

**Implementing an EMR Bundle to Optimize the Organizational
Response to Hypertensive Disorders of Pregnancy: A Quality Improvement Initiative**

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Abstract

In this quality improvement project, a standardized workflow was implemented into the electronic medical record (EMR) to improve the systemic management of hypertensive disorders of pregnancy (HDP). The complete use of the bundle included the use of the problem list and medical history to document a hypertensive diagnosis, as well as adding a specific smartphrase to the discharge summary to aid with postpartum education and proper follow up. This project was designed to implement organizational changes by increasing the utilization of the EMR to enhance organizational and practice efficiencies and improve the outcomes for people at risk for a pregnancy or postpartum hypertensive disorder. The project was carried out over 4 months, from September to December of 2023, and included 1 month of collecting baseline data and 3 PDSA cycles. The total percentage of HDP patients in this project was 34.4%. The correct use of the problem list increased from 55.6% to 70% throughout the project, while utilization of the patient's medical history decreased to 70% from 83.3%. The use of the HDP specific smartphrase in the discharge summary increased from 58.3% to 80%. The challenges to implementation of this project included organizational barriers such as a lack of communication with providers and lack of standardization in discharging. Future recommendations include creating a standardized discharge summary that includes general warning signs for HDP to be used for all patients. With 34.4% of the population served affected by HDP, all patients should be aware of warning signs for HDP at discharge. Additionally, the practice should continue the use of the HDP specific smartphrase for HDP patients.

Problem Description

Preeclampsia is a multisystem syndrome typically involving new-onset hypertension, proteinuria, and/or end-organ dysfunction that most often occurs after 20-week gestation during pregnancy and is included in the spectrum of disorders known as hypertensive disorders of pregnancy (HDP) (Hauspurg et al., 2019). HDP are responsible for significant maternal morbidity and mortality and are the most common reason for hospital readmission postpartum (Hauspurg & Jeyabalan, 2022). Rates of hypertension in the postpartum period are increasing, and a newer study suggests that more than 1 in 10 patients with normotensive pregnancies will develop new-onset hypertension in the postpartum period (Parker et al., 2023). Around 44% of deaths that occur in the first 6 days postpartum can be attributed to complications of hypertensive disorders (Cameron et al., 2022). Furthermore, around 70-75% of deaths related to preeclampsia occur after birth, which enforces the need for proper education and management postpartum (Lovgren et al., 2022; Preeclampsia Foundation [PF], 2019).

Postpartum preeclampsia has a prevalence of 0.3-27.5% in the United States, with the wide range most likely due to milder forms going unrecognized and high variation in the recognition and management among providers (Hauspurg & Jeyabalan, 2022). The most current research from 2019 states that the national average of HDP is 16% (Ford et al., 2022). Risk factors for developing postpartum preeclampsia are similar to the risks associated with preeclampsia during pregnancy, suggesting that the two diagnoses have similar pathophysiology. Black women born in the United States are at an increased risk of maternal morbidity, including preeclampsia, because of the continuous and detrimental effects of systemic racism. People are at an increased risk of developing postpartum preeclampsia if they are non-Hispanic Black, have a BMI > 40, and deliver via cesarean (Goel et al., 2015; Parker et al., 2023; Redman et al., 2019).

The burden of new-onset postpartum hypertension has an outright racial component, affecting Black patients 2.5x more often compared to white patients (Parker et al., 2023). An undetected or delayed diagnosis of postpartum preeclampsia puts the patient at risk of seizure, stroke, renal failure, pulmonary edema, heart failure, and death (Khedagi & Bello, 2021). Furthermore, 45% of postpartum preeclampsia patients develop chronic hypertension and are at an increased risk for long-term cardiovascular complications (Redman et al., 2019).

As hypertensive disorders increase in pregnant and postpartum people, new efforts to reshape the condition for both providers and patients are underway. One example is a movement to encourage providers to stop counseling patients that delivery is the cure for preeclampsia and instead educate patients that preeclampsia is still a serious risk in the postpartum period (PF, 2019). Since these disorders can also develop postpartum without a pregnancy hypertensive disorder, additional awareness and education are vital to reducing the severe morbidity in maternity patients.

In a collaborative midwifery and physician practice in a community hospital in the Pacific Northwest, providers were concerned about an increased number of postpartum patients readmitted with hypertensive disorders. Chart reviews showed a need for organizational quality improvement efforts for people with risk factors for postpartum preeclampsia. Patients readmitted to the hospital were found to have had overlooked risk factors and these factors were rooted in multifaceted system problems.

When patients ruled in for preeclampsia, there was an underutilization of the electronic medical record (EMR) and lack of practice routines in communication and function. The American College of Obstetricians and Gynecologists strongly recommends providing detailed counseling on postpartum preeclampsia warning signs and when to seek care at postpartum

discharge, since most patients who presented to emergency services with postpartum preeclampsia reported experiencing these symptoms for hours or days before seeking medical care (ACOG, 2020). This was a pattern the community hospital noticed too, which led to more severe disease progression in patients. The goal of this quality improvement project was to implement strategies throughout the organization to improve system efficiency and improve outcomes for people with postpartum hypertension.

Available Knowledge

Search Strategy

In this literature review the search terms used were “postpartum preeclampsia,” “hypertensive disorders of pregnancy,” “postpartum hypertension,” “(postpartum preeclampsia) AND (readmission), and (quality improvement) AND (postpartum hypertension). PubMed and CINAHL databases were searched for English language primary studies with no restriction on location. A filter of the past five years was originally placed but was extended to include more robust and relative studies.

Postpartum Hypertension and Preeclampsia

Postpartum hypertension can occur either as a continuation of the disorder that occurred during pregnancy or can present as a completely new condition without a previous diagnosis of hypertension. The pathophysiology of postpartum preeclampsia and its relation to the disorder during pregnancy is not fully understood and is the focus of current research (Goel et al., 2015). Slightly dated literature found that around 33-69% of patients presenting with postpartum preeclampsia had no prior history (Al-Safi et al., 2011; Yancey et al., 2011). Newer literature found the rate of new-onset postpartum hypertension to be between 10-12%, with the percentage

affected by patient demographics, change in practice guidelines, and provider comfortability (Goel et al., 2015; Parker et al., 2023).

The rate of preeclampsia in the United States is increasing, and the severity of mortality and morbidity of postpartum conditions are getting worse each year (ACOG, 2020; Johnson et al., 2019). Hospital readmission rates are increasing in the United States, and postpartum hypertension is the second most common cause, accounting for about 9.3% of all maternity-related readmissions (Clapp et al., 2016). The rate of hypertensive disorders in pregnancy in Oregon is about 7.7%, which ranks in the top five in the country (Butwick et al., 2020). There is a lack of research focusing on postpartum hypertension specifically in Oregon, so the data is limited. However, in Oregon there is about a 2.6% chance of at least one postpartum readmission over 12 months, 17.3% of which are related to HDP (Kaufman et al., 2023).

Risk Factors & Racial Disparities

Postpartum preeclampsia shares similar risk factors to preeclampsia during pregnancy, and half of the pregnancies with HDP continued to be hypertensive postpartum (Goel et al., 2015). But to further understand the origin of the onset of pathology during postpartum, most studies exclude all hypertension disorders during pregnancy to focus solely on postpartum. The most prominent risk factors for developing new-onset postpartum hypertension were non-Hispanic Black ethnicity, larger BMI, and cesarean delivery. Additional risk factors for postpartum hypertension include public insurance, comorbidities such as diabetes mellitus, a history of preeclampsia in a prior pregnancy, cigarette smoking, and a history of drug use (Clapp et al., 2016; Goel et al., 2015; Parker et al., 2023; Redman et al., 2019). One study found that if patients had a BMI>40, delivered by cesarean, and smoked cigarettes, they had a 29% chance of developing new-onset postpartum hypertension (Parker et al., 2023). Another study found that

the group that developed new-onset postpartum hypertension had higher systolic and diastolic blood pressures during admission, but still within the normal range, compared to the normotensive group (Goel et al., 2015). Since risk factors for postpartum hypertension are clear, providers and organizations should be able to clearly identify people at risk. Isolated elevated blood pressures are commonly thought of as benign and dismissed, but according to the literature, this increases a person's risk of developing preeclampsia and should be closely monitored (Johnson et al., 2020; Ohkuchi et al., 2019). Additionally, the management and interpretation of "white coat hypertension," defined as an abnormal elevation in blood pressure when in a medical environment, varies widely among healthcare providers and is commonly dismissed.

Systemic racism occurs within obstetric medicine, and this inequity exists in the postpartum period as well (Dmowska et al., 2023; Taylor, 2020). There are racial disparities among people diagnosed with postpartum hypertension, evident in both postpartum readmission rates and the severity of complications (Khedagi & Bello, 2021). Non-Hispanic Black women are more often to be readmitted postpartum, experience worse morbidity, and suffer from hypertensive-related complications compared with White women (Khedagi & Bello, 2021). Systemic disparities and the effects of social determinants of health are incredibly prominent in the postpartum period and should be a focus of future systemic awareness and interventions.

Clinical Implications

Researchers have explored timelines and causes of hospital readmissions for postpartum hypertensive patients. Two studies found that, on average, patients with postpartum hypertension were readmitted 3 days after delivery (Clapp et al., 2016; Lovgren et al., 2022), and another study found that 62% of the postpartum hypertensive patients presented 48-72 hours after

delivery (Goel et al., 2015). Another study found it was more common for patients to present on postpartum day 7, and that the number one complaint was a headache. For postpartum eclampsia specifically, 81.4% of patients were readmitted within the first 7 days after delivery (Yoselevskey et al., 2022). Comprehensively, researchers found that 93.4% of people presented with symptoms: 83% of them complaining of a headache, 26% had shortness of breath, and 22% had swelling. Interestingly, there were no readmissions after postpartum day 19, emphasizing the importance of close monitoring for high-risk patients in the immediate postpartum period (Redman et al., 2019).

Providers must recognize the disease progression, starting with identifying risk factors, as well as evidence-based treatment and management to appropriately reduce morbidity. Preeclampsia increases a pregnant person's risk of long-term cardiovascular complications, and recent literature states that postpartum preeclampsia also increases the person's risk of developing chronic hypertension and long-term cardiovascular complications (Redman et al., 2019).

Quality Improvement & Interventions

A wide range of patients present with new-onset postpartum hypertension, some of which may be related to system inefficiencies in people with risk factors. It is challenging to know if these patients presenting postpartum have completely new hypertension or if there were indicators that were missed during prior admissions. For this quality improvement project, the term hypertensive disorders of pregnancy will be used to include the entire spectrum of hypertensive disorders that occur during pregnancy and postpartum, possibly suggesting a future acronym of HDPP to include the entire range of known disorders. It is essential for nurses, residents, midwives, and physicians to recognize the increasing rate of postpartum hypertensive

disorders and to understand the importance of quick identification, proper communication, documentation, and patient education. It is essential for improvement projects to be focused on chart review of the EMR to determine if patients ever showed signs or had significant risk factors for developing hypertension after delivery (Chames et al., 2002). It is recommended that providers improve handoffs to other providers about suspected disorders, risks, and long-term considerations. According to the California Maternal Quality Care Collaborative, HDP diagnosis errors are most commonly caused by lack of or poor documentation in the EMR by providers (CMQCC, 2021). When the EMR is utilized more efficiently and effectively, better communication and documentation will decrease the chances of patients being missed, leading to worse disease progression (Hauspurg et al., 2019).

Quality improvement efforts have also centered around patients who presented postpartum from days 3 through 7, as the literature confirms this period is high risk. With the current medical model, most patients are discharged 24-48 hours after delivery in the United States (Khedagi & Bello, 2021). One study observed people who continued to be admitted for 1 week after delivery. Twelve percent of these people, who had no history of high blood pressure, became hypertensive and more than 50% of patients with a known pregnancy hypertensive disorder had a blood pressure $\geq 150/100$ during that week (Khedagi & Bello, 2021). Nationally only 40% of patients attend their postpartum appointments; some quality improvement efforts have considered whether there should be a new recommendation to shift how long patients stay in the hospital relative to not just their mode of delivery, but also their risk factors and intrapartum diagnosis (Clapp et al., 2016; Hauspurg et al., 2019).

Another systemic factor that possibly leads to the underdiagnosis of hypertensive disorders is unclear clinical guidelines and protocols for elevated blood pressure in people who

are postpartum, specifically around when to report it and to whom. One study performed chart reviews to identify major gaps, creating an order set to clarify the nurse's role in identifying and administering anti-hypertensives. These interventions resulted in quicker treatment time and increased treatment rates (Nguyen et al., 2022). Another similar study recognized the need for a collective understanding of the most up-to-date protocols to guide clinical management for nurses, midwives, residents, and physicians. They also determined that there was no standardized patient education upon discharge. These specific interventions lead to greater compliance with postpartum appointments and improved blood pressure regulation postpartum (Suresh et al., 2021). One study found that 82.1% of the time, a clinician was improperly coding for preeclampsia, most often caused by a lack of details in the chart stating if the disorder was mild or severe, which is an example of the important need for clear charting and documentation within the EMR (Geller et al., 2004). This project was designed to implement organizational changes by increasing the utilization of the EMR to enhance organizational and practice efficiencies and improve the outcomes for people at risk for a hypertensive disorder in pregnancy, including postpartum hypertension.

Rationale

The Institute for Healthcare Improvement (IHI) model for improvement guided this QI project. The IHI model for improvement is a framework designed by Associates in Process Improvement aimed at expanding and increasing improvement in an organized manner (IHI, 2023). The IHI model is a common framework to successfully accelerate quality improvement within the healthcare industry. Many quality improvement projects have used this framework and demonstrated success. One example is a quality improvement project that utilized the IHI

framework and partnered with the Illinois Perinatal Quality Collaborative to improve identification and treatment of severe hypertension during pregnancy (IHI, 2020).

After communicating with stakeholders to understand incentives for this project, it was clear there was a lack of standardization with how routinely the electronic medical record (EMR) was used to track and communicate the progression of HDPP. By initiating a standardized workflow, the goal was to reduce the gap and improve the management of HDPP, therefore decreasing maternal morbidity. A review of the literature determined that quality improvement efforts such as organizational adherence to evidence-based guidelines, increased standardization, and implementation of toolkits improved maternal outcomes in relation to HDPP (California Maternal Quality Care Collaborative [CMQCC], 2021; Skurnik et al., 2016; Suresh et al., 2021). Labor & delivery admissions are around 2-3 days, and because so many health care providers are involved in one person's care during this time, it is imperative to practice standardized communication to improve patient outcomes (O'Daniel & Rosenstein, 2008). When health care providers worked more effectively as a team it was associated with decreased patient morbidity and mortality (Zajac et al., 2021). Furthermore, the research suggested that when health care providers communicated effectively, this led to improved patient satisfaction, decreased length of hospital stay, and more efficient interventions (O'Daniel & Rosenstein, 2008).

Aims

The global aim of this quality improvement project was to support the providers at a community hospital in improved recognition, communication, and management of HDPP using a standardized workflow. The complete use of the bundle included the use of the problem list and medical history to document a hypertensive diagnosis, as well as using a specific smartphrase added to the discharge summary. Therefore, this project had three specific aims to standardize

the management of hypertensive disorders in pregnancy. First, by December 26th, 2023, 80% of the charts utilized the problem list to document a hypertensive diagnosis. Second, by December 26th, 2023, 80% of the charts utilized the medical history to add the hypertensive diagnosis to the chart. Thirdly, by December 26th, 2023, 80% of the charts had the hypertensive smartphrase in the discharge summary. The use of the bundle was measured through chart reviews, which looked specifically at the problem list, medical history, discharge summary, and admission blood pressures. Since the bundle had three parts and it was possible a provider utilized one aspect but not the others, each part of the bundle was individually tracked.

Context

This quality improvement project took place at a community hospital in the Pacific Northwest with a collaborative midwifery and physician practice. The hospital was affiliated with a university and was a prominent academic clinical environment for both midwifery students and family medicine residents. The practice, established in 2020, is a relatively newer collaborative practice, meaning patients are shared between the midwives and physicians during antepartum, intrapartum, and postpartum. Of note, 75% of patients are cared for by the midwives, and 84% of all births are completed by midwives (C. Emeis, personal communication, February 18, 2024). The practice had 5.1 FTE midwives and 5.3 FTE physicians and combined there are over 100 per diem providers that take OB call. The average annual number of births was 360 and around 30 births a month. The average total cesarean rate is around 25.2%, 19.1% of those being primary cesareans (D. Jolley, personal communication, February 18, 2024). The unit had fourteen patient rooms shared for antepartum, intrapartum, and postpartum, two triage rooms and one operating room. There was an adjacent level two neonatal intensive care unit for neonates ≥ 32 weeks. The demographics of the county were 78.6% white, 17.6% Hispanic or

Latino, 12.2% Asian 2.7% Black, and 1.2% American Indian and Alaskan native, and 45% of the patients at this practice utilized Medicaid for healthcare insurance (C. Emeis, personal communication, February 18, 2024). As a new clinical site, there were typically several quality improvement projects implemented simultaneously.

Interventions

The interventions for this project focused on implementing a standardized work-flow to improve provider-level communication and organizational management of hypertensive disorders of pregnancy, including postpartum preeclampsia. The bundle included adding the hypertension of pregnancy-specific diagnosis to the patient's problem list. This included adding "isolated elevated blood pressure" to ensure proper tracking of one mild or severe range blood pressure. If a patient did rule in for an HDP, that diagnosis was added to their medical history for proper postpartum and long-term management. Furthermore, a specific smartphrase was added to the discharge summary of HDP patients. The smartphrase was *"appropriate discharge teaching provided on postpartum preeclampsia warning signs, accurate home blood pressure monitoring, and how to access a blood pressure cuff after discharge. Patient informed of 72-hr clinic BP check and message sent to clinic front desk 'p tua tog front desk (4100065)' for scheduling. Patient also scheduled for **in-person** 2-week postpartum visit"*. The hypertensive smartphrase was manually added to the discharge summary by the discharging provider. The workflow was made into a process flow diagram (see Appendix A) and was placed in both midwife and physician call rooms as well as the shared workspace on the unit. Prior to implementation, a voice-over PowerPoint was emailed to all providers, including midwifery students, with an introduction to this project, instructions on how to use the workflow, and where the flow diagrams could be found.

Study of the Interventions

The goal of this project was by September 28th, 2023, to have educated providers on the project and the designed use of the bundle. To determine whether this project met its aims, regular data collection was performed through a series of PDSA cycles. The first PDSA cycle ran from October 1st-October 26th, ending with a monthly collaborative meeting to receive feedback from providers on October 26th. The next five days were used to implement changes from the provided feedback. The next two PDSA cycles will follow in a similar format. The second PDSA cycle ran from November 1st - November 26th and was supposed to end with a meeting, but it was cancelled due to the holiday. The third and final PDSA cycle ran from December 1st-December 26th. The meetings were used to collect feedback from the providers on how using the bundle was going, as well as suggestions for changes. The IHI had a PDSA cycle feedback form that was a part of their QI essentials toolkit that was utilized to collect information during the meetings. Feedback given during the meetings was implemented into the form, and changes were made for the next PDSA cycle.

Chart reviews and data extractions were also utilized to gather baseline data as well as study the progression of the intervention. Baseline data was collected from September 1-September 27th prior to any implementation. Collaboration with the hospital's billing team generated lists each month of all discharged patients in the collaborative practice. Additionally, further chart review was performed after every PDSA cycle to measure the continued use of the standardized hypertensive bundle.

Measures

After each PDSA cycle, the charts of all discharged patients who delivered a live neonate vaginally or via cesarean were reviewed to identify use of the hypertensive bundle. Both the

problem list and medical history were checked for any HDP diagnosis. Hypertensive disorders included preeclampsia diagnoses, gestational hypertension, postpartum hypertension, chronic hypertension, and one elevated blood pressure without the diagnosis of hypertension. The patient's blood pressures were reviewed to determine if they developed hypertension during the admission and therefore would have benefited from the standardized workflow. Additionally, the discharge summary was reviewed to determine if the smartphrase was used. It was noted when each one of the individual measures are used, as well as the times when it should have been used for a high-risk patient but was not. The percentage of charts with correct documentation of a hypertensive disorder in the problem list and medical history, the percentage of discharge summaries that utilized the new hypertensive smartphrase, and the percentage of how often hypertensive patients had a 72-hour blood pressure check were documented monthly. Lastly, since many different discharge templates are used, data was collected on when the project's specific smartphrase was not used but some hypertension alternate teaching was documented. The data extracted from charts was stored on Excel with no patient-protected health information.

It was expected that these interventions would be successful because the literature states that when the EMR is utilized more efficiently and effectively, there will be better communication and documentation, therefore decreasing the chances of patients being missed, leading to worse disease progression (Hauspurg et al., 2019). Prior to this project, there was a reported lack of routine use of the problem list and medical history amongst providers, which likely contributed to poorer patient outcomes. Furthermore, this practice utilized a varying amount of discharge summary templates, some of which mentioned generic postpartum warning signs, while others did not. Also, the discharge summary templates mentioned postpartum visits but could have been clearer about the recommendation for hypertensive patients to specifically

have a 3-day blood pressure check as well as the importance of the 2-week postpartum appointment being in person as opposed to virtual. The discharge provider was responsible for sending a message to the clinic scheduling team when a patient needed a 3-day blood pressure check, and because of this extra step and lack of reminders, this step was being missed and this likely contributed to higher postpartum readmissions with more progressed disease states. Furthermore, during the height of the COVID-19 pandemic, it was common for postpartum appointments at 2 weeks to be virtual, but it is presently recommended that patients with risk factors for developing postpartum preeclampsia have the first postpartum appointment in person for an office based blood pressure and nurse evaluation of symptoms..

While this quality improvement project was largely focused on the system level, there was an interrelated postpartum preeclampsia quality improvement project that focused on the patient level, which specifically targeted improved discharge teaching. There had been consistent collaboration with this project as interventions were implemented; specifically ensuring a new patient-friendly preeclampsia teaching worksheet was added to the after-visit summary upon discharge. The implementation of both projects allowed clinicians to better track and communicate risks regarding hypertensive patients and reduced the burden of postpartum preeclampsia. If utilizing the problem list, medical history, and improved discharge summary led to improved recognition of hypertensive disorders, then the patients had improved outcomes and decreased morbidity from the optimization of EMR (Hauspurg et al., 2019).

Data Analysis

The original plan to analyze the data was to make run charts for each intervention to portray the changes over time. However, after careful review of the data, the biostatistician team recommended creating line graphs. This recommendation was due to not having enough data

points to make a run chart since data was collected only once a month, rather than weekly. Utilizing the data collected from the three PDSA cycles, as well as the baseline data, two different line graphs were generated based on usage of the problem list, medical history, and smartphrase in discharge summary. In addition, a graph of how often patients received a 72-hour blood pressure check was made, as well as a graph of the total number of hypertensive patients in the study. Another part of the analysis of this project includes using the validated PDSA worksheet to organize provider feedback to drive change and improve the next cycle. The feedback was then organized into themes and made into a bar graph.

Ethical Considerations

The goal of this project was to overall improve patient care, but because of the added interventions, there is more added work for providers. The main ethical consideration is that this project could create additional stress on the system. All providers were notified of this project by email. This quality improvement project was reviewed by the Institutional Review Board and was deemed not to be human research.

Results

A total of 154 patient's charts were reviewed during the 4 months of this quality improvement project. Of those, 53 had an HDP diagnosis while 101 were not hypertensive (see Graph 4 in Appendix B). Therefore, the total percentage of HDP patients in this project was 34.4%. From baseline data through 3 PDSA cycles, the problem list was used correctly in HDP patients 55.6%, 100%, 76.9%, 70% of the time (see Graph 1 in Appendix B). In addition, an HDP diagnosis was added to the patient's medical history 83.3%, 75%, 92.3%, 70% of the time respectively (see Graph 1 in Appendix B). The hypertensive smartphrase used in the discharge summary was used in 58.3% of HDP patient's charts in PDSA cycle 1. It was used 46.2% of the

time in PDSA cycle 2, and 80% of the time in PDSA cycle 3 (see Graph 2 in Appendix B). Since the discharge smartphrase was an intervention that started with PDSA cycle 1, it was not used by providers during the baseline period. When the discharge smartphrase was not used, the percentage of how often patient's received alternate teaching was calculated. For PDSA cycle 1, for the HDP patient's charts where the discharge smartphrase was not utilized (41.7%), alternate preeclampsia teaching was documented 20% of the time. For PDSA cycle 2, the discharge smartphrase was not used 53.8% of the time, but of that number, 14.3% had alternate teaching documented. Lastly, in PDSA cycle 3, only 20% of HDP patients did not receive the discharge smartphrase, but 100% of those received adequate alternate teaching. From baseline data through PDSA cycle 3, patients who received an HDP diagnosis returned for their 72-hour clinical blood pressure check 61.1%, 58.3%, 53.8%, 50% of the time respectively (see Graph 3 in Appendix B).

Discussion

Interpretation

The prevalence of HDP for delivery hospitalizations during the 4 months of this project was 34.4%. This is more than double the national US average of 16% and four times more than the Oregon average (Butwick et al., 2020; Ford et al., 2022). Of note, the national data is from 2019 and the Oregon data is from 2017, and since HDP has been increasing, it is possible that hypertension in both the populations of the state and the nation are significantly underestimated or underreported. Half of patient population that utilized care at this location utilized Medicaid, and 7.6% of the people in this county were reported to be living in poverty (United States Census Bureau, 2023). This supports the research that people with lower socioeconomic statuses have worse maternal health outcomes, including preeclampsia (Kim et al., 2018).

Prior to this project, stakeholders reported a lack of consistent use of both the problem list and medical history amongst the midwives and physicians. The use of the problem list increased substantially from baseline to the first cycle, from 55.6% to 100% use. Just prior to the start of PDSA cycle 1, all full-time providers received a voice-over PowerPoint and an attachment of the proposed workflow (see appendix A) in their emails, which possibly correlated to the success of the problem list in the first cycle. However, over the next two PDSA cycles, the usage dropped from 100% to 76.9% and then to 70%. It is difficult to determine what exactly caused this decrease, but providers reported not remembering, and there was an increase of per diem providers working during the holidays for the last two months of the year. Overall, there was an increase from the practice's baseline use of the problem list which is reassuring for the accurate management of HDP. Use of a patient's medical history in the EMR is an important step to ensure proper long-term management since HDP patients are at risk for cardiovascular complications later in life (Redman et al., 2019). The use of the medical history fluctuated throughout the project, with the highest use after cycle 2 at 92.3%, but then decreased to 70% after cycle 3. The direct correlation to this decrease was unknown due to not receiving feedback after the monthly meeting was cancelled, which in itself was an example of one of many the challenges of implementing a quality improvement project at a large organization.

The first PDSA cycle showed a 58.3% use of the discharge smartphrase when discharging HDP patients. A decrease to 46.2% was noticed after cycle 2, and individual emails that solicited feedback were sent to the lowest-using providers. A general email to all full-time providers to remind them about the project going into the last month was also sent. Furthermore, since this is a teaching hospital, the midwifery students were involved in the discharge of patients. A reminder email was sent to all midwifery students to encourage use of the

hypertensive bundle. The next cycle use increased to a use of 80%, which officially met a global aim of the project. During chart reviews, it was discovered that occasionally providers were not using the HDP discharge smartphrase specifically but rather documented some other phrase that included postpartum preeclampsia teaching. It was decided to monitor this activity since it showed that while the specific bundle was not used, some patients still received adequate teaching. By the end of the project, 80% of the time the discharge smartphrase was used, but even in the instances it was not, adequate postpartum teaching was documented 100% of the time.

There is limited data on how often HDP patients follow-up for the recommended in person office based blood pressure check in the nation, but one study found that only 44% patients returned for this visit (Hirshberg et al., 2018). Interestingly, the incidence of an in person 72-hour blood pressure check declined throughout the course of the study. It is surprising that by the end of the project, 80% of HDP patients had the discharge smartphrase documented in their chart and providers recommended to have a clinic blood pressure check, but only 50% of patients attended the visit. More information is needed on the relationship between discharge instructions and postpartum visit attendance. This project measured how often a smartphrase was used, but not how much information the patient received or whether there were barriers to attendance.

One of the most challenging aspects of this project was provider buy-in at a very large organization. This was one of the first major quality improvement projects at this site and therefore, this project shed light on some organizational challenges. Throughout the project, emails were sent to both the full-time midwives and full-time physicians. However, emails were never sent to the per diem physicians because there were over 100 who took OB call. Instead, providers were encouraged to remind their colleagues of this project through report at change of

shift. It is difficult to determine how often this actually occurred. After PDSA cycle 2, it was apparent that a high number of per diem providers were not using the discharge smartphrase. An email was sent to the per diem midwives to remind them of the project. While this is a collaborative practice, the midwives and physicians are often seen as two different groups instead of a cohesive union, suggesting a possible weak link between the collaborative practice.

Furthermore, this project ran into further issues because it coincided with two major US holidays. First, the November meeting was cancelled due to one holiday, which was unfortunate because it was the end of PDSA cycle 2 when use of the hypertensive bundle was low. Additionally, per diem providers take a majority of the OB call during the holiday season which resulted in providers working who weren't familiar with the project.

Limitations

The generalizability of this QI initiative was limited by imprecision in the design in that there was little connection with the many providers of the organization, primarily per diem physicians. Furthermore, throughout the project there were very few actual meetings with physicians and typically poor response with email communication. The monthly chart reviews were completed by the author and the student leader of the simultaneous QI project that focused on the patient education arm. There is a possibility that human errors were made during data collection, as well as the two students interpreting clinical situations differently, which may have impacted the results. To get ahead of this, the first round of chart reviews were completed in tandem to make sure patient's charts were analyzed equally in the same manner.

Conclusion and Future Recommendations

First, this practice would benefit from utilizing a standardized discharge template. During chart reviews, it was noted that there were four different templates that providers used.

Increasing standardization in patient care leads to improved maternal HDPP outcomes (CMQCC, 2021; Skurnik et al., 2016; Suresh et al., 2021). The practice should have one discharge summary template for all patients that includes general postpartum teaching and postpartum hypertension warning signs. With 34.4% of the local population served affected by HDPP, many patients are at risk for postpartum hypertension and all patients should be aware of warning signs. Second, all providers who discharge patients from the practice should receive education on how to include HDPP in discharge teaching and utilize the new template. With this approach, patients would receive adequate postpartum teaching, which is critical for improved postpartum health and outcomes (Lovgren et al., 2022; PF, 2019).

The recommendation is that this project be continued by the next cohort of midwifery students. This project only scratched the surface of possible quality improvement efforts for HDPP at this site and it is imperative that the quality improvement work is continued. The next iteration of this project could include tracking patient HDPP rates and accurate documentation. It could also possibly include the patient associated demographics and risk factors due to the known racial component with non-Hispanic Black women facing an increased risk and disease burden (Parker et al., 2023). It is necessary for providers and hospitals to be aware of this specific burden on the patients and then take evidence based interventions towards health equity. The specific findings and recommendations were relayed to the practice to help inform the practice about the population that they serve and where quality improvement efforts need to continue.

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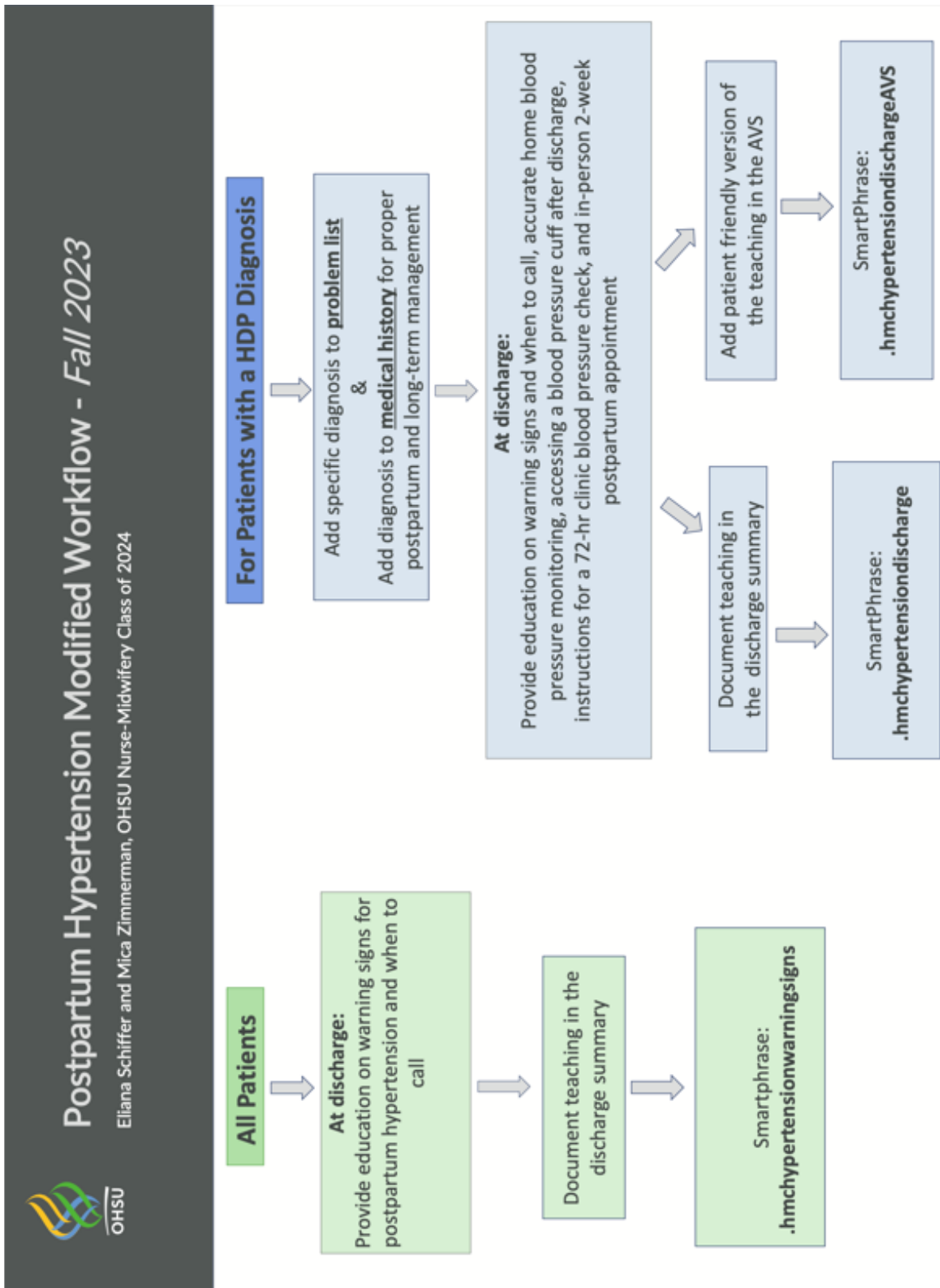
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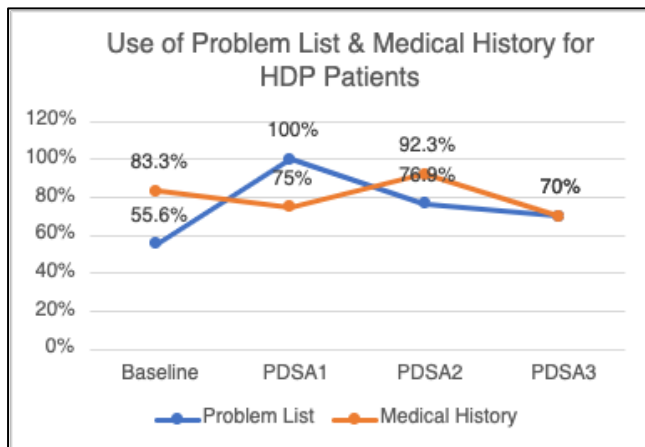
Appendix A: Postpartum Hypertension Modified Workflow



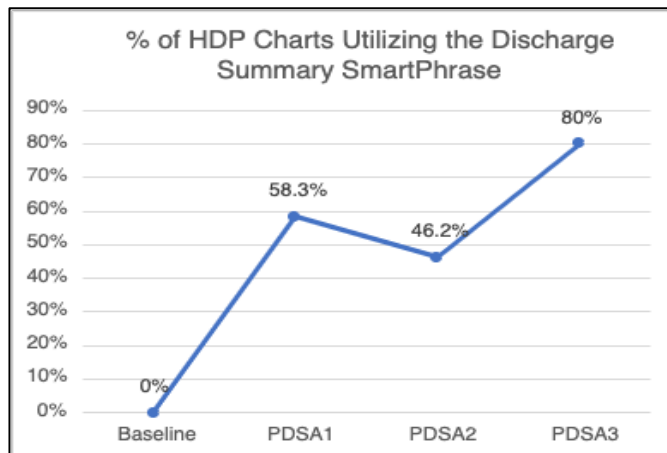
*The green workflow and patient friendly AVS were interventions from a related, but separate, QI project.

Appendix B: Results

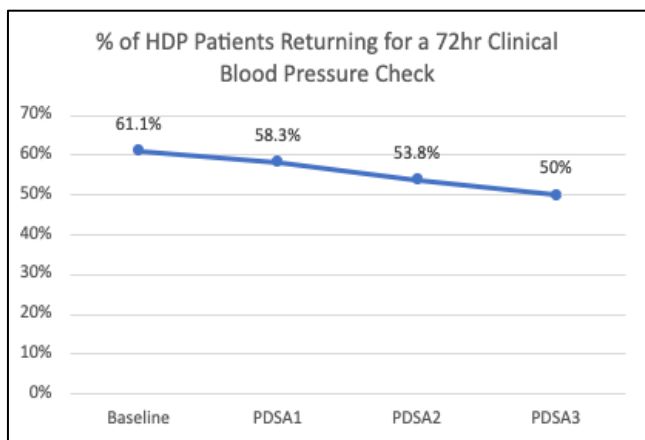
Graph 1:



Graph 2:



Graph 3:



Graph 4:

