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Timing of Outpatient Postpartum Care Utilization Among Women with Chronic Hypertension and Hypertensive Disorders of Pregnancy

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Abstract

Background: The postpartum period represents an opportunity to assess the cardiovascular health of women who experience chronic hypertension or hypertensive disorders of pregnancy.

Objectives: To determine whether women with chronic hypertension or hypertensive disorders of pregnancy access outpatient postpartum care more quickly compared to women with no hypertension.

Study Design: We used data from the Merative MarketScan® Commercial Claims and Encounters Database. We included 275,937 commercially insured women aged 12-55 years who had a live birth or stillbirth delivery hospitalization between 2017-2018 and continuous insurance enrollment from 3 months before the estimated start of pregnancy to 6 months after delivery discharge. Using International Classification of Diseases 10th Revision Clinical Modification codes, we identified hypertensive disorders of pregnancy from inpatient or outpatient claims from 20 weeks gestation through delivery hospitalization and identified chronic hypertension from inpatient or outpatient claims from the beginning of the continuous enrollment period through delivery hospitalization. Distributions of time-to-event survival curves (time-to-first outpatient

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postpartum visit with a women's health, primary care, or cardiology provider) were compared between the hypertension types using Kaplan-Meier estimators and log rank tests. We used Cox proportional hazards models to estimate adjusted hazard ratios (aHR) and 95% confidence intervals (CI). Time points of interest (3, 6, and 12 weeks) were evaluated per clinical postpartum care guidelines.

Results: Among commercially insured women, the prevalences of hypertensive disorders of pregnancy, chronic hypertension, and no documented hypertension were 11.7%, 3.4%, and 84.8%, respectively. The proportions of women with a visit within 3 weeks of delivery discharge were 28.5%, 26.4%, and 16.0% for hypertensive disorders of pregnancy, chronic, and no documented hypertension, respectively. By 12 weeks, the proportions increased to 62.4%, 64.5%, and 54.2%, respectively. Kaplan-Meier analyses indicated significant differences in utilization by hypertension type and interaction between hypertension type and time before and after 6 weeks. In adjusted Cox proportional hazards models, the utilization rate before 6 weeks among women with hypertensive disorders of pregnancy was 1.42 times the rate for women with no documented hypertension [aHR=1.42, 95% CI (1.39–1.45)]. Women with chronic hypertension also had higher utilization rates compared to women with no documented hypertension before 6 weeks [aHR=1.28, 95% CI: (1.24–1.33)]. Only chronic hypertension was significantly associated with utilization compared to the no documented hypertension group after 6 weeks [aHR=1.09, 95% CI: (1.03–1.14)].

Conclusions: In the 6 weeks following delivery discharge, women with hypertensive disorders of pregnancy and chronic hypertension attended outpatient postpartum care visits sooner than women with no documented hypertension. However, after 6 weeks this difference extended only to women with chronic hypertension. Overall, postpartum care utilization remained around 50-60% by 12 weeks in all groups. Addressing barriers to postpartum care attendance can ensure timely care for women at high risk for cardiovascular disease.

Condensation:

Women with chronic hypertension and hypertensive disorders of pregnancy attend outpatient postpartum care visits sooner than women with no hypertension, but utilization remains ~50-60% overall.

Keywords

Hypertensive disorders of pregnancy; hypertension; chronic hypertension; postpartum care; healthcare utilization

Introduction

The postpartum period represents an opportunity to assess the cardiovascular health of women with chronic hypertension or hypertensive disorders of pregnancy (HDP), including gestational hypertension, preeclampsia or eclampsia, and chronic hypertension with superimposed preeclampsia. Chronic and pregnancy-associated hypertension are associated with severe maternal morbidity, including postpartum hemorrhage and stroke.[1,2] Further, cardiovascular complications during pregnancy are associated with long-term risk of cardiovascular disease (CVD) for both the mother and child.[3-5] Women with HDP require

monitoring during and after pregnancy to manage their increased risk of adverse birth and long-term health outcomes.[6]

The American College of Obstetricians and Gynecologists (ACOG) provides clinical recommendations for postpartum care.[7-9] In 2018, ACOG updated its guidance for timing of postpartum care, recommending a shift away from an "arbitrary 6-week check" towards a more individualized and ongoing process, whereby women see their provider within the first 3 weeks postpartum for an initial assessment, followed by ongoing follow-up care as needed, and a comprehensive postpartum visit no later than 12 weeks after birth.[8] Early postpartum care initiation is critical for women with chronic hypertension or HDP, as substantial morbidity occurs in the early postpartum period.[8] Studies have shown that more than half of postpartum strokes occur within 10 days of discharge.[10] However, postpartum care rates range from 5.7%-95.4%, and a review of 9 observational US-based studies found lower utilization rates among Black and Hispanic persons (compared to White persons), persons with lower education, and persons with comorbidities (e.g., mental health disorders).[11] Postpartum care utilization also varies by hypertension type. A cohort study using US commercial claims found that by 6 months post-delivery, only 47% of women with normotensive pregnancies, 58% with HDP, and 60% with chronic hypertension had visited a health professional.[12] Factors associated with lower follow-up in this study included maternal age >30 years, Black or Hispanic racial/ethnic backgrounds, and multiple gestations.[12]

Despite these documented differences in postpartum care utilization, few studies have examined the distribution and timing of postpartum care among women with hypertension. Therefore, our objective was to assess postpartum care utilization according to timelines outlined by ACOG,[6,9] and we hypothesized that women with chronic hypertension or HDP would access postpartum care before women with no hypertension. Using a large, commercial US health insurance claims database, we examined whether women with chronic hypertension or HDP have similar timing of postpartum care utilization as women with no hypertension.

Materials and Methods

Study design and data source

We conducted a retrospective cohort study using 2016-2019 insurance claims data from the Merative MarketScan® Commercial Claims and Encounters (CCAE) Database, a large convenience sample of claims from persons with employer-sponsored insurance and their dependents.[13] The database includes de-identified, encounter-level services data from outpatient, inpatient, pharmacy, and laboratory claims that can all be linked by unique patient identifier.[14] We did not seek approval from an Institutional Review Board as all data were previously collected and statistically de-identified. These data comply with the conditions set forth in Sections 164.514(a)-(b)(1)ii of the Health Insurance Portability and Accountability Act of 1996 Privacy Rule.

Study population

We created an analytic cohort of women aged 12-55 years with ≥1 inpatient live birth or stillbirth delivery hospitalization between January 1, 2017 and December 31, 2018 (Figure 1). Delivery hospitalizations were identified using International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) diagnosis and procedure codes pertaining to delivery and diagnosis-related group (DRG) delivery codes, excluding ectopic and molar pregnancies and those with abortive outcomes (Supplemental Table A.1).[15-17] We excluded claims with gestational age <20 weeks, missing gestational age, and missing enrollee IDs.[16] For women with multiple delivery hospitalizations, we applied a clinically relevant wash-out period of 182 days.[18] For claims with admission dates <182 days apart, we selected the delivery hospitalization with older gestational age and longer length of stay.[16] We implemented a continuous enrollment restriction (allowing coverage gaps of ≤30 days) and excluded claims of women without continuous coverage from 3 months before the estimated start of pregnancy to 6 months after delivery discharge. The start of pregnancy was estimated with the last menstrual period date, which was calculated by subtracting the estimated gestational age from the hospital delivery discharge date. Among women with plausible multiple deliveries during our study period, we randomly selected one delivery.[16] We excluded women with unspecified maternal hypertension (ICD-10-CM code O16) at delivery hospitalization.

Defining hypertension types

Our exposure of interest was hypertension type (HDP, chronic hypertension, and no documented hypertension) and was identified using ICD-10-CM diagnosis codes (Supplemental Table A1). Because pregnancy-associated hypertension presents after 20 weeks gestation,[6] we identified HDP from any inpatient or outpatient claim from 20 weeks gestation through delivery hospitalization. Chronic hypertension, defined as diagnosed hypertension from the beginning of the continuous enrollment period through delivery hospitalization, was identified as ≥1 inpatient or ≥2 outpatient claims ≥30 days apart among women without HDP. Women without HDP or chronic hypertension were classified as having no documented hypertension.

Postpartum care utilization

Our outcome of interest was time (weeks) from the delivery hospitalization discharge date to the first outpatient postpartum visit with a women's health, primary care, or cardiology provider. We identified outpatient postpartum care providers using provider type codes from outpatient insurance claims (Supplemental Table A.2). Additionally, based on ACOG timing guidelines,[6,9] we determined the proportion of women with a postpartum care visit within 3, 6, and 12 weeks of delivery discharge.

Covariates

Demographic characteristics were abstracted from the CCAE database and delivery hospitalization record. Neither race nor ethnicity data were available in the CCAE database. Medical comorbidities (diabetes mellitus, hyperlipidemia, ischemic heart disease, obesity, chronic kidney disease, asthma, mental health conditions, substance use disorder, alcohol

use disorder, and tobacco use) were defined using ICD-10-CM diagnosis codes and identified as ≥1 inpatient or ≥2 outpatient claims ≥30 days apart from the beginning of the continuous enrollment period through delivery hospitalization (Supplemental Table A.1).[19] Obstetric outcomes (cesarean delivery, preterm delivery, multiple gestations, gestational diabetes, and stillbirth) were identified with ICD-10-CM diagnosis and procedure codes at delivery hospitalization (Supplemental Table A.1). Pre-pregnancy blood pressure medication use, which is associated with both hypertension and postpartum care attendance, was assessed using generic drug identifier codes reported on pharmacy claims data, identified from the beginning of the continuous enrollment period to the estimated start of pregnancy.

Statistical analyses

Descriptive statistics by hypertension type were calculated. Chi-square and t-tests were used to compare variables by hypertension type. We fit logistic regression models to estimate the odds of each hypertension type among those with a postpartum care visit within 3, 6, and 12 weeks, compared to those with no documented hypertension. For the time-to-event analysis, we generated adjusted Kaplan-Meier failure curves (*1 – survival probability*) to illustrate the time (weeks), from the delivery hospitalization discharge date to the first outpatient postpartum visit with a women's health, primary care, or cardiology provider by the 3 hypertension types. We used log rank tests to test for differences ($p<0.05$) in time-to-first visit between hypertension types. For the adjusted survival analyses, we used Cox proportional hazards models to estimate adjusted hazard ratios (aHR) and 95% confidence intervals (CI). Models were adjusted for age, residence, medical comorbidities, obstetrics outcomes, and pre-pregnancy blood pressure medication use. The final adjusted model additionally included an interaction term for exposure*time to correct for a violation of the proportional hazards assumption by the exposure and time at the 6-week mark. Therefore, aHRs were reported for 2 time periods: from delivery hospitalization discharge to 6 weeks postpartum, and from 6 to 12 weeks postpartum.

Results

Patient characteristics

We identified 517,151 claims of commercially insured women aged 12-55 years with an inpatient delivery hospitalization between 2017-2018. After instituting the continuous enrollment restriction, our sample decreased by approximately one-third (Figure 1). After applying all exclusion criteria, the analytic cohort included 275,937 women (Figure 1).

Overall patient characteristics are presented in Table 1. The mean age of women in our study was 30.7 years old (SD=5.3). Most women lived in an urban setting (78.7%). The prevalences of HDP, chronic hypertension, and no documented hypertension were 11.7%, 3.4%, and 84.8%, respectively.

Patient characteristics by hypertension type

The patient characteristics by hypertension type are presented in Table 1. Maternal age was similar across hypertension types. Women with HDP and chronic hypertension had a higher

prevalence of select comorbidities (chronic diabetes, hyperlipidemia, obesity, chronic kidney disease, mental health conditions) than women with no documented hypertension.

Postpartum care utilization within 3, 6, and 12 weeks of delivery discharge

The overall proportion of women with a visit after delivery discharge was 17.8% within three weeks; 36.4% within 6 weeks, and 55.5% within 12 weeks (Table 1). By hypertension type, the proportion of women with a visit within 3 weeks of delivery discharge was 28.5% for HDP, 26.4% for chronic hypertension, and 16.0% for no documented hypertension. By 12 weeks, the proportions rose to 62.4%, 64.5%, and 54.2%, respectively. Bivariate associations between patient characteristics and first postpartum care visit are presented in Table 2. Women with HDP [OR=2.09, 95% CI: (2.04–2.15)] or chronic hypertension [(OR=1.89, 95% CI: (1.80–1.98)] were significantly more likely to access postpartum care within the first 3 weeks of delivery discharge than women with no documented hypertension. These associations were similar at 6 weeks and 12 weeks postpartum, but the strength of the associations attenuated over time.

Associations between hypertension types and postpartum care utilization within 3, 6, and 12 weeks of delivery discharge

The adjusted associations between hypertension type and first postpartum care visit at 3, 6, and 12 weeks are presented in Table 3. Women with HDP were more likely to have a postpartum care visit within 3 weeks compared to women with no documented hypertension, after adjusting for covariates [(aOR=1.84, 95% CI: (1.79–1.90)]. Similarly, women with chronic hypertension were more likely to have a postpartum care visit within 3 weeks compared to women with no documented hypertension [(aOR=1.47, 95% CI: (1.40–1.56)]. These associations were similar at 6 and 12 weeks postpartum, but the strength of associations attenuated with time.

Time-to-first postpartum care visit

Kaplan-Meier analyses indicated statistically significant differences in time-to-first visit by hypertension type (log rank χ^2=1991.0; p<0.0001). The unadjusted survival curves showed that women with HDP and chronic hypertension had similar probabilities of postpartum care utilization, while women with no documented hypertension had significantly lower utilization. The survival curves for all 3 hypertension types showed a similar trend of a faster increase in time-to-first visit as time approached the 6-week mark. Further, the survival curves for HDP and chronic hypertension crossed at approximately 6 weeks, indicating interaction between the exposure (hypertension type) and time before and after 6 weeks.

After controlling for patient characteristics and an interaction term for exposure*time before and after 6 weeks, the proportional hazards assumption was satisfied (Figure 2).

In adjusted analyses, from delivery discharge to ≤6 weeks, among women with HDP, the utilization rate for postpartum care was 1.42 times the rate for women with no documented hypertension (aHR=1.42, 95% CI: 1.39–1.45); among women with chronic hypertension, the utilization rate for postpartum care was 1.29 times the rate for women with no documented hypertension (aHR=1.28, 95% CI: 1.24–1.33) (Table 4). From >6 to 12 weeks postpartum,

only the chronic hypertension group had a statistically significantly different time-to-first postpartum care visit compared to those with no documented hypertension (aHR=1.09, 95% CI: 1.03–1.14).

Comment

Principal findings

In our analysis of commercial insurance claims data, from delivery discharge through ≤6 weeks postpartum, women with HDP and chronic hypertension attended outpatient postpartum care visits sooner than women with no documented hypertension. Between >6 and 12 weeks after delivery, only women with chronic hypertension had a faster rate of postpartum care utilization compared to women with no documented hypertension. Despite these differences, in our assessment of utilization rates in line with timelines outlined in ACOG guidance,[6,9] the overall utilization of postpartum care, regardless of hypertension type, was 56%.

Results in the context of what is known

Our estimated prevalences of chronic hypertension and HDP are similar to those reported by Ford et al. (2022) in a nationally representative study of US delivery hospitalizations using ICD-10 codes.[20] Few studies have examined postpartum care utilization by hypertension status.[12,21] Our finding that roughly half of women attended a postpartum visit by 12 weeks following delivery discharge is similar to previous estimates.[12,22] A cohort study of 2017-2018 data from a hospital in Newark, NJ found that 51% of women with HDP attended a clinic visit 3-10 days after delivery for a blood pressure evaluation.[22] Further, this same study found that women with more severe hypertension and those with postpartum readmission or emergency department visits for hypertension were more likely to attend an early clinic visit for blood pressure evaluation, which is in line with our findings regarding differences in postpartum care utilization among women with HDP and chronic hypertension.

Our estimates are lower than a study using data from the Pregnancy Risk Assessment Monitoring System (PRAMS) that found that approximately 9-in-10 women reported attending a postpartum care visit during 2016-2017.[23] Differences might be explained by the timing of PRAMS data collection (survey administered approximately 2-6 months after live birth) , social desirability bias in self-reported data,[24] and/or differences in analytic sample composition (i.e., analysis of population based sample of live births in participating PRAMS jurisdictions vs. convenience sample of commercially insured women). Further, because maternity care is often paid for as a global payment, it is well-documented in Medicaid literature that postpartum care visits do not always show up in administrative data.[25] Although not as commonly cited for commercial insurance, global payment is still a known payment strategy for commercially insured patients[26] and may explain why self-reported utilization rates are higher in PRAMS.

Clinical implications

The updated 2018 ACOG Committee Opinion recommends moving towards individualized, women-centered timing of postpartum care with services and support tailored to individual needs.[8] Current guidelines suggest screening for HDP should start early and follow-up should be ongoing.[27] Recent (2023) draft recommendations on screening for HDP by the US Preventive Services Task Force continue to reinforce that all pregnant women should be screened for hypertension at every prenatal visit.[28,29] Further, continuing follow-up after the 12-week comprehensive postpartum evaluation offers the opportunity for counseling, planning, and interventions to improve underlying medical conditions, including the development of CVD, to improve future pregnancy outcomes and cardiovascular health.

The relative risk of developing long-term CVD complications after delivery with HDP is largest during the first 6 months through the first 5 years after delivery.[30,31] Monitoring and managing blood pressure in the first 6 weeks after birth predicts diastolic blood pressure at 3 to 4 years, underlining the importance of early initiation of postpartum care.[32] The 12-week postpartum care utilization rates among women with chronic hypertension (65%) and HDP (62%) in our study are concerning given the increased risk in this group.[33] Several observational and clinical experimental studies have demonstrated the effectiveness of transitional clinics, lifestyle modifications, out-of-office blood pressure monitoring, telemedicine, targeted medication, and patient and provider education on HDP, and such methods may be considered to improve CVD risk reduction among this population.[34-36]

Research implications

Future research may explore timing of postpartum care utilization by hypertension status among Medicare/Medicaid populations, who may have different prevalences and utilization patterns compared to commercially insured women. Disparities in access to postpartum care by social determinants such as socioeconomic status and race/ethnicity may also be explored. While we did not assess postpartum care utilization by provider type, future analyses may consider differences in utilization by women's health, primary care, or cardiology providers. Lastly, a pre-post analysis of changes before and after the updated ACOG guidelines were issued may also be explored.

Strengths and limitations

Our study has several strengths. First, this is the first study that examines the timing and rate of postpartum care utilization across hypertension types, contributing to the limited existing research about hypertension and postpartum care utilization. Second, we utilized a large, administrative claims database with approximately 18 months of follow-up per woman. Finally, understanding the timing of postpartum care utilization among hypertension types can help develop interventions and strategies to increasing postpartum care among this population.

This study is subject to several limitations. Data on delivery hospitalization, hypertension, comorbidities, and obstetric conditions depend on accurate ICD-10-CM coding and may be under-coded or not captured well in administrative claims. Further, our hypertension types were defined using only ICD-10-CM coding to ensure consistency with other

published reports;[20] such coding does not define anti-hypertensive medication, which may underestimate the prevalence of chronic hypertension in our sample. Chronic hypertension may also be underestimated due to underreporting if the diagnosis does not interfere with patient care, underreporting of women with chronic, controlled hypertension during birth, and lack of standard diagnostic criteria for chronic hypertension among providers.[37,38] Our study does not capture de novo hypertension in the immediate postpartum period, which contributes to approximately 10% of all HDP cases.[39] Our postpartum care outcome was based on provider codes and thus we cannot discern if the visit was for postpartum care broadly or for follow-up on a chronic condition or pregnancy complication. The CCAE database lacks important sociodemographic characteristics, such as race/ethnicity, limiting our ability to assess how patterns of hypertension and postpartum care may vary by this social construct. Lastly, results may not be generalizable to births outside of a hospital, patients without commercial insurance, and patients without continuous enrollment. As a result, we may overestimate utilization rates, as the discontinuity of insurance is associated with lower rates of care.

Conclusions

In the 6 weeks following delivery discharge, women with HDP and chronic hypertension attend outpatient postpartum care visits sooner than women with no documented hypertension. However, postpartum care utilization remains around 50-60% by 12 weeks among all hypertension types. Improving clinical and individual patient awareness of the importance of hypertension screening, ensuring timely follow-up care among those with hypertensive diseases, and addressing barriers to postpartum care attendance are critical steps to optimizing the health of women at high risk for CVD.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Glossary

Interaction	Interaction is present when the effect of one exposure on an outcome depends on the presence or absence of another factor, such that the effect of the two factors on the outcome is different than would be expected based on the independent effects of each factor.

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AJOG at a Glance:

A. **Why was this study conducted?** The postpartum period represents an opportunity to assess the cardiovascular health of women who experience chronic hypertension or hypertensive disorders of pregnancy. We examined the timing of outpatient postpartum care visits following hospital delivery discharge among women enrolled in a large, commercial US health insurance claims database.

B. **What are the key findings?** In the six weeks following delivery, women with hypertensive disorders of pregnancy attended postpartum care visits 42% sooner [aHR: 1.42, 95% CI: (1.39–1.45)] and women with chronic hypertension attended 28% sooner [aHR: 1.28, 95% CI: (1.24–1.33)] than women with no documented hypertension. However, utilization remained low (50-60%) among all women.

C. **What does this study add to what is already known?** There are known differences in postpartum care utilization rates by hypertension type. Our findings suggest there are also differences in the timing of postpartum care utilization by hypertension type.

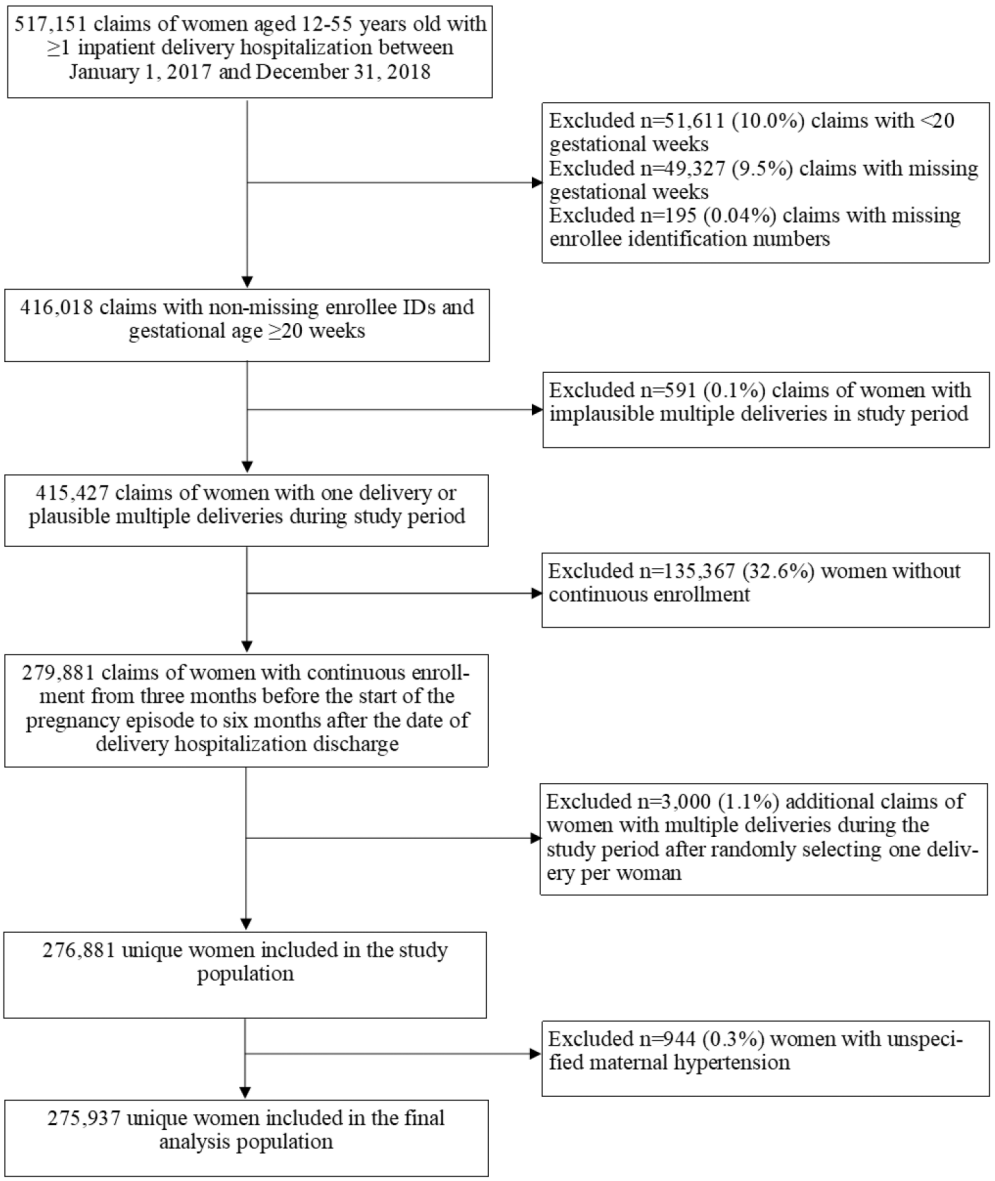

Figure 1:

Flow chart depicts creation of analysis population derived from the Merative™ MarketScan® Commercial Claims and Encounters Database (years 2016-2019) and includes delivery hospitalizations between January 1, 2017 – December 31, 2018.

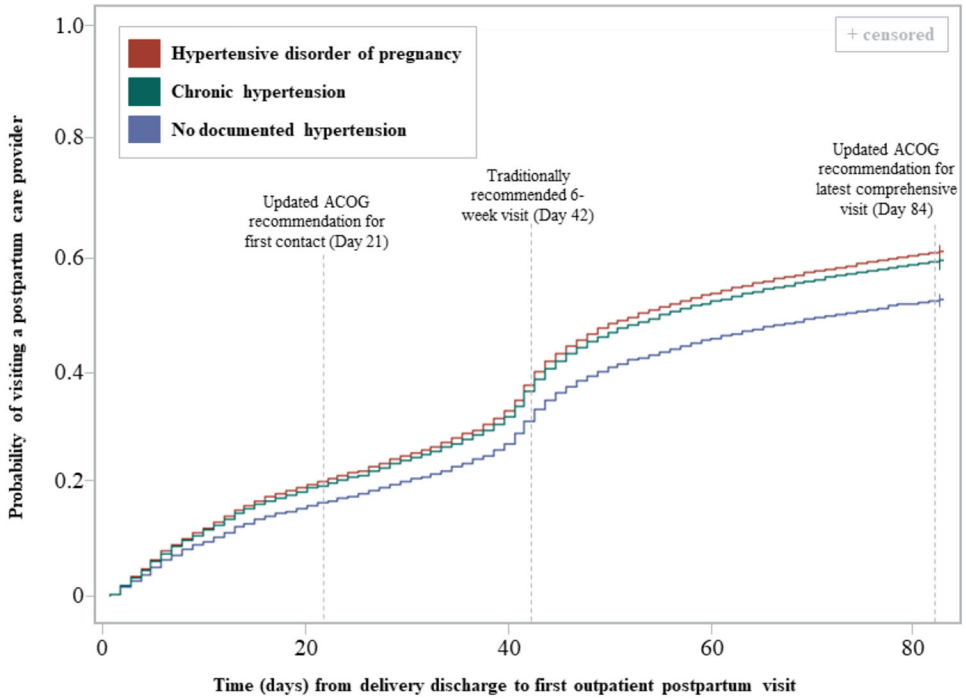

Figure 2:

Adjusted Kaplan-Meier curves for time-to-first outpatient postpartum care visit following delivery hospitalization discharge (days) by hypertension type; hazards ratios were adjusted for age, residence designation, region of residence, medical comorbidities, obstetrics outcomes, pre-pregnancy blood pressure medication use, and an interaction term for exposure*time before and after six weeks; abbreviations: ACOG = American College of Obstetricians and Gynecologists

Table 1.

Patient characteristics by hypertension types, Merative MarketScan® Commercial Claims and Encounters Database, 2016-2019 (N=275,937).

Patient characteristics	Overall (n=275,937)	Hypertensive disorder of pregnancy[a] (n=32,366)	Chronic hypertension[b] (n=9,469)	No documented hypertension (n=234,102)
	n(%)/mean(SD)	n(%)/mean(SD)	n(%)/mean(SD)	n(%)/mean(SD)
Demographic				
Age, years	30.7 (5.3)	30.5 (5.6)	32.5 (5.4)	30.7 (5.2)
Residence designation[c]				
Urban	217,101 (78.7)	24,832 (76.7)	7,046 (74.4)	185,223 (79.1)
Rural	28,939 (10.5)	1,243 (13.1)	1,501 (12.7)	23,794 (10.2)
Missing/unknown	29,897 (10.8)	1,180 (12.5)	1,421 (12.1)	25,085 (10.7)
Region				
Northeast	42,906 (15.6)	4,327 (13.4)	1,115 (11.8)	37,465 (16.0)
North Central	60,888 (22.1)	7,232 (22.3)	1,714 (18.1)	51,942 (22.2)
South	126,943 (46.0)	16,410 (50.7)	5,619 (59.3)	104,914 (44.8)
West	44,965 (16.3)	4,376 (13.5)	1,015 (10.7)	39,574 (16.9)
Missing/unknown	235 (0.1)	21 (0.1)	6 (0.1)	208 (0.1)
Medical				
Comorbidities[b]				
Diabetes mellitus	4,974 (1.8)	1,167 (3.6)	734 (7.8)	3,073 (1.3)
Hyperlipidemia	1,783 (0.7)	321 (1.0)	275 (2.9)	1,187 (0.5)
Ischemic heart disease	140 (0.1)	20 (0.1)	21 (0.2)	99 (0.1)
Obesity	33,171 (12.0)	7,314 (22.6)	3,201 (33.8)	22,656 (9.7)
Chronic kidney disease	1,074 (0.4)	257 (0.8)	117 (1.2)	700 (0.3)
Asthma	12,582 (4.6)	1,741 (5.4)	603 (6.4)	10,238 (4.4)
Mental health condition	29,661 (10.8)	4,087 (12.6)	1,357 (14.3)	24,217 (10.3)
Substance use disorder	3,523 (1.3)	473 (1.5)	192 (2.0)	2,855 (1.2)
Tobacco use	13,494 (4.9)	1,574 (4.9)	538 (5.7)	11,382 (4.9)
Alcohol use disorder	634 (0.2)	82 (0.3)	31 (0.3)	521 (0.2)
Obstetrics outcomes				
Cesarean delivery	92,861 (33.7)	14,551 (45.0)	4,574 (48.3)	73,733 (31.5)
Preterm delivery	26,165 (9.5)	7,510 (23.2)	1,161 (12.3)	17,494 (7.5)
Multiple gestations	17,416 (6.3)	2,859 (8.8)	691 (7.3)	13,866 (5.9)
Gestational diabetes	25,108 (9.1)	3,924 (12.1)	1,722 (18.2)	19,462 (8.3)
Stillbirth	1,677 (0.6)	175 (0.5)	99 (1.1)	1,403 (0.6)
Postpartum care utilization[d]				
First postpartum care visit within 3 weeks	49,094 (17.8)	9,220 (28.5)	2,501 (26.4)	37,373 (16.0)
First postpartum care visit within 6 weeks	100,342 (36.4)	14,756 (45.6)	4,296 (45.4)	81,290 (34.7)
First postpartum care visit within 12 weeks	153,179 (55.5)	20,205 (62.4)	6,109 (64.5)	126,865 (54.2)
No postpartum care visit within 12 weeks	122,758 (44.5)	12,161 (37.6)	3,3360 (35.5)	107,237 (45.8)

Patient characteristics	Overall (n=275,937) n(%)/mean(SD)	Hypertensive disorder of pregnancy[a] (n=32,366) n(%)/mean(SD)	Chronic hypertension[b] (n=9,469) n(%)/mean(SD)	No documented hypertension (n=234,102) n(%)/mean(SD)
Health care characteristics				
Insurance plan type				
Comprehensive	5,360 (1.9)	660 (2.0)	192 (2.0)	4,508 (1.9)
EPO	2,075 (0.8)	243 (0.8)	52 (0.6)	1,780 (0.8)
HMO	32,447 (11.8)	3,768 (11.6)	992 (10.5)	27,687 (11.8)
POS	18,700 (6.8)	2,396 (7.4)	838 (8.9)	15,466 (6.6)
PPO	140,863 (51.1)	16,709 (51.6)	4,808 (50.8)	119,364 (51.0)
POS with capitation	3,571 (1.3)	436 (1.4)	288 (3.0)	2,847 (1.2)
CDHP	34,721 (12.6)	4,134 (12.8)	1,123 (11.9)	29,464 (12.6)
HDHP	31,355 (11.4)	3,222 (10.0)	879 (9.3)	27,250 (11.6)
Unknown/missing	6,849 (2.5)	798 (2.5)	297 (3.1)	5,754 (2.5)
Pre-pregnancy blood pressure medication use	3,654 (1.3)	883 (2.7)	1,736 (18.3)	1,035 (0.4)

[a] Hypertensive disorders of pregnancy include gestational hypertension, preeclampsia or eclampsia, and chronic hypertension with superimposed preeclampsia documented in any inpatient or outpatient claims from 20 weeks gestation through delivery hospitalization

[b] Identified from inpatient (≥1 diagnosis) or outpatient claims (≥2 diagnoses, ≥30 days apart) from the beginning of the continuous enrollment period through delivery hospitalization

[c] Determined from Metropolitan Statistical Area (MSA) of primary beneficiary's residence

[d] Postpartum care visit defined as the first of any outpatient visit with a women's health provider, primary care provider, or cardiologist; calculated from date of delivery hospitalization discharge

Abbreviations: SD=standard deviation; EPO=exclusive provider organization; HMO=health maintenance organization; POS=point-of-service; PPO=preferred provider organization; CHDP=consumer-driven health plan; HDHP=high-deductible health plan

Table 2.

Unadjusted bivariate associations of patient characteristics with first postpartum care utilization within 3, 6, and 12 weeks of delivery hospitalization, 2016-2019 (N=275,937).

Patient characteristics	First postpartum care visit within 3 weeks[a] OR (95% CI)	First postpartum care visit within 6 weeks[a] OR (95% CI)	First postpartum care visit within 12 weeks[a] OR (95% CI)
Hypertension type [b]			
Hypertensive disorder of pregnancy	**2.09** * (2.04–2.15)	**1.58** * (1.54–1.61)	**1.40** * (1.37–1.44)
Chronic hypertension	**1.89** * (1.80–1.98)	**1.56** * (1.50–1.63)	**1.54** * (1.47–1.60)
No documented hypertension	ref		ref
Demographic			
Age, years			
Under 35	**0.87** * (0.85–0.89)	**0.96** * (0.95–0.98)	0.98 (0.97–1.00)
35 and older	ref	ref	ref
Residence designation[c]			
Urban	ref	ref	ref
Rural	0.99 (0.96–1.02)	1.01 (0.99–1.04)	0.99 (0.97–1.02)
Region			
Northeast	ref	ref	ref
North Central	**1.08** * (1.04–1.11)	**1.32** * (1.29–1.36)	**1.31** * (1.28–1.34)
South	0.98 (0.95–1.01)	**1.14** * (1.11–1.17)	**1.08** * (1.06–1.11)
West	0.99 (0.95–1.02)	**1.05** * (1.02–1.08)	0.99 (0.96–1.01)
Medical			
Comorbidities[d]			
Diabetes mellitus	**1.94** * (1.82–2.06)	**1.67** * (1.58–1.77)	**1.63** * (1.54–1.73)
Hyperlipidemia	**1.84** * (1.66–2.04)	**1.66** * (1.51–1.82)	**1.66** * (1.51–1.84)
Ischemic heart disease	**1.73** * (1.19–2.50)	**1.75** * (1.26–2.44)	1.35 (0.96–1.90)
Obesity	**1.45** * (1.41–1.49)	**1.31** * (1.28–1.34)	**1.30** * (1.27–1.33)
Chronic kidney disease	**1.54** * (1.34–1.77)	**1.44** * (1.28–1.62)	**1.37** * (1.18–1.51)
Asthma	**1.30** * (1.24–1.35)	**1.21** * (1.17–1.26)	**1.22** * (1.18–1.27)
Mental health condition	**1.57** * (1.53–1.62)	**1.47** * (1.43–1.50)	**1.54** * (1.50–1.58)
Substance use disorder	**1.56** * (1.44–1.68)	**1.37** * (1.28–1.46)	**1.27** * (1.19–1.36)
Alcohol use disorder	**1.30** * (1.08–1.57)	**1.25** * (1.07–1.46)	**1.22** * (1.04–1.43)
Tobacco use	**1.17** * (1.12–1.22)	**1.17** * (1.13–1.21)	**1.18** * (1.14–1.22)
Obstetrics outcomes			
Cesarean delivery	**1.61** * (1.57–1.64)	**1.27** * (1.25–1.29)	**1.09** * (1.08–1.11)
Preterm delivery	**1.65** * (1.60–1.70)	**1.39** * (1.36–1.43)	**1.28** * (1.24–1.31)
Multiple gestations	**1.27** * (1.23–1.32)	**1.16** * (1.12–1.20)	**1.11** * (1.08–1.15)

Patient characteristics	First postpartum care visit within 3 weeks[a] OR (95% CI)	First postpartum care visit within 6 weeks[a] OR (95% CI)	First postpartum care visit within 12 weeks[a] OR (95% CI)
Gestational diabetes	**1.26** * (1.22–1.31)	**1.17** * (1.14–1.20)	**1.18** * (1.15–1.21)
Stillbirth	**2.53** * (2.29–2.80)	**1.82** * (1.66–2.01)	**1.61** * (1.46–1.78)
Health care characteristics			
Pre-pregnancy blood pressure medication use	**2.19** * (2.05–2.35)	**1.82** * (1.70–1.94)	**1.93** * (1.79–2.07)

*P-value<0.05

[a]Postpartum care visit defined as the first of any outpatient visit with a women's health provider, primary care provider, or cardiologist; calculated from date of hospitalization discharge

[b]Hypertensive disorders of pregnancy include gestational hypertension, preeclampsia or eclampsia, and chronic hypertension with superimposed preeclampsia documented in any inpatient or outpatient claims from 20 weeks gestation through delivery hospitalization; chronic hypertension identified from inpatient (≥1 diagnosis) or outpatient (≥2 diagnoses, ≥30 days apart) claims from the beginning of the continuous enrollment period through delivery hospitalization

[c]Determined from Metropolitan Statistical Area (MSA) of primary beneficiary's residence

[d]Identified from inpatient (≥1 diagnosis) or outpatient claims (≥2 diagnoses, ≥30 days apart) from the beginning of the continuous enrollment period through delivery hospitalization

Note: Number of observations for modeling is n=275,937, with the exception of residence designation (n=246,040) and region (n=275,702)

Abbreviations: OR=odds ratio; CI=confidence interval; ref=referent group

Table 3.

Adjusted multivariate associations of hypertension type with first postpartum care utilization within 3, 6, and 12 weeks, (N=275,937).

	First postpartum care visit within 3 weeks[a]	First postpartum care visit within 6 weeks[a]	First postpartum care visit within 12 weeks[a]
Hypertension type[c]	**aOR[b] (95% CI)**	**aOR[b] (95% CI)[b]**	**aOR[b] (95% CI)**
Hypertensive disorder of pregnancy	**1.84** * (1.79–1.90)	**1.44** * (1.41–1.48)	**1.30** * (1.27–1.34)
Chronic hypertension	**1.47** * (1.40–1.56)	**1.31** * (1.25–1.37)	**1.30** * (1.24–1.37)
No documented hypertension	ref	ref	ref

*P-value<0.05

[a]Postpartum care visit defined as the first of any outpatient visit with a women's health provider, primary care provider, or cardiologist; calculated from date of delivery hospitalization discharge

[b]Adjusted for all covariates listed in Table 2

[c]Hypertensive disorders of pregnancy include gestational hypertension, preeclampsia or eclampsia, and chronic hypertension with superimposed preeclampsia documented in any inpatient or outpatient claims from 20 weeks gestation through delivery hospitalization; chronic hypertension identified from inpatient (≥1 diagnosis) or outpatient (≥2 diagnoses, ≥30 days apart) claims from the beginning of the continuous enrollment period through delivery hospitalization

Abbreviations: aOR=adjusted odds ratio; CI=confidence interval; ref=referent group

Table 4.

Multivariate Cox proportional hazards regression models estimating time-to-first postpartum care visit by hypertension category, (N=275,937).

	Delivery discharge to ≤6 weeks postpartum[a]	>6 to 12 weeks postpartum[a]
	Adjusted HR[b] (95% CI)	**Adjusted HR[b] (95% CI)**
Hypertension category [c]		
Hypertensive disorder of pregnancy	**1.42** * (1.39–1.45)	0.98 (0.95–1.01)
Chronic hypertension	**1.28** * (1.24–1.33)	**1.09** * (1.03–1.14)
No documented hypertension	Ref	Ref

*P-value<0.05

[a]Postpartum care visit defined as the first of any outpatient visit with a women's health provider, primary care provider, or cardiologist; calculated from date of delivery hospitalization discharge

[b]Adjusted for all covariates listed in Table 2 and an interaction term for exposure*time before and after six weeks

[c]Hypertensive disorders of pregnancy include gestational hypertension, preeclampsia or eclampsia, and chronic hypertension with superimposed preeclampsia documented in any inpatient or outpatient claims from 20 weeks gestation through delivery hospitalization; chronic hypertension identified from inpatient (≥1 diagnosis) or outpatient (≥2 diagnoses, ≥30 days apart) claims from the beginning of the continuous enrollment period through delivery hospitalization

Abbreviations: HR=hazard ratio; CI=confidence interval; ref=referent group