A. STAMPP-HTN BUNDLE SHOWED EFFECTIVENESS IN CONTROLLING BLOOD PRESSURE AND IMPROVED POSTPARTUM FOLLOW UP

Women with a hypertensive disorder of pregnancy (HDP) have high rates of postpartum hypertension with associated morbidity, such as postpartum heart failure, stroke, and long-term cardiovascular diseases (1). Controlling blood pressure in the postpartum period is critical and reduces cardiovascular disease among women. Unfortunately, follow-up compliance is often poor and historically up to 70% of women will not attend a postpartum visit (2). In Black women, HDPs are more common and result in greater morbidity and mortality and Black women have an even lower likelihood to attend a postpartum follow-up visit than white women (3). Thus, while Black women face a higher risk from HDP, especially postpartum, they also have even lower rates of follow up compliance.

To address this issue, Dr. Rana (PI) established a quality improvement initiative called the Systematic Treatment and Management of Postpartum Hypertension (STAMPP-HTN) Program, which was implemented as a series of interventions from January 2019 to September 2019 to improve postpartum care for women with HDPs at the University of Chicago, a tertiary urban care center with a predominantly Black and publicly insured population. Figure 1 shows the component of STAMPP-HTN bundle which requires patients to watch an educational video on recognizing and seeking prompt treatment for postpartum hypertension (PPHTN), a dedicated nurse educator for patient education about preeclampsia and postpartum follow up, education for all care providers (nurses, residents, staff physicians, medical assistants) in labor and delivery and postpartum units, updated clinic protocols for patients with PPHTN, distribution of a STAMPP-HTN kit (included a blood pressure monitor, instructions, warning signs, and a preeclampsia alert wrist bracelet) to all postpartum patients with a HDP, consistent scheduling of follow-up appointments prior to discharge, standardized protocols and workflows for the management of patients with PPHTN who present at our emergency room, and creation of dedicated outpatient PPHTN clinics. Of note, patients with HDPs were given appointments at the University of Chicago for PPHTN follow up prior to discharge regardless of the location of their primary obstetrician. STAMPP-HTN protocols were created based on evidence-based guidelines and expert consensus of the University of Chicago Medicine maternal-fetal medicine group. The outpatient PPHTN protocol was developed in concert with cardiologists and included a referral to cardiology for counseling to mitigate the long-term impact of preeclampsia. Implementation of the STAMPP-HTN bundle was approved as a quality improvement initiative by the University of Chicago Medicine. Collection of data was approved by Institutional Review Board.

A total of 926 patients who delivered between September 2018 and November 2019 were analyzed. Overall, the median age of patients was 28 years of age, 65.8% were publicly insured, and 79.9% were Black. Adherence to postpartum hypertension visits significantly improved following full implementation of the intervention bundle compared with pre-intervention adherence rates (overall 33.5% -> 59.4%, \( P < 0.0001 \). 30%->54.9% in Black; 53.6%-->76.2% in White). Blood pressure (BP) in the first 24 hours postpartum also decreased with intervention when compared to baseline (systolic BP 137 vs 149 mmHg; \( P < 0.0001 \)). Fewer patients after full implementation experienced a BP \( \geq 140/90 \) mmHg at the first postpartum BP check compared to before implementation (18.5% vs 39.1%; \( P = 0.004 \) (4). While we found the postpartum follow-up rate improved from 33.5% to 59.4% (\( P < 0.001 \)) following this initiative, the preexisting racial disparity in the follow-up rate did not
change, with a persistent disparity in the post-implementation group (54.9% follow-up for Black people; 76.2% for non-Black people; racial gap of 21.3%,  P = 0.03).

**B. STAMPP-HTN BUNDLE REDUCED INEQUALITY AND INEQUITY: ELIMINATING HEALTH DISPARITIES THROUGH TELEHEALTH**

With the onset of the COVID-19 pandemic, we made several protocol changes to the postpartum care of our patients in this initiative. Specifically, all initial PPHTN visits were switched from in-person to telehealth visits, as all patients in the program already had a home blood pressure cuff. Telehealth was defined as appointments done via phone call as recorded in the Epic electronic record. All other elements of the preexisting STAMPP-HTN program stayed the same, including protocols and workflows for patient management (4). To analyze the impact of telehealth on PPHTN follow-up rates, patients who delivered between December 1, 2019, and February 14, 2020, represented the pre-telehealth cohort, and patients who delivered after March 15, 2020, represented the post-telehealth cohort. Of note, February 15 to March 14, 2020, was considered a washout implementation period to account for telehealth’s implementation. A total of 473 patients were included in this analysis. The median age of the study group was 29 years of age, 64.8% of patients were publicly insured, and 76.3% identified as non-Hispanic Black. By the post-telehealth period, the visit adherence for Black patients increased to 76.3% and for White patients it increased to 76.7%, leaving only a 0.4% racial gap (P=.97). Figure 2 shows that STAMPP-telehealth improved rates of postpartum follow up and eliminated racial disparity, findings we have published in peer-reviewed journals (5, 6).

**C. STAMPP-HTN DEMONSTRATES TO BE SUSTAINABLE AND VIABLE LONG-TERM: REMOTE PATIENT MONITORING (RPM) AS STANDARD OF CARE AT UCM**

Home blood pressure telemonitoring is a combination of at-home BP monitoring and telematic data transmission to the care provider in the form of remote patient monitoring (RPM), enabling real-time feedback on patient status. RPM has been shown to improve blood pressure control and compliance to treatment and may help in optimizing the patient’s therapeutic regimen (7). RPM interventions have shown a high degree of acceptance by patients and improvement to their quality of life. RPM can also be an advantageous choice when a network of healthcare professionals (doctors, nurses, and pharmacists) is needed to improve the screening and management of HTN. However, no data exists on whether RPM is effective in managing PPHTN, specifically among Black women.

To further enhance the STAMPP-HTN bundle, we collaborated with the University of Chicago Medicine Department of Digital Health and Health Recovery Solutions to start the remote patient monitoring program for all patients enrolled in STAMPP-HTN (Figure 3). The RPM program started in July 2021. To analyze the success of STAMPP-HTN/RPM, we conducted analysis of patients enrolled between October 2021 and April 2022. 545 patients were enrolled in the RPM program, of which 306 consented to data collection. Overall, 64.7% of patients identified as Black. A total of 6801 BP readings...
were recorded across the six weeks. 92.8% of patients had at least one BP reading recorded within six weeks postpartum.

We found that the attendance at the postpartum telehealth BP check visit further increased to 84.0% and was similar in Black patients and non-Black patients (81.3% vs 88.9%, p=0.08) (Figure 4). Amongst all patients reporting blood pressure through the RPM system, rates of Stage 2 hypertension defined by the American Heart Association (AHA) decreased from 42.2% to 14.3% from postpartum week one to week six (Figure 5). There was also an incremental increase in the percentage of patients that interacted with the healthcare system through BP readings and many patients achieved BP control within six weeks. Thus, we found that adding the RPM program to the existing STAMPP-HTN initiative maintained a high rate of attendance at postpartum BP follow-up visits and did not increase disparity. These findings are under review for journal publication.

![Rates of PPHTN follow up](image)

**Figure 4.** Figure shows the evolution of STAMPP program and progressive improvement of PPHTN follow up.

**Baseline**- September- December 2018  
**STAMPP-HTN** October-November 2019  
**STAMPP-HTN/Telehealth** - March – June 2020  
**STAMPP- HTN/RPM** - October 2021- April 2022

![Patient Perceptions Regarding Remote Patient Monitoring For Postpartum Hypertension](image)

**Figure 5.** Data from 306 patients who enrolled in STAMPP-HTN/RPM from October 2021 to April 2022. BP categories are listed per AHA. There was a significant reduction in HTN among patients (BP >140/90 reduced from 42.2% at week 1 to 14.3% at week 6, p<0.001).

Implementation of STAMPP-HTN program with telehealth and remote patient monitoring led to an overall improvement in rates of postpartum BP follow from 30.0% to 81.3% among Black women and eliminated the racial disparity. The program also led to significant reduction of BPs throughout the PP period.

**D. STAMPP-HTN/RPM PERCEIVED BY WOMEN AS A USEFUL TOOL FOR THE MANAGEMENT OF BLOOD PRESSURE POSTPARTUM**

To gain more insights about RPM, we evaluated patient perceptions on remote monitoring through surveys of patients enrolled in the program. This analysis included survey responses of patients with a HDP enrolled in the RPM program for 6 weeks after delivery. Patients received a survey incrementally at one week after enrollment, three weeks postpartum, and six weeks postpartum through the mobile application associated with the RPM program. The survey questions assessed patient perceptions of the program and knowledge of hypertensive disorders. Patient responses were automatically transmitted from the mobile application to the RPM clinician portal. A descriptive analysis of the survey responses was then conducted. We found that postpartum women perceived the RPM program to be a

![Survey responses collected from RPM portal for 306 patients into the RPM program and consented for the study from October 2021 to April 2022](image)
useful tool for managing postpartum blood pressures (Figure 6). The program also encouraged postpartum follow-up based on patient responses. These data are submitted for publication. We are further investigating the association of survey responses to clinical outcomes, as well addressing any barriers to care for patients who did not utilize the program.

E. LEVERAGING COMMUNITY HEALTH WORKERS AS PART OF STAMPP-HTN PROGRAM

We believe that community health workers (CHWs) can be a key stake holder and facilitator to improve engagement of postpartum patients. We collaborated with the liaison to care (LinC) program at the University of Chicago to incorporate CHWs as part of STAMPP-HTN program (Figure 7). Referral to CHW is placed by the clinical team managing patients in the STAMPP-HTN program. Between July 2022 and July 2023, 332 patients were contacted by CHWs. Out of these, 178 were successful at establishing contact. Most initiations were for BP readings/ education/ noncompliance, reminder of upcoming PP visit and missed visit. We analyzed data from July 2022 to October 2022 among 65 patients with noncompliance with blood pressure who were referred to CHWs. The CHW was able to contact 36/65 patients (55%) for follow-up. We found that among patients contacted by the CHW, 29/36 (80%) attended telehealth visits, compared to 13/29 (45%), unable to be contacted by the community health worker, P=0.01. Further, the CHWs provided referral and follow-up services, coordinated care and provided guidance and social assistance to these patients. An interview with the CHW revealed that she provided culturally appropriate health education and information and care coordination to the patients. We are currently analyzing data for impact of CHW facilitation on STAMP-HTN program. This will help us specifically answer questions such as: what was the intervention by the CHW, how did patients perceive the program/intervention, what were outcomes for patients who participated, how did they differ from other program participants, who most benefited from the program?

F. STAMPP-HTN HAS BEEN REPLICATED AND EXPANDED TO INSTITUTIONS ACROSS THE COUNTRY: DOCUMENTATION OF OUTCOMES FROM MISSISSIPPI

In December 2020, STAMPP-HTN was launched at the University of Mississippi Medical Center (UMMC) under the leadership of Dr. Kedra Wallace. Women who delivered at UMMC received the same information regarding PPHTN and BP management, were telemonitored for six weeks, and were given the same questionnaires as participants at University of Chicago Medicine to compare their knowledge at the end of the telemonitoring period. Participants were recruited and enrolled from December 2020 to 2021. Two hundred fifty women provided informed consent to participate in the study and were included in this analysis. 73.6% of the study participants were Black, 79.8% were classified as Class I obese or greater, and 61.5% were Medicaid recipients. Much of our study population (77%) live in at-risk or distressed communities. At the end of the study, there were significant improvements in the number of women who were able to correctly state their diagnosis compared with the pre-education questionnaire (54.5% and 44.6%, respectively; P = 0.02), and who believed that HTN would spontaneously resolve following pregnancy compared with the pre-education questionnaire (16% and 33%, respectively; P = 0.02). At both testing time points, 94% of women knew that BP readings of 150/100 or higher needed to be repeated and/or managed, and there was an increase in the number of women who knew to only stop taking anti-hypertensive medication following a doctor’s advice (10.2% increase; P = 0.12). Thus, implementing a standardized education bundle for managing PPHTN increased women’s understanding of their pregnancy-related hypertensive disorder. This is the first study in Mississippi that used innovative teletext option that allowed women to manage their health with minimal interruption to postpartum period. Findings of this study are in review for publication.
In addition to Mississippi, Dr. Rana (PI) has helped several other institutions to start STAMPP-HTN program for management of PPHTN. These programs are utilizing preeclampsia education, video, follow up workflows, blood pressure control protocols, RPM and escalation protocols developed by Dr. Rana. These sites include: 1) RWJ Barnabas- New Jersey, 2) Novant- North Carolina, 3) Avera- North and South Dakota, 4) Catholic Health - Upstate NY, 5) University of Michigan Health West and 6) Centura Health- Colorado.

G. DISSEMINATION OF KNOWLEDGE GAINED FROM STAMPP-HTN PROGRAM. The data generated from the STAMPP-HTN program has resulted in 20 abstracts (presented at regional, national and international conferences and meetings) and 8 publications (3 in print and 5 in analysis/review). We have also disseminated information about STAMPP-HTN through news media articles, interviews and podcasts.

Dissemination through webinars/forums and lectures (done by Dr. Rana) since 2022

<table>
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<tr>
<th>Year</th>
<th>Details</th>
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<tr>
<td>2022</td>
<td>Invited Speaker, Virtual Texas AIM Severe Hypertension in Pregnancy Summer Speaker Series, July 2022</td>
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<tr>
<td>2022</td>
<td>Organizing Chair- preeclampsia Forum, July 28th. Co-hosted with preeclampsia Foundation. An educational program inviting local OB providers and discuss updates in care for women with preeclampsia, ongoing research at UCM and quality improvement and programs for reducing disparity</td>
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<tr>
<td>2022</td>
<td>Plenary Speaker, Role of remote patient monitoring and telehealth in management of Postpartum HTN, ISSHP World Congress, France (Montpellier), August 28-Sep 1,2022</td>
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<tr>
<td>2022</td>
<td>Invited Speaker, webinar, Recent updates in the care of HTN in pregnancy, IPHDA (Illinois Primary Health Care Association), Nov 4, 2022</td>
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<td>2023</td>
<td>Invited Faculty- Workshop on Postpartum Hypertension, ISSHP, Sep 24-27, Bengaluru, India</td>
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<td>2023</td>
<td>Panel presentation, Keeping Your Finger on the Pulse: Innovative Community Efforts to Support Women's Heart Health – 2023 National Women’s Blood Pressure Awareness Week (October 19), HHS</td>
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<tr>
<td>2023</td>
<td>Building sustainable equity strategies for postpartum safety. Birth Equity Webinar, IPQC, Dec 11</td>
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AWARDS and ACCOLADES received by the STAMPP-HTN program (since 2022)

- 2022- The program was selected for Magnet story as “Magnet Exemplar” for American Nurses Credentialing Center (ANCC).
- 2022- Dr. Rana (PI) received the Distinguished Leader in Program Innovation, University of Chicago Biological Sciences Division.
- 2023- American Hospital Association “citation of merit” and equitable maternal health practices- Review case example.
- 2023- IL Perinatal Quality Collaborative annual meeting- Abstract of Excellence Award, Implementation Plan Excellence Award, Data Excellence Award.

H. FUTURE OF STAMPP-HTN AT THE UNIVERSITY OF CHICAGO

We demonstrated that a bundled PPHTN initiative for women with a HDP improved several maternal outcomes, including decreased inpatient postpartum blood pressure, increased adherence to PPHTN visits, and fewer patients with elevated blood pressures at their PPHTN and 6-week visit. More importantly this bundle eliminated disparity in postpartum care especially among Black women. STAMPP-HTN was originally implemented in January 2019; and we have since incorporated telehealth and remote patient monitoring as part of this program.

Given its overwhelming popularity and evidence-based success, the program now serves as the standard of care at University of Chicago Medicine. In the immediate future, we are planning to extend the STAMPP-HTN/RPM program to one year postpartum to continue to care for these women beyond six weeks. In addition, we plan to start RPM program for early diagnosis and treatment of hypertension during pregnancy, with CHW support, and a 24/7 surveillance program. Currently, Dr. Rana (PI) is working with the Illinois Department of Public Health to implement the STAMPP-HTN program at the state level as part of the IL birth equity initiative. Dr. Rana was also recently appointed as Chief Obstetrical Transformation Officer and will work with the South Side Healthy Community Organization in Chicago, in which the STAMPP-HTN bundle is included as a key program for improving maternal morbidity and mortality in participating hospitals in Illinois.
References


