Hypertensive disorders of pregnancy and breastfeeding practices: A secondary analysis of data from the All Our Families Cohort

Kristin Horsley1 | Kathleen Chaput2 | Deborah Da Costa3 | Tuong-Vi Nguyen4 | Natalie Dayan3 | Lianne Tomfohr-Madsen5 | Suzanne Tough6

1Department of Psychology, Faculty of Science, McGill University, Montreal, Quebec, Canada
2Department of Obstetrics and Gynecology, Cummings School of Medicine, University of Calgary, Calgary, Alberta, Canada
3Department of Medicine, Faculty of Medicine, McGill University, Montreal, Quebec, Canada
4Department of Psychiatry, Faculty of Medicine, McGill University, Montreal, Quebec, Canada
5Department of Psychology, Faculty of Arts, University of Calgary, Calgary, Alberta, Canada
6Department of Pediatrics and Community Health Sciences, Cummings School of Medicine, University of Calgary, Calgary, Alberta, Canada

Correspondence
Kristin Horsley, Department of Psychology, McGill University 2001 Avenue McGill College, Montreal, Quebec H3A 1G1, Canada.
Email: kristin.horsley@mail.mcgill.ca

Funding information
Alberta Innovates Health Solutions provided funding for the All Our Families Cohort (AHPMR Interdisciplinary Team Grants Program Number 200700595) and salary support for ST. Additional funding was provided by the Alberta Children’s Hospital Foundation.

Abstract
Introduction: Hypertensive disorders of pregnancy occur in approximately 7%–10% of pregnancies and are associated with adverse maternal cardiovascular health outcomes across the lifespan. In contrast, breastfeeding has been associated with a reduction in cardiovascular risk factors in a dose-dependent manner. Despite the potential protective effects of lactation on cardiovascular risk, how hypertensive disorders of pregnancy relate to breastfeeding practices and experiences is not well understood. The aim of this study was to investigate the association between hypertensive disorders of pregnancy and breastfeeding outcomes in the first year postpartum.

Material and methods: We conducted a secondary analysis of prospective data from the All Our Families Cohort, a population-based study conducted in Calgary, Alberta, Canada. Women with a singleton pregnancy (n = 1418) who completed self-report questionnaires at <25 weeks and 34–36 weeks of gestation, and 4 months and 12 months postpartum, and provided consent to link to electronic medical records that identified diagnoses of hypertensive disorders of pregnancy (n = 122). Logistic and multiple linear regression analyses were used to model associations between hypertensive disorders of pregnancy and breastfeeding outcomes. Outcomes included breastfeeding intention, intended duration, exclusive breastfeeding at 4 months, breastfeeding duration at 12 months and breastfeeding difficulties.

Results: Hypertensive disorders of pregnancy were not associated with breastfeeding intention (odds ratio [OR] 1.30, 95% confidence interval [CI] 0.47–3.03, P = 0.57), intended breastfeeding duration (b = −3.28, 95% CI −7.04 to 0.48, P = 0.09), or initiation (OR = 0.64, 95% CI 0.29 –1.65, P = 0.32), but were associated with an increase in the odds of non-exclusive breastfeeding at 4 months postpartum (OR = 2.11, 95% CI 1.39–3.22, P < 0.001). Women with hypertensive disorders breastfed for 6.26 (95% CI −10.00 to −2.51, P < 0.001) weeks less over 12 months postpartum, had significantly

Abbreviations: AOF, All Our Families Cohort; BMI, body mass index; CI, confidence interval; EBF, exclusive breastfeeding; HDP, hypertensive disorders of pregnancy; HR, hazard ratio; OR, odds ratio.

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2022 The Authors. Acta Obstetricia et Gynecologica Scandinavica published by John Wiley & Sons Ltd on behalf of Nordic Federation of Societies of Obstetrics and Gynecology (NFOG).
1 INTRODUCTION

Hypertensive disorders of pregnancy (HDP; ie chronic hypertension, gestational hypertension, preeclampsia and eclampsia) occur in approximately 7%–10% of pregnancies and are a leading cause of perinatal morbidity and mortality. Approximately 16% of maternal deaths in developed countries and up to 30% in developing countries are attributable to HDP. There is strong evidence that HDP are associated with adverse maternal cardiovascular health outcomes as much as 55 years after pregnancy. Previous research has shown that HDP are associated with an elevated risk of cardiovascular disease that ranges from 1.7 (adjusted hazard ratio [HR]; 95% confidence interval [CI] 1.3–2.2) in women with gestational hypertension to 4.4 (adjusted HR; 95% CI, 2.4–7.9) in women with severe or pre-term preeclampsia. Cardiovascular disease remains a leading cause of death among women.

In contrast, breastfeeding has been associated with a reduction in cardiovascular risk factors in a dose-dependent manner. Epidemiological data have revealed that postmenopausal women who reported lactation for ≥12 months have a reduction in odds of hypertension (odds ratio [OR] 0.89, 95% CI 0.84–0.93) and hyperlipidemia (OR 0.81, 95% CI 0.76–0.87) after adjusting for sociodemographic, family history and lifestyle variables. Similar associations with reduced risk of type 2 diabetes have also been observed. Even though women with HDP potentially stand to benefit from the risk reduction afforded by breastfeeding, the breastfeeding practices and experiences of women with HDP remain poorly understood.

There has been some research conducted to examine the impact of HDP on breastfeeding initiation and duration. For example, Leeners et al. revealed that women with HDP had lower rates of breastfeeding initiation and were less likely to be breastfeeding at 1 and 3 months postpartum compared with women without HDP. Cordero et al. found no association between severe preeclampsia and breastfeeding initiation among women who were separated from their infants in the immediate postpartum period (ie first 24h) due to magnesium sulfate treatment, a finding that may be accounted for by the inclusion of only late-preterm infants. Others have found that women with HDP report lower rates of breastfeeding initiation and exclusive breastfeeding (EBF) duration during the first 6 months postpartum relative to normotensive controls. Although these studies document differences in breastfeeding outcomes among women with and without HDP, findings are limited by retrospective study design, short follow-up assessments and exclusion of confounding variables, and potential reasons for observed differences are often not considered.

Given the potentially important role of lactation for women with HDP, and the relative paucity of previous research examining the link between HDP and breastfeeding outcomes, the aim of the present study was to investigate the association between HDP and breastfeeding practices during the first year postpartum. Specifically, we evaluated whether pregnant women with HDP, relative to those without HDP, show differences in rates of breastfeeding intention and initiation, intended breastfeeding duration, rates of EBF at 4 months postpartum, reported breastfeeding duration at 12 months postpartum, and breastfeeding difficulties. Our hypotheses were that participants with HDP would report: (1) similar rates of breastfeeding intention and initiation, (2) no difference in prenatal intended breastfeeding duration, (3) lower rates of EBF at 4 months postpartum, (4) shorter breastfeeding duration at 12 months postpartum and (5) higher rates of breastfeeding difficulties, relative to the reference group.

Key message

Associations between hypertensive disorders of pregnancy and breastfeeding practices remain unclear. Findings showed that women with a hypertensive disorder of pregnancy had higher odds of non-exclusive breastfeeding, shorter breastfeeding duration, and experienced different breastfeeding difficulties relative to their unaffected counterparts.
2 | MATERIAL AND METHODS

This was a secondary data analysis of existing data collected as part of the All Our Families Cohort study (AOF). AOF is a Canadian longitudinal prospective pregnancy cohort study that aimed to identify risk factors for preterm birth and to examine perinatal health service use, parental well-being, and maternal, child and family health outcomes. AOF collected data in early and late pregnancy, 4 months postpartum, and 1, 2, 3, 5 and 8 years after delivery. We selected AOF data as it allowed for the analysis of HDP and breastfeeding intention during pregnancy, and of breastfeeding outcomes at two timepoints in the first year postpartum.

Population-based recruitment for the AOF study occurred between 2008 and 2011 in Calgary, Alberta, Canada (population 1.2 million). Recruitment methods, sample characteristics, including study attrition and representativeness, and detailed information on the questionnaires administered have been published elsewhere. In the province of Alberta, approximately 87% of women reported breastfeeding initiation, and approximately 27% reported exclusively breastfeeding for at least 6 months, slightly below the national average (32%).

For the present study, we included data from 1574 participants who completed questionnaires at <25 weeks and at 34–36 weeks of gestation, 4 months and 12 months postpartum, and who had linked electronic medical records. We excluded multiple gestations (n = 11/1%), as early breastfeeding stresses are different for multiples than singletons, and those for whom electronic medical health record data were not available (n = 145/9.2%), preventing reliable measurement of HDP status, for a final sample of 1418.

2.1 | Measures

Participant demographic and health-related characteristics were retrieved from the self-report questionnaire completed at <25 weeks of gestation, and included maternal age, marital status (ie married/common-law [living with a person with whom you have a conjugal relationship but who is not a spouse], single), education (ie high school or less, some or completed postsecondary), household income (ie <$40,000; $40,000–$79,999; ≥$80,000 CAD), ethnicity, <24.99 kg/m² and overweight or obese (BMI ≥ 25.00 kg/m²).

Information regarding the presence of hypertension during pregnancy, gestational age at birth and mode of delivery (vaginal or cesarean delivery) was retrieved from the maternal discharge abstract of the electronic health record. A hypertensive disorder diagnosis was based on the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Version: 2008, Canada (ICD10-CA). Accordingly, gestational hypertension was defined as hypertension (ie systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg) that develops for the first time after 20 weeks’ gestation (code 013), and preeclampsia as gestational hypertension with significant proteinuria that can range from moderate to severe (code 014); no cases of eclampsia (code 015) were recorded in this sample, and the code for preexisting hypertension (010) was not indicated. HDP was considered present if preexisting hypertension or codes 013 or 014 were listed on the maternal discharge abstract from labor and delivery for the index pregnancy. Information on the date of diagnosis and disease severity was not available and therefore it was not possible to identify cases of early onset preeclampsia. These definitions are in accordance with the 2014 Society of Obstetricians and Gynaecologists of Canada (SOGC) and the American College of Obstetricians and Gynecologists (ACOG) guidelines for the evaluation, diagnosis and treatment of hypertensive disorders. The division of the HDP variable indicates the research group (present, HDP = 1) and reference group (absent, HDP = 0).

Breastfeeding intention was assessed between 34 and 36 weeks of gestation through two self-report questionnaire items that asked: (1) Are you planning to breastfeed this baby? (Yes/No) and (2) If YES, for how many weeks are you planning to breastfeed your baby? and was treated as both a binary (ie yes/no) and continuous (ie number of intended weeks) outcome. Breastfeeding initiation was determined through one item on the 4-month postpartum questionnaire that asked participants: Did you breastfeed or feed breast milk to your baby, even if only for a short time? (Yes/No), and was treated as a binary outcome.

The assessment of EBF duration was derived from a question at the 4-month postpartum questionnaire that asked: In the past week, what best describes what your baby was fed? Response options included: (1) only breastmilk, (2) mostly breastmilk but with small amounts of formula, (3) mostly formula but with small amounts of breastmilk and (4) only formula. We collapsed the categories into a binary variable of only breastmilk (EBF) vs all other categories (non-EBF).

Breastfeeding difficulties were assessed through six self-report questionnaire items that measure the presence or absence (ie yes/no response options) of infant and maternal difficulties. Specifically, participants were asked: As a result of breastfeeding your baby, have you experienced: (1) difficulties with baby such as the baby having trouble latching or having a sleepy baby; (2) discomfort such as swollen breasts, sore nipples or painful breasts; (3) difficulty breastfeeding such as not producing enough milk, or having flat or inverted nipples; (4) being tired or fatigued; (5) infection of some kind; and (6) oversupply of milk, fast let down, etc.). Question response options were binary (ie yes/no). We collapsed the responses to each question into a binary variable with no reported breastfeeding difficulties coded as 0 and one or more difficulties as 1, and assessed individual difficulties separately in our logistic regression analyses.

Breastfeeding duration at 12 months postpartum was assessed with one question that asked: Did you breastfeed or feed breast milk to your baby, even if only for a short time? (Yes/No). If participants answered yes to this question, they were asked: How long did you breastfeed your baby (weeks)?” Participants who reported that they were still breastfeeding were considered to have breastfed for 52 weeks. Breastfeeding duration was treated as a continuous variable.
2.2 | Statistical analyses

Statistical analyses were performed using SPSS 24.0 and RSTUDIO. 23,24 We summarized all pertinent variables using descriptive statistics. All breastfeeding outcomes prespecified based on previous research. We used logistic regression to model the associations between HDP and the dichotomous outcomes of breastfeeding intention, breastfeeding initiation, non-EBF at 4 months postpartum, and breastfeeding difficulties, followed by multiple linear regression to model the association between HDP and intended and reported breastfeeding duration. For breastfeeding difficulties, additional analyses were conducted to examine whether maternal-specific problems were more commonly reported among those with HDP, relative to the reference group. We identified covariates that could potentially confound the relation between HDP and breastfeeding outcomes based on previous research and theoretical relevance, namely maternal age, total annual household income, ethnicity, parity, infant gestational age at birth, mode of delivery, and maternal pre-pregnancy overweight/obesity (ie pre-pregnancy BMI ≥25 kg/m²). Using a reverse elimination modeling process, the maximum number of possible confounding variables were included in the initial models, and then non-significant variables and those that did not confound the association between HDP and breastfeeding outcomes were removed. 25 Across models, missing data (<5%) were handled by pairwise deletion to maximize the use of available variables in the dataset.

Assumptions of multiple linear regression analyses were checked for models with continuous outcomes (ie intended and 12-month reported breastfeeding duration). For intended breastfeeding duration, the normality of the residuals showed a positive skew and 43 datapoints were identified as statistical outliers using the median absolute deviation. 26 Outlier values occurred in both the research and reference group, were plausible and unlikely due to error, and the exclusion of outlier values led to statistically significant results. Log transformation of intended breastfeeding duration did not change the pattern of results or influence statistical significance, but it did lead to normality of the residuals. Thus, for the association between HDP and intended breastfeeding duration, please note that the model includes outlier values (Table 3).

2.3 | Ethical approval

Ethics approval for the AOF cohort study was granted by the Conjoint Health Research Ethics Board at the University of Calgary, Alberta Canada Conjoint Health Research Ethics Board (Ethics ID: E-22128, Approval date: 7 June 2007). All participants provided informed consent.

3 | RESULTS

Background variables, breastfeeding outcomes and differences between the research and reference groups are presented in Table 1. Participants were predominately white, highly educated, married women who were pregnant with their second child. A majority (69%/n = 983) reported an annual household income of $80,000 or more. Pre-pregnancy overweight/obesity (ie ≥25 kg/m²) was present in 35.6% (n = 505) of the sample. Participant age at time of delivery ranged from 18 to 43 years, and gestational age at birth ranged from 23 to 42 weeks of gestation (M = 38.89, SD = 1.85). HDP were present in 8.6% (n = 122) of women, which reflects estimates from the Canadian population. 18 Relative to the reference group, participants with HDP reported higher rates of overweight/obesity, primiparity, planned (scheduled) or emergency cesarean delivery, had a shorter median intended breastfeeding duration, and gave birth approximately 1 week earlier.

Analyses of data from the 34–36 weeks of gestation questionnaire showed that majority (95%) of participants reported that they intended to breastfeed their child. Participants intended to breastfeed for a median of 40.00 weeks (range 1–156, inter-quartile range 24–52). Likewise, almost all (96%) of participants reported that they had breastfed their child, if even for a short period of time. At 4 months postpartum, of those participants who initiated breastfeeding, 57% (n = 815) reported EBF their baby within the last week.

Results from logistic regression analyses showed that there was no association between HDP and breastfeeding intention as a binary outcome variable (ie yes/no; OR = 1.30, 95% CI 0.47, 3.03; Table 2), after adjusting for pre-pregnancy overweight/obesity. Participants with HDP reported a three-week shorter median intended breastfeeding duration relative to those without HDP, but this was not statistically significant (b = −3.28, 95% CI −7.04, 0.48, P = 0.09) after adjusting for parity, pre-pregnancy overweight/obesity, and ethnicity (Table 3). Likewise, rates of breastfeeding initiation were not significantly different among women with HDP relative to those without (OR = 0.64, 95% CI 0.29, 1.65; Table 2), controlling for maternal age, pre-pregnancy overweight/obesity, and parity.

The rate of EBF was significantly lower among women with HDP (36.1% vs 59.5%, χ² = 25.88, P < 0.001). Participants with HDP had 2.11 times the odds of non-EBF at 4-months postpartum compared to the reference group (OR 2.11, 95% CI 1.39–3.22), adjusting for maternal age, pre-pregnancy overweight/obesity, gestational age at birth, and mode of delivery (Table 2). Participants with HDP also breastfed for 6 weeks less over 12 months postpartum, (b = −6.26, 95% CI −10.00 to −2.51, P < 0.001), adjusting for maternal age, total household income, pre-pregnancy overweight/obesity and mode of delivery (Table 3).

HDP were not significantly associated with reporting one or more breastfeeding difficulties in general, relative to the reference group (OR 1.11, 95% CI 0.95–1.31) after adjusting for pre-pregnancy overweight/obesity and gestational age at birth. However, when we examined breastfeeding difficulties that are plausibly linked to HDP (ie maternal factors only), women with HDP had significantly higher odds of insufficient milk supply (OR 1.75, 95% CI 1.19–2.46) and lower odds of breast and/or nipple pain (OR 0.66, 95% CI 0.44–0.92), adjusting for pre-pregnancy overweight/obesity (Table 2).
**TABLE 1** Maternal, obstetric and breastfeeding characteristics according to hypertensive disorders of pregnancy status in 1418 singleton pregnancies, the All Our Families Cohort, 2008–2012, Canada

| Background variables | All participants (n = 1418) | Hypertensive disorders of pregnancy<sup>a</sup> |  |  |  |  |  |
|----------------------|-----------------------------|-----------------------------------------------|---|---|---|---|---|
| Age (years), M (SD) | 31.43 (4.42) | 31.39 (4.44) | 31.87 (4.31) | −1.17 | 146.2 | 0.245 |
| Pre-pregnancy body mass index, n (%) | 79.69 | 2 | <0.001 |
| Underweight/normal (<24.9 kg/m<sup>2</sup>) | 885 (62.0) | 853 (65.8) | 32 (26.3) |
| Overweight/obesity (≥25 kg/m<sup>2</sup>) | 505 (35.6) | 417 (32.2) | 88 (72.1) |
| Missing/undisclosed | 28 (2.0) | 26 (2.0) | 2 (1.6) |
| Marital status, n (%) | 3.70 | 1 | 0.055 |
| Married/Common law | 1353 (95.4) | 1241 (95.8) | 112 (91.8) |
| Other | 62 (4.4) | 52 (4.0) | 10 (8.5) |
| Missing | 3 (2.1) | 3 (0.2) | 0 (0.0) |
| Ethnicity, n (%) | 1.53 | 1 | 0.217 |
| White/caucasian | 1166 (82.2) | 1060 (81.8) | 106 (86.9) |
| Visible minority | 249 (17.6) | 233 (18.0) | 16 (13.1) |
| Education, n (%) | 0.89 | 2 | 0.642 |
| High school | 121 (9.3) | 10 (8.2) |
| Some or complete post-secondary | 968 (74.7) | 96 (78.7) |
| Some or complete graduate school | 204 (15.7) | 16 (13.1) |
| Missing | 3 (0.2) | 0 (0.0) |
| Income, n (%) | 3.43 | 2 | 0.180 |
| <$40000 | 85 (6.6) | 8 (6.6) |
| $40000 to $79999 | 275 (21.2) | 17 (13.9) |
| ≥$80000 | 892 (71.2) | 91 (74.6) |
| Missing/undisclosed | 44 (3.4) | 6 (4.9) |
| Parity | 11.42 | 1 | <0.001 |
| No previous births | 683 (48.2) | 606 (47.1) | 77 (63.6) |
| One or more previous births | 724 (51.1) | 680 (46.3) | 44 (36.4) |
| Missing/not recorded | 11 (7.6) | 10 (7.8) | 1 (0.01) |
| Gestational age at delivery | 38.89 (1.85) | 38.99 (1.79) | 37.80 (2.17) | 137.0 | <0.001 |
| Type of delivery, n (%) | 21.60 | 2 | <0.001 |
| Vaginal | 1047 (73.8) | 972 (75.0) | 75 (61.5) |
| Planned (scheduled)/emergency cesarean | 371 (26.1) | 324 (25.0) | 47 (38.5) |
| Outcome variables | 0.42 |
| Breastfeeding intention, n (%) | 1346 (95.0) | 1233 (95.1) | 113 (92.6) |
| Yes | 51 (3.6) | 45 (3.5) | 6 (5.0) |
| No | 21 (1.5) | 18 (1.4) | 2 (1.6) |
| Intended breastfeeding duration, Median [IQR]<sup>b</sup> | 40.00 (24–52) | 40.00 (24–52) | 30.00 (24–48) | 11.58 | 1 | <0.001 |
| Breastfeeding initiation, n (%) | 0.35 | 1 | 0.55 |
| Yes | 1363 (96.2) | 1250 (96.5) | 113 (92.6) |
| No | 54 (3.8) | 45 (3.5) | 9 (7.4) |
| Infant feeding status at 4-months postpartum, n (%) | 30.37 | 3 | <0.001 |

(Continues)
In this study, women with HDP reported significantly higher rates of overweight/obesity, primiparity and cesarean delivery, and gave birth approximately 1 week earlier, relative to the reference group. Our results indicate that whereas those with HDP had no difference in breastfeeding intention or initiation, HDP was associated with lower odds of EBF at 4 months postpartum and, on average,
participants discontinued breastfeeding significantly earlier than those without HDP. Additionally, our findings explore breastfeeding difficulties as a potential reason for observed shortened EBF or breastfeeding duration at 12 months and suggest that women with HDP have higher odds of maternal breastfeeding difficulties such as insufficient milk supply but are less likely to report breast/nipple pain relative to the reference group.

Our results are similar to previous research that has shown an impact of HDP on breastfeeding initiation and continuation early in the postpartum period, and add to this literature through the assessment of breastfeeding exclusivity and difficulties and control for potential confounding variables. In contrast to one study, in our sample, women with HDP had similar rates of breastfeeding intention and initiation. This finding likely reflects Canadian population-based increases in breastfeeding initiation over the last 15 years, and that previously reported rates were from the USA, where base rates of breastfeeding initiation are lower than those in Canada (77% vs 89%). Taken together, research findings suggest that women with HDP have different breastfeeding outcomes compared with those without the diagnosis.

The reason that women with HDP have shorter breastfeeding duration and are less likely to be exclusively breastfeeding at 4 months is unknown, but is likely complex and might be due to a physiological impact on milk production associated with risk factors for HDP such as overweight and obesity or to a shorter intended breastfeeding duration at the outset. For example, low milk supply can be attributed to poor infant latch, which creates insufficient milk transfer and thus decreased demand for milk production on the breast; in the vast majority of cases, poor latch is associated with nipple pain, nipple trauma and breast pain. In our study, women with HDP had both higher odds of low milk supply and lower odds of pain and nipple trauma than women without HDP, suggesting that the mechanism for low milk supply in this population may not be related to poor infant latch. Further, lactogenesis involves complex cellular metabolism and proliferation of epithelial cell growth, which may be impacted by HDP. More research is needed to elucidate potential physiological mechanisms for poor milk supply among mothers with HDP and the role of pre-pregnancy overweight/obesity in this association.

It is also plausible that the impact of HDP on breastfeeding outcomes is the result of interactions among biopsychosocial factors that, together, influence breastfeeding practices. Previous researchers have applied a self-efficacy framework to understand how biopsychosocial factors such as maternal confidence influence breastfeeding outcomes. Breastfeeding self-efficacy refers to a mother’s perceived confidence in her ability to initiate, perform and maintain breastfeeding, and the ability to cope with obstacles. Recent qualitative work has shown that women perceive HDP to have a “whole person” impact that can lead to a disruption in maternal and infant bonding, increased guilt and frustration related to early separation from their infant, and reduced maternal confidence. Within this context, it is possible that maternal and/or obstetrical complications associated with HDP have a detrimental impact on a woman’s perceived ability to perform maternal related behaviors such as prolonged breastfeeding. This notion could also account for our finding that women in late pregnancy (i.e. between 34 and 36 weeks of gestation) with HDP intended to breastfeed for a shorter median duration. How the biopsychosocial consequences of HDP influence breastfeeding experiences and practices represents an additional opportunity for further research.

The strengths of this study include a large sample size with an incidence of HDP that is comparable to established prevalence in the Canadian population. A prospective, longitudinal study design allowed for assessment of breastfeeding intention, duration and experiences across pregnancy and up to the first year postpartum and addresses a gap in this area of research. Although this is a strength of using existing data for secondary analysis, a limitation is that the study was not specifically designed for our research question, so data on important variables that may influence breastfeeding goals and milk supply such as previous cesarean

| Variables | b       | 95% CI [LL, UL] | P     |
|-----------|---------|----------------|-------|
| Intended breastfeeding duration (weeks) |         |                |       |
| HDP (1 = present) | -3.28   | [-7.04 to 0.48] | 0.088 |
| Parity (1 = previous birth) | 6.14    | [4.10 to 8.18]  | <0.001|
| Pre-pregnancy overweight/obesity | -2.17   | [-4.90 to -0.53] | 0.015 |
| Ethnicity (0 = white/caucasian) | -3.28   | [-6.17 to -0.81] | 0.011 |
| Breastfeeding duration at 12 months |         |                |       |
| HDP (1 = present) | -6.26   | [-10.00 to -2.51] | <0.001|
| Maternal age | 0.40    | [0.15 to 0.65]  | 0.002 |
| Total household income | 2.44    | [0.60 to 4.29]  | 0.010 |
| Pre-pregnancy overweight/obesity | -3.16   | [-5.42 to -0.91] | 0.006 |
| Delivery mode (1 = cesarean) | -2.70   | [-5.11 to -0.29] | 0.028 |

Note: HDP, hypertensive disorders of pregnancy. b indicates the change in prenatal intended breastfeeding duration and reported breastfeeding duration at 12 months postpartum associated with a one-unit increase in the predictor variable. LL and UL indicate the lower and upper limits of a confidence interval, respectively.
section, HDP or other medical complications in a previous pregnancy, or antihypertensive medication use were unavailable. Since women reported on their breastfeeding experiences, we also gained a better understanding of the unique breastfeeding difficulties reported by women with HDP, which sheds light on some potential reasons for the observed differences in breastfeeding outcomes.

Although the sample size was large and representative of an urban maternal population, the sample is not highly sociodemographically diverse and therefore generalizability of these results to populations with greater diversity is limited. At the 12-month postpartum assessment, information on breastfeeding duration was retrospectively reported for those who had discontinued breastfeeding prior to self-report questionnaire completion and is therefore subject to recall bias. Finally, although we included pre-pregnancy BMI as a covariate to account for the role of metabolic health, the variable available for these analyses was categorical and prevented a more nuanced investigation of how HDP may interact with BMI to influence breastfeeding outcomes. Further research is needed to examine whether associations between HDP and breastfeeding practices and experiences are present in the more racially and ethnically diverse samples, and to obtain more detailed information on biological and behavioral factors that influence breastfeeding practices.

Since data collection occurred from 2008 to 2011, it is possible that they do not accurately represent rates of breastfeeding among women with HDP. Our results are, however, consistent and comparable to two, more recent studies that evaluated breastfeeding practices among women with HDP during the first 6 months postpartum. Our results add to this work by including a longer follow-up period (ie first 12 months postpartum), and through an examination of the specific types of difficulties faced by women with HDP. Given the increasing rates of HDP and the impact of these disorders on cardiovascular health across the lifespan, our results make a meaningful contribution to a growing literature on how HDP relates to breastfeeding outcomes during the first year postpartum and highlight the need for further prospective, longitudinal and interventional research.

5 | CONCLUSION

Taken together, our results demonstrate that HDP is associated with altered breastfeeding experiences and shorter duration of exclusive breast feeding relative to women without HDP. An accumulation of research indicates that women with HDP represent a specific population of pregnant women that may benefit from targeted interventions in the prenatal and postpartum period to address barriers to EBF, improve the breastfeeding experience and to assist with achieving prolonged EBF. Further research is needed to better understand the biopsychosocial pathways through which HDP is associated with breastfeeding intention and duration, and to determine whether breastfeeding duration and intensity/exclusivity afford cardioprotective benefits for this important subgroup of the pregnant population.

AUTHOR CONTRIBUTIONS

KH: conceptualization, formal analysis, writing – original draft, visualization. KC: conceptualization, investigation, formal analysis, writing – review & editing, supervision. DDC: writing – review & editing. TVN: conceptualization, writing – review & editing. ND: conceptualization, writing – review & editing. LTM: conceptualization, writing – review & editing. ST: conceptualization, methodology, funding acquisition, project administration, supervision, resources, writing – review & editing.

CONFLICT OF INTEREST

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

ORCID

Kristin Horsley https://orcid.org/0000-0002-7882-4494

REFERENCES

1. Magee LA, Helewa M, Mb W, et al. Diagnosis, evaluation, and management of the hypertensive disorders of pregnancy: executive summary. J Obstet Gynaecol Can. 2014;36:416-441.
2. Magnussen EB, Vatten LJ, Lund-Nilsen TI, Salvesen KA, Davey Smith G, Romundstad PR. Prepregnancy cardiovascular risk factors as predictors of pre-eclampsia: population based cohort study. BMJ. 2007;335:978.
3. Hutcheon JA, Lisonkova S, Joseph KS. Epidemiology of pre-eclampsia and the other hypertensive disorders of pregnancy. Best Pract Res Clin Obstet Gynaecol. 2011;25:391-403.
4. Khan KS, Wojdyla D, Say L, Gülmezoglu AM, Van Look PF. WHO analysis of causes of maternal death: a systematic review. Lancet. 2006;367:1066-1074.
5. Grandi SM, Fillion KB, Yoon S, et al. Cardiovascular disease-related morbidity and mortality in women with a history of pregnancy complications. Circulation. 2019;139:1069-1079.
6. Ray JG, Vermeulen MJ, Schull MJ, Redelmeier DA. Cardiovascular health after maternal placental syndromes (CHAMPS): population-based retrospective cohort study. Lancet. 2005;366:1797-1803.
7. McDonald SD, Malinowski A, Zhou Q, Yusuf S, Devereaux PJ. Cardiovascular sequelae of preeclampsia/eclampsia: a systematic review and meta-analyses. Am Heart J. 2008;156:918-930.
8. Wu P, Hithhhotuwa R, Kwok CS, et al. Preeclampsia and future cardiovascular health: a systematic review and meta-analysis. Circ Cardiovasc Qual Outcomes. 2017;10:e003497.
9. Vogel B, Acevedo M, Appelman Y, et al. The lancet women and cardiovascular disease commission: reducing the global burden by 2030. Lancet. 2021;397:2385-2438.
10. Schwarz EB, Ray RM, Stuebe AM, et al. Duration of lactation and risk factors for maternal cardiovascular disease. Obstet Gynecol. 2009;113:974-982.
11. Bonifacio E, Schwartz EB, Jun H, Wessel CB, Corbelli JA. Effect of lactation on maternal hypertension: a systematic review. Breastfeed Med. 2018;13:578-588. Erratum in: Breastfeed Med 2020;15:682.
12. Natland ST, Nilsen TIL, Midthjell K, Andersen LF, Forsmo S. Lactation and cardiovascular risk factors in mothers in a population-based study: the HUNT-study. Int Breastfeed J. 2012;7:8.
13. Aune D, Norat T, Romundstad P, Vatten LJ. Breastfeeding and the maternal risk of type 2 diabetes: a systematic review and
14. Cordero L, Valentine CJ, Samuels P, Giannone PJ, Nankervis CA. Breastfeeding in women with severe preeclampsia. Breastfeed Med. 2012;7:457-463.
15. Leeners B, Rath W, Kuse S, Neumaier-Wagner P. Breast-feeding in women with hypertensive disorders in pregnancy. J Perinat Med. 2005;33:553-560.
16. Burgess A, Eichelman E, Rhodes B. Lactation patterns in women with hypertensive disorders of pregnancy: an analysis of Illinois 2012–2015 pregnancy risk assessment monitoring system (PRAMS) data. Matern Child Health J. 2021;25:666-675.
17. Strapasson MR, Ferreira CF, Ramos JGL. Feeding practices in the first 6 months after delivery: effects of gestational hypertension. Pregnancy Hypertens. 2018;13:254-259.
18. McDonald SW, Lyon AW, Benzies KM, et al. The all our babies pregnancy cohort: design, methods, and participant characteristics. BMC Pregnancy Childbirth. 2013;13(Suppl 1):S2.
19. Statistics Canada. Table 105-0509 Canadian health characteristics, two year period estimates, by age group and sex, Canada, provinces, territories and health regions. 2018. https://www150.statcan.gc.ca/
20. Health Canada. Canadian Guidelines for Body Weight Classification in Adults - Quick Reference Tool for Professionals. 2003. https://www.canada.ca/
21. World Health Organization. International Statistical Classification of Diseases and Related Health Problems 10th Revision. 2007.
22. Roberts JM, August PA, Bakris G, et al. ACOG guidelines: hypertension in pregnancy. Am Coll Obstet Gynecol. 2013;122:1122-1131.
23. IBM. IBM SPSS advanced statistics 24. Ibm2016. p. 184.
24. Team R. RStudio: Integrated Development for R. RStudio, Inc.; 2016.
25. Sun GW, Shook TL, Kay GL. Inappropriate use of bivariable analysis to screen risk factors for use in multivariable analysis. J Clin Epidemiol. 1996;49:907-916.
26. Leys C, Ley C, Klein O, Bernard P, Licata L. Detecting outliers: do not use standard deviation around the mean, use absolute deviation around the median. J Exp Soc Psychol. 2013;49:764-766.
27. Gionet L. Breastfeeding Trends in Canada. Health at a Glance 2013. p. 135-140.