

## Cardiovascular Health After Preeclampsia: Patient and Provider Perspective

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### Abstract

**Background:** Preeclampsia predicts future cardiovascular disease (CVD) yet few programs exist for post-preeclampsia care.

**Methods:** The Health after Preeclampsia Patient and Provider Engagement Network workshop was convened at the Radcliffe Institute for Advanced Study in June 2018. The workshop sought to identify: 1) patient perspectives on barriers and facilitators to CVD risk reduction; 2) clinical programs specialized in post-preeclampsia care; 3) recommendations by national organizations for risk reduction; and 4) next steps. Stakeholders included the Preeclampsia Foundation, patients, clinicians who had initiated CVD risk reduction programs for women with prior preeclampsia, researchers, and national task force members.

**Results:** Participants agreed there is insufficient awareness and action to prevent CVD after preeclampsia. Patients suggested a clinician checklist to ensure communication of CVD risks, enhanced training for clinicians on the link between preeclampsia and CVD, and a post-delivery appointment with a clinician knowledgeable about this link. Clinical programs primarily served patients in the first postpartum year, bridging obstetrical and primary care. They recommended CVD risk modification with periodic blood pressure, weight, lipid and diabetes screening. Barriers included the paucity of programs designed for this population and gaps in insurance coverage after delivery. The American Heart Association, the American College of Obstetricians and Gynecologists, and the Preeclampsia Foundation have developed guidelines and materials for patients and providers to guide management of women with prior preeclampsia.

**Conclusions:** Integrated efforts of patients, caregivers, researchers, and national organizations are needed to improve CVD prevention after preeclampsia. This meeting's recommendations can serve as a resource and catalyst for this effort.

**Keywords:** preeclampsia, cardiovascular disease, maternal health, pregnancy complications, preventive health care

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## Introduction

**P**REGNANCY COMPLICATIONS ARE unique risk markers for cardiovascular disease (CVD) in women made evident through the cardiometabolic “stress test” of pregnancy.<sup>1</sup> Preeclampsia occurs in 2%–8% of pregnancies and is the complication most strongly and consistently related to future CVD.<sup>2–6</sup> Women with a history of preeclampsia experience twice the rate of CVD events, a 2.2-fold increased rate of chronic hypertension, 80% increased rate of type 2 diabetes, and 30% increased rate of elevated cholesterol compared with women with normotensive pregnancies.<sup>7</sup> Even higher risks of CVD are seen in women with recurrent episodes of preeclampsia or preterm preeclampsia.<sup>4,8</sup> As a result, the American Heart Association (AHA) has recognized preeclampsia as a risk factor for CVD in women since 2011.<sup>9</sup> In 2018, the AHA and the American College of Obstetricians and Gynecologists (ACOG) published a joint Presidential Advisory endorsing preeclampsia as a risk-enhancing factor that may direct statin initiation.<sup>10</sup> ACOG also endorses preeclampsia as a CVD risk factor and recommends annual assessment of traditional CVD risk factors for women with a history of recurrent or preterm preeclampsia.<sup>4,11</sup>

While much of the increased risk of CVD associated with a history of preeclampsia appears to be mediated through traditional CVD risk factors such as chronic hypertension or obesity that arise in the years or decades after pregnancy, some 20% to 40% of the excess CVD risk associated with preeclampsia history is not explained by conventional risk factors.<sup>12,13</sup> Furthermore, even when it predicts later-developing CVD risk factors, preeclampsia remains an *early* warning system of future CVD risk, predicting a doubling of CVD risk before the traditional CVD risk factors emerge. This yields survivors and clinicians a longer time to enact lifestyle changes known to reduce risk even among this high risk group.<sup>14,15</sup> Thus, the occurrence of preeclampsia becomes an early opportunity to intervene with steps aimed at preventing or delaying later CVD risk factors and events.<sup>1,16</sup>

The postpartum period following a complicated pregnancy has the potential to serve as a “teachable window” for healthy behavior change.<sup>17–20</sup> Postpartum women who had preeclampsia may be especially receptive to making lifestyle changes, and more motivated to create a healthy home for their family, if they become aware of their increased CVD risk revealed by their preeclamptic pregnancy.<sup>21</sup> However, both women<sup>22,23</sup> and their clinical providers<sup>24</sup> are often unaware of the link between preeclampsia and CVD, which creates a significant barrier to the initiation of preventive measures in this high-risk population. In addition, there is a dearth of CVD risk reduction programs specifically developed to accommodate the unique challenges faced by new mothers with recent preeclampsia. Any attempted behavior change in postpartum women needs to accommodate the difficulty for mothers with newborns in participating in in-person programs because of the lack of time and conflicting responsibilities.

## Methods

In an effort to optimize the cardiovascular health of women following preeclampsia, we established the “Health After Preeclampsia Patient and Provider Engagement Network”

(HAPPEN), which includes stakeholders actively engaged in this mission. We convened a 1-day meeting in Cambridge, Massachusetts at the Radcliffe Institute for Advanced Study on June 29, 2018. The goal of the HAPPEN meeting was to identify and discuss the following: (1) patient perspectives regarding barriers and facilitators to improve patient and provider communication regarding CVD risk reduction after preeclampsia; (2) clinical programs specialized in the care of women after preeclampsia; (3) recommendations by national organizations for risk reduction in this population; and (4) reach a consensus among HAPPEN members regarding next steps to take to improve care of women who have experienced preeclampsia during pregnancy.

The stakeholders were identified by the Preeclampsia Foundation (a not-for-profit patient advocacy organization), the world’s largest organization of preeclampsia survivors, and included patients with a history of preeclampsia, the chief executive officer (CEO) and representatives of the Preeclampsia Foundation, clinicians who had initiated programs for CVD risk reduction in women with recent preeclampsia from different regions across the United States, preeclampsia researchers, and members of several relevant task forces of the AHA and ACOG. Another goal for this meeting was to establish an ongoing network that could work together to improve the care of women with preeclampsia. Meeting minutes, presentations, and updates since the meeting were used by HAPPEN members to write this report.

## Results

### *The patient perspective*

The HAPPEN meeting included four preeclampsia survivors who were invited to participate by the Preeclampsia Foundation. These patient participants were selected to offer diverse perspectives in terms of age, years since the pregnancy complicated by preeclampsia, race, and geography. They were 6 months, 2½ years, 4 years, and 16 years removed from their pregnancy complicated by preeclampsia and lived in California, Florida, New York, and South Carolina. The preeclampsia survivors participated by sharing their experiences during and following their preeclamptic pregnancy.

Key themes of discussion focused on CVD risk awareness and potential barriers and facilitators to healthy lifestyle changes. Importantly, the preeclampsia survivors reported that they did not learn about their increased risk for CVD from their health care providers. Rather, they learned about their increased CVD risk through the Preeclampsia Foundation’s website and social media channels, participation in a lifestyle intervention trial for women with recent preeclampsia,<sup>25</sup> and via an online mothers’ group. One participant was not aware of the association until she was invited to participate in the HAPPEN meeting. Several themes became apparent when the women with preeclampsia shared their experiences and are listed below with representative quotes.

The lack of proactive information from their provider was a source of great concern to patients—both for their own health management and the impact on their children’s future health.

*“The early warning system doesn’t work if we’re not told about it.”*

*“I am 35, what does this mean for my future?”*

*“I feel fine, but am I?”*

Patients often felt dismissed by their providers when they raised the issue of their preeclampsia history and its impact on their future health.

*“That’s just your new normal.”*

*“You’re no different than anyone else.”*

Women did not feel they received the information necessary to make informed decisions about their health care and felt frustrated with the lack of knowledgeable resources after what was for many a dramatic health event.

*“I saw a lot of ‘ologists, but no one understood preeclampsia.”*

*“Today [after delivery] you tell me I’m OK, but yesterday you told me I could die.”*

Patients also stressed the importance of increased awareness of the psychologic sequelae, including not only depression but also post-traumatic stress disorder (PTSD) stemming from a severe maternal adverse event in pregnancy and/or delivery, such as preeclampsia.<sup>26,27</sup> One woman in attendance spoke about the impact her preeclampsia experience had on her emotional health after pregnancy, noting that screening for “postpartum depression” did not capture her experience and calling for more specific emotional care after a pregnancy complicated by preeclampsia. The experiences of these patient participants are echoed in emerging literature about the mental health sequelae of preeclampsia. Women with a history of preeclampsia are more likely to experience severe depressive symptoms during the immediate postpartum period and later in life compared with women without a history of preeclampsia.<sup>28</sup> PTSD, which differs from depression, is also more common in women with prior preeclampsia<sup>26,27</sup> than in women with normotensive pregnancies and may not be detected when screening for postpartum depression.

When discussing characteristics of a potential risk modification program for women with a history of preeclampsia, the patient participants emphasized the importance of it (1) being offered in a virtual setting such as online or via a mobile device (2) including a peer-to-peer support component within a safe community of shared experiences, and (3) starting between 6 weeks and 6 months postpartum.

HAPPEN patient participants agreed with many of the themes raised in two earlier reports<sup>22,23</sup> of focus groups held among women with prior preeclampsia. Specifically, focus group participants in prior studies commented on their lack of knowledge of the link between preeclampsia and future CVD, the gap in communication of this link to them by their providers, the perceived need for greater provider education about the link, the desire to engage in a postdelivery program to reduce CVD risk and interest in a mobile device delivered program. Recommendations for patients who have had preeclampsia and their providers are listed in Table 1.

*Models of care for women after preeclampsia*

**Face-to-face clinics.** Several clinical programs designed to follow up women after a pregnancy complicated with a hypertensive disorder, including preeclampsia, have emerged in recent years across the United States. The face-to-face clinic models presented at the meeting were based at Brigham and Women’s Hospital (BWH), Boston, MA; Cedars-Sinai Medical Center, Los Angeles, CA; Northside Hospital, Atlanta, GA; and St. Thomas Health/Tennessee Maternal Fetal Medicine, Nashville, TN. HAPPEN clinician participants involved

TABLE 1. RECOMMENDATIONS FOR PATIENTS WHO HAD PREECLAMPSIA AND THEIR PROVIDERS

Recommendations for both clinicians and patients	
Development of widely distributed digital, web-based, print, and video educational materials on preeclampsia and associated CVD risk for patients, providers, and trainees	
Discussion introduced at time of discharge, to include information about the relationship between preeclampsia and CVD	
Provision to patient of schedule for testing and checklist of recommended testing (Table 2)	
Postpartum consultation with a knowledgeable medical professional, scheduled at the time of hospital discharge or at the postpartum visit	
Development of a national directory of post-preeclampsia clinics and providers who specialize in care for women with a history of preeclampsia and associated later life risks	
Creation of and referral to more CVD risk reduction programs for women with prior preeclampsia	
Additional recommendations targeted to clinicians	
Training for medical professionals starting in medical or graduate school and continuing throughout their careers about the association between preeclampsia and future CVD	
Formal screening of women with recent preeclampsia not only for depression <sup>29</sup> but also for PTSD <sup>30</sup>	
Additional recommendations targeted to patients	
Mental health resources and support groups, especially for women with PTSD symptoms associated with preeclampsia	

CVD, cardiovascular disease; PTSD, post-traumatic stress disorder.

in these programs included primary care internists, cardiologists, maternal fetal medicine (MFM) physicians, and nurse practitioners.

The clinical programs mostly focused on postpartum care in the first year after delivery, although one included preconception care (Tennessee MFM) and two additionally saw women years after the delivery (Northside and Cedars-Sinai). In addition to women with a history of preeclampsia, some clinics also saw women with other pregnancy complications associated with increased risk of CVD, including women with prior gestational hypertension, preterm delivery, intrauterine growth restriction, and gestational diabetes. All clinical settings had their own standard patient intake forms that asked for information on family history of heart disease and other cardiovascular risk factors. The clinical protocols for these patients include the performance of a medical history, physical exam with attention to weight and blood pressure. Height is determined for calculation of BMI.

A primary focus of the clinics is to educate and empower women to stop smoking, adopt a heart healthy diet, and engage in physical activity to lower blood pressure, weight, glucose, and cholesterol, recommendations in concert with the AHA Life’s Simple 7.<sup>31</sup> Many of these clinics offer additional collaborations and consultations with nutritionists, physiologists, cardiologists, and/or psychologists and all include communication with primary obstetrics and medical providers. Women are encouraged to make an appointment with their primary provider, or, if they do not have one, they

are encouraged to identify one. When needed, the programs assist women in finding a primary provider.

Recommendations for yearly physical exam and laboratory evaluation are conveyed to the patient's primary provider (Table 2). The measures and lab tests recommended by the clinical programs are similar to those suggested by ACOG<sup>10</sup> and AHA<sup>9</sup> with a few variations. As per AHA guidelines, the clinics recommend the testing for all women with prior preeclampsia (ACOG makes this recommendation only for women with preterm or recurrent preeclampsia, as their risk is amplified).<sup>10</sup> Per ACOG guidelines, the clinics recommend an annual interval for testing (the AHA does not provide a recommended interval). While both ACOG<sup>10</sup> and AHA<sup>9</sup> recommend a fasting blood glucose test, given the logistical challenges of obtaining this test, the clinics recommend use of a hemoglobin A1C (HbA1C) as an alternative method of assessing risk of diabetes or glucose intolerance.

For most programs, women are primarily referred at their discharge from the hospital after delivery and are scheduled to be seen in the immediate postpartum period for antihypertensive medication titration and immediate medical issues (BWH, Cedars-Sinai, St. Thomas Health). Patients are also referred to these programs by their primary providers after discharge. Most programs provide home blood pressure

monitoring devices for women who have hypertension on discharge. In some programs, women are seen up to 6 months postpartum for CVD risk stratification testing and CVD education (Northside, Cedars-Sinai). The funding for the clinics comes from a mix of private and public insurance reimbursement for generated billings. All four of the programs accept Medicaid. The funding of health care in the United States makes the experience of these program different from those reported in Canada.<sup>32,33</sup>

Most clinics have faced challenges with maintaining referral volume, appointment attendance, and the financial viability of this clinical model. Lack of awareness of pregnancy-related CVD risk factors by providers<sup>24</sup> may limit referrals and encouragement of their patients to attend appointments. Limited patient engagement on the importance of self-care after delivery and lack of knowledge about long-term implications of pregnancy-related risk factors<sup>22,34</sup> can further diminish perceived importance of keeping appointments. Uninsured and underinsured patients also commonly have limited access to follow-up care, although there are variations by state. Further, while many women may be eligible for Medicaid coverage while pregnant, in many states it may end at 60 days postpartum, preventing longer follow-up for many women.<sup>35</sup> Other expressed barriers included travel distance from the health care facility and lack of resources for non-English speakers.

The HAPPEN clinician participants described actions taken to overcome these barriers. Often, the postpartum clinic was publicized through presentation at grand rounds and work rounds. Fliers and brochures were frequently used to publicize the clinic. Having an appointment made for a postpartum Heart Health clinic at the time of discharge was reported as improving the likelihood of clinic attendance. Clinics also utilized phone call reminders before the appointment. Developing a hospital order at the time of discharge to refer the woman to the specialized clinic also improved access. A coordinated approach of provider and patient education about the program and reminder calls has been helpful in increasing patient referrals and clinic attendance.<sup>36</sup> Recommendations for postpartum clinical care models for women with preeclampsia are listed in Table 2.

**Virtual programs.** The effectiveness of traditional clinic-based programs is commonly limited by low participation rates.<sup>37-39</sup> This limitation is due, at least in part, to multiple barriers to clinic visit attendance described by postpartum women, including distance from clinic, time constraints, infant and breastfeeding demands, older childcare responsibilities, and reluctance to spend time away from family.<sup>40,41</sup> Many of these issues are multiplied for women who live in remote or under resourced areas. Women of childbearing age are one of the fastest growing user groups for cell phones and smartphones, across racial and socioeconomic groups.<sup>42</sup> Mobile technology provides the opportunity to engage postpartum women at times convenient for them to provide health education and support for lifestyle changes. Given the widespread use of mobile devices, there is potential to overcome some of the barriers faced by postpartum women and reach greater numbers of women through virtual programs enabled by mobile-health platforms.

Heart Health 4 Moms (HH4M) was designed as a web-based program for women with recent preeclampsia to be delivered through personal computers or mobile devices such

TABLE 2. RECOMMENDATIONS FOR POSTPARTUM CARE MODELS FOR WOMEN AFTER PREECLAMPSIA

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Improved communication between obstetrical and primary care providers about patients' pregnancy complications
Documentation of preeclampsia in the permanent medical record problem list
Development of a common patient intake and data collection form
Establishment of a common exam and set of labs ordered by clinics serving this population
→ <i>Suggested:</i> blood pressure, weight, height (for BMI calculation), fasting glucose or HbA1C, lipids
Establishment of more clinical programs geared to women with prior preeclampsia
Creation of a national directory of clinical programs geared to women with prior preeclampsia
Scheduling of appointment at clinical program dedicated to women with prior preeclampsia before or at patient discharge from delivery hospitalization
Tailored counseling for CVD risk reduction in the postpartum woman to account for postpartum concerns such as breastfeeding, contraception, and planning for subsequent pregnancies and mental health
Development and testing of strategies to improve access to CVD risk reduction programs to women across multiple settings
Clinical research to evaluate efficacy of interventions to reduce CVD
Additional considerations for virtual programs
Further clinical testing of the efficacy of postpartum blood pressure home monitoring <sup>54,55</sup> coupled with telehealth support
Further development and testing of tailored mobile and app-based CVD risk reduction programs, particularly in large, diverse populations
Development and evaluation of integrated health care between virtual programs and more traditional clinical models

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BMI, body mass index; HbA1C, hemoglobin A1c.

as smart phones. The goal of HH4M was to educate women about the link between preeclampsia and future CVD risk and to empower them with the knowledge and confidence to make healthy lifestyle changes. The program was developed through a collaboration of preeclampsia survivors, the Preeclampsia Foundation, and an interdisciplinary group of investigators and was funded by the Patient Centered Outcomes Research Institute. The HH4M randomized trial demonstrated that a web-based lifestyle program could engage women with recent preeclampsia, increase self-efficacy for healthy eating, decrease physical inactivity, and increase knowledge of the association between preeclampsia and future CVD as compared to a control group at the end of 9 months of study.<sup>25</sup> Participants in the intervention arm

expressed interest in the program being offered as a mobile application (app). This program remains in the research testing and is not currently available for clinical use. Similar e-health programs (such as the Fit After Baby app currently being tested)<sup>43</sup> may be helpful not only for women with prior preeclampsia but also for women with other pregnancy complications associated with future CVD, such as gestational diabetes and preterm delivery.<sup>3,44</sup> Recommendations for virtual programs are listed in Table 2.

*Organizational efforts*

Promoting women’s long-term cardiovascular health is a priority for key stakeholders including the ACOG, ACC,



**Preeclampsia: a screening test for heart disease**

Heart disease is the leading cause of death for women and it is increasing in women aged 35 to 54 years. Women who have had preeclampsia have approximately double the risk for heart disease and stroke over their next five to 15 years. That risk increases if preeclampsia occurred in more than one pregnancy or if the baby was small. For some women the stress of pregnancy on the body can possibly expose underlying health issues.

Many of the risk factors for preeclampsia, high blood pressure and heart diseases are the same. These risk factors include being overweight, problems with blood clotting, diabetes, high cholesterol, high blood pressure or having a family history of those conditions.

**What can I do to reduce my risk for heart disease?**

If you had preeclampsia, you should take extra care to monitor the health of your heart, see your healthcare provider regularly and make lifestyle modifications now to reduce your risk. If you have other risk factors in addition to your history of preeclampsia, these steps become even more important.

**Talk to your healthcare provider about your pregnancy history**

2011 guidelines from the American Heart Association and 2013 guidelines from the American College of Obstetricians and Gynecologists encourage assessment of a woman’s pregnancy history. You should let your healthcare providers know:

- How many pregnancies have you had?
- How many miscarriages or stillbirths?
- Did you have preeclampsia (or high blood pressure)?
- Were any of your babies born early or small?
- Did you have gestational diabetes?
- What was the weight of your babies?

**Know your family health history and tell your healthcare team about it**

If you have a family history of high blood pressure or heart disease, you are more likely to get it later in life.

**Live a healthy life**

Eat a heart-healthy diet and get regular exercise, such as walking 30 minutes five times a week and doing muscle-strengthening exercises two or more times a week. Proper diet and exercise can reduce your risk factors for heart disease.

**Stay at a healthy weight**

Body mass index (BMI) measures your body fat based on your height. A healthy BMI is between 19 and 25. A BMI greater than 25 may increase your risk for heart disease. If your BMI is too high, talk to your healthcare provider about how to lose weight.

**If you smoke, stop!**

You should also try to avoid second-hand smoke. Tobacco raises blood pressure and damages blood vessels.

**Know your numbers – Talk to your doctor about tracking these important measurements**

<p><b>Blood Pressure</b> A healthy blood pressure is around 120/80. If your blood pressure is higher, talk to your care provider about ways to lower it including lifestyle and diet modifications.</p>	<p><b>Cholesterol (blood fats or “lipids”)</b> If your levels are high, ask how you can lower them. Aim for these levels: Total cholesterol: &lt; 200 mg/dl HDL (good cholesterol): = or &gt; 50 mg/dl LDL (bad cholesterol): &lt; 100 mg/dl Triglycerides: &lt; 150 mg/dl</p>	<p><b>Blood glucose (blood sugar) and HbA1C</b> If either is high, ask how you can lower it. Aim for these levels: <b>Fasting Blood Glucose</b>                      <b>HbA1C</b> Normal: &lt; 100 mg/dl                              &lt; 5.7% Pre-diabetes: 100 to 125 mg/dl                      5.7-6.4% Diabetes: = or &gt; 126 mg/dl                              = or &gt; 6.5%</p>
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**FIG. 1.** Preeclampsia: a screening test for heart disease. The preeclampsia foundation patient information sheet.

AHA, and Preeclampsia Foundation. These organizations currently have programs to disseminate the latest science through ongoing health care provider and patient education and efforts to develop clinical algorithms that can be used for risk stratification to direct lifestyle modification and pharmacologic interventions. As such, these organizations are crucial partners for educating women and providers and developing new algorithms that leverage female-specific and female-predominant CVD risk factors.

In 2018, ACOG initiated a redesign of postpartum care to emphasize the importance of an ongoing process that is individualized and transitions seamlessly to well-woman care.<sup>45</sup> Rather than a single visit, optimal postpartum care employs a patient-focused “medical home” care model that transforms the previous episodic and fragmented approach into a continuous comprehensive health care model. The postpartum period is viewed as a guide to lifelong health care and tailored to each woman’s needs. Depending on the particular clinical scenario, early and timely follow-up after delivery may be indicated, which is especially important for women with complicated pregnancies, such as those with preeclampsia. ACOG has described the first 12 months after delivery as the “Fourth Trimester,” and they have developed a *Postpartum Toolkit* for women’s health care providers to utilize as a comprehensive resource of key components of postpartum care.<sup>46</sup> The Toolkit contains guidance for the clinician for long-term follow-up from pregnancy complications, including preeclampsia.

The ACOG and AHA Presidential Advisory in 2018 offered guidance to women’s health providers about promoting risk identification and reduction of CVD in women with a history of preeclampsia.<sup>10</sup> ACOG recently released clinical management guidelines for obstetricians and gynecologists that specifically address pregnancy and heart disease, including immediate and long-term continuity of care considerations for hypertensive pregnancy. An early postpartum visit (within 7–10 days of delivery) is advised for women with hypertensive disorders. CVD risk assessment within 3 months postpartum is outlined with the recommendation that at-risk women be counseled, and a long-term care plan be created. The ACOG recommendation endorses the AHA’s *Life’s Simple 7* that describes seven steps to a healthy lifestyle.<sup>31,47</sup>

The 2019 ACC/AHA Guideline on Primary Prevention of CVD added preeclampsia as a risk factor that should be part of the clinician’s evaluation of the patient’s risk.<sup>48</sup> ACOG developed “Frequently Asked Questions on Heart Health for Women,”<sup>49</sup> as patient education material that can be viewed online or printed for patients; this resource highlights preeclampsia as a risk factor for CVD. These organizations are also involved in advocacy to improve and prolong the duration of health care coverage after delivery. Medicaid currently covers almost half of all U.S. births for up to 60 days postpartum. It is now widely recognized that many pregnancy-related deaths occur during the first year after birth.<sup>50</sup> ACOG has garnered the support of the American Medical Association (AMA) House of Delegates to recommend that Medicaid coverage be extended to 12 months postpartum. To be effective, advocacy for expanded health care coverage will need to occur on both the federal and state levels. Additionally, many maternal mortality review committees hosted by state departments of health also recom-

TABLE 3. RECOMMENDATIONS FOR ORGANIZATIONS

Partner with HAPPEN and other preeclampsia-focused stakeholder groups
Reinforce ongoing health care coordination and navigation of health care resources
Advocate and collaborate with health care institutions to create policy changes on both the state and federal levels; particularly extending Medicaid beyond 60 days postpartum to 12 months postpartum
Publicize training materials for providers, trainees, and patients available through existing organizational networks (AHA, ACOG, Preeclampsia Foundation, and others)
Include education regarding CVD risk in women with prior preeclampsia in organizationally sponsored national and continuing medical education (CME) programs
Facilitate and encourage the clinical coordination of health care providers across fields (such as primary care, obstetrics, and cardiology)
Fund research evaluating the effectiveness of interventions to improve future CVD health in women with prior preeclampsia

ACOG, American College of Obstetricians and Gynecologists; AHA, American Heart Association; HAPPEN, Health after Preeclampsia Patient and Provider Engagement Network.

mend extending Medicaid coverage to first year postpartum to improve health outcomes.

The Preeclampsia Foundation has long recognized the importance of the impact of preeclampsia on long-term health and the need to educate women about their risk.<sup>51</sup> Their website provides information about the association between preeclampsia and increased risk for future CVD<sup>52</sup> along with measures women with preeclampsia can take to reduce their risk.<sup>51</sup> The Preeclampsia Foundation Position article “Preeclampsia and Future Cardiovascular Disease in Women: What Do We Know and What Can We Do?” posted in February 2019 is available as an educational resource for both patients and providers.<sup>53</sup> The Preeclampsia Foundation developed a patient information sheet (Fig. 1)<sup>51</sup> and led numerous public education campaigns on the topic.

The Preeclampsia Foundation is very active in advocating for legislation that will improve the lives of women with preeclampsia. Collaboration is key to advocacy, so the Foundation continually works with other professionals and organizations to further this cause. For example, the Foundation served on the ACOG Pregnancy and Heart Disease task force that developed the Gestational Hypertension and Preeclampsia Practice Bulletin.<sup>4</sup> Recommendations for organizations are listed in Table 3.

## Discussion

Beyond the specific recommendations laid out above and based on the experiences of patients, advocates, and clinicians participating in the HAPPEN meeting who launched these first clinics and mobile health resources to treat women with a history of preeclampsia, more research is needed. Further research is needed on methods to best implement and sustain clinics specifically designed to bridge the gap between delivery and establishment of routine primary care for women with a history of recent preeclampsia. Telehealth models offering virtual programs to support lifestyle change

and remote blood pressure monitoring hold great promise to extend reach to women with limited health care access.

Additionally, research is needed to evaluate specific screening and medication protocols to prevent or delay CVD, and to refine and test behavioral change programs in women with a history of preeclampsia. In terms of behavior change, further research should identify the most effective ways to empower new mothers with recent preeclampsia to adopt heart-healthy lifestyles. Behavior change is always difficult, but there are particular challenges to reaching new mothers who may otherwise feel healthy. For example, it may be that focusing first on meeting any mental health needs after a traumatic pregnancy is key to motivating lifestyle change in women with recent preeclampsia. In addition, population-based research can help further refine the specific CVD risk (e.g., hypertension, coronary heart disease, stroke, heart failure) after particular subtypes of preeclampsia (e.g., preterm vs. term; in patients with or without obesity; in preeclampsia characterized by angiogenic profile).

Although we focused on the risk factor of preeclampsia, additional adverse outcomes of pregnancy, including spontaneous preterm delivery, gestational hypertension, gestational diabetes, and intrauterine fetal growth restriction are also associated with a twofold risk of developing later CVD.<sup>20</sup> The findings of this meeting should have relevance for the follow-up of these pregnancy complications as well.

### Conclusion

At present, the foundational research is clear: women with a history of preeclampsia are at an elevated risk of heart disease and stroke. A first line of intervention is to inform health care providers about this risk and, as recommended by the AHA and ACOG, to have providers then educate their patients with a history of preeclampsia about their risk, and to discuss CVD screening and prevention options. Organizations such as the Preeclampsia Foundation offer up-to-date resources to help with these provider-patient conversations and directly to patients. Inclusion of both patient and provider perspectives in the design of education materials and research agendas is essential. Clinicians also need to help women bridge the common gap between obstetric and primary care.

Novel care models, including virtual programs, are being explored to help reduce CVD risk in women with a history of preeclampsia, and more resources are becoming available. These models will need to be tested to determine whether they are effective in reducing CVD risk. The discussion and recommendations from this meeting can serve both as a resource and catalyst for this effort. By working together across disciplines and fields in the areas of research, care delivery, and advocacy, we can improve care for women with a history of preeclampsia.

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