al., 2020). Triebwasser et al. (2021) found patient counseling after HDP on cardiovascular risk and the importance of follow-up was limited at the postpartum visit, with only about 25% of women in their study receiving appropriate counseling at the postpartum visit. It is important for nurses to create processes to standardize distribution of education on recommendations about cardiovascular risk reduction and follow-up after HDP.

TABLE 2. SUMMARY OF PROGRAM OUTCOMES

Birth Month 2021–2022	Total Patients on Registry	Patients Who Visited a PCP to Discuss Cardiovascular Risk	Patients Who Visited a PCP and Had Blood Work Ordered
	N	% (*n*)	% (*n*)
May	79	40.5% (32)	56.3% (18)
June	90	26.77% (24)	66.7% (16)
July	82	20.7% (17)	64.7% (11)
August	84	26.2% (22)	72.7% (16)
September	76	27.6% (21)	57.1% (12)
October	78	26.9% (21)	85.7% (18)
November	67	13.4% (9)	100% (9)
December	73	28.8% (21)	76.2% (16)
January	78	23.1% (18)	72.2% (13)

PCP = primary care provider

Our program saw an increase over baseline in patients completing visits with a PCP to discuss cardiovascular risk related to their HDP with rates of follow-up increasing from 16% to 26%. Our program promoted completion of recommended laboratory assessments by creating a laboratory panel within the EHR. Lewey et al. (2020) found that women with HDP more often follow-up with a PCP (18%) within 6 months after birth than their normotensive counterparts (13%); however, rates of follow-up were low in both groups. The design of their study limited the conclusions that can be drawn as it was a retrospective review of claims data which did not allow the authors to assess what specifically was discussed at the visit with the PCP (Lewey et al., 2020). Understanding the significant knowledge gap of providers about the association between HDP and cardiovascular risk and recommendations, it is very possible that this was not addressed during these visits. We noted a number of women on our registry who visited their PCP in the 6 months postpartum, yet discussions about cardiovascular risk were not documented. Patients often visited their PCP to discuss mental health challenges or COVID. It is possible that cardiovascular risk was discussed during these visits and not documented; however, this highlights that postpartum patients have many competing priorities which may hinder their ability to prioritize their cardiometabolic health.

Several factors complicate the development of programs that address cardiovascular risk after HDP including lack of consistent recommendations from professional societies on timing of and components of cardiovascular follow-up for this population (Benschop et al., 2019; Hauspurg et al., 2019). Core tenets of follow-up recommended by most professional societies include a visit with a PCP to discuss risk and preventative strategies, annual blood pressure monitoring, and monitoring of biochemical markers such as lipids and glucose (Benschop et al., 2019). Many PCPs may be unaware of the association of HDP and CVD. This lack of knowledge could affect patients receiving recommended follow-up (Seely et al., 2021). Our program design ensured that through in basket messaging in the EHR, 76% of patient's PCPs received education about the association between HDP and cardiovascular risk and timing of and components of the recommended follow-up. By adding history of the patient-specific HDP to the medical history in the EHR, we made HDP more visible to nonobstetric providers with the hope of improving its recognition as an important cardiovascular risk factor.

Vogel et al. (2021) reported prevalence of CVD is increasing, CVD mortality is increasing in young women, and hypertension is one of the most crucial risk factors to CVD mortality. Nurses play a critical role in reducing the global burden of CVD among women by educating health care providers and young women on prevention and detection, developing outreach programs about cardiovascular risk factors in settings frequented by women, and designing healthy heart programs (Vogel et al., 2021). By creating outreach programs targeted at women during postpartum with HDP, nurses can ensure that patients and their PCPs are educated on the association between HDP and increased cardiovascular risk, so they support and enact preventative strategies earlier in life. However, since approximately, 18% of those who gave birth at our health system and had an HDP did not have a PCP at the time of birth, it is essential that perinatal nurses work to educate and support women in registering with a PCP to bridge interconception care gaps and promote health maintenance.

CLINICAL IMPLICATIONS

- Communication using the personal electronic health record early in postpartum about cardiovascular risk after an HDP has the potential to increase patient knowledge of cardiovascular risk and encourage follow-up with a primary care provider.
- Nurses caring for women during pregnancy and postpartum should seek opportunities to communicate and collaborate with primary care providers to promote recognition of sex-specific cardiovascular risk factors.
- The electronic health record is an effective way to reach primary care providers to ensure education on cardiovascular risk after a diagnosis of a HDP, standardize follow-up, and promote completion of biochemical assessments.
- Nurses working with childbearing women should ensure they have a primary care provider, especially for those who experience obstetric complications known to affect lifelong cardiometabolic health.
- It is essential that obstetric complications known to affect cardiovascular health are easily reviewed in the electronic health record by nonobstetric providers. After birth, these risk factors should be included in the patient's medical history.

Limitations

This program provides a process to ensure education on cardiovascular risk after HDP and the need for appropriate follow-up and implementation of preventative strategies is shared with patients and their PCPs. Although we could assess the number of women during postpartum who followed up with their PCP to discuss cardiovascular risk, we were not able to measure how or if this program motivated women to enact lifestyle changes such as diet modification, increased exercise, or weight reduction strategies when appropriate. The program requires a dedicated professional who manages the registry; however, the workflow is simple and not overly time consuming once developed in the EHR, making it something that can be incorporated into workflows of other nursing roles. We optimized use of the personal EHR for patient outreach and education. Although this could be a barrier for some due to lack of access or enrollment in a personal EHR, childbearing women in our system had high adoption. However, if considering replicating this type of program, it would be important to evaluate rates of patient enrollment to determine if this is the most effective way to provide outreach. To address this gap moving forward, we are working to provide educational outreach to those without a personal EHR via mail.

Clinical Implications

Nurses play an integral role in the development, implementation, and evaluation of these types of programs. Nurses should ensure that women during postpartum with a history of an HDP receive education about their cardiovascular risk soon after birth and should view an HDP as an early opportunity to support patients in care coordination, understanding cardiovascular risk, and identifying primary preventative strategies to reduce cardiovascular risk. Seely et al. (2021) clearly outline recommendations for patients and providers to address cardiovascular health after preeclampsia. The Preeclampsia Foundation (2022) is an excellent resource that can be used when developing cardiovascular follow-up programs for patients with a history of HDP. Roth et al. (2021) reported that women with a history of HDP prefer to receive information on cardiovascular risk and prevention soon after birth, along with information they can review later. Our program has shown that the EHR provides an optimal strategy to access this population while also communicating with PCPs. Many women are motivated to modify their lifestyle during postpartum (Spaan et al., 2012); therefore, standardizing workflows within the EHR to ensure childbearing women who experience HDP, and their PCPs receive education on cardiovascular risk, cardiopreventative strategies, and recommendations for follow-up has potential to successfully engage this population. ✣

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