Interventions to Address Cardiovascular Risk and Improve Pregnancy Outcomes & Discussion: Postpartum Hypertension Care

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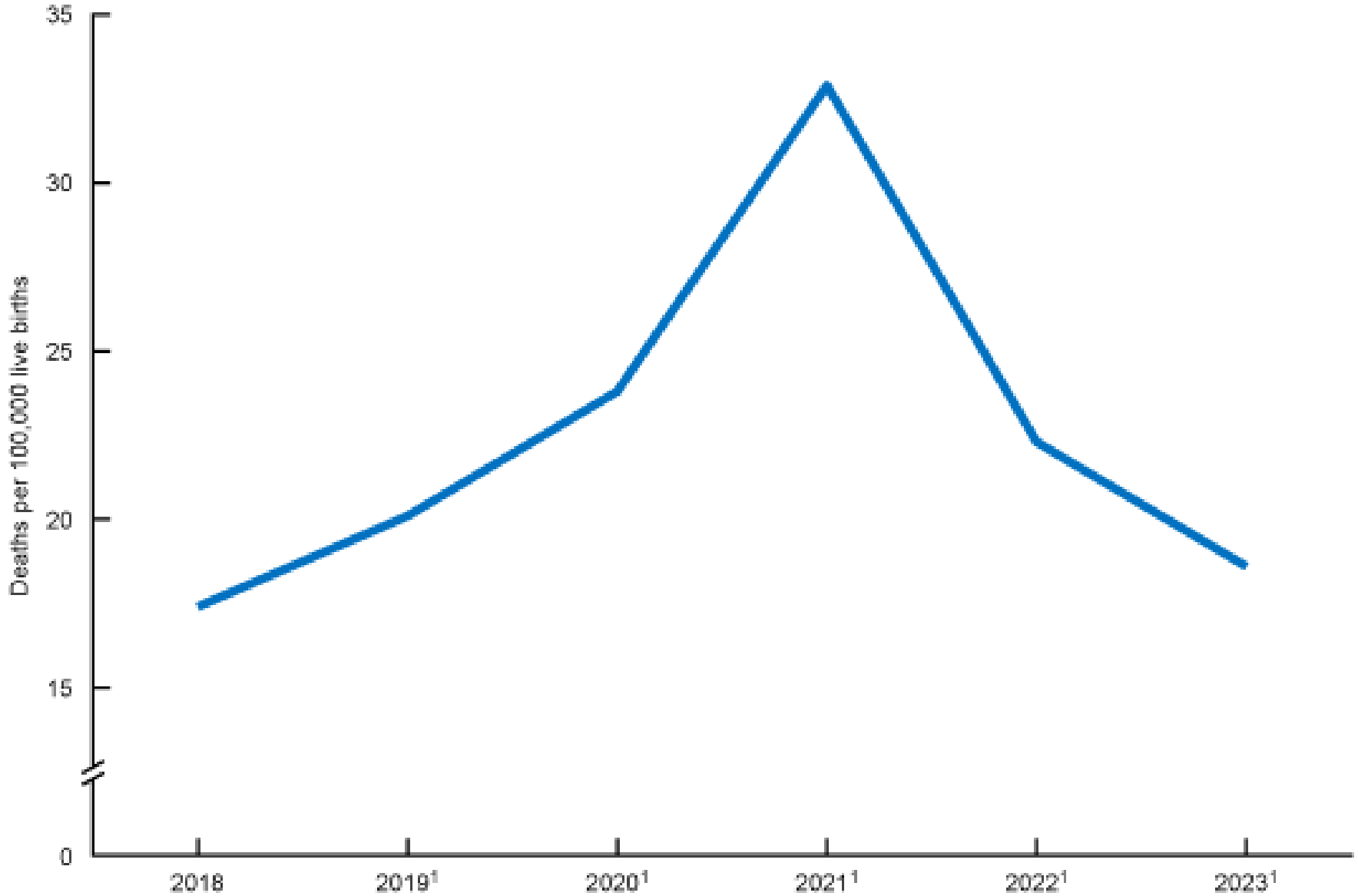
Outline

- Cardiovascular-related maternal mortality
- Hypertensive disorders of pregnancy (HDP) and association with cardiovascular (CV) disease risk
- Ways to reduce care disparities in the postpartum period
- Results from a local experience: UPMC Postpartum Hypertension Clinic and remote blood pressure monitoring program
- Future directions

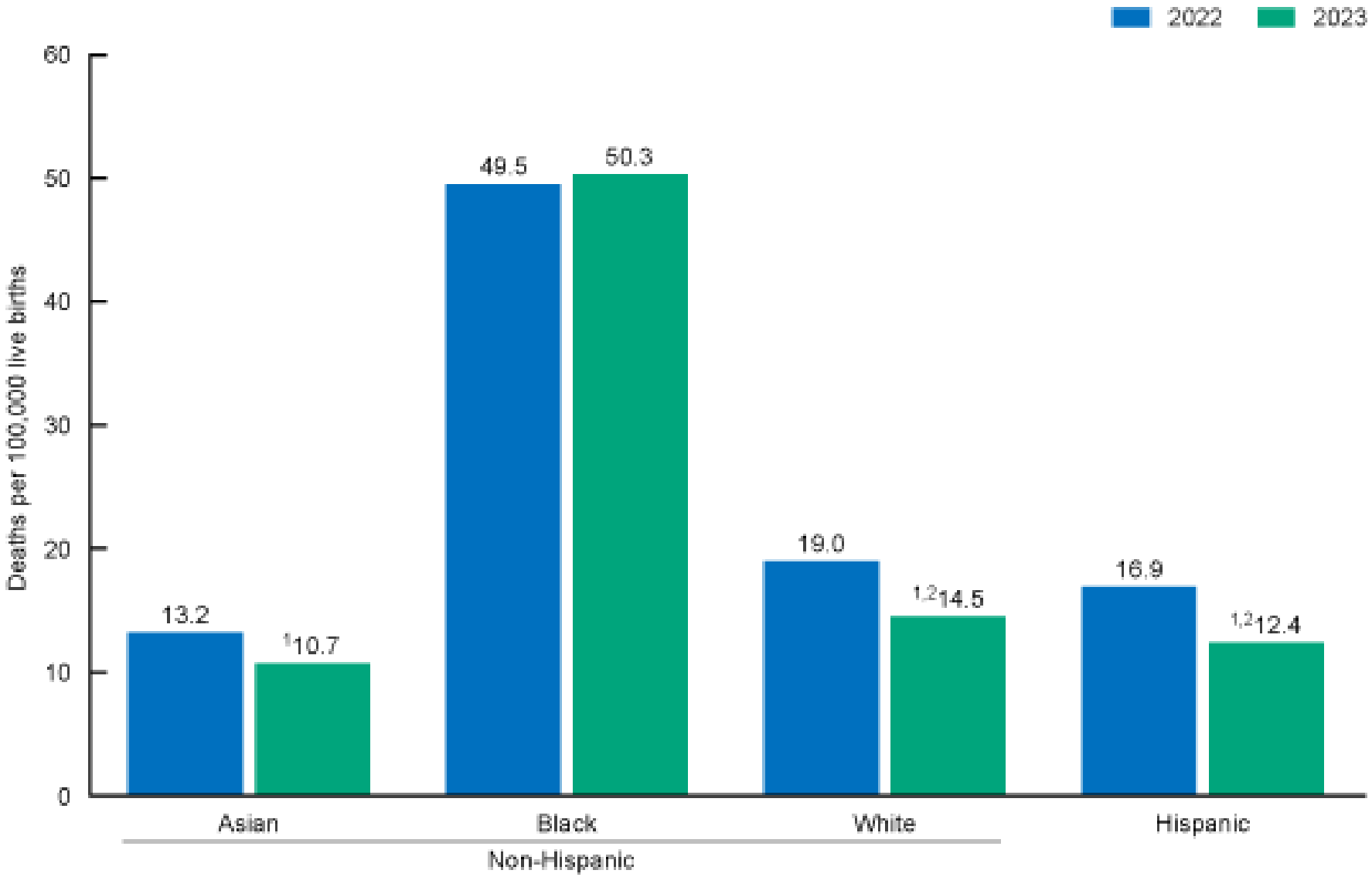
Maternal Mortality Statistics

Maternal mortality was the worst in 2021



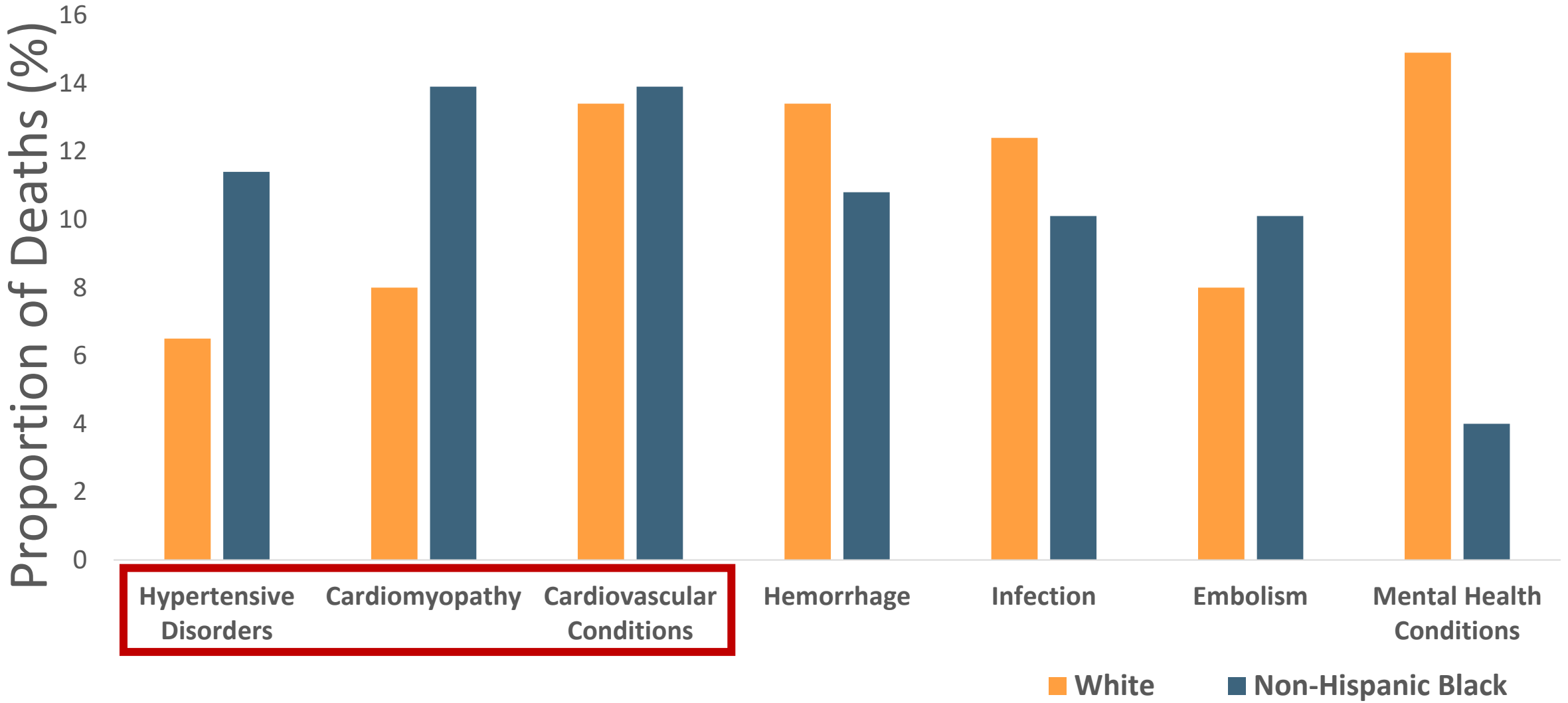
SOURCE: National Center for Health Statistics, National Vital Statistics System, mortality data files.

Significant disparities in racial mortality remain

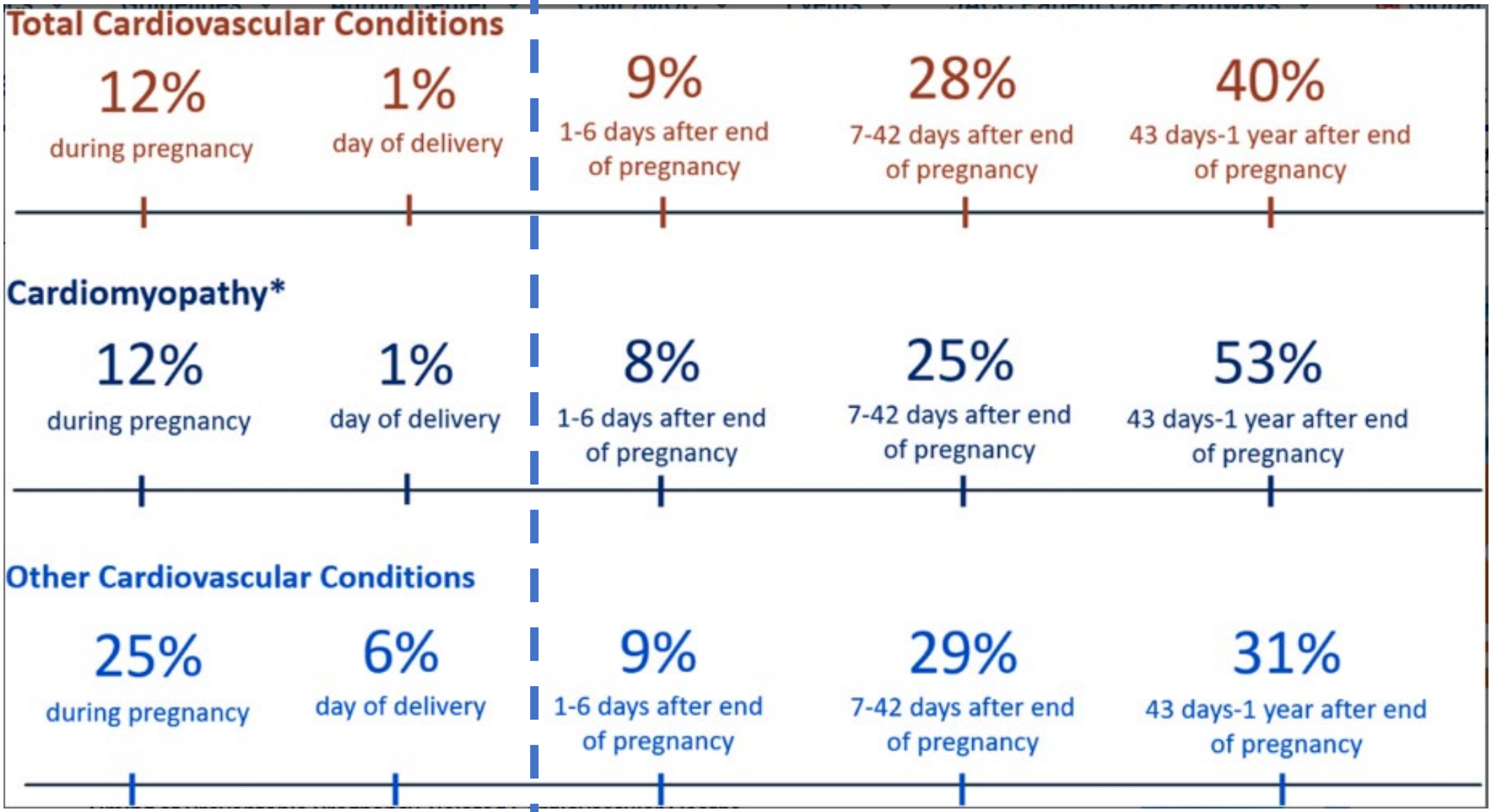


SOURCE: National Center for Health Statistics, National Vital Statistics System, mortality data file.

Black women disproportionately impacted by cardiovascular-related mortality



Majority of maternal cardiovascular deaths occur after delivery



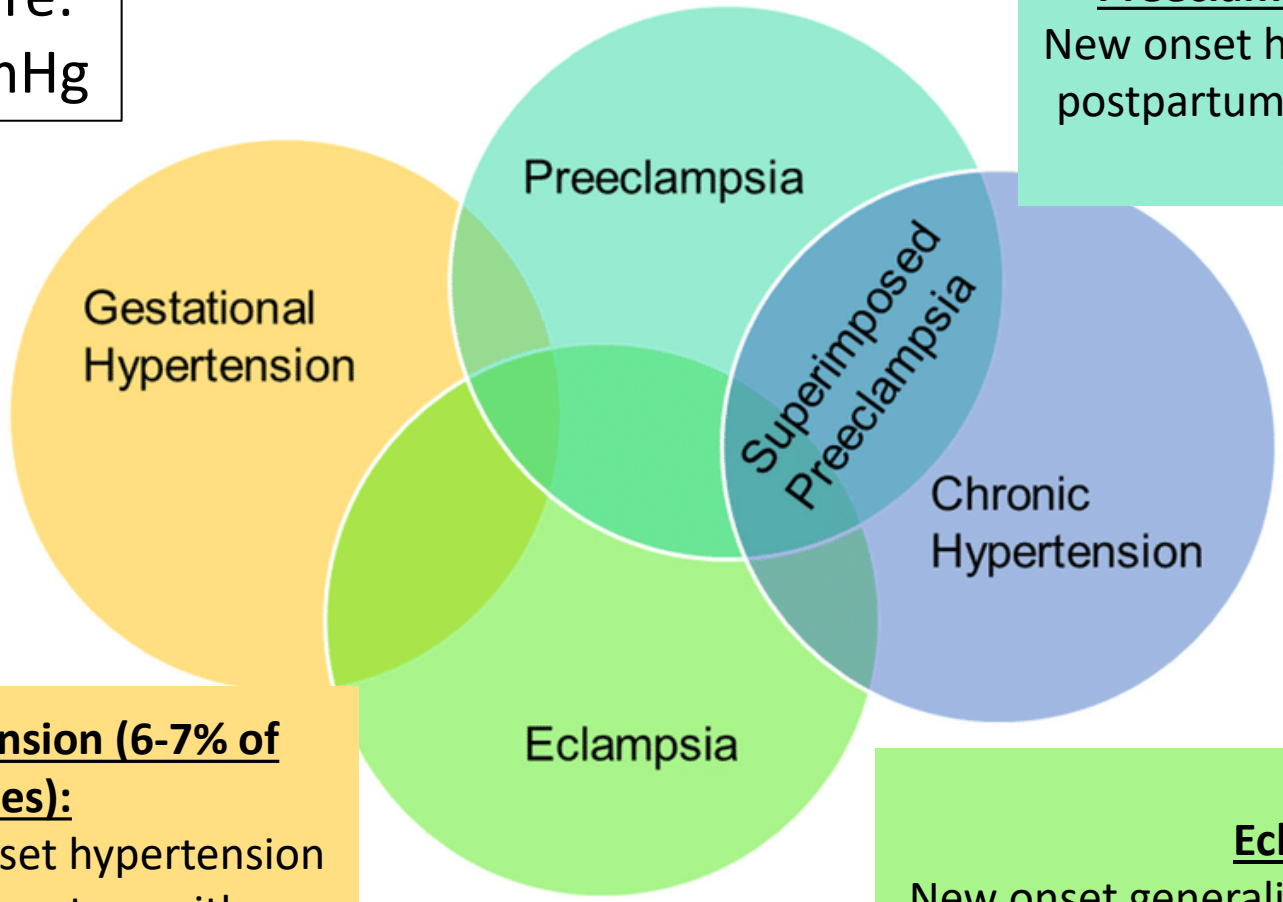
Briller, J, et al.. *JACC Adv.* 2024.

Hypertensive Disorders of Pregnancy and Cardiovascular Risk

Hypertensive Disorders of Pregnancy (HDP)

>15% of pregnant individuals

Blood pressure:
>=140/90 mmHg



Preeclampsia (2-6% of pregnancies):
New onset hypertension after 20 weeks or postpartum with proteinuria and/or end-organ dysfunction

Chronic Hypertension (2-3% of pregnancies):
Hypertension diagnosed before 20 weeks gestation

Gestational Hypertension (6-7% of pregnancies):
Asymptomatic, new onset hypertension after 20 weeks or postpartum with no end-organ dysfunction

Eclampsia:
New onset generalized, tonic-clonic seizures with hypertensive disorder of pregnancy

High blood pressure in pregnancy is common and increases future cardiovascular risk

Complicates 10-20% of pregnant individuals

Most common reason for postpartum hospitalization

40% develop hypertension within 5 years

2 out of 3 women die from cardiovascular disease

Preeclampsia Increases Risk of CVD

Window to the Future
Laurie Thompson

Outcome	Mean follow up (yrs)	Relative Risk
Hypertension (HTN)	14.1	3.70 (95% CI 2.70 -5.05)
Ischemic heart disease	11.7	2.50 (95% CI 1.43-4.37)
Stroke	10.4	1.81 (95% CI 1.45-2.27)
Heart failure	7.0	4.19 (95% CI 2.09-8.38)
CVD mortality	14.5	2.21 (95% CI 1.83-2.66)

Benschop et al. *Hypertension*. 2018

Bellamy et al. *BMJ*. 2007

Wu et al. *Circ Outcomes*. 2017

The 4th Trimester – a Key Time for Intervention

Pregnancy

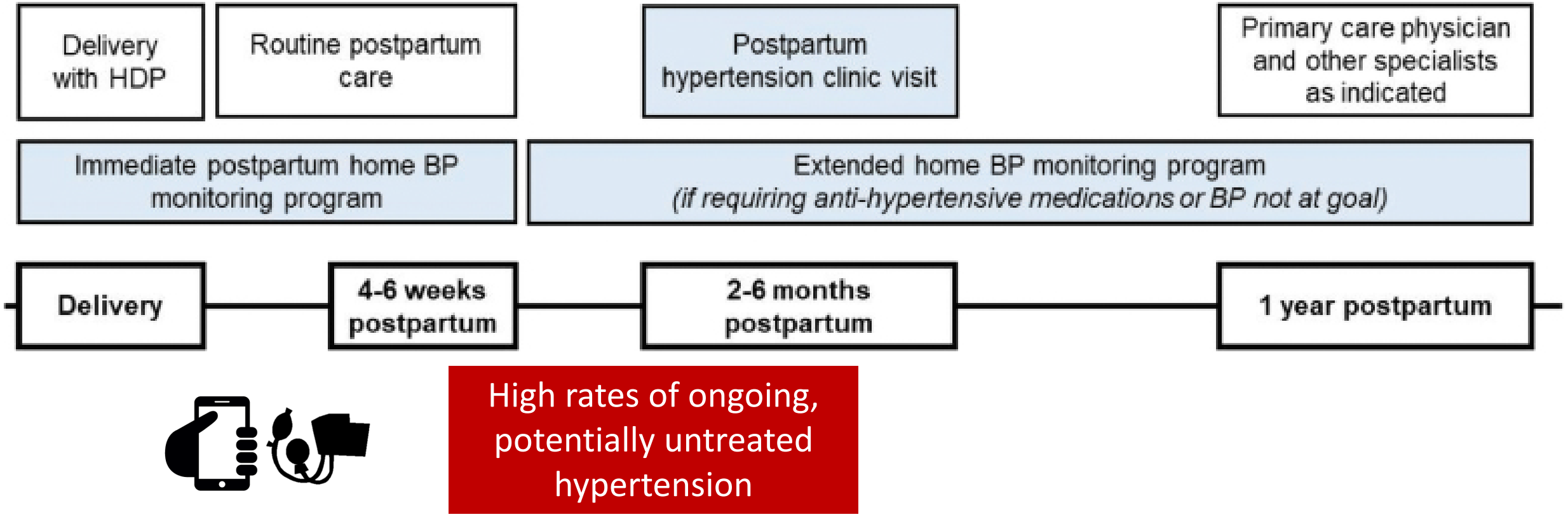
Delivery

4th Trimester

1 year postpartum

Management after HDP

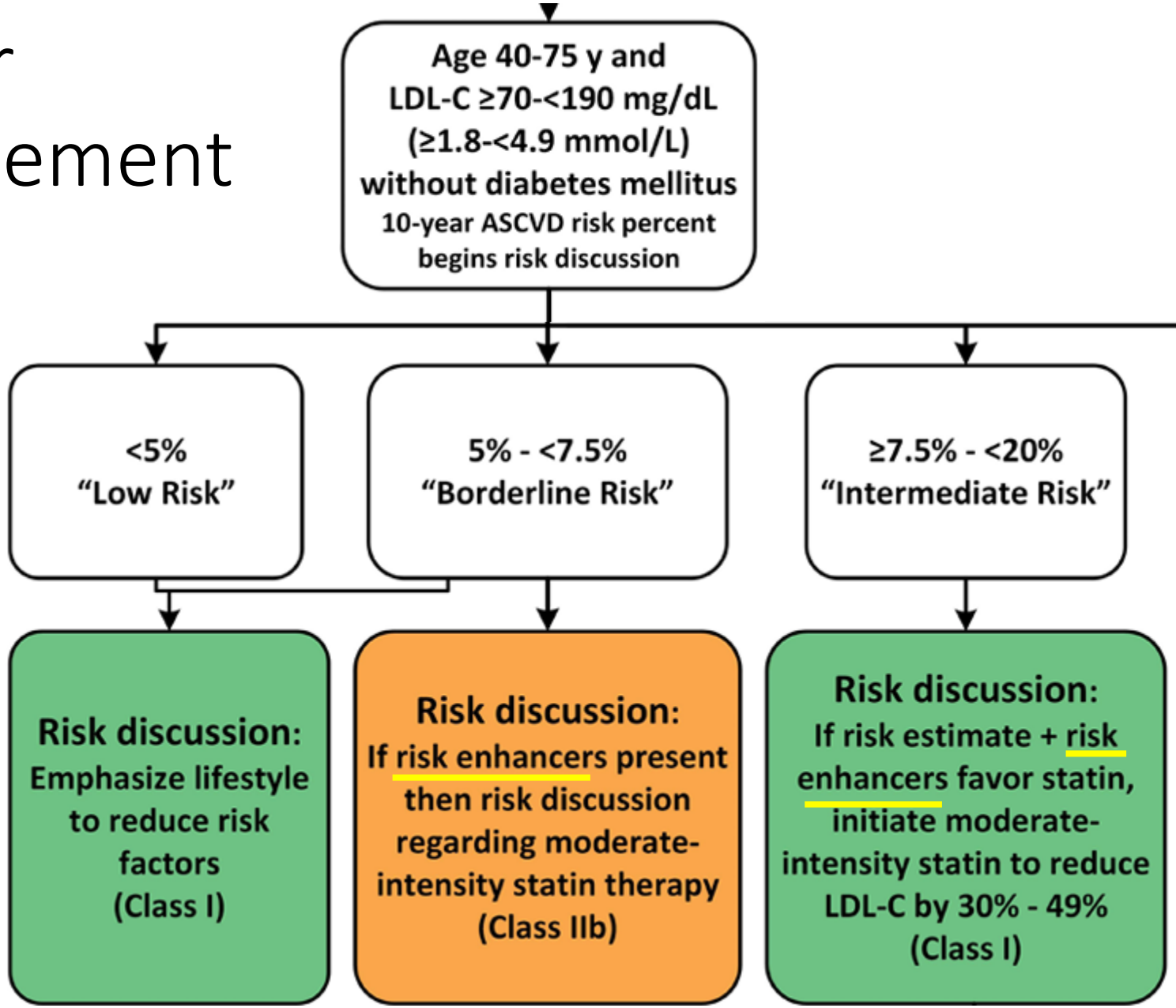
Integration of remote BP monitoring and clinical care



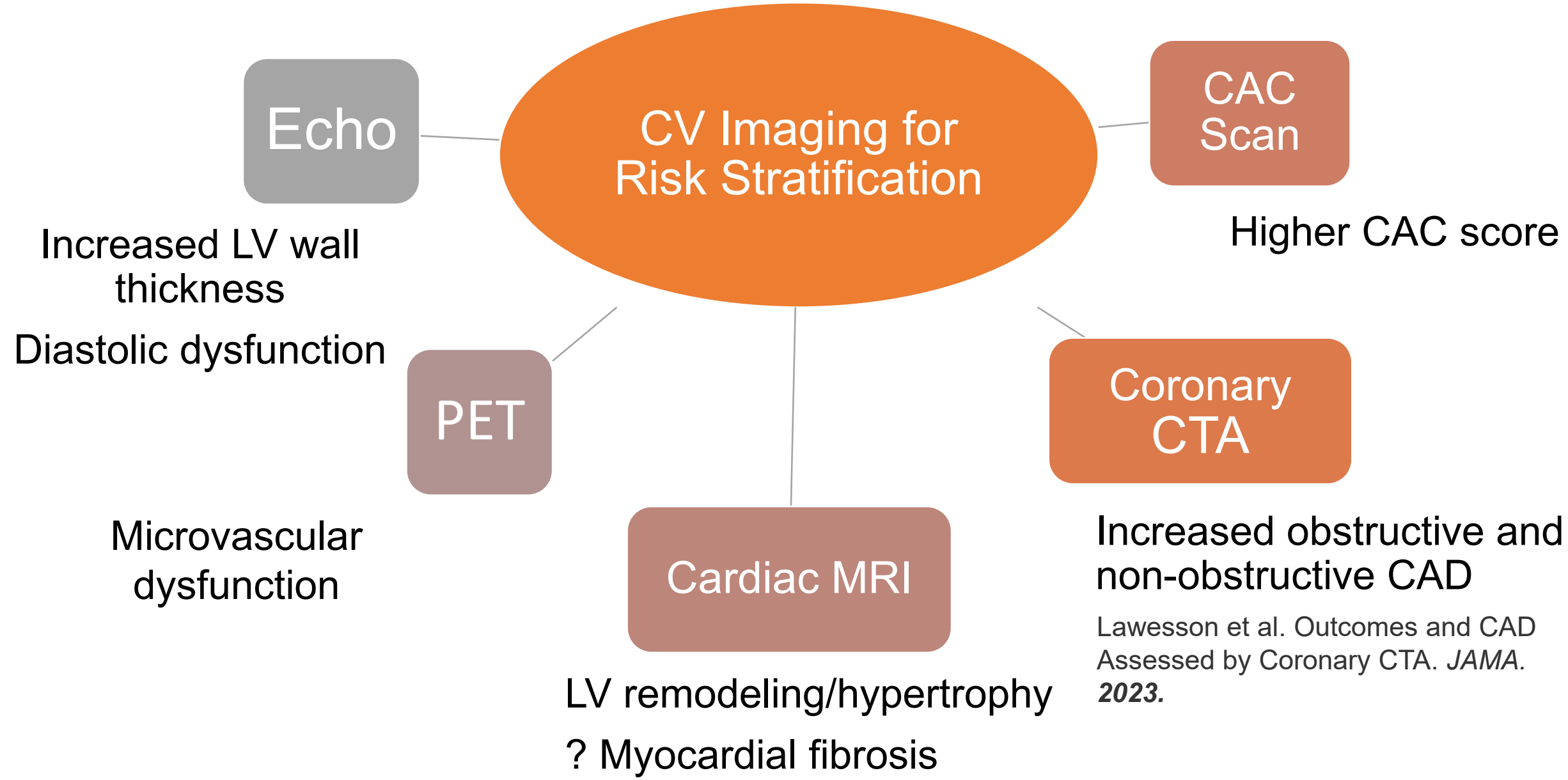
Countouris, Berlacher, Hauspurg et al Women's Health Reports, 2022

Aggressive Risk Factor Screening and Management

- Yearly BP check
- Regular lipid panel and diabetes screening
- AHA/ACC 2018 Cholesterol Guidelines
  - Preeclampsia is a “risk enhancer”

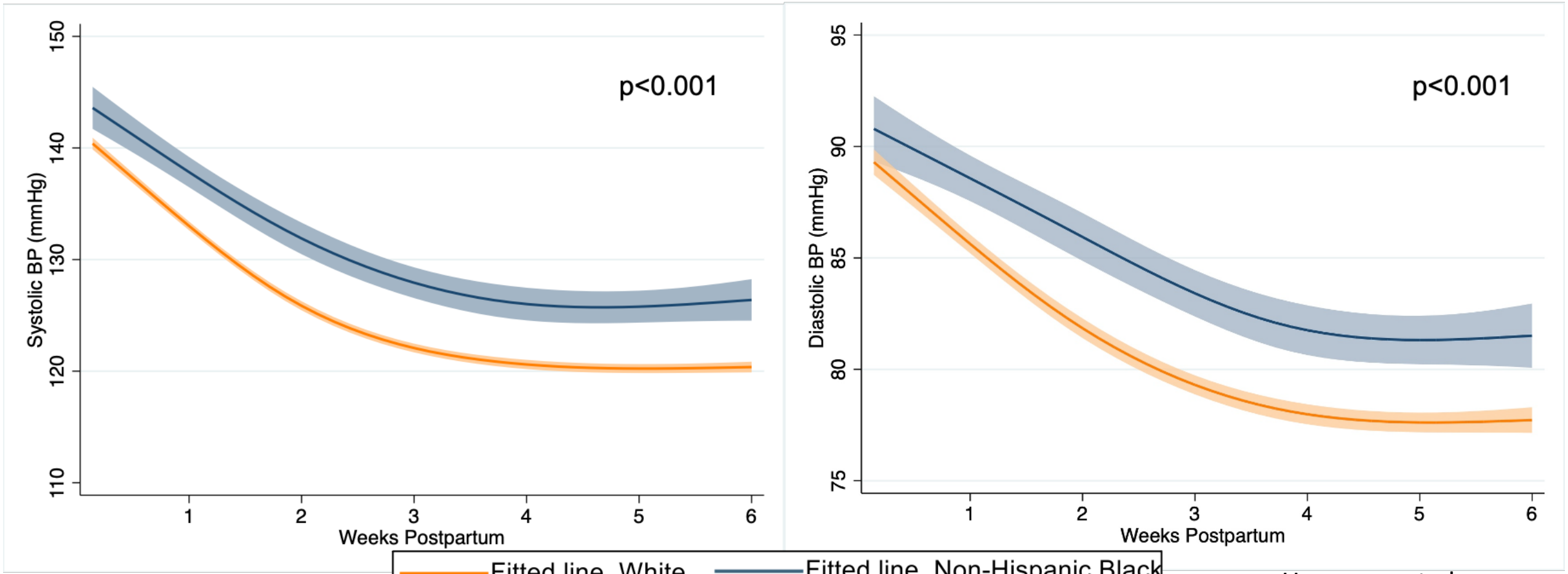


Guideline on the Management of Blood Cholesterol. *Circulation*. 2018


CV Imaging for Risk Stratification
Echo
Increased LV wall thickness
Diastolic dysfunction
CAC Scan
Higher CAC score
PET
Microvascular dysfunction
Cardiac MRI
LV remodeling/hypertrophy
? Myocardial fibrosis
Coronary CTA
Increased obstructive and non-obstructive CAD
Lawesson et al. Outcomes and CAD Assessed by Coronary CTA. JAMA. 2023.

Disparities in postpartum care after HDP

Black women have a more adverse postpartum blood pressure trajectory

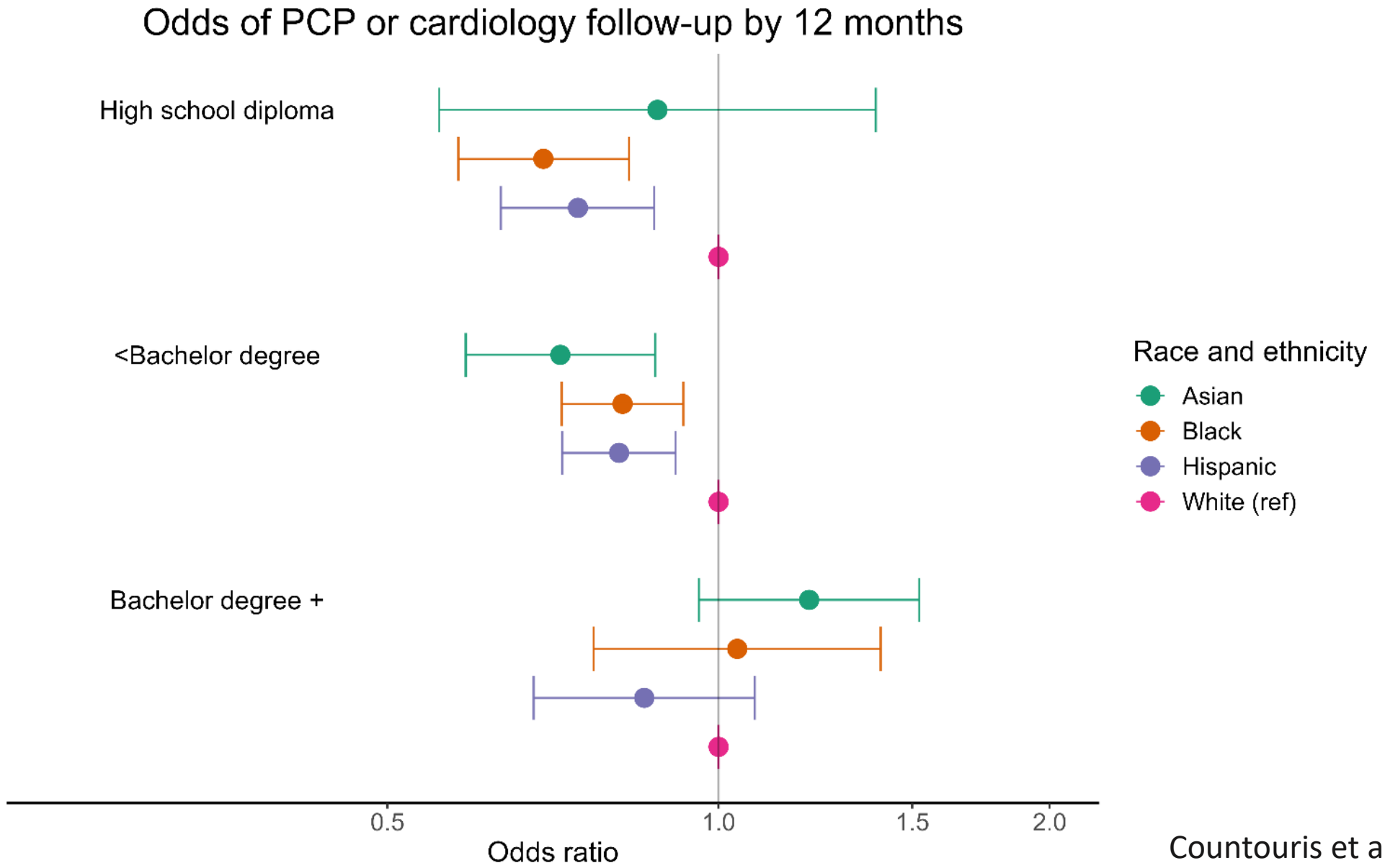


Hauspurg et al,
JAMA Netw Open 2020

Identifying Care Inequities: Racial and Socioeconomic Postpartum Disparities in HDP

- Black individuals have **higher postpartum BP** than White referents
  - **Higher risk of serious morbidity** including CVA, pulmonary edema, and HF
- Black individuals, those in the poorest quartile of median income, and those with public insurance, had **higher postpartum 30-day readmission rates**
- Black individuals have **lower rates of follow-up** compared with White individuals, as do those with lower educational attainment
- Additional social factors limit postpartum care
  - Access to social resources, health literacy, inequities in delivery of care, and structural racism

Among those with **preeclampsia, Black** & **Hispanic** individuals were **less likely** to have postpartum **PCP or cardiology follow-up,** modified by education attainment.



Countouris et al. *In Press JAHA*

Multifactorial etiologies to racial and ethnic disparities in maternal health

Structural racism -> generational income inequality, educational, and social disadvantage for Black and Brown communities

Systemic barriers that limit health care access (e.g., limited clinic hours, lack of virtual visit options)

Provider biases and limited organizational attention towards health literacy

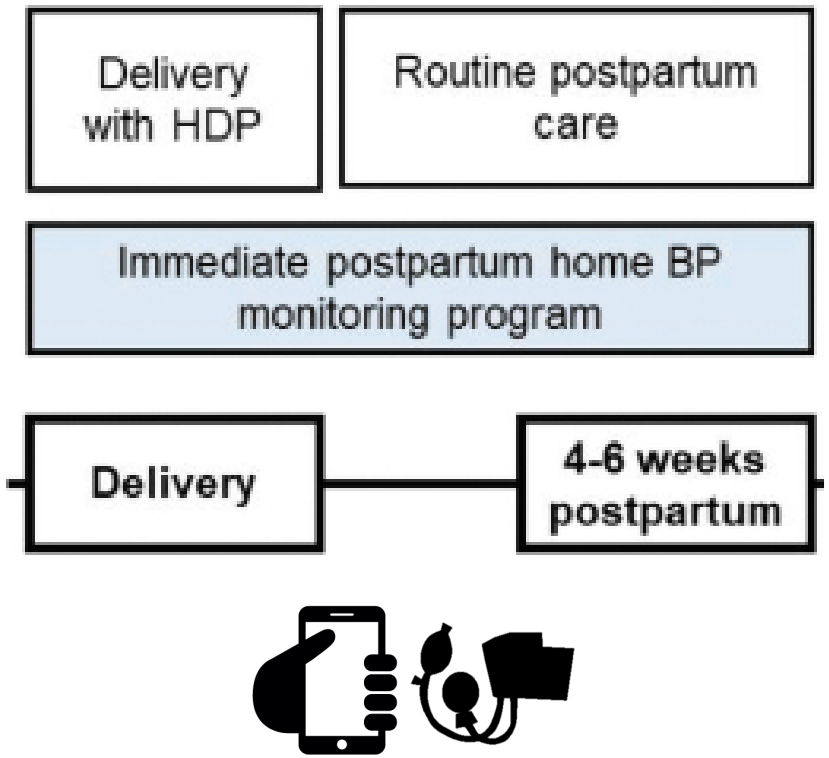
Individual-level factors such as resources embedded in one's social network

What are some ways we can improve care postpartum?

Improving care postpartum after HDP

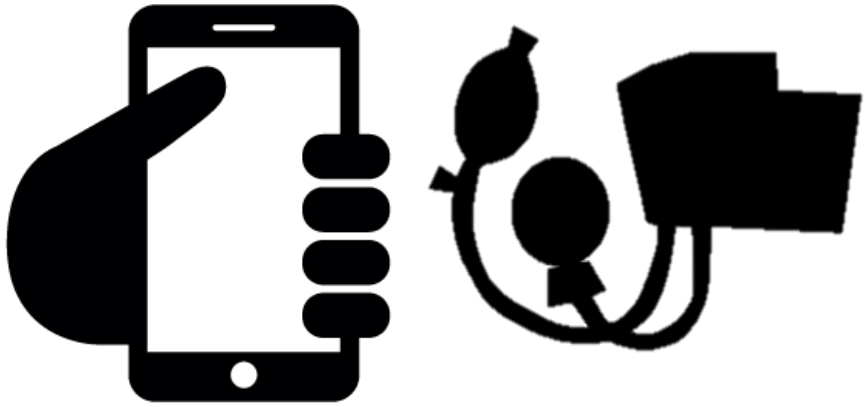
- Home BP monitoring programs
- Postpartum hypertension clinics
- Postpartum navigators

Integration of remote BP monitoring and clinical care – early management



Countouris, Berlacher, Hauspurg et al Women's Health Reports, 2022

OR



Office Visit

Text Messaging

Single BP measurement within 10 days

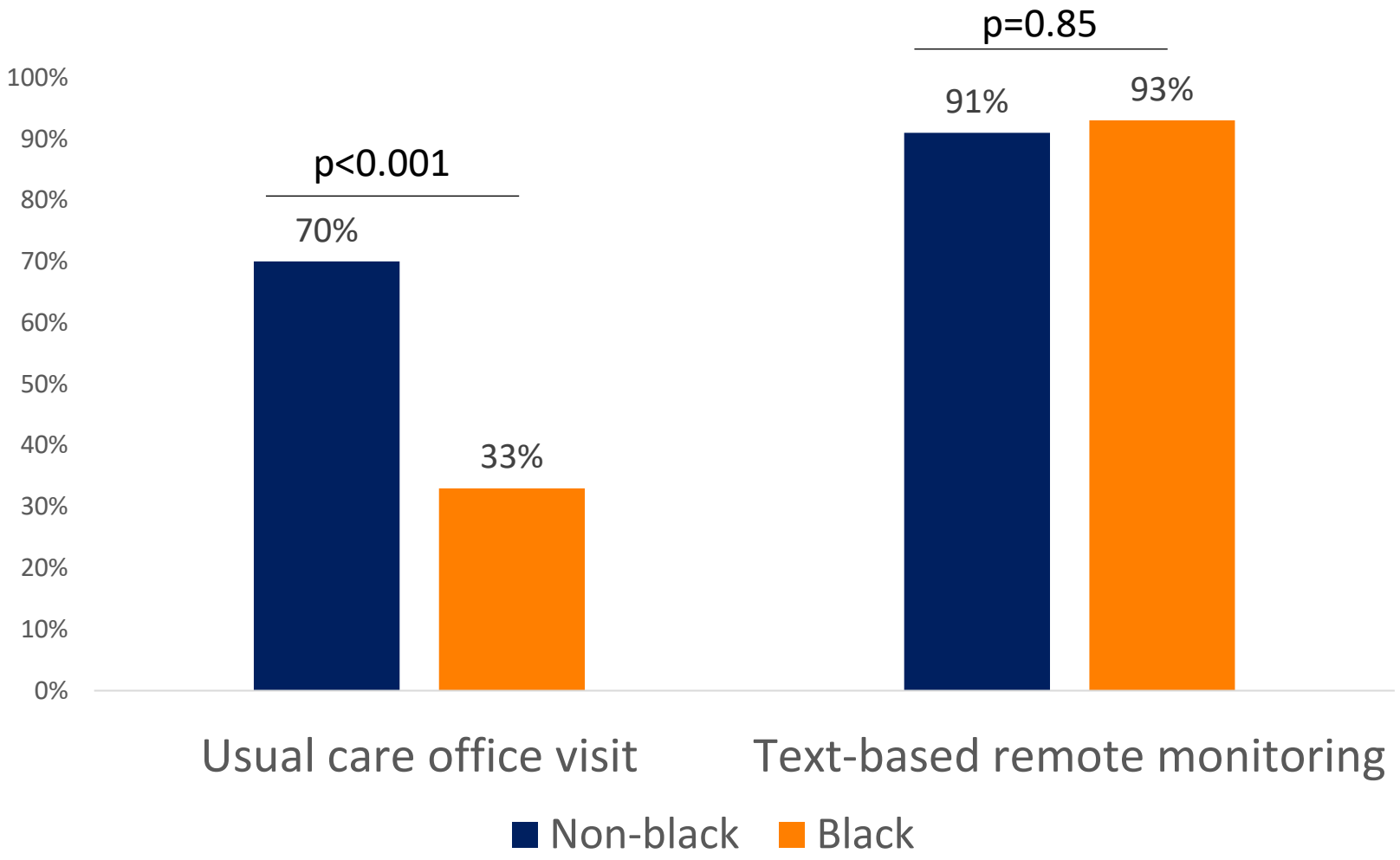
Comparing standard office-based follow-up with text-based remote

Table 3 Postdischarge outcomes

Postdischarge outcome	Office visit n=103 (%)	Text messaging n=103 (%)	P values	aOR (95% CI)	P values
Blood pressure obtained within 10 days*	45 (43.7)	95 (92.2)	<0.001	58.2 (16.2 to 208.1)	<0.001
Outpatient antihypertensive medication initiated within 2 weeks post partum†	10/45‡ (22.2)	17/103 (16.5)	0.41	1.0 (0.3 to 3.1)	0.95
Additional emergency department or office visit for hypertension not resulting in readmission†	2 (1.9)	3 (2.9)	0.65		
Postpartum hypertension readmission	4 (3.9)	0 (0)	0.04		
Attended postpartum visit§	60 (58.2)	71 (68.9)	0.11	2.3 (1.05 to 5.07)	0.04

Hirshberg et al, *BMJ Qual Safety* 2018

Text-based remote monitoring eliminates racial disparities in postpartum HTN care



Hirshberg et al. *AJOG 2019*

Text-based remote monitoring results in reduced postpartum ED visits and readmissions

Health Care Utilization and Cost Outcomes 6 Months Postdischarge, Program Participants Compared With Those in the Contemporaneous Comparison Cohort

Outcome	Program (n=1,276)	Cohort C (n=1,276)	Difference (% Difference)*	*P*	OR (95% CI)
Cardiologist visits	152 (11.9)	108 (8.4)	44 (41.7)	.004	1.46 (1.13–1.90)
Specialist visits	869 (68.1)	783 (61.4)	86 (10.9)	<.001	1.34 (1.14–1.58)
ED visits	21 (1.6)	36 (2.8)	−15 (−42.9)	.044	0.58 (0.33–0.99)
Inpatient readmissions	17 (1.3)	38 (3.0)	−21 (−56.7)	.005	0.44 (0.25–0.78)

Cohort C, contemporaneous comparison group; OR, odds ratio; ED, emergency department.
Data are n (%) unless otherwise specified.
* The % difference shows the percentage differences in the number of visits between the treatment and comparison cohort.

Hirshberg et al. *Obstetrics & Gynecology, 2023*

JAMA

QUESTION Does self-monitoring and physician-guided titration of antihypertensive medications provide better long-term blood pressure control among women with gestational hypertension or preeclampsia than usual care at 9 months after discharge?

CONCLUSION Self-monitoring and physician-guided titration of antihypertensive medications vs usual postnatal care was associated with lower blood pressure 9 months after discharge.

POPULATION

220 Participants

Participants (≥18 y) with gestational hypertension or preeclampsia who needed antihypertensive medicine at discharge

Mean age: 32.6 years

LOCATIONS

1
Center
in the UK

INTERVENTION

220 Participants randomized
200 Participants analyzed

112	108
Self-monitoring	**Standard care**
Self-monitored daily blood pressure readings transmitted via app triggering titration notifications to patients	Blood pressure review within 7 to 10 days with midwife and review within 6 to 8 weeks with general practitioner

PRIMARY OUTCOME

24-Hour mean diastolic blood pressure 9 months after discharge, adjusted for baseline postnatal blood pressure

FINDINGS

24-Hour mean diastolic blood pressure at 9 months

Self-monitoring
71.2 (SD, 5.8) mm Hg

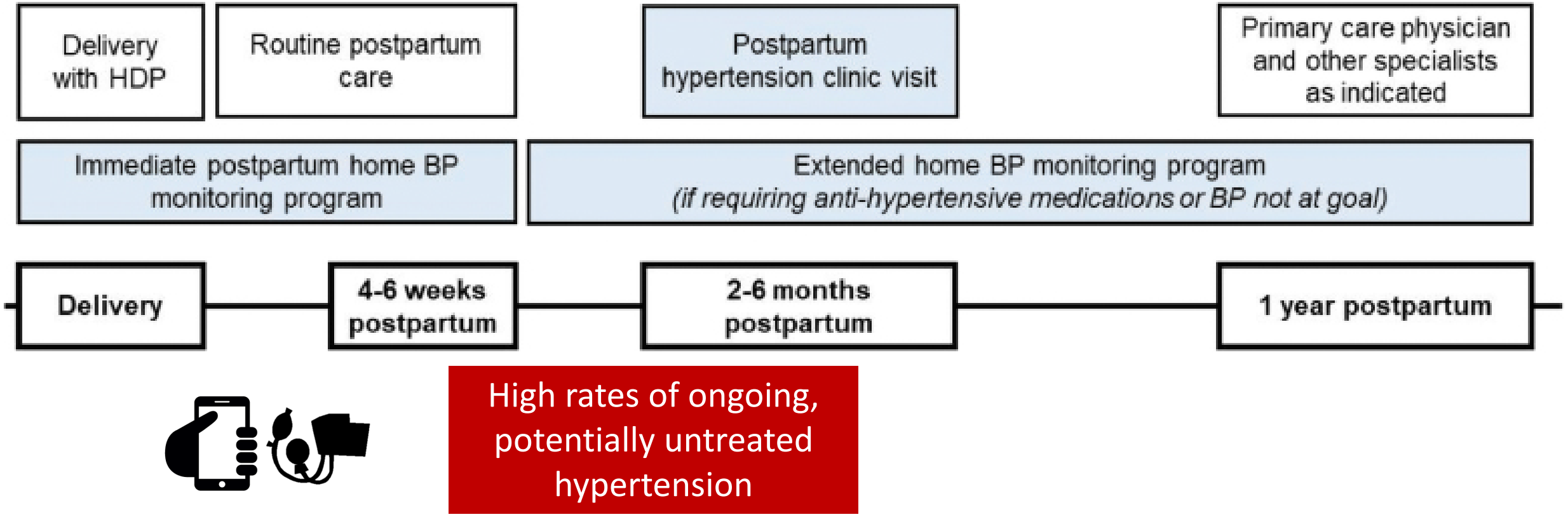
Standard care
76.6 (SD, 5.7) mm Hg

Antihypertensive titration vs standard care was associated with lower blood pressure at 9 months:

Between-group difference, −5.8 mm Hg
(95% CI, −7.4 to −4.20 mm Hg)

Kitt J, Fox R, Frost A, et al. Long-term blood pressure control after hypertensive pregnancy following physician-optimized self-management: the POP-HT randomized clinical trial. *JAMA*. Published November 11, 2023. doi:10.1001/jama.2023.21523

Integration of remote BP monitoring and clinical care – extended BP monitoring



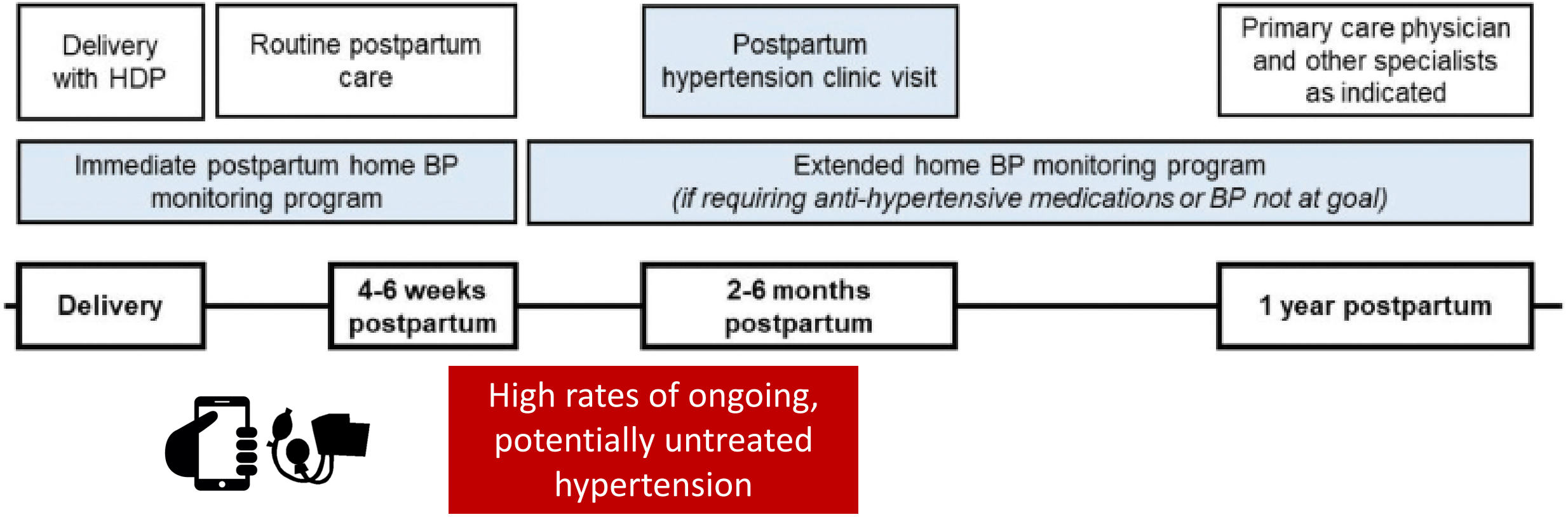
Countouris, Berlacher, Hauspurg et al Women's Health Reports, 2022

Postpartum Hypertension Remote Monitoring **Extension** Program **(> 6 weeks)**

	6-Wk Remote Monitoring (n = 2,344)	Extended Remote Monitoring (n = 1,318)	*P* Value
Maternal demographics			
Maternal age (y)	31.1 ± 5	32.6 ± 5.2	<0.001
Race			0.020
Caucasian	1,840 (79)	959 (73)	
Black	612 (16)	285 (22)	
Other (Asian, Hispanic, Native American)	116 (5)	74 (5)	
Discharged postpartum with medication	568 (24)	414 (31)	<0.001
Initiated or titrated medications	1,423 (60)	1,011 (77)	<0.001
PP hypertension clinic visits	52 (2)	254 (20)	<0.001
Primary care visit within 18 mo postpartum	906 (39)	602 (46)	<0.001
Number of wk in the program	5.9 (5-6)	23.0 (11-31)	<0.001

Reddy, Countouris, et al., *JACC Advances*, 2024

Integration of remote BP monitoring and clinical care – postpartum HTN clinics



Countouris, Berlacher, Hauspurg et al Women's Health Reports, 2022

Thank you

- Natalie Bello, MD, MPH
- Colleen Harrington, MD
- Jennifer Lewey, MD
- Kathryn Lindley, MD
- Megan Mclaughlin, MD, MPH
- Kayle Shapero, MD, PhD
- Tina Battaile
- Jennifer Ray Beckman

Accessing the toolkit

REPRODUCTIVE HEALTH & CARDIO-OBSTETRICS MEMBER SECTION

Activities and Resources

- Reproductive Health & Cardio-Obstetrics Member Section
  - Section Announcements
  - \+ About Us
  - Activities and Resources

Resources

Postpartum Hypertension Clinic Development Toolkit

5-part series: *JACC* Focus Seminar: Cardio-Obstetrics

✔ 1/5: J Am Coll Cardiol. 2021 Apr, 77 (14) 1763–1777

QR Code

CONTENTS

Goals of Postpartum Hypertension Programs

(1) To provide ongoing monitoring and management of blood pressure with timely, active titration of antihypertensive medications

(2) To allow time for discussion and education of optimal cardiovascular lifestyle behaviors and modifications to prompt behavior change

(3) To initiate screening and management of cardiovascular risk factors (dyslipidemia, diabetes, obesity)

(4) To serve as a bridge to longitudinal care

Clinic Models

Clinic referral

Automated

All patients meeting criteria

Opt-in or opt-out

Visit scheduled prior to hospital discharge

Clinician-initiated

High-risk patients referred from inpatient or outpatient

OB, MFM, primary care, or sub-specialist

EHR order set

Patient-initiated

All patients given info about clinic and can call to schedule

Printed info at discharge, website

Clinic models

Consider telemedicine and HBPM to improve access

Combined obstetrics & specialty model

Co-located clinic.

Encounters can be shared or separate.

Primary care or subspecialty model

Specific postpartum visit type can help maintain timely access.

Obstetrics or family medicine model

Scheduled in addition to postpartum visit to focus on CV prevention

Clinic Activities

- Blood pressure measurement and management

- Weight management

- Assess social determinants of health

- CV risk factor screening
  - Lipid panel
  - Fasting glucose/HbA1c

- Lactation status
- Contraception

- CV risk assessment

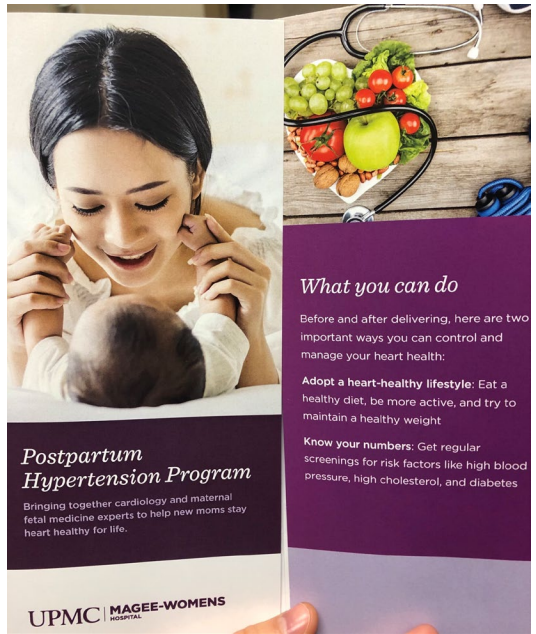
- Referrals – dietician, weight loss center, nephro, endocrine, social work, behavioral health

- Counseling
  - CV risk
  - Home blood pressure monitoring
  - Heart healthy lifestyle
  - Future preeclampsia risk

- Cardiac testing

Developing a Postpartum Hypertension Clinic

Bridges Clinic



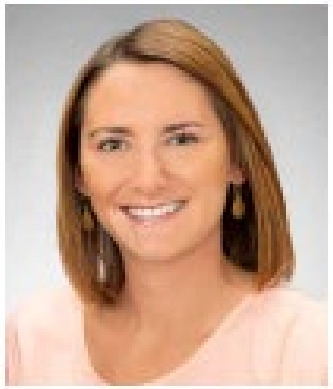
Meet our experts

Cardiology

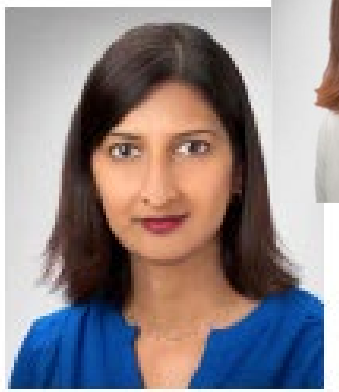
Kathryn Berlacher,

Malamo Countouris, MD

Maternal Fetal Medicine



Alisse Hauspurg, M



Arun Jeyabalan, MD

RESEARCH ARTICLE Open Access

Feasibility of Utilizing Telehealth in a Multidisciplinary Postpartum Hypertension Clinic

Malamo Countouris,[1,*] Valentina Jaramillo Restrepo,[2] Shruti Bidani,[3] Janet Catov,[4,5] Kathryn Berlacher,[1] Arun Jeyabalan,[4] and Alisse Hauspurg[4]

Table 4. Select Demographic and Follow-Up Characteristics for Patients Seen in the Postpartum Hypertension Clinic Compared with Overall Deliveries Complicated by Hypertensive Disorders of Pregnancy

	Overall deliveries with HDP[a] (*N* = 2307)	Seen in HDP clinic (*N* = 140)	*p*
Pregnancy demographics			
Age, mean ± SD (years)[b]	30.0 ± 5.9	33.6 ± 5.7	<0.01
Race, *n* (%)			0.02
White	1616 (70.0)	82 (58.6)	
Black	551 (23.9)	46 (32.9)	
Asian	81 (3.5)	9 (6.4)	
Other	59 (2.6)	3 (2.1)	
Type of insurance, *n* (%)			0.8
Private	1404 (60.9)	84 (60.0)	
Medicaid	903 (39.1)	56 (40.0)	
ADI	63.1 (26.4)	64.5 (25.0)	0.5

Women's Health Reports, 2022

We see an at-risk population

MEAN BMI (KG/M²)

31 ± 8

ANTI-HYPERTENSIVE MEDICATION USE

69%

MEAN BLOOD PRESSURE (mmHg)

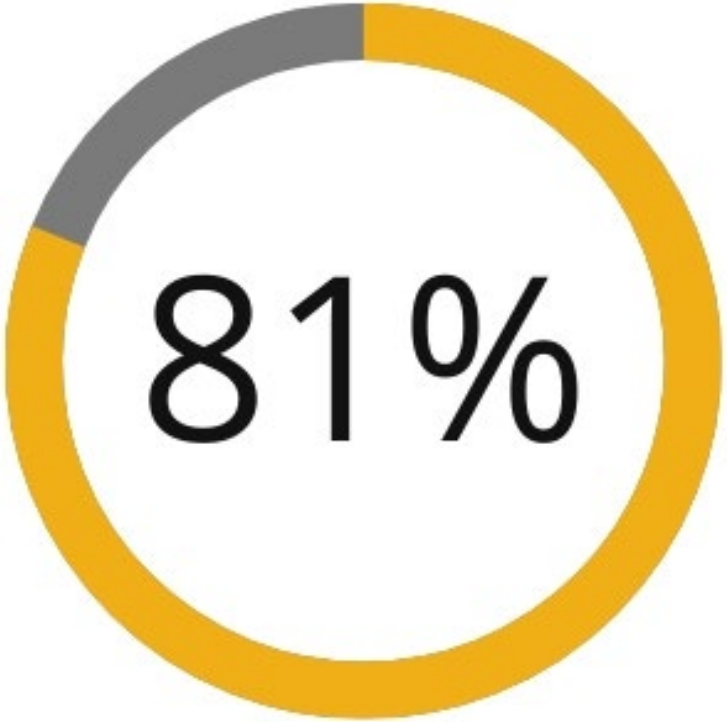
126/82

Countouris, Berlacher, Hauspurg et al Women's Health Reports, 2022

Outcomes for first 24 months

81% Show Rate

173 scheduled → 140 attended →



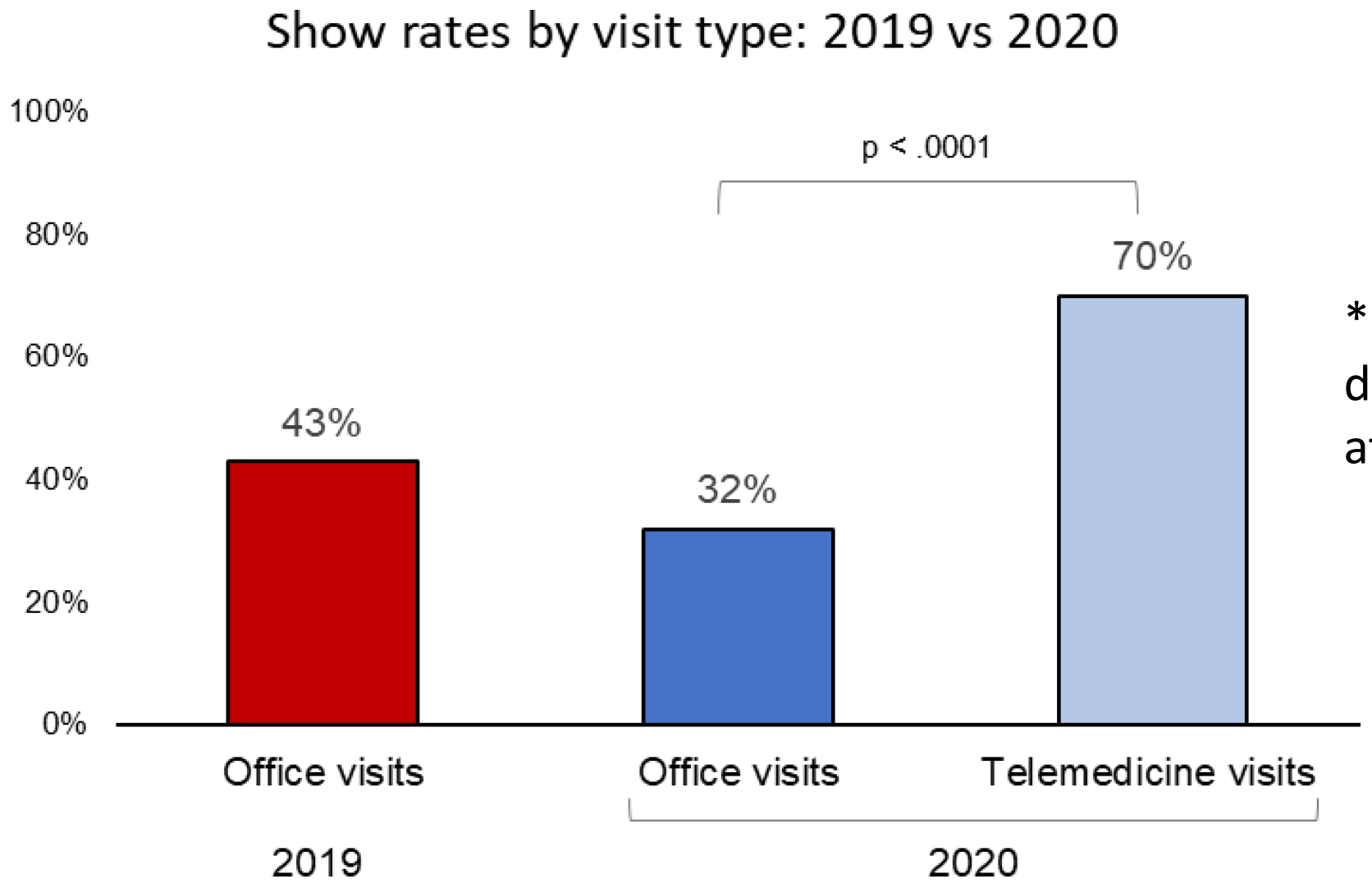
Results of Intervention to Address Barriers to Attendance - >70% had follow-up after nurse call

Self Reported Reasons for Non-Attendance	N (16)
Technology issue	5
Childcare	4
Death in the family	3
“A lot going on” (NICU, ED visit, school)	4

Outcome After Follow-Up Call (n=32)	
Rescheduled	15 (47%)
Following with PCP	8 (25%)
Declined to reschedule	4 (13%)
Did not answer	5 (16%)

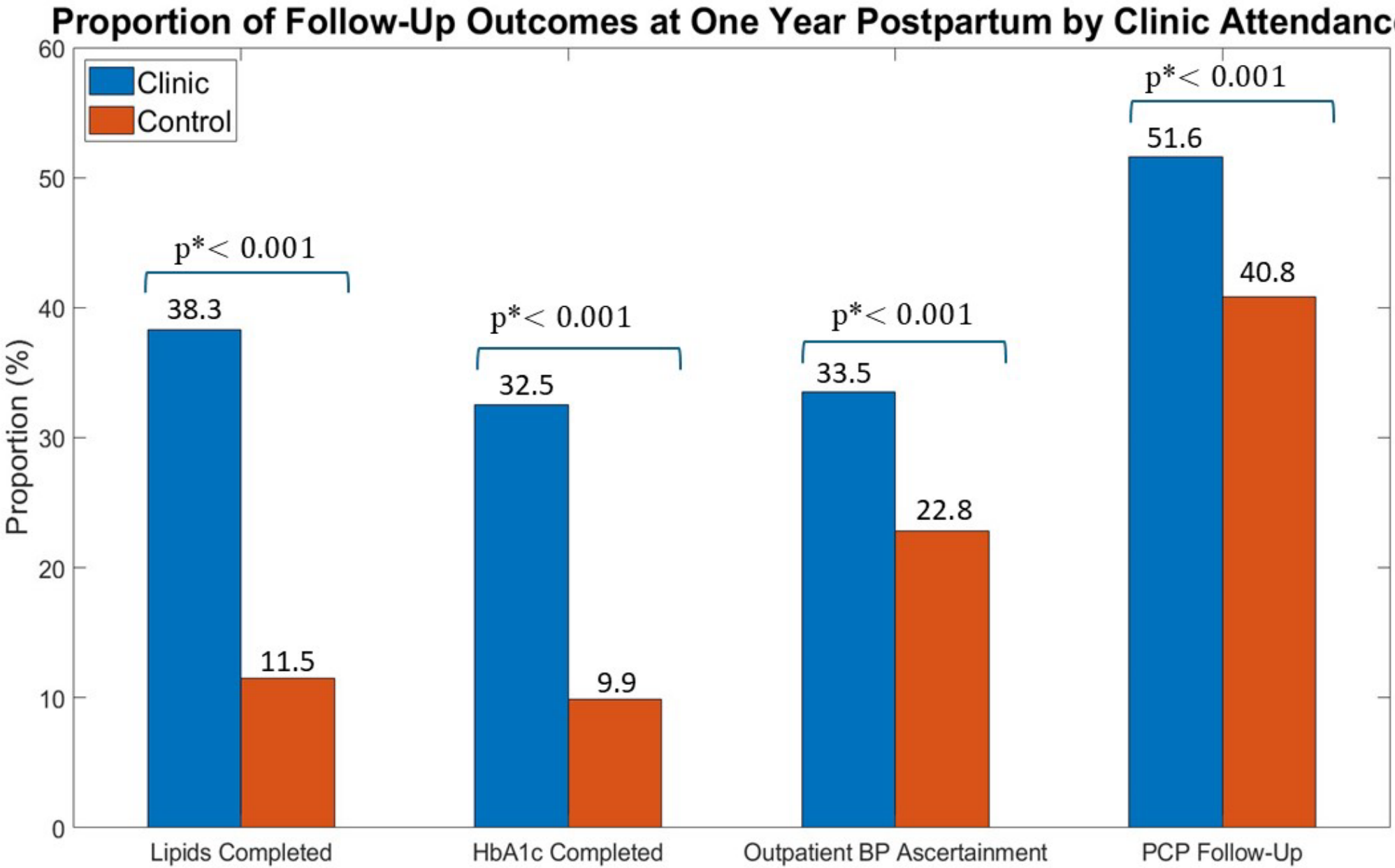
Credit: Nuzhat Kabir, MS-3

Virtual visits improve attendance



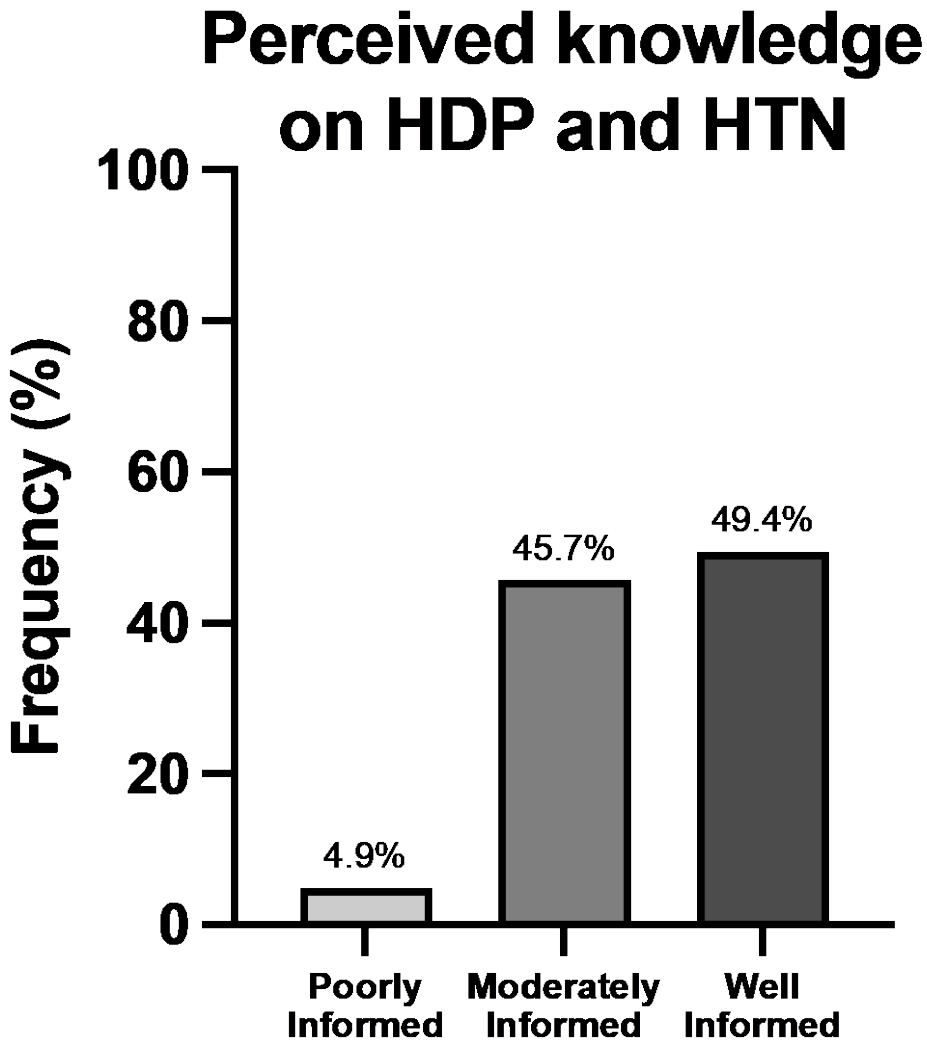
** Eliminated racial disparities in visit attendance

Sanghavi, Lewey, et al. *PLOS One, 2022*



Credit: Melina McCabe, MS-2

HDP patients in postpartum HTN clinic are well-informed about risk of HTN and future CVD



Credit: Caroline Smith, MS-2

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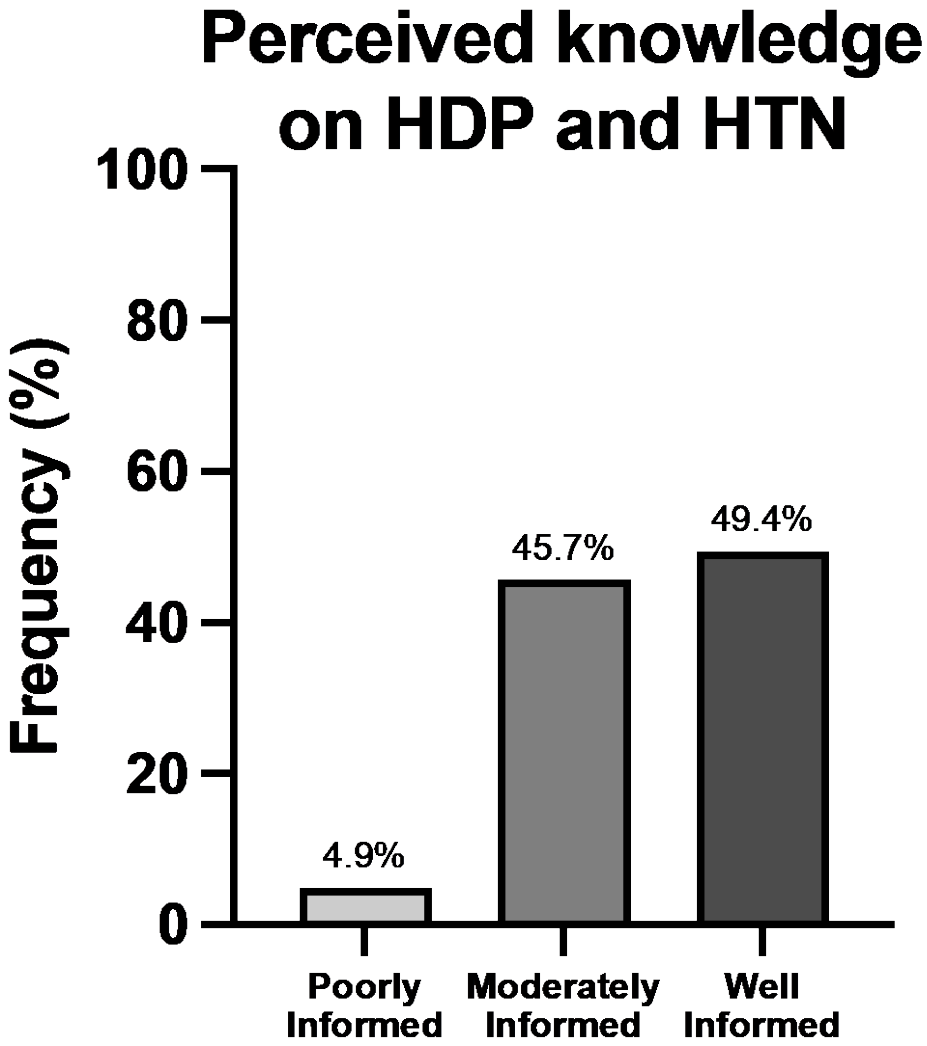

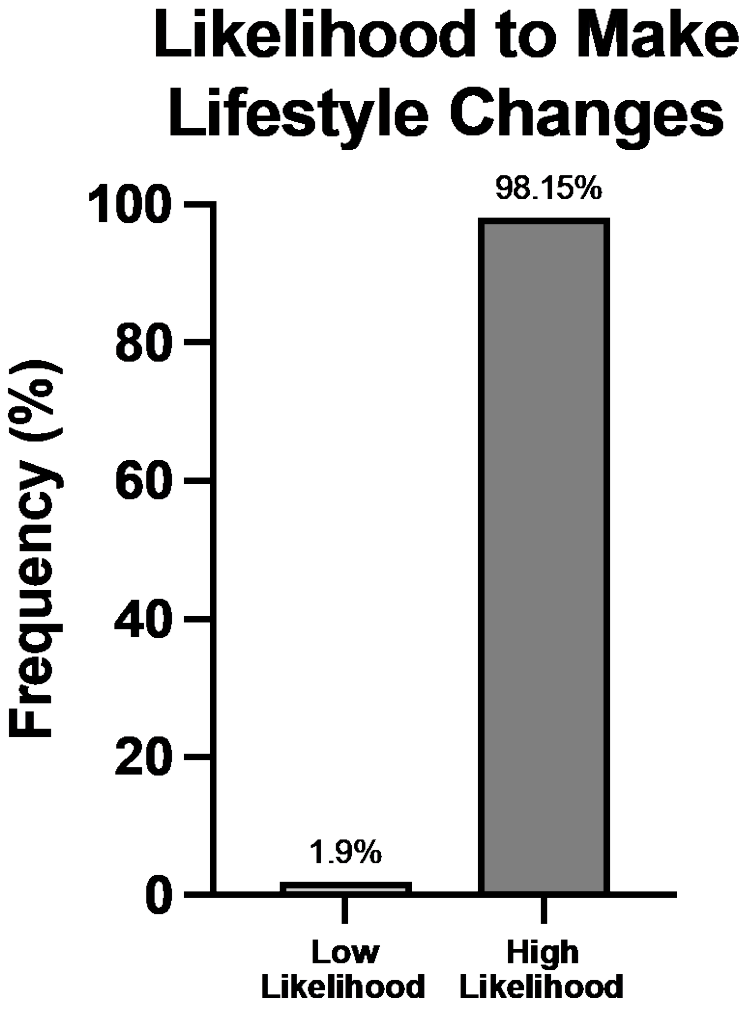

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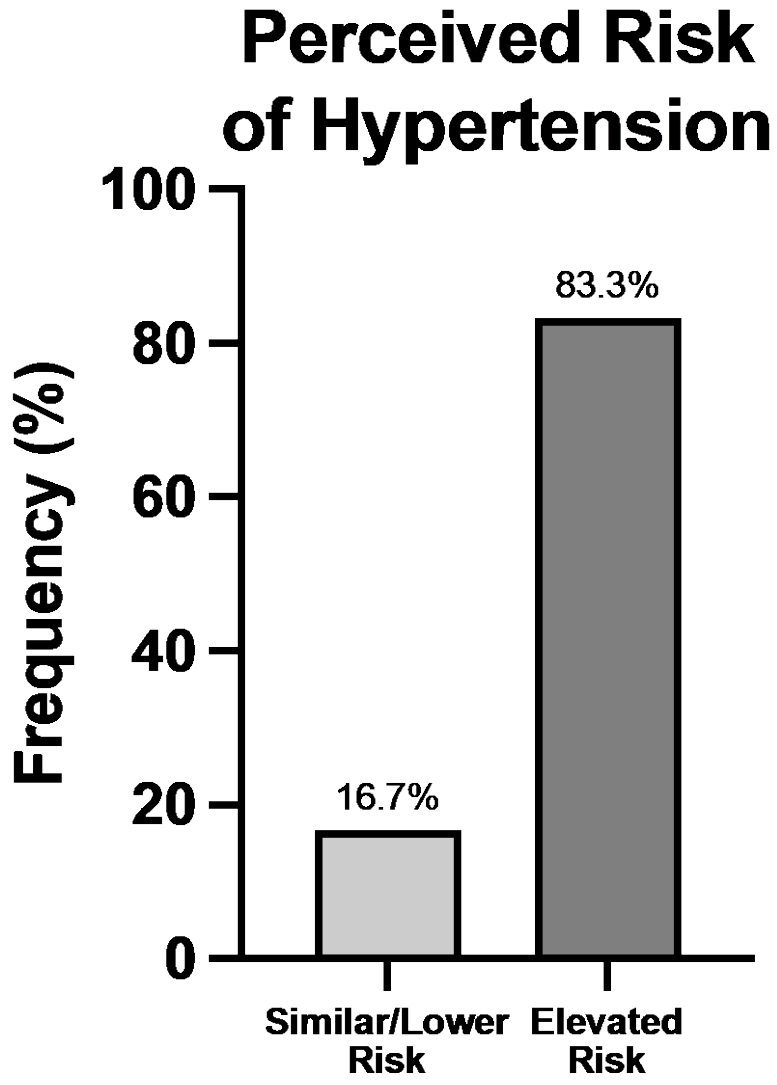

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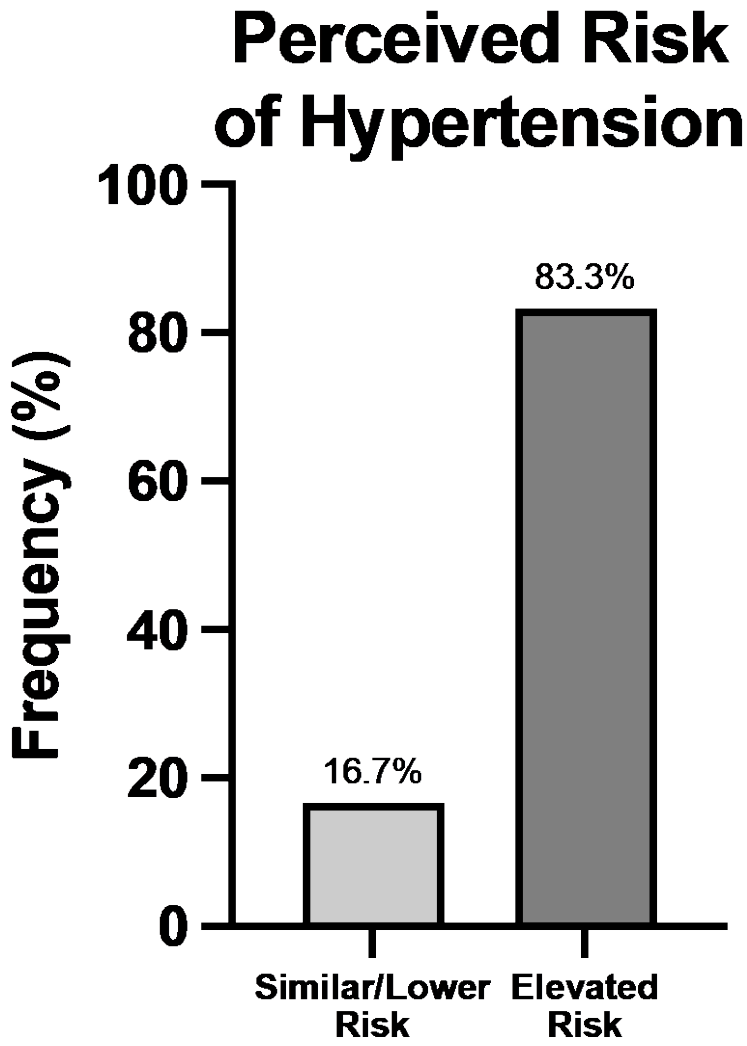
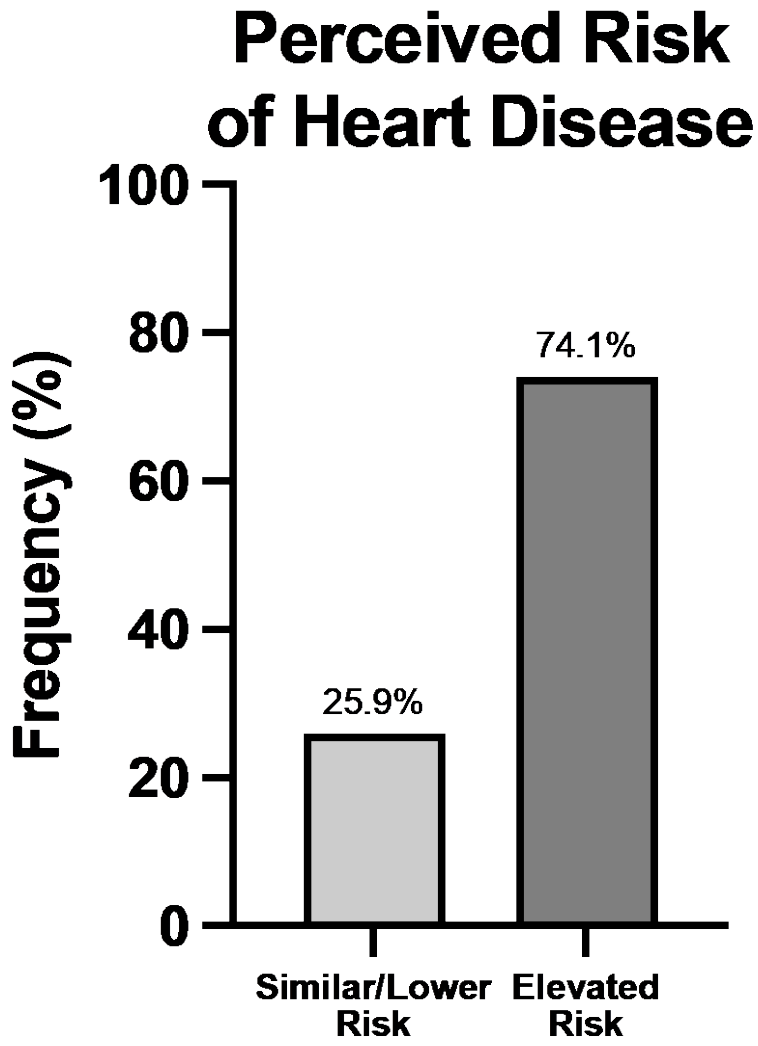
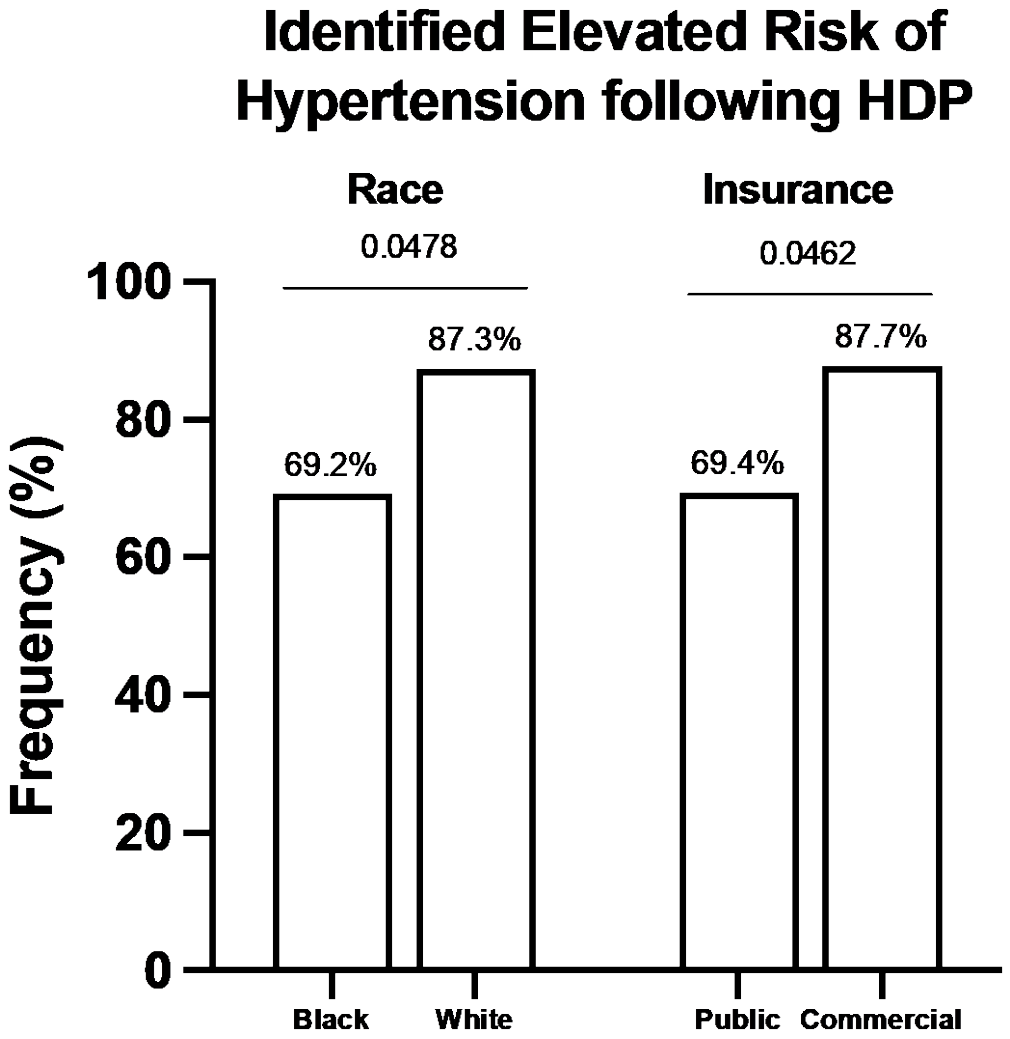




Credit: Caroline Smith, MS-2

Race and SES are associated with knowledge of HTN & CVD Risk



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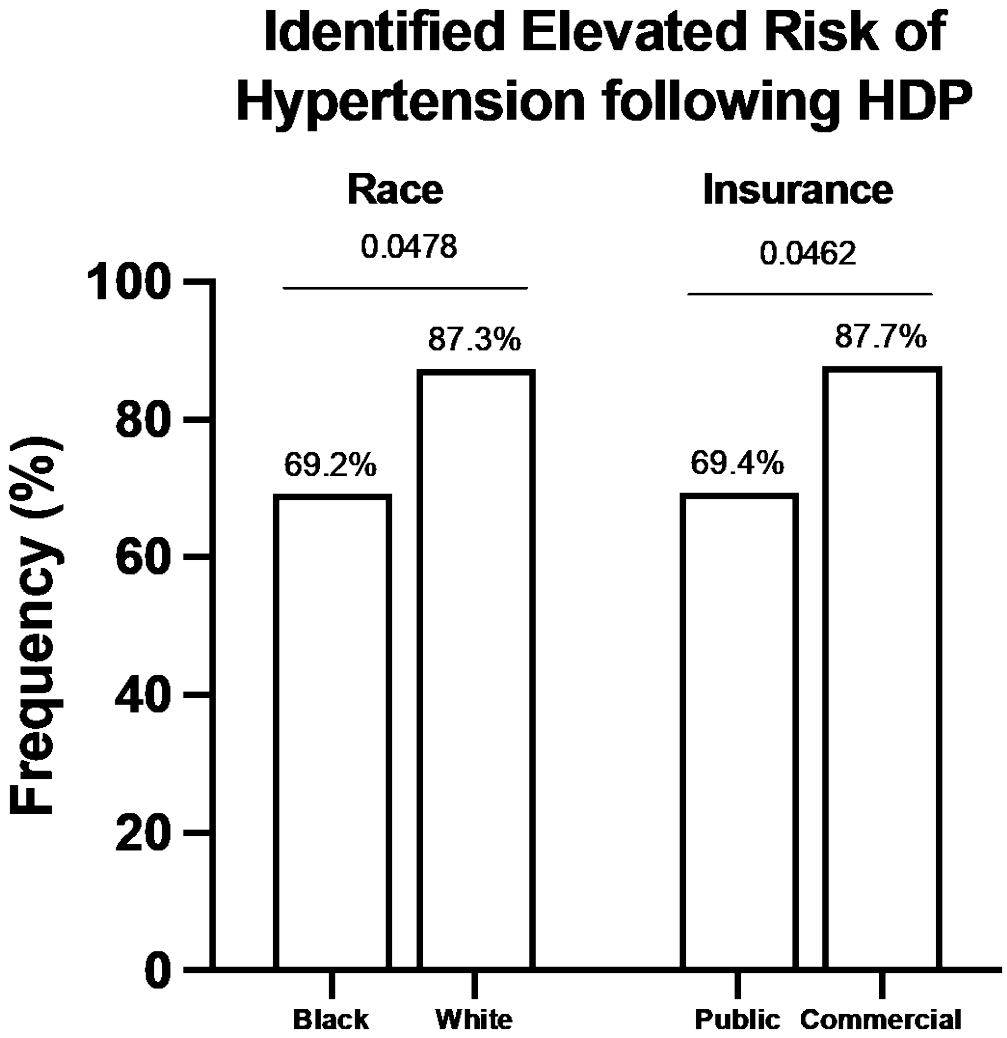
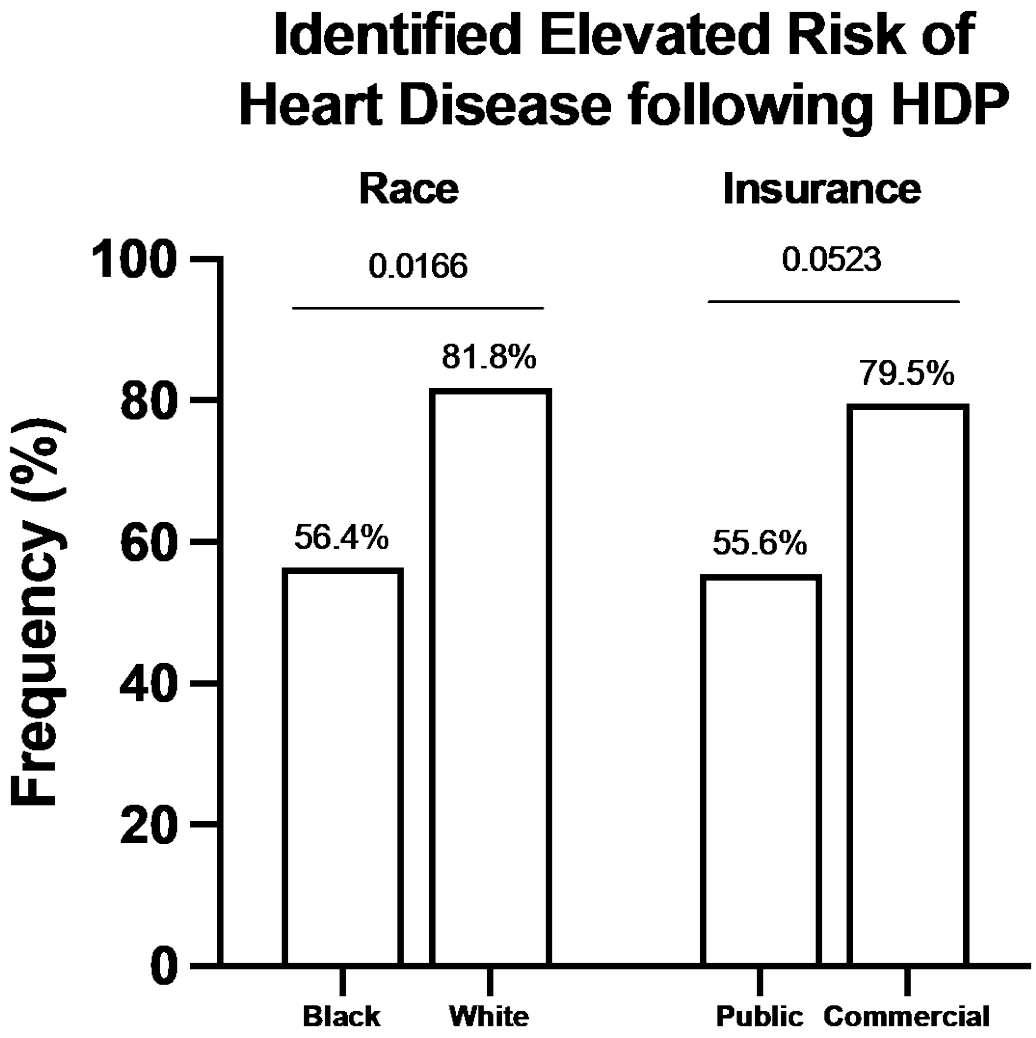
Race and SES are associated with knowledge of HTN & CVD Risk





Credit: Caroline Smith, MS-2

What do you think would be helpful for women with high blood pressure after delivery?

Being able to talk to a support group/person. My first experience with pre-eclampsia was very severe and after delivering my son, I developed PTSD and would have loved not having so many difficulties attempting to find someone to talk to that had an understanding of what I went through.

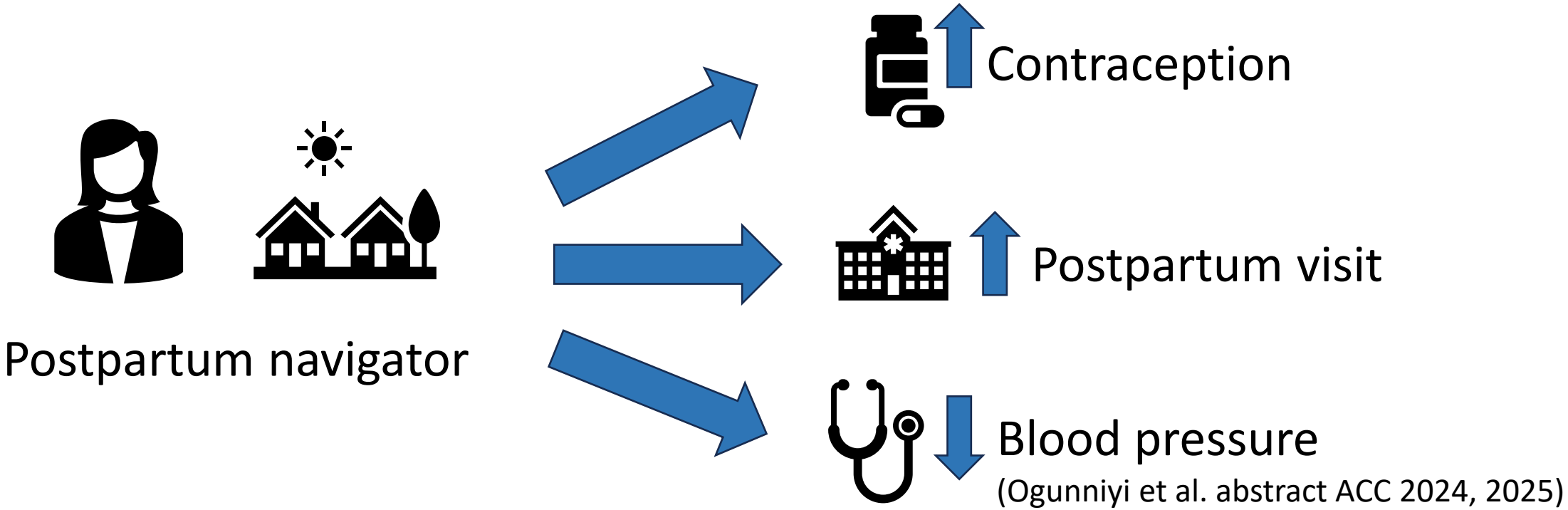
Written info and timelines for what people need to watch for and do; sleep deprivation and having a new baby makes it hard to remember things and with the overwhelmed health care system you often feel as though you're in your own to remember. Clear and concise - not paragraphs.

The daily monitoring and then Bridges program is incredibly helpful. I would feel really lost without it.

EASY meal ideas. 5 minute guided meditation videos. Detailed guidance on how to return to physical activity

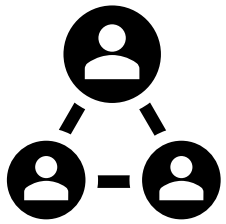
A postpartum coach

Postpartum Navigators, Doulas, and Community Health Workers



Yee et al., *Obstet Gynecol,* 2017

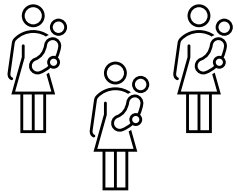
Ongoing initiatives: Ideas for interventions to reduce inequities and improve long-term health



Direct scheduling with PCPs

Targeted education sessions

Communication for missed appointments and labs to address barriers to care



Creating a peer support program

Ongoing research

Preeclampsia prevention

- Pravastatin for prevention of preeclampsia (ClinicalTrials.gov ID NCT01717586)

Postpartum medications for blood pressure recovery

- Aspirin for Postpartum Patients With Preeclampsia (ASAPP) (ClinicalTrials.gov ID NCT05924971)
- Treatment With Aspirin After Preeclampsia: TAP Trial (TAP) (ClinicalTrials.gov ID NCT06281665)
- Spironolactone to Improve Pregnancy-Associated Hypertension Trajectories (IMPACT-HT)

Postpartum care initiatives

- Comprehensive Postpartum Management for Women With Hypertensive Disorders of Pregnancy (ClinicalTrials.gov ID NCT05849103)
- Eliminating Severe Maternal Morbidity with Heart Health Doulas Trial (HHD) (ClinicalTrials.gov ID NCT05655936)

Postpartum blood pressure management

- Optimal Blood Pressure Treatment Thresholds Postpartum (ClinicalTrials.gov ID NCT06069102)
- Intensive Postpartum Antihypertensive Treatment (IPAT) (ClinicalTrials.gov ID NCT05687344)

Conclusions

- HDP are common and warrant close postpartum management due to increased maternal morbidity and mortality
- Access the **ACC Postpartum Hypertension Clinic Development Toolkit** from the ACC Cardio-Obstetrics and Reproductive Health website
- Remote BP monitoring programs improve postpartum outcomes
- CV risk factor screening, CV risk assessment, and BP management are key elements of a postpartum HTN clinic
- Virtual visits and remote BP monitoring help make postpartum care more feasible for diverse populations