Original Research

Clinical Outcomes Associated With a Remote Postpartum Hypertension Monitoring Program

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OBJECTIVE: To evaluate differences in health care utilization and guideline adherence for postpartum individuals with hypertensive disorders of pregnancy (HDP) who are engaged in a remote monitoring program, compared with usual care.

METHODS: This was a retrospective cohort study of postpartum individuals with HDP who delivered between March 2019 and June 2023 at a single institution. The primary exposure was enrollment in a remote hypertension management program that relies on patient home blood pressure (BP) measurement and centralized nursing team management. Patients enrolled in the program were compared with those receiving usual care. Outcomes included postpartum readmission, office visit within 6 weeks postpartum, BP measurement within 10 days, and initiation of antihypertensive medication. We performed multivariable logistic and conditional regression in a propensity score matched cohort. Propensity scores, generated by modeling likelihood of program participation, were assessed for even distribution by group, ensuring standardized bias of less than 10% after matching.

RESULTS: Overall, 12,038 eligible individuals (6,556 participants, 5,482 in the control group) were included. Program participants were more likely to be White, commercially insured, be diagnosed with preeclampsia, and have higher prenatal and inpatient postpartum BPs. Differences in baseline factors were well-balanced after implementation of propensity score. Program enrollment was associated with lower 6-week postpartum readmission rates, demonstrating 1 fewer readmission for every 100 individuals in the program (propensity score–matched adjusted risk difference [aRD] −1.5, 95% CI, −2.6 to −0.46; adjusted risk ratio [aRR] 0.78, 95% CI, 0.65–0.93). For every 100 individuals enrolled in the program, 85 more had a BP recorded within 10 days (propensity score–matched aRD 85.4, 95% CI, 84.3–86.6), and six more had a 6-week postpartum office visit (propensity score–matched aRD 5.7, 95% CI, 3.9–7.6). Program enrollment was also associated with increased initiation of an antihypertensive medication postpartum (propensity score–matched aRR 4.44, 95% CI, 3.88–5.07).

CONCLUSION: Participation in a postpartum remote BP monitoring program was associated with fewer postpartum hospital readmissions, higher attendance at postpartum visits, improved guideline adherence, and higher rates of antihypertensive use.

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Maternal morbidity and mortality are increasing in the United States, with the majority of deaths occurring in the postpartum period.[1] Hypertension complicates 10–20% of pregnancies, and is a significant contributor to postpartum morbidity and mortality.[2] Prior studies have shown worsening hypertension between days 3 and 6 postpartum, typically after discharge from the delivery hospitaliza-

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tion, which can be associated with serious morbidity, including seizure, stroke, and, rarely, death.[3,4] Additionally, blood pressures (BPs) can be labile during the postpartum period, necessitating frequent antihypertensive medication titrations.[5,6] As such, hypertensive disorders of pregnancy (HDP) are the most common etiology of postpartum readmissions with a significant associated cost burden.[7]

The American College of Obstetricians and Gynecologists (ACOG) recommends that individuals with HDP have their BP measured within 10 days after delivery.[2,8] However, prior studies have shown that attendance at these recommended in-person visits is low, with less than 50% of patients attending in-office BP checks.[9,10] More recently, with the growth of telemedicine, many institutions have developed and implemented remote BP management programs. A recent systematic review contracted by the Agency for Healthcare Research and Quality demonstrated that home BP monitoring likely improves ascertainment of BP in the immediate postpartum period; however, the effect of these programs on postpartum outcomes is less clear.[11] The objective of this study was to evaluate outcomes after implementation of a remote monitoring program for postpartum individuals with HDP. Specifically, we sought to evaluate the association between enrollment in the remote monitoring program and postpartum care utilization, attendance at a postpartum office visit, and initiation of antihypertensive medications within 6 weeks postpartum.

METHODS

This was a retrospective cohort study that included all birthing individuals who were eligible for our remote hypertension management program and delivered between March 2019 and June 2023 at Magee-Womens Hospital. Magee-Womens Hospital is the largest delivery hospital in Pennsylvania, with an estimated 10,000 births each year; 30% of birthing individuals have HDP and are eligible for remote BP management. Eligibility for the program requires a diagnosis of HDP during the delivery admission (preexisting or pregnancy-induced), or at least two inpatient postpartum BPs higher than 140/90 mm Hg during the delivery hospitalization.[12] Participants must speak English, Spanish, or Portuguese, and have a cellular device that accepts text messages. Individuals opt in to the program and are enrolled either by manual entry by a physician or nurse or through recognition by an automated flag created in the electronic medical record to identify individuals with multiple elevated BPs during the delivery hospitalization. The automated flag is set up to send a daily list of individuals with elevated BPs to the nurse managers on the postpartum units to ensure all eligible individuals are offered participation in the program. Once enrolled, patients are provided with a BP cuff and taught how to properly measure their BP at home.

We designed nursing call center-driven BP management and treatment algorithms that were developed by local expert stakeholders, consistent with national guidelines on goals for hypertension management postpartum.[2] After discharge from the hospital, individuals are prompted by text to check their BP at least daily for the first 2 weeks of the program and between three and five times per week for the remainder of the program through 6 weeks postpartum. Blood pressures are reported using text messaging. Elevated BPs (140/90 mm Hg or higher) or symptoms trigger automated alerts within the portal, which are reviewed by nursing staff and prompt physician contact based on our established protocol.[5] Because there are no clear guidelines on BP thresholds for antihypertensive medication initiation or titration in the postpartum period, decision making surrounding medication management is based on clinical judgment from the call center physician. Our program uses four call center physicians, all of whom are board-certified maternal–fetal medicine physicians who have been overseeing the program since its inception in 2018. Individuals with symptoms such as chest pain, severe headache, visual disturbances, shortness of breath, or BPs of 180 mm Hg systolic or 120 mm Hg diastolic or higher are referred to the emergency department (ED) for further evaluation.

All data were extracted from the University of Pittsburgh Medical Center's Clinical Data Warehouse, which stores all discrete documentation into the electronic health records. Baseline sociodemographic characteristics included year of delivery, race and ethnicity, maternal age, insurance, medical comorbidities, prepregnancy and time-of-delivery body mass index (BMI, calculated as weight in kilograms divided by height in meters squared), area deprivation index for neighborhood of residence, parity, plurality, and gestational age at first prenatal visit. Additional clinical characteristics included type of hypertension, receipt of magnesium sulfate, mode of delivery, and discharge on an antihypertensive medication. Inpatient and outpatient visit BPs were extracted from the Clinical Data Warehouse. Additionally, the Clinical Data Warehouse stored BPs that were patient-entered into a cell-phone interface through the third-party platform (Vivify). Blood pressures recorded in the hospital, at an office visit, or through the program

were included in the analysis. Variables missing at the prenatal visit were filled in with those populated at the time of delivery if available. If they remain missing, these variables were replaced with the median value by exposure group. The remote monitoring program was approved by the University of Pittsburgh Medical Center's Quality Improvement Review Committee, and this research was reviewed by the University of Pittsburgh IRB. Data collection and analysis were approved as an exempt study posing no greater than minimal risk; thus, written informed consent was not required.

The primary exposure was enrollment in the remote monitoring program. Because all individuals in this population are offered participation, we defined *enrollment* as accepting enrollment in the program and at least one remote BP entry postpartum. The primary outcome was postpartum care utilization, including hospital (readmission and ED visits) along with attendance of a postpartum office visit within 6 weeks postpartum. Secondarily, we assessed hypertension-specific outcomes, including adherence to ACOG guidelines of BP measurement within 10 days of delivery and initiation of antihypertensive medications in the postpartum period. We compared eligible patients enrolled in the program with those who were not enrolled, using Pearson's χ^2, two sample t tests, and Wilcoxon rank-sum tests, as appropriate. Because patients who enrolled in the program were different at baseline from those who did not enroll (Table 1), we generated propensity scores using logistic regression to model likelihood of program enrollment. Propensity scores included demographic and clinical information obtained about the individual before program enrollment. Variables included in the propensity score were a combination of a priori decisions made by clinical experts, along with data-driven decisions from univariable analysis. Scores were evaluated for balance between groups.

We then conducted logistic regression modeling for each postpartum outcome, using three approaches to evaluate robustness of our results: 1) propensity score-matched conditional logistic regression, 2) propensity score-adjusted multivariable logistic regression, and 3) multivariable logistic regression adjusted for known confounders. Matching on likelihood of engagement was completed in a 1:1 ratio matching to nearest neighbor with a caliper of 0.036 without replacement. Results are reported as both risk-adjusted frequencies and associated difference for every 100 patients engaged in the program, along with risk ratios.

We performed a secondary analysis to evaluate BP trajectories for participants in the remote monitoring program. Blood pressures at first prenatal visit, average inpatient BPs before delivery, average inpatient postpartum BPs, BPs closest to 7 days (within 2 days; ie, between 5 and 9 days) and at 6 weeks (within 2 weeks; ie, between 4 and 8 weeks postpartum) postpartum were used as the time points of interest. We limited this analysis to only patients engaged in the program due to differential missingness of BP recorded at 6 weeks when attempting to compare with those not enrolled (61% vs 80%, no remote monitoring vs remote monitoring; $P<.001$), and because prior work has demonstrated that BPs recorded at office visits vary from self-measured home BP values.[13] This secondary analysis included only participants with data available at all five time points in care and was limited to BPs entered remotely.

All analyses were performed using Stata 16.0. $P<.05$ was considered statistically significant.

RESULTS

In our cohort of 12,038 deliveries eligible for remote monitoring of hypertension, a total of 6,566 (54.5%) enrolled in the program and had at least one remote BP measurement. Rates of participation varied by year (Table 1). Individuals who enrolled in the program were more likely to be non-Hispanic White, be commercially insured, and reside in a more advantaged neighborhood. Clinically, individuals engaged in the program had higher prepregnancy weights and BMI at time of delivery, were more likely to be nulliparous, have prenatal care within the University of Pittsburgh Medical Center that started earlier, be hypertensive in pregnancy (gestational hypertension 55.1% vs 41.5%, $P<.001$; preeclampsia 9.6% vs 3.9%, $P<.11$), deliver by cesarean, receive inpatient intravenous magnesium sulfate (29.0% vs 9.3%, $P<.001$), and be discharged on an antihypertensive medication (28.1% vs 8.4%, $P<.001$). Both prenatal and inpatient systolic BP (prenatal: 139 vs 134 mm Hg; $P<.001$; inpatient: 147 vs 142 mm Hg; $P<.001$) and diastolic BP (prenatal: 88 vs 84 mm Hg; $P<.001$; inpatient: 93 vs 91 mm Hg; $P<.001$) were significantly higher in the enrolled group.

In univariable analyses, patients enrolled in the remote monitoring program were more likely to attend an office visit within 6 weeks postpartum (77.0% vs 64.4%, $P<.001$), be initiated on a new antihypertensive postpartum (24.4% vs 5.4%, $P<.001$), have a BP recorded at 10 days or less from the time of delivery (97.6% vs 11.5%, $P<.001$), and be at 6 weeks postpartum (80.2% vs 60.9%, $P<.001$). Five baseline variables had missing data that were equally distributed across groups: area deprivation index (5%), parity (6%), plurality (1%), weight (less than 1%) and height at time of delivery (less than 1%).

Table 1. Baseline Sociodemographic and Clinical Characteristics of Patients Eligible for Remote Monitoring at Magee-Womens Hospital Between March 1, 2019, and June 30, 2023 (N=12,038), Comparing Individuals Enrolled in a Remote Blood Pressure Monitoring Program With Those Not Enrolled*

Characteristic	Remote BP Monitoring		
	No (n=5,482)	Yes (n=6,556)	P†
Delivery year			
2019	1,468 (26.8)	700 (10.7)	<.001
2020	1,187 (21.7)	1,493 (22.8)	
2021	1,149 (21.0)	1,646 (25.1)	
2022	1,158 (21.1)	1,810 (27.6)	
2023	520 (9.5)	907 (13.8)	
Self-reported race			
Black	1,357 (24.8)	1,333 (20.3)	<.001
White	3,710 (67.7)	4,829 (73.7)	
None of the above	396 (7.2)	362 (5.5)	
Unknown	19 (0.3)	32 (0.5)	
Ethnicity			
Not specified	529 (9.6)	362 (5.5)	<.001
Hispanic or Latina	117 (2.1)	111 (1.7)	
Not Hispanic or Latina	4,836 (88.2)	5,961 (90.9)	
Maternal age (y)	30.3±5.6	30.7±5.6	.002
BMI at time of delivery (kg/m²)	34 (29, 40)	35 (30, 40)	<.001
Insurance			
Commercial	2,964 (54.1)	4,240 (64.7)	
Medicaid	2,301 (42.0)	2,144 (32.7)	
Medicare	85 (1.6)	79 (1.2)	
Self-pay or other	132 (2.4)	93 (1.4)	
Area deprivation index	63.5±28.5	61.2±28.3	<.001
Nulliparous	2,720 (49.6)	3,805 (58.0)	<.001
Prenatal care at UPMC	4,964 (90.6)	6,135 (93.6)	<.001
Singleton delivery	5,270 (96.1)	6,236 (95.1)	.007
Gestational age at 1st visit (d)	65 (56, 84)	64 (55, 78)	<.001
Trimester at first visit			
1st	3,967 (72.4)	5,186 (79.1)	<.001
2nd	675 (12.3)	625 (9.5)	
3rd	307 (5.6)	313 (4.8)	
Prepregnancy weight (lb)	170 (140, 210)	175 (145, 213)	<.001
Comorbidity			
Morbid obesity	1,232 (24.8)	1,610 (26.2)	.087
Chronic HTN	669 (13.5)	791 (12.9)	.37
Any gestational HTN	2,060 (41.5)	3,380 (55.1)	<.001
Preeclampsia	193 (3.9)	587 (9.6)	<.001
Diabetes, type 1 or type 2	141 (2.8)	203 (3.3)	.16
GDM	611 (12.3)	778 (12.7)	.56
Anxiety	952 (19.2)	1,348 (22.0)	<.001
Depression	1,063 (21.4)	1,416 (23.1)	.036
Cesarean delivery	2,266 (41.3)	2,871 (43.8)	.007
BP (mm Hg)			
Highest prenatal SBP	134 (128, 142)	139 (130, 146)	<.001
Highest prenatal DBP	84 (80, 90)	88 (82, 94)	<.001
Highest postpartum SBP within 2 h of delivery	142 (133, 150)	147 (137, 158)	<.001
Highest postpartum DBP within 2 h of delivery	91 (85, 98)	93 (87, 101)	<.001
Inpatient magnesium sulfate	511 (9.3)	1,898 (29.0)	<.001
SMM	375 (6.8)	416 (6.3)	.27
Discharged on antihypertensive meds	459 (8.4)	1,840 (28.1)	<.001

BP, blood pressure; BMI, body mass index; UPMC, University of Pittsburgh Medical Center; HTN, hypertension; GDM, gestational diabetes; SBP, systolic blood pressure; DBP, diastolic blood pressure; SMM, severe maternal morbidity.
Data are n (%), mean±SD, or median (interquartile range) unless otherwise specified.
* Variables missing at the prenatal visit were filled in with those populated at the time of delivery if available.
† Pearson's χ^2, two sample *t* test, or Wilcoxon rank-sum, as appropriate.

Propensity scores were well balanced, with 11,988 (99%) in the area of common support (Appendices 1–3, available online at http://links.lww.com/AOG/D749). Final propensity score models included delivery year and month, maternal race and ethnicity, insurer, area deprivation index, BMI, parity, singleton compared with multiple gestation, mode of delivery, induced delivery, highest inpatient postpartum BPs within 2 hours after delivery, having prenatal care within the University of Pittsburgh Medical Center, pregnancy comorbidities (preexisting hypertension, preeclampsia, gestational hypertension, gestational diabetes, anxiety, depression, cardiomyopathy), delivering practitioner, and severe maternal morbidity at time of delivery. When matched in a 1:1 ratio on propensity score, all variables had a standardized bias decreased to be less than 10% (Fig. 1).

In primary analyses, program participation was consistently associated with decreased hospital readmission. Results demonstrate 1 less readmission for every 100 patients engaged in the program (propensity score–matched adjusted risk difference [aRD] −1.5, 95% CI, −2.6 to −0.46), with no significant difference in ED visits (Table 2). There were also six more individuals attending an office visit within 6 weeks postpartum (propensity score–matched aRD 5.7, 95% CI, 3.9–7.6). Adherence to hypertension-specific guidelines increased, indicating 85 more individuals with a BP recorded within 10 days of delivery (propensity score–matched aRD 85.4, 95% CI, 84.3, 86.6) and 20 more initiated on an antihypertensive medication (propensity score–matched aRD 20.0, 95% CI, 18.4–21.5) for every 100 engaged in the program (Table 2).

In the secondary BP trajectory analyses, 4,334 patients enrolled in the program had at least one BP recorded prenatally, during delivery admission, at 7 days and 6 weeks postpartum. Trajectories demonstrate a marked increase in systolic BP at 1 week postpartum that importantly returns to prenatal values

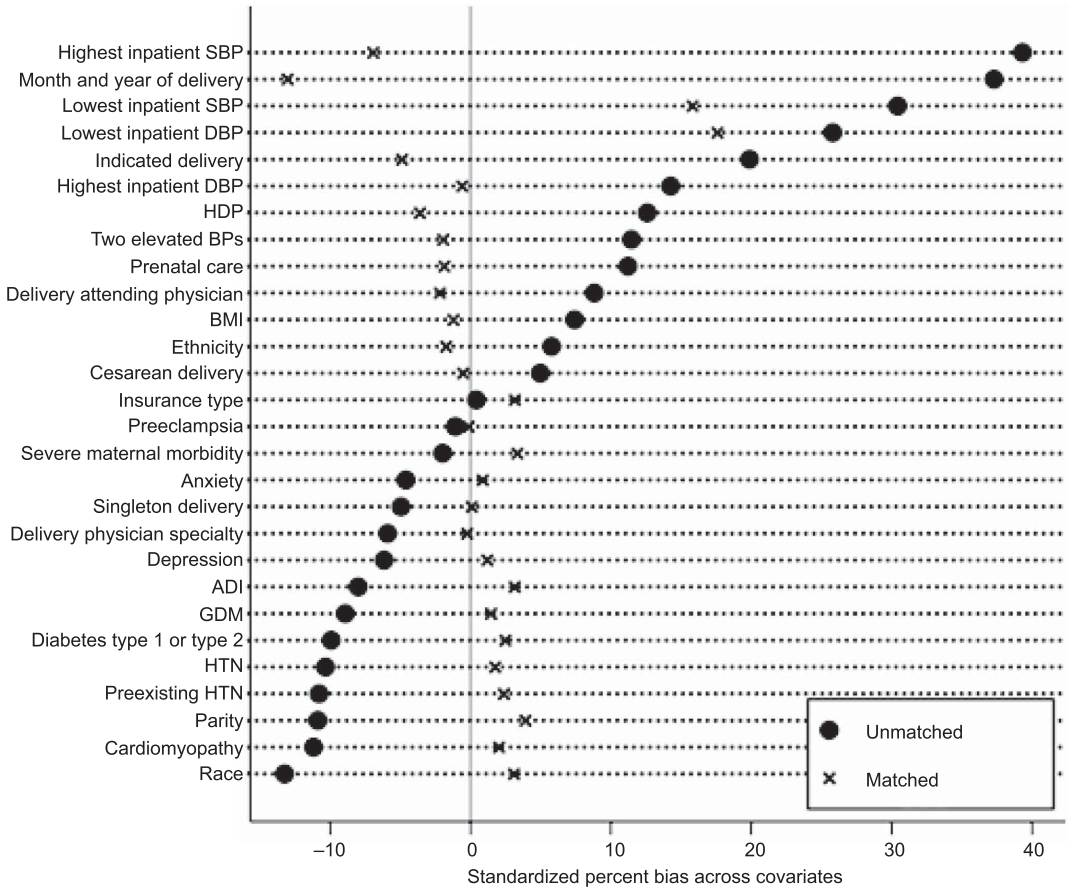

Fig. 1. Standardized bias for demographics and delivery characteristics before and after matching on propensity score. SBP, systolic blood pressure; DBP, diastolic blood pressure; HDP, hypertensive disorders of pregnancy; BP, blood pressure; BMI, body mass index; ADI, area deprivation index; GDM, gestation diabetes mellitus; HTN, hypertension.

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by 6 weeks postpartum for patients enrolled in the program (Fig. 2; 121.1 mm Hg vs 120.6 mm Hg; paired *t* test $P=.045$). Trajectories of diastolic BP show a similar spike at 7 days, though they did not return entirely to prenatal measurements by 6 weeks postpartum (75.5 mm Hg vs 78.6 mmHg; paired *t* test $P<.001$).

DISCUSSION

We found that participation in a postpartum remote BP management program was associated with fewer postpartum hospital readmissions, higher attendance at postpartum visits, improved national guideline adherence, and higher rates of antihypertensive use. Importantly, although we and others have previously shown that remote BP management improves ascertainment of BP, this study demonstrates the downstream effects of such a program on clinical outcomes.[10–12,14] Additionally, BP trajectories for patients enrolled in the program demonstrated that systolic BPs returned to prenatal values despite a marked increase in the first 7 days postpartum. These findings have implications for reducing hypertension-related maternal morbidity and mortality in the postpartum period.

There are significant limitations to the postpartum care structures in the United States, namely that the majority of postpartum individuals do not attend visits after delivery.[8] The major barriers to in-person care that exist in the postpartum period are only exacerbated among individuals in the most marginalized groups, who may have difficulties accessing transportation, obtaining child care, or may have to return to work soon after delivery.[15,16] Blood pressure peaks on postpartum days 5–7, as previously reported and confirmed in our data, and these gaps in care in the postpartum period may lead to untreated severe hypertension and resultant hypertension-related morbidity.[3,17] Thus, innovative care in the postpartum period is essential to reducing maternal morbidity and mortality in the United States.

Home BP monitoring has been consistently shown to improve adherence to ACOG guidelines; however, whether that translates to a reduction in maternal morbidity or improved outcomes has not been as well studied.[9,11,12,14,18] In line with prior studies, we demonstrate that more than 95% of postpartum individuals participating in remote monitoring have a BP ascertained within the first 10 days after delivery. Although improved ascertainment of BP in this period is critical to identify hypertension, it is not necessarily sufficient to improve outcomes unless combined with access to systems for medication initiation and escalation of care, if needed. We demonstrate that, when compared with individuals who did not enroll, those who participated in our home management program were more than 4-fold more likely to be initiated on antihypertensive agents in the postpartum period, which may translate to improvements in postpartum BP trajectory.

Although patients who participated had higher BP at the time of their delivery hospitalization and clinical evidence of more severe hypertensive disease (ie, more likely to be treated with magnesium, more likely to be discharged on antihypertensive medications), our program was associated with a return to early prenatal systolic BP by the 6 weeks postpartum. This improved BP control in the postpartum period has the potential to affect longer-term maternal cardiovascular health. The SNAP-HT (Self-Management of Postnatal Hypertension) POP-HT (Physician-Optimized Postpartum Hypertension Treatment) trials randomized postpartum individuals on antihypertensive agents after HDP to usual care with in-office BP assessments compared with home BP monitoring plus management with systematic titration of antihypertensive medications in the postpartum period.[19,20] Both studies found improvements in diastolic BP with a lowering of 4.5 mm Hg seen in the intervention group up to 6 months postpartum, improved cardiovascular remodeling and have more recently have demonstrated sustained effects up to 3–4 years postpartum.[21]

The relationship between home BP management programs and care utilization is more complex. Hypertensive disorders of pregnancy are the most common reason for postpartum hospital readmission, with significant health care and personal costs and implications on maternal–infant bonding.[7,22] However, increasing recognition of hypertension and contact with the health care system has the potential to lead to an increase in ED visits and postpartum hospital readmissions. Although we demonstrate a reduction in postpartum hospital readmissions associated with our remote management program, our readmission rates are higher than previously published studies, which range from 1.5% to 5.0%.[9,10,14] This is likely related to baseline demographic differences and geographic variation in practice. In line with prior studies, we also demonstrate that program participants were more likely to attend 6-week in-person postpartum visits when compared with those who did not participate. Although there may be significant upfront costs to establish remote monitoring programs, recent analyses have demonstrated that these programs are cost saving at $93 per patient

Table 2. Risk-Adjusted Frequency of Outcomes Comparing Individuals Enrolled in a Remote Monitoring of Postpartum Hypertension Program With Those Who Were Eligible But Did Not Participate (N=12,038)

Model	n	Total Visits	
		RM	No RM
Readmission within 6 wk			
PS-matched†	8,166	219/4,083 (5.4)	285/4,083 (7.0)
PS-adjusted	11,988	371/6,555 (5.7)	351/5,433 (6.5)
Crude	12,038	371/6,556 (5.7)	354/5,482 (6.5)
ED visit within 6 wk			
PS-matched†	8,166	468/4,083 (11.5)	459/4,083 (11.2)
PS-adjusted	11,988	758/6,555 (11.6)	618/5,433 (11.4)
Crude	12,038	758/6,556 (11.6)	620/5,482 (11.3)
Office visit within 6 wk			
PS-matched†	8,166	3,014/4,083 (73.8)	2,722/,4,083 (66.7)
PS-adjusted	11,988	5,044/6,555 (77.0)	3,509/5,433 (64.6)
Crude	12,038	5,045/6,556 (77.0)	3,528/5,428 (64.4)
BP recorded within 10 d of delivery			
PS-matched†	8,166	3,990/4,083 (97.7)	482/4,083 (11.8)
PS-adjusted	11,988	6,400/6,555 (97.6)	627/5,433 (11.5)
Crude	12,038	6,401/6,556 (97.6)	629/5,482 (11.5)
Initiation of antihypertensive medications			
PS-matched†	8,166	1,023/4,083 (25.1)	245/4,083 (6.0)
PS-adjusted	11,988	1,599/6,555 (24.4)	293/5,433 (5.4)
Crude	12,038	1,599/6,556 (24.4)	294/5,482 (5.4)

Model	Risk-Adjusted* Frequency/100 Deliveries (95% CI)			
	RM	No RM	RD/100 Deliveries (95% CI)	RR (95% CI)
Readmission within 6 wk				
PS-matched†	5.4 (4.7–6.1)	6.9 (6.2–7.7)	−1.5 (−2.6 to −0.46)	0.78 (0.65–0.93)
PS-adjusted	5.4 (4.8–5.9)	6.9 (6.2–7.6)	−1.5 (−2.5 to −0.61)	0.78 (0.67–0.90)
Crude	5.4 (4.9–6.0)	6.8 (6.1–7.5)	−1.3 (−2.3 to −0.40)	0.80 (0.69–0.93)
ED visit within 6 wk				
PS-matched†	11.5 (10.5–12.5)	11.2 (10.2–12.2)	0.34 (−1.1 to 1.7)	1.03 (0.91–1.17)
PS-adjusted	P1.6 (10.8–12.3)	11.4 (10.5–12.3)	0.15 (−1.1 to 1.4)	1.01 (0.91–1.13)
Crude	11.7 (10.9–12.5)	11.1 (10.3–12.0)	0.60 (−0.62 to 1.8)	1.05 (0.95–1.17)
Office visit within 6 wk				
PS-matched†	73.2 (71.9–74.4)	67.4 (66.1–68.7)	5.7 (3.9–7.6)	1.08 (1.06–1.11)
PS-adjusted	75.2 (74.1–76.3)	67.1 (65.8–68.3)	8.2 (6.4–9.9)	1.12 (1.09–1.15)
Crude	74.8 (73.5–P5.5)	67.6 (66.5–68.8)	6.9 (5.3–8.5)	1.10 (1.08–1.13)
BP recorded within 10 d of delivery				
PS-matched†	97.6 (97.1–98.1)	12.2 (11.2–13.2)	85.4 (84.3–86.6)	8.00 (7.35–8.71)
PS-adjusted	97.6 (97.3–98.0)	11.6 (10.7–12.5)	86.1 (85.1–87.1)	8.43 (7.79–9.12)
Crude	97.5 (97.2–97.9)	11.7 (10.8–12.7)	85.8 (84.8–86.8)	8.31 (7.67–9.00)
Initiation of antihypertensive medications				
PS-matched†	25.8 (24.4–27.1)	5.8 (5.1–6.5)	20.0 (18.4–21.5)	4.44 (3.88–5.07)
PS-adjusted	24.5 (23.4–25.6)	5.4 (4.8–6.0)	19.1 (17.9–20.4)	4.57 (4.04–5.17)
Crude	24.9 (23.4–26.0)	5.2 (4.6–5.8)	19.7 (18.5–21.0)	4.78 (4.23–5.40)

RD, risk difference; RR, risk ratio; RM, remote monitoring; PS, propensity score; ED, emergency department; UPMC, University of Pittsburgh Medical Center.

Data are n/N (%) unless otherwise specified.

* Adjusted for delivery year and month, maternal age, race, ethnicity, area deprivation index, parity, mode of delivery, commercial insurance, plurality, severe maternal morbidity, highest postpartum blood pressure at least 2 hours after delivery, administration of intravenous magnesium, body mass index at time of delivery admission, and prenatal care within UPMC.

† Matched on propensity score, including delivery year and month, race, ethnicity, area deprivation index, body mass index at time of delivery admission, parity, mode of delivery, induction, insurance type, severe maternal morbidity, plurality, highest and lowest postpartum blood pressure 2 hours after delivery, prenatal care within UPMC, prenatal diagnosis of diabetes, chronic hypertension, preexisting hypertension, preeclampsia, super imposed preeclampsia, gestational diabetes, anxiety, depression, cardiomyopathy, and delivering practitioner and their specialty.

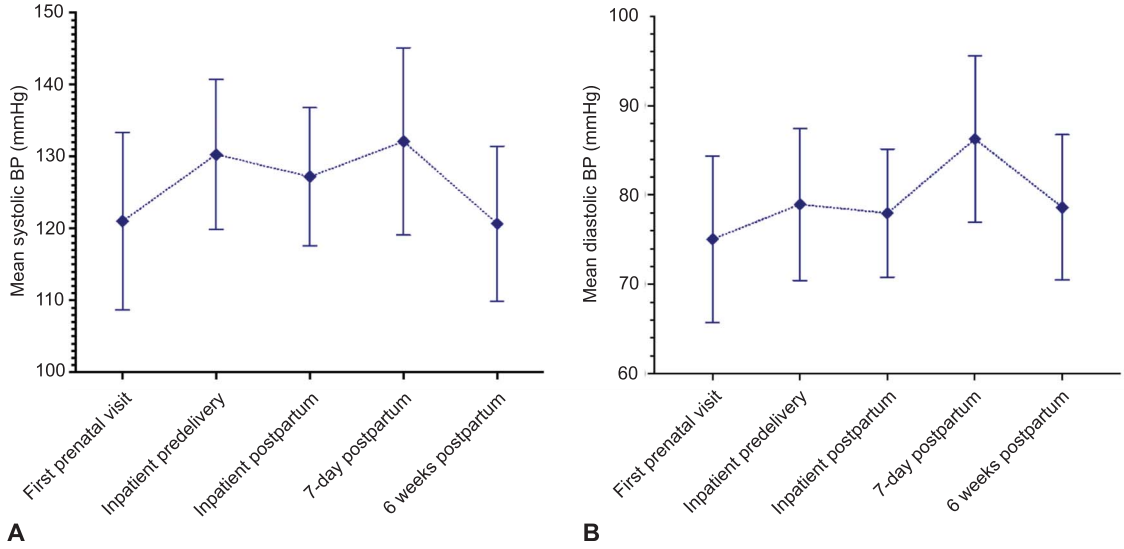

Fig. 2. Blood pressure (BP) trajectory of initial prenatal blood pressure, average antenatal and postpartum blood pressure during delivery admission, postpartum remote blood pressure at 1 week, and postpartum remote blood pressure at 6 weeks for those engaged in a remote monitoring of postpartum blood pressure program (n=4,334). Mean systolic BP (mm Hg) (**A**) and mean diastolic BP (mm Hg) (**B**).

Lemon. Remote Monitoring of Postpartum Hypertension. Obstet Gynecol 2024.

and remain cost effective when the postpartum readmission rate is 3.0% or higher with standard monitoring.[23,24]

Our study is strengthened by the large sample size and time period of 4.5 years. Our remote monitoring program incorporates standardized protocols for contact to maternal–fetal medicine physicians,[5] minimizing variation; however, initiation of treatment is at the discretion of the on-call physician. Though our program currently enrolls more than 50% of the hypertensive population, future work should focus on optimizing engagement of all eligible individual, which likely will include community-based interventions. We used several methods to address bias, including propensity-score matching and propensity-score adjustment, though were not able to conduct a randomized controlled trial. We were also able to integrate data from the entire obstetric period, using prenatal and delivery admission data in conjunction with our remote monitoring BPs.

Our study has limited generalizability given that our data are from a single institution. Furthermore, we are limited to evaluating postpartum care utilization only within our health system. Additionally, we included all ED visits and rehospitalizations, not just those primarily related to hypertension, in an effort to characterize health care utilization for other reasons that may indirectly be related to hypertension (such as heart failure or headaches). Finally, our program is only available to persons with access to a cellphone who speak English, Spanish, or Portuguese. Lack of access to a cellphone, for roughly 10 individuals (annually) who opted out, may indicate higher social risks, and these individuals are, unfortunately, not captured in this program.

Our data add to the growing body of literature supporting the critical role of remote BP management programs to improve adherence to guidelines and reduce postpartum hospital readmissions. Additionally, we show a favorable effect on postpartum BP trajectory among remote management participants. Remote management programs for postpartum hypertension show promise to bridge care gaps in the postpartum period, reduce disparities and potentially improve short and long-term maternal health.[11]

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