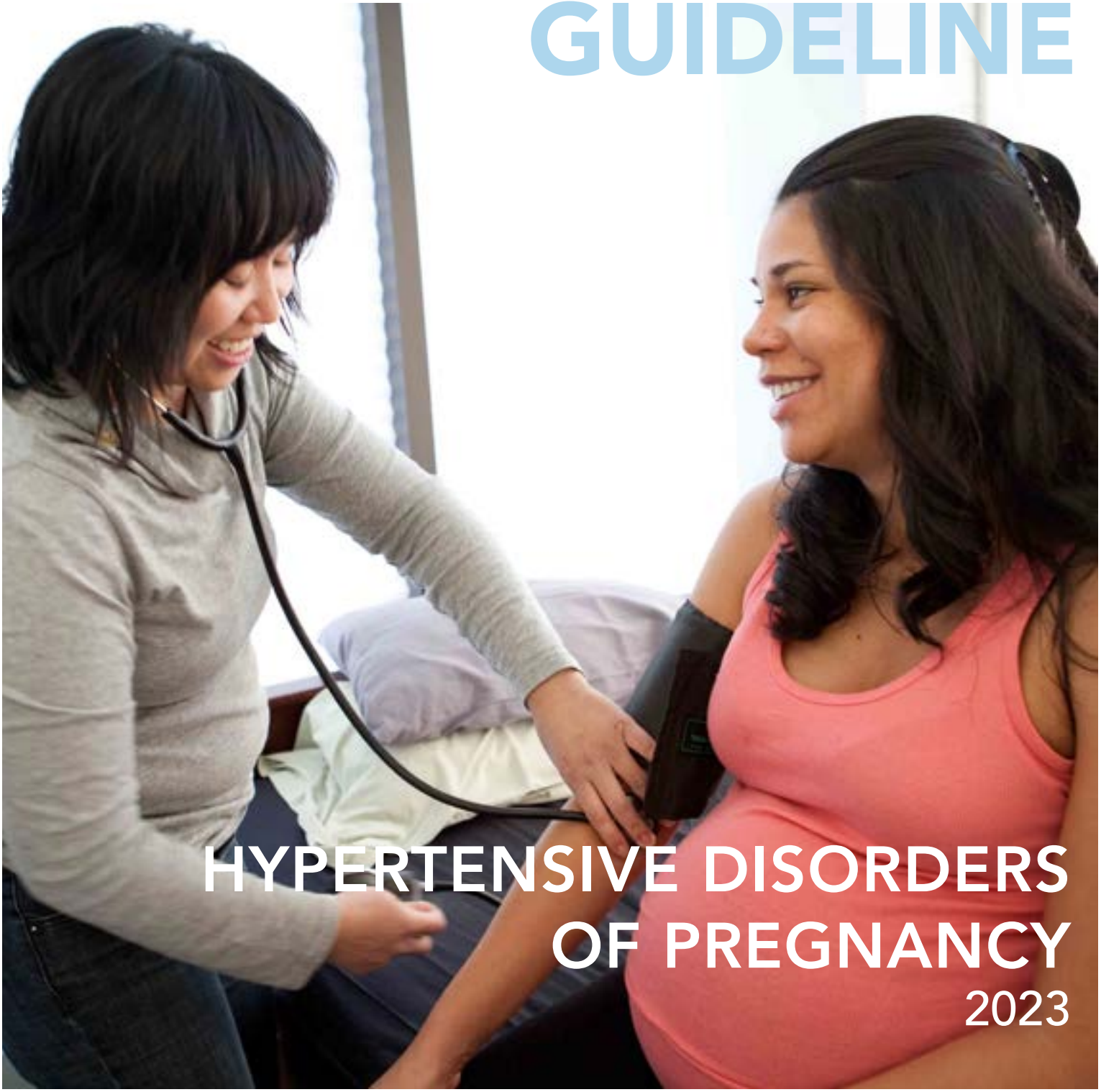
CLINICAL PRACTICE GUIDELINE 15



HYPERTENSIVE DISORDERS OF PREGNANCY

2023

Association of Ontario Midwives
Delivering what matters.

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The views expressed in this guideline are strictly those of the Association of Ontario Midwives. No official endorsement by the Ministry of Health is intended or should be inferred.

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The AOM is committed, through our statement on Gender Inclusivity and Human Rights, to reflect and include trans, genderqueer and intersex communities in all aspects of our work.

In this document, there are references to sources that use gendered language to refer to populations of pregnant and birthing parents. To accurately represent these sources, the AOM may have maintained gendered language.

The AOM supports research and knowledge translation that engages and reflects the entire childbearing population.

About this CPG

This guideline reflects information consistent with the best evidence available as of the date issued and is subject to change. The information in this guideline is not intended to dictate a course of action, but to inform clinical decision-making. Local standards may cause practices to diverge from the suggestions within this guideline. If practice groups develop protocols that depart from a guideline, it is advisable to document the rationale for the departure.

Midwives recognize that client expectations, preferences and interests are an essential component in clinical decision-making. Clients may choose a course of action that differs from the recommendations in this guideline, within the context of informed choice. When clients choose a course of action that diverges from a clinical practice guideline and/or practice group protocol, this should be well documented in their charts.

ABBREVIATIONS

AOR Adjusted odds ratio
ACR Albumin:creatinine ratio
ALT Alanine aminotransferase
AST Aspartate aminotransferase
BMI Body mass index (kg/m^2)
BP Blood pressure (mmHg)
dBP Diastolic blood pressure (mmHg)
sBP Systolic blood pressure (mmHg)
CI Confidence interval
CS Caesarean section
HELLP Hemolysis, elevated liver enzymes, low platelet count
HDP Hypertensive disorders of pregnancy
IUGR Intrauterine growth restriction
NST Non-stress test
OR Odds ratio
PAPP-A Pregnancy-associated plasma protein A
PCR Protein:creatinine ratio
PROM Prelabour rupture of membranes
RCT Randomized controlled trial
RR Relative risk
SGA Small for gestational age

TABLE OF CONTENTS

AIM OF THE GUIDELINE

Statement of purpose

The goal of this document is to provide an evidence based clinical practice guideline (CPG) on antepartum, intrapartum, and postpartum management of hypertensive disorders of pregnancy (HDP) that is consistent with the midwifery philosophy and model of care. Midwives in Ontario are encouraged to use this CPG as a tool in clinical decision-making.

Objective

The objective of this CPG is to provide a critical review of the research literature on the screening, diagnosis, and management of hypertensive disorders of pregnancy (HDP) within the content of provision of midwifery care in Ontario. Evidence relating to the following will be discussed:

- Definition and incidence
- Risk factors
- Prevention
- Screening, diagnosis, assessment, and monitoring
- Management in the antenatal, intrapartum, and postpartum periods
- Client experiences

Outcomes of interest

The following outcomes were rated as either "critical" or "important," following the GRADE (Grading of Recommendations, Assessment, Development and Evaluation) process for each research question addressed in the guideline.

Pregnant person outcomes:

- incidence of HDPs
- morbidity
- mortality
- rates of induction
- caesarean section

Neonatal outcomes:

- neonatal mortality
- neonatal morbidity
- preterm birth

Literature search

A search of MEDLINE, CINAHL and the Cochrane Library from 2009 to 2021 was conducted using a defined search strategy. Literature from the original CPG was reviewed for inclusion. Reference lists of relevant systematic reviews and key papers were also reviewed. When synthesizing evidence, systematic reviews were prioritized; if no systematic reviews were found, randomized controlled trials (RCTs) and observational studies were retrieved.

Methods

This CPG uses the GRADE methodology for guideline development. The GRADE process determines the certainty of the evidence (how certain practitioners should be of the results) as well as the strength of the recommendation. Certainty of evidence in this CPG is rated from very low to high, according to five GRADE domains: risk of bias, inconsistency, indirectness, imprecision and publication bias. Methodological concerns about the included studies, variability across results, applicability of the evidence to our context, precision of the results and completeness of the evidence base are considered as part of these domains. The CPG Committee's judgments about the certainty of evidence reflect the work group's confidence that available evidence correctly reflects the true effect of an intervention and is sufficient to support decision-making.

Results from low certainty of evidence are described using language such as "may"; results from moderate certainty of evidence are described using language such as "probably" or "likely"; and results from high certainty of evidence are described without these qualifiers.

When RCT evidence was available, it was assessed using GRADE methodology. In instances where RCT evidence was not available, observational studies were assessed using GRADE.

CERTAINTY OF EVIDENCE	How certain we ought to be about an estimate of effect or association
High	Further research is very unlikely to change confidence in the estimate of effect. • This evidence provides a very good basis for decision-making.
Moderate	Further research is likely to have an important impact on confidence in the estimate of effect and may change the estimate. • This evidence provides a good basis for decision-making.
Low	Further research is very likely to have an important impact on confidence in the estimate of effect and is likely to change the estimate. • This evidence provides some basis for decision-making.
Very low	Any estimate of effect is very uncertain. • This evidence does not provide much of a basis for decision-making.

(1-3)

Recommendations in this CPG are based on formal ratings of the certainty of evidence and are described as either strong or weak according to the GRADE approach. The strength of recommendation reflects the extent to which the CPG Committee is confident that the benefits of a recommended intervention outweigh its harms or vice versa. The strength of recommendation is influenced by the certainty of supporting evidence, the balance between desirable and undesirable effects and the perceived variability or uncertainty in clients' values and preferences with respect to the intervention. (1–5) For these reasons, weak recommendations use the terminology "may" and strong recommendations use the terminology "should" within this CPG.

Good practice statements in this CPG represent guidance that the CPG Committee deemed important but not appropriate for formal ratings of certainty of evidence, as there was no direct evidence on the research question. Good practice statements are made when the CPG Committee is confident that the action has a net benefit to the client and no sensible alternatives exist. (6)

Complete GRADE evidence tables used to summarize research and inform the recommendations in this guideline are available on the AOM website. A full description of the AOM's approach to clinical practice guideline development using GRADE is also available on the AOM website.

TYPES OF STATEMENTS IN THIS CPG

- **Recommendations:** Action statements about the intervention based on the certainty of the evidence, clinical considerations, preferences and values.
- **No recommendation:** The CPG Committee has deemed that there is insufficient evidence available to make a recommendation about the intervention.
- **Good practice statements:** Statements whereby the net benefit of the intervention is large and unequivocal and the CPG Committee has considered it useful to provide guidance to clinicians in this area. The evidence for good practice statements is typically difficult to collect and summarize, and therefore no formal rating of the certainty of evidence is undertaken.
- **Summary statements:** The CPG Committee has deemed a recommendation unnecessary according to standards of care.

STRENGTH OF RECOMMENDATION	The extent to which the CPG Committee is confident that the benefits of the recommended intervention outweigh its harms (or vice versa)
Strong	Benefits clearly outweigh risks and burdens (or vice versa). *Can be interpreted as:* • Most clients should be offered the intervention, assuming that they have been informed about and understand its benefits, harms and burdens. • Most clients would want the recommended course of action, and only a small proportion would not.
Weak	Benefits, risks and burdens are closely balanced. *Can be interpreted as:* • The majority of clients would want the suggested course of action, but an appreciable proportion would not. • Values and preferences vary widely.

Based on: (1-4)

Updating the CPG:

In 2022-2023, this CPG was updated to include more recent literature published from 2012 to 2021. Based on consultation with the AOM's CPG Committee and a preliminary review of emerging research, all sections of the guideline were selected for updating. Changes have been made to the current edition of the guideline to reflect this new research.

Recommendations and good practice statements in updated CPGs will now be marked with one of the following labels: [new 2023] or [2023]. These labels will appear at the end of recommendations and good practice statements. See the table below for an explanation of these labels.

The Appendix provides a detailed list of the updated recommendations and good practice statements in this guideline along with an explanation of these changes.

Key to partial update labelling for recommendations and good practice statements	
Recommendation or good practice statement label	**Meaning of label**
[new 2023]	New recommendation or good practice statement as of 2023 • Indicates that the recommendation or good practice statement is new as of 2023. New evidence has prompted a change to or the addition of a recommendation or good practice statement. • An explanation of this change is provided in the Appendix.
[2023]	Reaffirmed recommendation or good practice statement as of 2023 • Indicates that the recommendation or good practice statement is consistent with new evidence as of 2023. New evidence has not prompted a change to the original statement. • Small changes may have been made to the wording of this statement but do not affect the meaning.

Review

This CPG was reviewed using a modified version of the AGREE instrument (Appraisal of Guidelines for Research and Evaluation), the AOM Values-based Approach to CPG Development, as well as the consensus of the CPG committee, the Quality, Insurance and Risk Management Committee and the AOM Board of Directors.

INTRODUCTION

Hypertensive disorders of pregnancy (HDP) encompass a spectrum of conditions, including pre-existing hypertension, gestational hypertension and preeclampsia. HDPs are a major cause of poor pregnancy outcomes in Canada and internationally.

This guideline focuses on midwifery management of HDP for both the pregnant person and the neonate. Midwifery management of HDP is complex, given that elements of care may fall outside the legislative scope of practice. For example, the Laboratory and Specimen Collection Centre Licensing Act, 1990, authorizes midwives to collect specimens and order laboratory tests in accordance with a specific list outlined in Appendix B. This list currently precludes many of the tests used in the diagnosis of preeclampsia.

Within the legislative midwifery scope of practice, midwives monitor for elevated blood pressure and other signs and symptoms of HDP throughout the pregnancy and the intrapartum and postpartum periods. Depending on its timing and severity, a midwife may determine that the condition warrants consultation and/or a transfer of care. When care is transferred, the midwife will collaborate with the most responsible provider to deliver care that is in the best interest of the client. This may include working under delegation, providing support and empathetic counselling to clients and/or advocating on the client's behalf with other health-care providers. As with any transfer of care, it is important to clearly establish and communicate the ongoing roles of all providers involved, both to the client and between providers. These discussions require clarity about both the legislative and personal scope of practice of the midwife.

Readers are encouraged to look to the 2022 CPG produced by the Society of Obstetricians and Gynecologists of Canada (SOGC) (7) and the 2019 CPG by the National Institute for Health and Care Excellence (NICE) for further information on management of HDP. (8)

DEFINITIONS AND CLASSICATION

To enable clarity and communication in an interprofessional setting, this CPG uses the definitions provided in the SOGC's 2022 CPG 426: Hypertensive Disorders of Pregnancy: Diagnosis, Prediction, Prevention, and Management. (7)

Definitions

Hypertension in pregnancy is defined as a clinic (or in-hospital) systolic blood pressure (sBP) of ≥ 140 mmHg and/or diastolic blood pressure (dBP) of ≥ 90 mmHg, based on the average of at least two measurements taken after five minutes' rest, at least 15 minutes apart, using the same arm.

Severe hypertension is defined as sBP of ≥ 160 mmHg and/or dBP of ≥ 110 mmHg, based on the average of at least two measurements taken within 15 minutes at most, using the same arm.

Transient hypertension is defined as elevated blood pressure of ≥ 140/90 mmHg, typically in a clinic setting, that resolves with repeated blood pressure measurement.

White-coat hypertension is defined as a clinic blood pressure measurement of ≥ 140/90 mmHg, but an out-of-office blood pressure measurement of < 135/85 mmHg.

Masked hypertension is defined as a clinic blood pressure of < 140/90 mmHg, but an out-of-clinic blood pressure of ≥ 135/85 mmHg.

Proteinuria is defined as ≥ 30 mg/mmol urinary PCR in a spot urine sample, or ACR of ≥ 8 mg/mmol or ≥ 0.3 g/day during a complete 24-hour urine collection.

Classification

HDPs should be classified as chronic (pre-existing) hypertension or gestational hypertension. **Pre-existing hypertension** predates pregnancy or is diagnosed before 20 weeks' gestation. (7–9) **Gestational hypertension** develops for the first time at 20 weeks' gestation or later, without evidence of preeclampsia.

Preeclampsia is defined as gestational hypertension with new-onset proteinuria, or the presence of one or more adverse conditions associated with end-organ dysfunction or uteroplacental dysfunction.

INCIDENCE OF HDP

In Canada, approximately 7% of all pregnancies are affected by hypertensive disorders of pregnancy. (10) Among Ontario midwifery clients who gave birth between April 1, 2020, and March 31, 2021, 0.3% had pre-existing hypertension, 2.9% had gestational hypertension and 0.7% had preeclampsia.

In Canada between 2003-2004 and 2014-2015, hypertension complicating pregnancy, childbirth and the puerperium was associated with 1.2 deaths per 100 000 hospital deliveries (95% CI 0.8-1.6). (11)

PHYSIOLOGY OF HYPERTENSIVE DISORDERS IN PREGNANCY

Changes in blood pressure occur naturally during normal pregnancy. In the first trimester, a decrease in blood pressure is caused by vasodilation. By the second trimester, a reduction in dBP by 15 mmHg is typical. (12) A gradual increase in blood pressure follows until term, when pre-pregnancy levels are attained. (13,14) These blood pressure changes occur to meet increased metabolic demands and to ensure adequate blood flow to the uterus and the placenta. (15) In HDPs, these physiological processes are impaired. (15)

The etiology and pathophysiology of HDP remain incompletely explained. (16–18) This may be due to the heterogenous nature of HDP and its varied clinical progression. Pathogenesis may also differ according to the presence of risk factors and the timing of disease onset. (14,19)

Progression and prognosis

Hypertensive disorders of pregnancy range in severity from a mild increase in blood pressure at term with no additional signs, symptoms or adverse sequelae, to multi-system dysfunction with potential harm for the pregnant person and the fetus. For many of the clinical manifestations of HDP, optimal strategies for prevention and management have yet to be determined, with delivery of the fetus being the only definitive treatment. (16,20)

Up to 50% of pregnant people with gestational hypertension will develop preeclampsia. (21) The rate of progression depends on the gestational age at diagnosis. The earlier that gestational hypertension develops, the greater likelihood of progression to preeclampsia. (21–23) Superimposed preeclampsia occurs in about 20% of pregnant people with chronic hypertension. (24)

Pathophysiology of preeclampsia

Research suggests that preeclampsia can be divided into early and late onset, with different pathophysiology. Early onset is typified as placental in origin and diagnosed prior to 34 weeks' gestation. (19) Late onset is diagnosed from 34 weeks onward; it is thought to stem from oxidative changes in the placenta caused by inadequate blood flow from the parental system compared to the needs of the fetus, along with the pregnant person's genetic susceptibility for disease of the heart and blood vessels. (19)

Hypotheses suggest that the disease process begins when typical physiological changes in the trophoblast's remodelling of the spiral arteries of the decidua and myometrium are incomplete, resulting in reduced placental perfusion. (25,26) Oxidative stress then triggers the syncytiotrophoblasts to release substances that include pro-inflammatory cytokines, exosomes, anti-angiogenic agents and cell-free fetal DNA that damage the endothelial cells of the pregnant person's circulatory system. (19,25) This provokes systemic inflammation, increasing vascular reactivity and leading to:

- Vasospasm and increased blood pressure
- Abnormal coagulation and thrombosis
- Increased endothelial permeability, resulting in proteinuria, edema and hypovolemia (27)

Poor placentation can also cause fetoplacental demands that exceed a pregnant person's circulatory supply, restricting fetal growth and increasing the risk of stillbirth or neonatal death. (17,19) Fetal manifestations can occur before, with or following manifestations of preeclampsia in the pregnant person.

Current research suggests that poor placentation is not necessarily a cause of preeclampsia but a powerful predisposing factor. In individuals for whom placental growth is appropriate for gestational age, or when preeclampsia has developed late in pregnancy, placental maturity, along with pre-existing cardiovascular or metabolic disorders, may precipitate the cascade of systemic inflammation. (17,19) Genetic, behavioural and environmental factors are thought to increase the risk of abnormal placentation and modify the progression of preeclampsia. (27)

Systems affected

Preeclampsia is a multi-system disease with variable progression. (18) The organ systems susceptible to the inflammation and endothelial damage of preeclampsia include the liver, the kidneys, the lungs and the hematological and central nervous systems. (19) Complications increase with the number of organ systems affected. (17) See Table 1 for a description of ways in which preeclampsia may manifest.

TABLE 1: MANIFESTATIONS OF PREECLAMPSIA

Organ system involved	Pathological process	Signs/symptoms
Central nervous system	Cerebral vasospasm and hemorrhage, ischemia and/or edema of the cerebral hemispheres	• Persistent headache • Visual disturbance (e.g., blurring or flashing lights before the eyes) • Seizure • Stroke • Clonus, hyper-reflexivity • Hemiplegia
Hepatic system	Vasospasm and inflammatory infiltration	• Elevated serum AST or ALT • Falling albumin levels • Epigastric or right upper quadrant pain • Liver hematoma, rupture
Renal system	Damage to the endothelial cells of the glomerular capillaries as a result of vasospasm and decreased renal blood flow	• Proteinuria • Oliguria • Reduced creatinine clearance • Elevated serum creatinine • Elevated uric acid
Respiratory system	Increased capillary permeability	• Dyspnea • Chest pain • Pulmonary edema • Oxygen saturation < 97% • Myocardial ischemia or infarction
Cardiovascular system	Vasospasm, increased capillary	• Cardiomyopathy • Left ventricle failure • Pulmonary edema
Hematological system	Peripheral vascular vasospasm and coagulation cascade activation	• Clotting abnormalities • Prolonged prothrombin time • Low platelet count • Edema of the hands and face
Uteroplacental unit	Vasoconstriction reduces uterine blood flow	• Placental abruption • Atypical or abnormal NST • Intrauterine growth restriction • Oligohydramnios • Absent or reversed end-diastolic flow by umbilical artery Doppler velocimetry • Angiogenic imbalance

Adapted from: (7,18,19,28)

Associated complications

Outcomes of preeclampsia depend on the gestational age at onset of disease and the severity of the disease. (14) HDP increases the risk of placental abruption, organ failure, cerebrovascular accident and disseminated intravascular coagulation (DIC), as well as fetal risk of intrauterine growth restriction (IUGR), intrauterine death and prematurity. (29–31)

Hemolysis, elevated liver enzymes and low platelets syndrome (HELLP) can occur with or without other typical symptoms of preeclampsia. (32,33) The etiology of HELLP syndrome is unclear, although it is thought to share a similar pathogenesis with preeclampsia. (31) Serious complications of HELLP syndrome include DIC, liver hematoma and rupture, placental abruption, pulmonary edema and adult respiratory distress, pleural effusions and acute renal failure. (18,32)

Despite these risks, mortality from HDP and serious morbidity are rare. While hypertension-related causes account for a large proportion of pregnant person deaths, absolute numbers remain low. Most cases of preeclampsia in healthy primiparas present in the third trimester and are associated with little increased risk of adverse pregnancy outcome. (18)

In Ontario, racial disparities in outcomes associated with HDP exist; for example, rates of preeclampsia in Black pregnant people (aRR 1.10, 95% CI 1.05-1.14) and early preterm birth (< 34 weeks: aRR 2.29, 95% CI 2.23-2.35) are greater than in white pregnant people. (34) Additionally, research from the US shows that Black pregnant people suffer disproportionately from severe morbidity associated with preeclampsia, such as stroke, pulmonary edema and acute heart failure. (35)

In health research, it is common for racial differences in outcomes to be interpreted as biological rather than as a result of socially constructed inequities, yet there is no inherent underlying reason for certain communities to develop HDP. (36–38) Rather, racial inequities in outcomes are a result of structural racism, colonization and discrimination, which negatively affect an individual's ability to receive timely, safe and appropriate health care. (34) The ever-growing body of research on health-care inequities further demonstrates that Indigenous and racialized communities continue to grapple with implicit biases and overt discrimination from health-care providers that is detrimental to the quality and timing of care these individuals receive. (39–43)

In efforts to close gaps in the quality and safety of care for racialized clients and other equity-deserving birthing communities, midwives must acknowledge and name racism as the cause of health disparities observed in clients with HDP. Midwives should refrain from providing *colour-blind care*[1] , which fails to recognize the intersecting ways that racism impacts health. (37,44,45) Rather, midwives can help minimize these disparities by being aware of and addressing their own implicit biases, supporting racially concordant care where available, and advocating for equitable access and the highest level of care for all clients.

Research gap

Ontario currently lacks a system for collecting race- and ethnicity-based health data, making the extent of differences in outcomes for the perinatal population difficult to ascertain. Moreover, the data indicators collected in the Ontario perinatal database do not reflect the importance and value of culturally appropriate care and safety provided by Indigenous, Black and racialized midwives. The AOM continues to advocate for perinatal data collection that is applicable and meaningful and upholds data governance frameworks such as the First Nations principles of ownership, control, access and possession (OCAP) as well as Black communities' engagement, governance, access and protection (EGAP) principles.

[1] An approach in the provision of health care that prioritizes treating all people the same, regardless of their race and/or ethnicity, in the erroneous belief that this approach prevents the impact of implicit biases on the provision of said care. (45)

FACTORS ASSOCIATED WITH THE DEVELOPMENT OF HYPERTENSION IN PREGNANCY

The largest body of research on the prediction of hypertension in pregnancy focuses on risk factors associated with HDP.

Risk factors for gestational hypertension

There is considerably less research that examines risk factors for gestational hypertension than preeclampsia. One cohort study (n = 7633) that compared risk factors between gestational hypertension and preeclampsia reports that the two conditions share many risk factors, including obesity, nulliparity, history of preeclampsia, diabetes and multiple pregnancy. However, the strength of associations between these factors and gestational hypertension were generally weaker than the associations reported for preeclampsia. (46)

Risk factors for preeclampsia

A 2016 meta-analysis of 92 cohort studies investigating risk factors for preeclampsia at 16 weeks' gestation or earlier found that a prior pregnancy with preeclampsia, chronic hypertension or pregestational diabetes was most strongly associated with an increased risk of preeclampsia in the current pregnancy. (47) Table 2 summarizes the findings of this meta-analysis. Table 3 explores the relationship between BMI and the risk of preeclampsia, suggesting that the risk rises with higher BMI. (48)

Family history has also been found to be a risk factor for preeclampsia. A 2005 meta-analysis (n = 692) found that those with a family history of preeclampsia had an increased risk of preeclampsia compared with those who did not (RR 2.90, 95% CI 1.70-4.93). (49) A more recent 2019 retrospective study found that having a parent who experienced preeclampsia increases the odds of preeclampsia in the next generation (OR 2.9, 95% CI 1.4-5.8). (50)

Other factors thought to increase the risk of preeclampsia include length of exposure to one person's sperm and birth interval. A 2020 retrospective cohort study (n = 2003) indicates that individuals with a previously normotensive pregnancy were two times more likely to develop preeclampsia in a subsequent pregnancy conceived with new sperm (OR 2.27, 95% CI 1.18-4.93) or after a birth interval greater than four years (OR 2.05, 95% CI 1.30-3.24). (51) However, the mechanism, interrelationship and strength of these associations are not well established. (51–55)

There is evidence that social determinants (e.g., access to education and safe housing, income, food security, employment and environmental exposures) as well as health-care factors, such as lack of access to prenatal care (56, 57) or publicly funded health insurance (58), influence the risk of severe preeclampsia. Several systemic barriers affect access to care, including administrative and legal barriers, poor information about health-care services and a lack of trust in them. (58) These barriers and the resulting lack of access have been associated with an increase in the risk of severe morbidity and mortality from preeclampsia. (57, 59, 60) Individuals affected by racism, colonialism, and intersecting social and socioeconomic factors, as well as newcomers to Canada, disproportionality experience these barriers, which affect the development, prognosis and management of HDP. (37, 58, 61-63)

Midwifery care can interrupt these pathways in several important ways. For example, midwives provide care to pregnant people regardless of insurance status. Alternative and expanded practice models that provide services beyond the midwifery course of care model work to meet diverse community needs. Midwives also serve as strong advocates for clients, ensuring that respectful, person-centered care is provided throughout pregnancy. Lastly, midwives can consider the influence of various determinants of health and use this knowledge to provide culturally responsive, person-centred care (e.g., referrals to free community services, counselling support) and enhance informed choice discussions.

TABLE 2. RISK FACTORS FOR DEVELOPING PREECLAMPSIA

Risk factor	RR	Interpretation	Source
Strong predictive factor (RR > 1.75 or < 0.25)			
Prior pregnancy with preeclampsia	8.4 (95% CI 7.1 to 9.9)	Increases likelihood	(47)
Chronic hypertension	5.1 (95% CI 4.0 to 6.5)	Increases likelihood	(47)
Pregestational diabetes	3.7 (95% CI 3.1 to 4.3)	Increases likelihood	(47)
Multifetal pregnancy	2.9 (95% CI 2.6 to 3.1)	Increases likelihood	(47)
Pre-pregnancy BMI >30	2.8 (95% CI 2.6 to 3.1)	Increases likelihood	(47)
Antiphospholipid antibody syndrome	2.8 (95% CI 1.8 to 4.3)	Increases likelihood	(47)
Systemic lupus erythematosus	2.5 (95% CI 1.0 to 6.3)	May increase likelihood	(47)
Prior stillbirth	2.4 (95% CI 1.7 to 3.4)	Increases likelihood	(47)
Nulliparity	2.1 (95% CI 1.9 to 2.4)	Increases likelihood	(47)
Prior placental abruption	2.0 (95% CI 1.4 to 2.7)	Increases likelihood	(47)
Assisted reproductive therapy	1.8 (95% CI 1.6 to 2.1)	Increases likelihood	(47)
Chronic kidney disease	1.8 (95% CI 1.5 to 2.1)	Increases likelihood	(47)
Moderate predictive factor (RR 1.25-1.75 or 0.26-0.75)			
Age > 40	1.5 (95% CI 1.2 to 2.0)	Increases likelihood	(47)
Weak predictive factor (RR < 1.25 and > 0.76)			
Age > 35	1.2 (95% CI 1.1 to 1.3)	Increases likelihood	(47)

TABLE 3: ASSOCIATION BETWEEN BMI AND THE RISK OF PREECLAMPSIA*

BMI	aOR (95% CI)	
BMI ≤25	Referent	(48)
BMI >25-30	1.65 (95% CI 1.13 to 2.41)	(48)
BMI >30-35	2.34 (95% CI 1.51 to 3.61)	(48)
BMI >35-40	3.59 (95% CI 2.13 to 6.03)	(48)
BMI >40	6.04 (95% CI 3.56 to 10.24)	(48)

*This study controlled for chronic hypertension, pregestational diabetes, multiple gestation, African American race, prior preeclampsia, nulliparity and assisted reproductive technique.

Good Practice Statement

1. Midwives should identify and discuss risk factors for preeclampsia with clients early in care. [2023]

Good practice statement

This good practice statement recognizes midwives' ability to develop a care plan and assess the need for interprofessional collaboration as the clinical picture requires.

Preeclampsia risk stratification

Researchers have attempted to integrate known risk factors for preeclampsia into risk stratification systems for use in routine antenatal care. Both the SOGC in Canada and NICE in the UK provide guidance on when an individual should be classified as high risk, based on a set of demographic and pregnancy-related factors (Table 4). (7,8) In both guidelines, pregnant people are considered high risk if they have one or more high risk factors or two or more moderate risk factors. While these are associated with an increased risk of preeclampsia, most clients who possess one or more of these factors will not be diagnosed with it.

TABLE 4: COMPARISON OF RISK STRATIFICATION SYSTEMS

SOGC CPG(7)		Risk factor	NICE CPG(8)	
Suggested action		Preeclampsia in previous pregnancy	**Suggested action**	
		Chronic hypertension		
		Autoimmune disease*	**Any 1 factor**	**Treat as high risk**
Treat as high risk	**Any 1 factor**	Pre-existing diabetes		
		Chronic kidney disease		
		Pre-pregnancy BMI>30kg/m^2		
		Assisted reproductive therapy		
		Prior placental abruption		
		Prior stillbirth		
		Prior fetal growth restriction		
Treat as high risk	**≤2 factors**	Nulliparity		
		Age >40		
		Multifetal pregnancy	**≤2 factors**	**Treat as high risk**
		≥ 10 years since last pregnancy		
		BMI ≥ 35 kg/m^2 at first visit		
		Family history of preeclampsia		

(7,8)

* Systemic lupus erythematosus or antiphospholipid antibody syndrome

Screening tests for prediction of preeclampsia

Due to limitations associated with risk factor stratification systems, several laboratory tests and ultrasonographic measures have been proposed as means by which to predict preeclampsia.

First-trimester tests for the prediction of preeclampsia – biochemical tests

Low serum levels of pregnancy-associated plasma protein A (PAPP-A) are known to be associated with preeclampsia. A 2017 meta-analysis of eight studies with a total of 132 000 participants (*moderate certainty of evidence*) shows that those with low PAPP-A (< 5th centile) in the first trimester are two times more likely to develop preeclampsia than those with PAPP-A (> 5th centile) (OR 1.94, 95% CI 1.63-2.30). (64)

However, research that specifically examines the diagnostic accuracy of first-trimester PAPP-A (< 5th centile) screening to predict preeclampsia shows poor predictive ability. (64) Results from this research show a sensitivity of 0.16 (95% CI 0.09-0.28) and a specificity of 0.92 (95% CI 0.85-0.96). The sensitivity of 0.16 suggests that of pregnant people who have low PAPP-A,

only 16% will develop preeclampsia. Although this test lacks strong diagnostic accuracy, those with low PAPP-A are at increased risk of preeclampsia, so low PAPP-A levels may warrant a higher index of suspicion for HDP.

Low levels of placental growth factor (PlGF) are also associated with preeclampsia, as low PlGF is thought to reflect syncytiotrophoblast stress and poor placentation. (65,66) A 2019 meta-analysis that included 15 studies (*moderate certainty of evidence*) examined the predictive performance of low PlGF concentrations (cut-offs were variably defined across the studies) at < 14 weeks' gestation in participants with no current signs of preeclampsia. The results show a sensitivity of 0.50 (95% CI 0.36-0.64) and a specificity of 0.89 (95% CI 0.85-0.95), suggesting that this test will only identify about half of the individuals likely to develop preeclampsia as their pregnancy advances. (67)

First-trimester tests for the prediction of preeclampsia – uterine artery Doppler

Because impaired placentation is associated with preeclampsia, there has been interest in using uterine artery Doppler to detect placental abnormalities. Results from a 2014 meta-analysis that included eight studies (n = 37 971) (*moderate certainty of evidence*) to examine the diagnostic accuracy of abnormal uterine artery flow velocity waveform (defined as resistance index or pulsatility index ≥ 90th centile) in predicting preeclampsia at any gestational age; they show a sensitivity of 0.26 (95% CI 0.23-0.31) and a specificity of 0.93 (95% CI 0.90-0.96). The sensitivity of 0.26 suggests that only 26% of individuals who are at risk of developing preeclampsia, and therefore would benefit from early intervention such as low–dose acetylsalicylic acid, would be identified, making uterine artery Doppler alone a poor screening tool in clinical practice. (67)

Second trimester tests for the prediction of preeclampsia

Currently, most research focuses on first-trimester prediction of preeclampsia, as identifying risk early in pregnancy is important to determine who would benefit from preventive measures. However, there is some research that investigates the predictive value of tests conducted in the second and third trimester.

A meta-analysis that included 18 studies (*moderate certainty of evidence*) to investigate the diagnostic accuracy of PlGF to predict preeclampsia when assessed at > 19 weeks' gestation suggests that PlGF alone is a better predictor of preeclampsia when taken after the first trimester of pregnancy. Results show a sensitivity of 0.72 (95% CI 0.64-0.74) and a specificity of 0.82 (95% CI 0.75-0.87). (67) These results are supported by a prospective observational study (*high certainty of evidence*) that examined the predictive performance of PlGF to determine the need for delivery due to preeclampsia within 14 days of testing. The study included 625 participants with suspected preeclampsia between 20 and 35 weeks' gestation. Among those < 35 weeks' gestation at enrolment (n = 287) low PlGF levels (< 5th centile for gestation) had a sensitivity of 0.96 (95% CI 0.89-0.99) and a specificity of 0.55 (95% CI 0.48-0.61) for predicting preeclampsia requiring delivery within 14 days.

To further understand the utility of measuring PlGF concentrations, Duhig et al. conducted a randomized control trial to assess whether PlGF testing decreases the time that clinicians take to diagnosis preeclampsia. (69) This study included pregnant people between 20 and 36 weeks' gestation with suspected preeclampsia defined as new onset or worsening of existing hypertension, dipstick proteinuria, epigastric or right upper quadrant pain, headache with visual disturbances, fetal growth restriction or abnormal blood tests that were suggestive of disease (such as thrombocytopenia or hepatic or renal dysfunction). Participants were randomized to receive usual care, which included blood pressure measurement or usual care plus PlGF measurement. The results show that the median time to preeclampsia diagnosis was 4.1 days in the usual care group and 1.9 days in the PlGF group (*high certainty of evidence*), which corresponds to a 64% reduction in the time to diagnosis, when PlGF measurement was used to diagnose preeclampsia.

Multiple marker algorithms for the prediction of preeclampsia

Additional efforts to identify those at risk of preeclampsia include the use of multiple marker algorithms.

The most well-studied algorithm, developed by the Fetal Medicine Foundation (FMF), combines data from clinical risk factors and measurements from uterine artery pulsatility index (UtA-PI), mean arterial pressure (MAP), and placental growth factor (PlGF). One prospective cohort study compared the effectiveness of the NICE risk stratification method with the FMF algorithm between 11 and 13 weeks' gestation and found that the FMF algorithm performed better than the NICE risk stratification method in predicting preeclampsia. Screening using the FMF algorithm detected 75% of those who would go on to develop preeclampsia at < 37 weeks, while NICE only detected 39% of cases. (70) Following research that has demonstrated the effectiveness of the FMF algorithm (71, 72), a UK hospital moved from using the NICE risk stratification method to using the FMF algorithm

for screening in the first trimester. (73) This allowed for a comparison of the two methods. The study found that after implementing the FMF screening algorithm there was a reduction in the number of people screening high risk (OR 0.50, 95% CI 0.41-0.53) as well as a reduction in the prevalence of preeclampsia (OR 0.77, 95% CI 0.63-0.95). The authors suggest that the more manageable screen-positive rate associated with the FMF algorithm contributed to higher rates of aspirin being prescribed by physicians, which could explain the lower prevalence of preeclampsia. The FMF algorithm also performed better than NICE at screening for preterm (< 37 weeks) preeclampsia.

It is important to note that the FMF algorithm includes racial origin as an input. While the algorithm's recommended course of action does not differ for two individuals whose only differentiating characteristic is race, the risk score for preeclampsia is considerably higher for individuals who are Black and South Asian compared with their white counterparts. Attributing higher risk to individuals who are racialized reinforces biological determinism while ignoring the social conditions and systemic racism that affect racialized clients and increase their risk of preeclampsia. (74,75) It may also introduce provider bias, which can pathologize care of the pregnant person. (74) This may result in additional interventions and more aggressive management without any corresponding improvement in outcomes. (74,75)

In summary, screening for preeclampsia using risk stratification systems remains common practice in part because there are no single tests that accurately predict the development of preeclampsia. While there is a large body of evidence on multiple marker algorithms that seems promising, this system has yet to be widely adopted in Ontario. This may change as Ontario Health, in December 2022, recommended publicly funding a population-wide first-trimester screening program using the Fetal Medicine Foundation algorithm. (76) For midwives, the use of multiple marker algorithms remains particularly challenging as access to tests is limited by the current laboratory regulations. Moreover, access to uterine artery pulsatility index (UtA-PI) and placental growth factor (PlGF) remains limited in rural, remote and northern areas, which makes their use in clinical practice challenging without placing significant burdens on the client to travel far distances to undergo testing. As new technologies develop these tests may become more cost effective and accessible. For example, point of care PlGF testing has been implemented alongside blood pressure measurement in some hospitals in the UK. (77,78)

Recommendation
2. Midwives should consider clients' clinical picture and consensus-based criteria (e.g., the SOGC or NICE risk factor stratification systems) to determine individuals' level of preeclampsia risk and offer preventive measures. [2023] **Strong recommendation: moderate certainty evidence** *This recommendation recognizes midwives' ability to identify emerging complications and escalate care as the clinical picture requires.*

PREVENTION OF HDP

There are various interventions aimed at preventing or delaying the onset of hypertensive disorders of pregnancy as well as reducing their severity once diagnosed.

Low-dose acetylsalicylic acid

As preeclampsia is associated with an activation of platelets and the clotting system, researchers have hypothesized that anti-platelet agents, in particular low-dose acetylsalicylic acid (ASA), may prevent or delay the development of preeclampsia. Results from a 2019 Cochrane review of 32 000 pregnant people (*high certainty of evidence*) investigating daily low-dose ASA intake (50-150 mg) compared with a placebo or no treatment found that low-dose ASA reduces the risk of preeclampsia (RR 0.89, 95% CI 0.82-0.95). (79) The reduction in the risk of preeclampsia was greatest in those at high risk, when the dose was ≥ 75 mg, and when ASA was initiated at ≤ 16 weeks' gestation. (79, 80) See Table 5.

TABLE 5: LOW DOSE ASA AND RISK OF PREECLAMPSIA

	Number of studies	Pooled relative risk (95% CI)
All studies included in meta-analysis	32 271 participants 32 studies	0.89 (0.82 to 0.95)
Participants at high risk* of developing preeclampsia	11 076 participants 26 studies	0.90 (0.82 to 0.98)
Participants at low risk of developing preeclampsia	20 583 participants 25 studies	0.88 (0.77 to 1.00)
Low-dose ASA < 75 mg	22 618 participants 11 studies	0.92 (0.85 to 1.00)
Low-dose ASA ≥ 75 mg	9 107 participants 16 studies	0.78 (0.66 to 0.92)
Low-dose ASA initiated ≤ 16 weeks' gestation	15 370 participants 21 studies	0.57 (0.43 to 0.75)
Low-dose ASA initiated at > 16 weeks' gestation	5 113 participants 19 studies	0.81 (0.66 to 0.99)

* Participants were classified as high risk if they had one of the following conditions: diabetes, chronic hypertension, renal disease, autoimmune disease, gestational hypertension, positive uterine artery Doppler, previous preeclampsia or previous fetal/neonatal death associated with preeclampsia.

There is little evidence to suggest an optimal gestational age at which to discontinue low-dose ASA, although concerns exist that low-dose ASA supplementation may increase the risk of postpartum hemorrhage, particularly when it is taken until delivery. The same Cochrane review (*moderate certainty of evidence*) comparing low-dose ASA consumption with a placebo or no intervention found that low-dose ASA intake probably slightly increases the risk of postpartum hemorrhage > 500 mL (RR 1.06, 95% CI 1.00-1.12). (79) However, this review did not investigate the risk of PPH based on the dose of low-dose ASA or the timing of discontinuation; therefore, it cannot be ascertained how the risk of PPH might be affected by these factors. The SOGC writes that a daily dose of 162 mg or greater maximizes effectiveness in reducing the risk of preeclampsia, whereas a daily dose of 81 mg maximizes safety for the birthing parent. (7) Guideline groups have made differing recommendations on the timing of low-dose ASA discontinuation; the SOGC recommends discontinuing low-dose ASA at 36 weeks, whereas NICE recommends continuing until delivery. (7,8)

Further considerations regarding low-dose ASA use have been related to the optimal time for consumption. Research in the general population has shown that blood pressure is better regulated when ASA is taken at night. (81) This was confirmed in one study conducted with a pregnant population; it found that taking ASA at bedtime was more effective in regulating blood pressure and reducing preeclampsia than taking it in the morning. (82)

Contraindications to low-dose ASA use in pregnancy

Absolute contraindications:

- Allergy to ASA
- Known hypersensitivity to NSAIDs
- Nasal polyps
- Asthma with a history of ASA-induced bronchospasms

Relative contraindications:

- History of gastrointestinal bleeding
- Active peptic ulcer disease
- Gastrointestinal or genitourinary bleeding
- Severe hepatic dysfunction (5,6)

Recommendation

3. Midwives may recommend low-dose ASA (81-162 mg/day), administered at bedtime, to clients at increased risk of developing preeclampsia, beginning once the client's increased risk has been identified (ideally before 16 weeks' gestation) and continuing between 36 weeks' gestation and delivery. [new 2023]

   This recommendation presupposes an absence of contraindications to low-dose ASA (see list of contraindications above).

   Weak recommendation: high certainty of evidence

   This recommendation recognizes the client as the primary decision-maker and acknowledges the variations in community standards across Ontario.

Calcium supplementation

While the mechanism through which calcium affects blood pressure during pregnancy is unknown, it is hypothesized that calcium may reduce vasoconstriction and smooth muscle contractility. (83) Results from a 2018 Cochrane review show that compared with a placebo, calcium supplementation ≥ 1 g/day:

- May reduce the risk of high blood pressure (RR 0.65, 95% CI 0.53-0.81) [*low certainty of evidence*, n = 15 470, 12 RCTs].
- May reduce the risk of preeclampsia (RR 0.45, 95% CI 0.31-0.65) [*low certainty of evidence*, n = 15 730, 13 RCTs].
- May reduce preterm birth (RR 0.76, 95% CI 0.60-0.97) [*low certainty of evidence*, n = 15 275, 11 RCTs].

The reduction in risk was most pronounced in individuals who were either at high risk of preeclampsia or had low baseline levels of dietary calcium. See Table 6.

While calcium supplementation has not historically been associated with any harms, the Cochrane review noted two trials (n = 12 901) (*moderate certainty of evidence*) that show calcium supplementation probably increases the risk of HELLP syndrome compared with a placebo (RR 2.67, 95% CI 1.05-6.82), although the absolute risk is low. In 1000 people taking calcium supplements, there could be two more cases of HELLP syndrome (ranging from 0 to 5 more cases). The authors suggest that calcium supplementation may reduce blood pressure but not the underlying preeclamptic process, thereby delaying diagnosis and treatment and allowing more time for preeclampsia to progress to HELLP syndrome.

For individuals with relatively varied, nutritious and energy-rich diets, calcium supplementation may not offer widespread benefit in terms of decreasing the risk of HDP. The recommended dose of 1000-2500 mg is based on research that indicates that > 1000 mg appears to reduce the risk of preeclampsia (most of the studies in this research used 1500-2000 mg). Health Canada suggests a recommended dietary allowance of 1000 mg of elemental calcium per day for adults 19 to 50 years of age, including those who are pregnant or chest or breastfeeding; tolerable upper intake levels are set at 2500 mg/day. (84) Clients with calcium intake < 1000 mg/day may consider increasing their daily intake to 1000-2500 mg by consuming additional foods high in calcium or through supplementation.

TABLE 6. CALCIUM SUPPLEMENTATION ≥ 1 G/DAY AND RISK OF GESTATIONAL HYPERTENSION AND PREECLAMPSIA

	Gestational hypertension Pooled relative risk (95% CI)		Preeclampsia Pooled relative risk (95% CI)	
All studies included in meta-analysis	15 470 participants 12 studies	0.65 (0.53-0.81)	15 730 participants 13 studies	0.45 (0.31-0.65)
Participants at high risk* of developing preeclampsia	327 participants 4 studies	0.47 (0.22-0.97)	587 participants 5 studies	0.22 (0.12-0.42)
Participants with adequate calcium diet	5022 participants 4 studies	0.90 (0.81-0.99)	5022 participants 4 studies	0.62 (0.32-1.20)
Participants with low calcium** diet	10 418 participants 7 studies	0.44 (0.28-0.70)	10 678 participants 8 studies	0.36 (0.20-0.65)

* "High risk" was variably defined in the included studies, and comprised adolescents, individuals with previous preeclampsia or chronic hypertension and those with increased sensitivity to angiotensin II.

** "Low-calcium" diet was variably defined in the included studies.

(83)

Recommendation

4. Midwives may offer calcium supplementation (1000-2500 mg/day) to those at increased risk of preeclampsia and whose dietary intake is below recommended levels (< 1000 mg/day). [2023]

   Weak recommendation: low certainty of evidence

   This recommendation recognizes the client as the primary decision-maker and acknowledges midwives' skill in providing health information to clients.

Vitamin C and E

Supplementation with antioxidants during pregnancy has been proposed as a means of counteracting oxidative stress, thereby preventing or delaying the onset of preeclampsia. A 2015 Cochrane review (85) investigated vitamins C and E taken together compared with a placebo or no intervention for prevention of preeclampsia. Participants varied in their level of risk for preeclampsia. Results show that vitamins C and E supplementation:

- likely results in little to no difference in the risk of preeclampsia, (RR 0.91, 95% CI 0.78 to 1.06) [*moderate certainty of evidence*, n=20 765, 13 RCTs]
- likely increases the risk of term prelabour rupture of membranes (PROM) (RR 1.73, 95% CI 1.34 to 2.23), [*high certainty of evidence*, n=3060, 2 RCTs]

The mechanism by which vitamin C and E supplementation may increase risk of early membrane rupture is unclear. (85) Further research is required to quantify this risk more precisely. In the meantime, the balance of suspected risks and benefits associated with vitamin C and E supplementation suggest that it should not be recommended to reduce the risk of preeclampsia or its complications.

Recommendation

5. Vitamin C/E supplementation is not recommended for the prevention of HDP. [new 2023]

   Strong recommendation: moderate certainty of evidence

   This recommendation recognizes the client as the primary decision-maker and acknowledges midwives' skill in providing health information to clients.

Folic acid

Folic acid is known to reduce blood homocysteine levels and has been suggested as a preventive measure for preeclampsia. A 2018 meta-analysis (86) that included RCTs and observational studies investigated folic acid supplementation compared with no intervention, and found that supplementation with folic acid alone may result in little to no difference in the risk of gestational hypertension (RR 1.19, 95% CI 0.92-1.54) or preeclampsia (RR 0.97, 95% CI 0.80-1.17). However, supplementation with a multivitamin containing folic acid may reduce the risk of preeclampsia (RR 0.70, 95% CI 0.53-0.93). In explaining this finding, study authors propose that the other vitamins in the multivitamin may play a role in the prevention of preeclampsia or that the effects of folic acid are enhanced by the other vitamins.

Recommendation

6. Taking a periconceptual multivitamin with folic acid has established benefits and may reduce the risk of HDP. [new 2023]

   Weak recommendation: very low certainty of evidence

   This recommendation recognizes the client as the primary decision-maker and acknowledges midwives' skill in providing health information to clients.

Preventive measures with potential protective effects

The following interventions all show some benefit in preventing preeclampsia. Although promising, the body of evidence is limited by a small number of studies, small sample sizes and low event rates, and it is therefore not yet compelling enough to make a recommendation in favour or against each of the interventions. Further research is required to provide more definitive evidence of the relationship between these supplements and the prevention of HDP.

Vitamin D

Data from a 2019 Cochrane review of four studies (*low certainty of evidence*) indicates that vitamin D supplementation may reduce the risk of preeclampsia compared with a placebo or no intervention (RR 0.48, 95% CI 0.30-0.79), but it may make little to no difference in rates of gestational hypertension (RR 0.78, 95% CI 0.41-1.49) or preterm birth (RR 0.66, 95% CI 0.34-1.30). (87) The evidence is limited by small sample sizes, and most studies did not consider the participants' pre-intervention vitamin D levels. Moreover, the studies used varying doses of vitamin D, ranging from 200 IU to 3500 IU, which prevented determination of an optimal dosage for the prevention of preeclampsia. (87) Health Canada suggests a recommended dietary allowance of 600 IU/day for those who are pregnant or lactating; the upper tolerable intake level is 4000 IU/day. (84)

Selenium

Selenium, a mineral that occurs naturally in many foods, including nuts and fish, is known for its antioxidant activity and has been implicated in placental protection against oxidative stress. A meta-analysis of three RCTs of 439 participants (*low certainty of evidence*) found that selenium supplementation (60-100 µg/day) compared with a placebo may reduce the risk of preeclampsia (RR 0.28, 95% CI 0.09-0.84). (88)

L-arginine

Evidence from a meta-analysis of two RCTs (*moderate certainty of evidence*) with 546 participants at high risk for preeclampsia investigated the l-arginine supplementation (through medical food bars or capsules). It found that l-arginine supplementation likely reduces the risk of preeclampsia (OR 0.40, 95% CI 0.28- 0.59). (89, 90)

Recommendation

7. There is insufficient evidence to support the use of vitamin D, selenium or l-arginine for the prevention of HDP. [new 2023]

   No recommendation: low certainty of evidence

   This recommendation recognizes the lack of high certainty of evidence to support these measures although small benefits and no harms have been noted.

Preventive measures with uncertain effect

The following preventive measures have conflicting evidence, with some research suggesting that they may be effective in preventing HDP and some suggesting otherwise. Further research is required to understand the significance of these measures to prevent HDPs.

Probiotics

Probiotics have been suggested to modify placental trophoblast inflammation, systemic inflammation and blood pressure. There is conflicting evidence about the impact of probiotics on HDP. One large population-based study using data from a national Norwegian pregnancy cohort (n = 33 399) (*low certainty of evidence*) examined the intake of probiotic milk or yogurt on the risk of preeclampsia. (91) Results show that consuming one or more portions daily of milk-based products containing probiotics may slightly reduce the risk of preeclampsia compared with consuming no probiotics (OR 0.80, 95% CI 0.66-0.96). (91) Conversely, a 2021 Cochrane review (*low certainty of evidence*) that investigated measures to prevent gestational diabetes by supplementation with probiotic capsules found that probiotic intake may increase the risk of preeclampsia (RR 1.85, 95% CI 1.04-3.29). (92) It is important to note that the Cochrane review only included 955 participants and that the populations of the included studies had higher BMI (> 25 kg/m^2 or > 30 kg/m^2).

Exercise

The research on the effects of exercise in pregnant populations is uncertain. A 2019 umbrella review reported on nine meta-analyses and systematic reviews, with some showing an association between physical activity and a reduction in HDP and others finding none. The estimates of association among these reviews ranged from 0.22 to 1.05, and they often had wide confidence intervals that crossed the null. The authors of the umbrella review concluded that there is only limited evidence of an inverse relationship between exercise and the risk of preeclampsia or gestational hypertension. (93) Despite this evidence, regular exercise has been proposed as a preventive strategy for HDP, based on the well-established association between physical activity and reduced risk of hypertension in the general population. Possible explanations for such a relationship include enhanced vascularization and placental growth, reduced oxidative stress and lowered inflammatory cytokines. While no harms are generally associated with exercise during pregnancy, the available research does not provide information about the optimal type (e.g., cardiovascular, strength or occupational physical activity) or duration of physical activity for preventing HDP.

Summary Statement

Further research is required before the use of probiotics or exercise for the prevention of HDP is recommended.

Preventive measures with no protective benefit

Research on the following interventions suggests that they are not effective in preventing hypertensive disorders of pregnancy.

Omega 3 fatty acids

Several population-based studies have found that higher consumption of fish during pregnancy is associated with lower risk of preeclampsia, as fatty acids in fish may minimize inflammatory responses and oxidative stress. A 2018 Cochrane review (*moderate certainty of evidence*) investigated consumption of omega 3 fatty acids in pregnancy (i.e., fish oil or algal oil capsules or enriched food). Meta-analyses show that supplementation with omega 3 fatty acids results in little to no difference in the risk of preeclampsia (RR 0.95, 95% CI 0.76-1.19) or high blood pressure (RR 1.05, 95% CI 0.90-1.22). (94)

Magnesium

A 2014 Cochrane review identified three RCTs (l*ow certainty of evidence*) that investigated magnesium supplementation compared with a placebo or no intervention to prevent preeclampsia. Results from these studies indicate that magnesium supplementation may result in little to no difference in the risk of preeclampsia (RR 0.87, 95% CI 0.58-1.32) or preterm birth (RR 0.89, 95% CI 0.69-1.14). (95)

Vitamin B6

Meta-analyses from a 2015 Cochrane review of two studies (*low certainty of evidence*) compared antenatal oral vitamin B6 supplementation with a placebo or no intervention among 1197 participants. Results show that vitamin B6 may result in little to no difference in the risk of preeclampsia (RR 1.71, 95% CI 0.85-3.45). (96)

Zinc

Data from six studies meta-analyzed in a 2021 Cochrane review (*low certainty of evidence*) found that zinc supplementation (5-50 mg/day) compared with a placebo or no intervention may result in little to no difference in the risk of preeclampsia (RR 0.93, 95% CI 0.62-1.42) or preterm birth (RR 0.87, 95% CI 0.74-1.04). (97)

Garlic

A 2006 Cochrane review identified one RCT of 100 participants (*low certainty of evidence*) that investigated the impact of garlic on preeclampsia. (98) Results show that supplementation with garlic tablets (800 mg/day) makes little to no difference in the risk of preeclampsia (RR 0.78, 95% CI 0.31-1.93).

Rest

One RCT involving 32 participants was included in a 2006 Cochrane review (*very low certainty of evidence*) that examined the impact of four to six hours of rest per day on the risk of HDP. Results show that four to six hours of rest per day may reduce the risk of preeclampsia (RR 0.05, 95% CI 0.00-0.83), but it had little to no difference on the risk of gestational hypertension (RR 0.25, 95% CI 0.03-2.00). (99) These trials were small and of uncertain quality, and they did not report on potential adverse effects of rest nor on individuals' views or perceptions of the impact on their quality of life. A 2016 qualitative study that examined the experiences of individuals with preeclampsia who were put on bed rest found that participants reported mental health challenges, including stress, frustration, anxiety and depression. (100) Due to the limited evidence on the effectiveness of rest, and the potential negative impacts, rest is not suggested for the prevention of HDP.

Summary Statement

Evidence shows that omega 3 fatty acids, magnesium, vitamin B6, zinc, garlic and rest are not effective in preventing HDP.

ANTENATAL CONSIDERATIONS

Detection of HDP

Accurate determination of blood pressure is essential in ensuring appropriate treatment. Standard care includes screening for elevated blood pressure at antenatal visits. (101,102) However, the optimal frequency and timing of blood pressure measurement has not been definitively established. A 2015 Cochrane review of six trials involving a low-risk pregnant population compared antenatal care schedules involving a reduced number of visits (8-12 over the antenatal period) with standard care (13-14 visits). It found no clear difference in the incidence of hypertensive disorders of pregnancy (RR 0.95, 95% CI 0.80-1.12). (103)

The presentation of HDP can vary. More than 20% of pregnant individuals will receive a blood pressure reading of 140/90 mmHg or higher after 20 weeks' gestation. Blood pressure will remain elevated, and other symptoms of preeclampsia will develop, in a minority of these populations. (101) In one review, hypertension or proteinuria was absent in 12% to 18% of individuals with HELLP syndrome. (102) Given the varied clinical manifestations and unpredictable onset of HDP, opportunistic monitoring of blood pressure and other signs and symptoms is justified and advisable.

Measurement and recording of blood pressure

Accurate measurement of blood pressure requires consideration of several factors. As anxiety, excitement, caffeine or physical or emotional stress may cause transient elevations in blood pressure, allow at least five minutes of rest before measuring. (104,105) The client should be seated, with their arm positioned at the level of the heart, as brachial artery pressure is highest when the client is sitting upright (and lower in a supine or lateral position). Consequently, a reading taken when a client is reclined may be falsely low. (105) The correct-sized cuff (at least 1.5 times the circumference of the arm) should be used. (105)

Considerations for blood pressure monitoring
• Use a calibrated device (automated or aneroid) and a cuff of the appropriate size. • Provide a relaxed environment for the client. • Ensure that the arm is supported at heart level. • Determine sBP by the onset of palpation or appearance of clear tapping sounds. (Korotkoff phase I). • Denote dBP as the disappearance of sounds (Korotkoff phase V). (105)

Although mercury sphygmomanometers were once considered the gold standard for measuring blood pressure, they are no longer recommended because of concerns about the use of mercury in clinical settings. (18,106) The SOGC recommends using a calibrated aneroid device or an automated device validated for use in pregnancy and preeclampsia. (7) It is important to note that aneroid devices are prone to calibration errors and should be calibrated according to manufacturers' guidelines, typically at least every two years. (105) Systolic blood pressure is determined by the onset of palpation or appearance of clear tapping sounds (Korotkoff phase I). Korotkoff V should be used to classify diastolic blood pressure. (9,106)

TABLE 7: KOROTKOFF SOUNDS

Phase	Description
Phase I	Appearance of clear tapping sounds corresponding to the appearance of a palpable pulse
Phase II	Sounds become softer and longer
Phase III	Sounds become crisper and louder
Phase IV	Sounds become muffled and softer
Phase V	Sounds disappear completely

Midwives should be mindful of white-coat hypertension and masked hypertension. White-coat hypertension may occur in up to 30% of pregnant individuals. (107, 108) Masked hypertension should be suspected when a pregnant individual has symptoms of HDP but normal in-office BP measurements.

Home blood pressure monitoring (HBPM) has been proposed as a tool to aid in the detection of HDP, as it would allow for more frequent measurements and lead to earlier detection of elevated blood pressure. The BUMP trial (n = 2441) (*high certainty of evidence*) investigated whether self-monitoring of blood pressure, compared with clinic monitoring, in pregnant people at risk for hypertension leads to earlier detection of HDP. (109) Results show that the intervention group had a mean time to diagnosis of 104 days, and the clinical monitoring group had a mean time to diagnosis of 106 days (mean difference 1.6, 95% CI-8.1 to 4.9). These findings suggest that HBPM does not make a meaningful difference in the time taken to detect hypertension. However, out-of-office blood pressure measurement can be a useful tool to detect white-coat hypertension. If elevated measurements are noted by a client using their own HBPM device, the midwife should confirm the readings.

The Blood Pressure Measurement Algorithm on page 37 illustrates a clinical pathway to guide midwives through decision-making regarding BP measurements and follow-up actions.

Good Practice Statements

8. At least two BP measurements using the same arm should be recorded before a diagnosis of hypertension is made:
    - Midwives should use clinical judgment to determine an appropriate interval between measurements, based on clients' gestational age, risk factors and presence of other signs and/or symptoms of preeclampsia. Repeated measurements should be taken at least 15 minutes apart.
    - If initial sBP is greater than or equal to 140 mmHg but less than 160 mmHg, and dBP is less than 90 mmHg, assess whether the client has risk factors for transiently elevated sBP (e.g., anxiety, stress, caffeine intake, recent exercise).
    - If white-coat hypertension is suspected or known, consider conducting the second BP measurement in the home environment.
    - Identify hypertension in pregnancy when sBP is greater than or equal to 140 mmHg and/or dBP is greater than or equal to 90 mmHg, based on the average of at least two measurements, using the same arm. [new 2023]

The following good practice statements refer to management of persistently elevated sBP and/or dBP. Base management decisions on the average of at least two BP measurements:

9. For severe hypertension (sBP greater than or equal to 160 mmHg and/or dBP greater than or equal to 110 mmHg), and/or signs and symptoms of HDP, a prompt assessment in hospital or in a higher-level clinical setting is warranted, involving investigations and physician consultation as per community standards. [new 2023]
10. sBP less than 160 mmHg and dBP between 90-109 mmHg requires further investigation, which may include consultation as per community standards. [new 2023]
11. If sBP is 140-159 mmHg but dBP is less than 90 mmHg, reassess risk factors for transiently elevated sBP (e.g., anxiety, stress, caffeine intake, recent exercise). In determining when to reassess, use judgment, considering the clinical picture and risk factors. Advise the client to contact their midwife if any signs and/or symptoms of preeclampsia develop in the meantime. [new 2023]

Good practice statements

These good practice statements recognize midwives' ability to identify emerging complications and escalate care as the clinical picture requires.

Assessment of proteinuria

Proteinuria occurs when hypertension-associated decreases in renal blood flow damage the endothelial cells of the glomerulus of the kidney, allowing plasma proteins to filter into the urine. (110) Renal damage is also signalled by reduced creatinine clearance. (18)

In the past, proteinuria was considered necessary for the diagnosis of preeclampsia. There is now agreement that proteinuria is not an essential parameter for the diagnosis of preeclampsia, but rather preeclampsia can be diagnosed in the absence of proteinuria, provided one or more other adverse conditions are present. (7–9) These include thrombocytopenia, rental insufficiency, impaired liver function, pulmonary edema and new-onset headache. (9) It was also once thought that the likelihood of adverse outcomes increased with higher levels of proteinuria, but current research suggests that proteinuria is not an adequate predictor of adverse outcomes in those with preeclampsia. (110-113) This is reflected in the 2022 SOGC guidance, which recommends against measuring proteinuria once a diagnosis of preeclampsia has been made. (7)

Proteinuria can also occur in the absence of hypertension or other signs of preeclampsia. The exact incidence of isolated proteinuria is unknown. One study (n = 11 651) found that 7.7% of pregnant individuals experienced isolated proteinuria on one occasion, 1.3% on two occasions and 0.6% on more than two occasions. (114) It is estimated that up to 30% of individuals with isolated proteinuria may progress to preeclampsia. (115–117)

Detection of proteinuria

The gold standard for diagnosing proteinuria in pregnancy is ≥ 300 mg of protein in a 24-hour urine collection. At present, it is common to initially assess proteinuria by dipstick testing due to its ease of use, low cost, and availability of a rapid result. If a positive screen is returned, laboratory measurements or a 24-hour urine collection are performed to confirm findings.

A dipstick reading of nil or trace is considered to be negative for urinary protein, a value of +1 to +4 is considered positive. The inaccuracy of dipstick analysis as compared with the detection of proteinuria by 24-hour urinalysis is well documented. (118) A meta-analysis

that included 13 studies (n = 2156) (*low certainty of evidence*) compared dipstick testing with a threshold of ≥ +1 to a 24-hour urine collection (the gold standard). It found a pooled sensitivity of 0.63 (95% CI 0.53-0.73) and a pooled specificity of 0.84 (95% CI 0.68-0.93). (118) These results indicate that dipstick testing is better at identifying those without proteinuria than those who have proteinuria. It is suspected that protein readings from dipstick analysis may also be contaminated by leucorrhea, blood or semen, although no research is available to substantiate this possibility. (119) Midwives may find that recommending the use of an obstetric towelette prior to voiding may reduce contamination and aid in obtaining an accurate result. While research suggests that perineal cleansing is not useful in reducing bacterial contamination of urine samples, its value in reducing the presence of leucorrhea, blood or semen has not been investigated. (120)

The feasibility and acceptability of dipstick self-testing has also been investigated. (121) One study compared clients' readings of a dipstick with their health-care professional's reading of a dipstick using the same sample. Of the 25 comparisons between readings by the client and those from a health-care provider, 88% of the participant-read dipsticks were congruent with the reading from the health-care professional. In the 12% of cases with discrepant results, the discrepancy would not have resulted in different clinical action. The study also surveyed participants (n = 39) on their experience with self-testing, and 87% reported that the dipsticks were easy to read. All the participants reported that self-testing helped them feel involved in their care, with only 10% reporting that it increased their anxiety.

Other tests for proteinuria assessment

Due to the low diagnostic accuracy of dipstick testing and the expense and time needed for 24-hour urine collection, there has been interest in other tests to detect proteinuria. This includes testing of the protein-creatinine and albumin-creatinine ratios.

A meta-analysis that included 13 studies (n = 3577) (*low certainty of evidence*) compared a protein-creatinine ratio with a threshold of 30 mg/mmol with the gold standard of a 24-hour urine collection. (122) The pooled sensitivity was 0.91 (95% CI 0.85-0.94), and the pooled specificity was 0.89 (95% CI 0.77-0.95), indicating that the protein-creatinine ratio measurement is quite good at identifying both those who have proteinuria and those who do not.

The albumin-creatinine ratio has also been used to detect proteinuria. A meta-analysis that included four studies (n = 1412) (*low certainty of evidence*) compared an albumin-creatinine ratio with a threshold of 2 mg/mmol with the gold standard of a 24-hour urine collection. (122) The pooled sensitivity was 0.98 (95% CI 0.94-0.99), and the pooled specificity was 0.69 (95% CI 0.38-0.89). One additional study compared an albumin-creatinine ratio test with a threshold of 8 mg/mmol with the gold standard of a 24-hour urine collection. (123) It found that the test had a sensitivity of 1.00 (95% CI 0.75-1.00) and a specificity of 0.96 (95% CI 0.92-0.99). This suggests that an albumin-creatinine test with a threshold of 8 mg/mmol may perform better than using the cut-off of 2 mg/mmol, but both thresholds were very good at identifying those who have proteinuria.

Routine dipstick testing of pregnant individuals at low risk of HDP and/or with no signs of HDP at every antenatal visit has been found to hold little clinical value, as it is rare for individuals to present with proteinuria before the hypertension of preeclampsia. (124, 125) This is reflected in current guidance from the SOGC, which recommends against proteinuria screening for preeclampsia in low-risk, normotensive pregnant people. (7)

Recommendation

12. Consider urinary dipstick testing when:
    - A client's sBP is greater than or equal to 140 mmHg or dBP is greater than or equal to 90 mmHg, based on the average of at least two readings, and/or
    - There are other signs and/or symptoms of preeclampsia.

    If a dipstick result ≥ +1 is present, further investigation is warranted, which may include consultation as per community standards. [new 2023]

    Weak recommendation: low certainty of evidence

    This good practice statement recognizes midwives' ability to identify emerging complications and escalate care as the clinical picture requires.

Assessment of other signs and symptoms of preeclampsia

The most common manifestations of preeclampsia are hypertension and proteinuria; however, preeclampsia may progress in the absence of one or both conditions. (21) Midwives and clients should be vigilant for other signs and symptoms of end-organ dysfunction associated with preeclampsia (see text box below; Table 1 provides a fuller explanation of the pathological process underlying the manifestations of preeclampsia). Fetal manifestations of preeclampsia may precede, coincide with or occur in the absence of the pregnant person's signs and symptoms. Table 8 lists tests commonly used to monitor well-being of the dyad during pregnancy.

Symptoms of preeclampsia

- Persistent headache
- Visual disturbances (blurring, flashing, dark spots in the field of vision)
- Epigastric pain/ right upper quadrant pain
- Nausea and/or vomiting
- Chest pain
- Shortness of breath

Education

During the prenatal period, clients should be informed of the symptoms of preeclampsia, and they should be aware of how to contact their midwife in the rare event that these symptoms arise. Multiple studies have found that many pregnant people may have a poor understanding of preeclampsia, as a result of not receiving information or not fully understanding the information provided. (126–128) It is essential that clients are given clear information about preeclampsia that enables them to identify the signs and symptoms. (126,127) Documentation of this discussion is recommended.

Good Practice Statements

13. Midwives should discuss the signs and/or symptoms of preeclampsia with clients during the prenatal period (see "Symptoms of Preeclampsia") and ensure that clients are aware of how to contact their midwife if these symptoms arise. [2023]

    Good practice statement

    This good practice statement recognizes midwives' ability to identify emerging risk factors for and complications of preeclampsia and the need for timely decision-making.

MANAGEMENT OF HDP

Treatment options for HDP vary according to diagnosis, severity, gestational age and the client's wishes. The information provided below is intended to provide an overview of some possible management options for the care of clients diagnosed with HDP.

Midwives' ability to manage HDP can differ depending on the clinical situation and community standards. In cases where midwives are not managing care, this information can help guide discussions with clients to help them understand the options available, and it can be useful in navigating discussions with other care providers.

The CMO, in its Midwifery Scope of Practice document (2021), states that following a transfer of care midwives "should continue providing care in collaboration with the most responsible provider and in the best interest of the client." (129) As with any transfer of care, it is important to clearly establish and communicate the ongoing roles of all providers involved, both to the client and between providers.

Antepartum surveillance of the pregnant person

The goal of antepartum surveillance in individuals with chronic hypertension and gestational hypertension is to watch for exacerbation of disease and progression to preeclampsia. Individuals with pre-existing hypertension or gestational hypertension experience up to a 20% and 50% risk, respectively, of developing preeclampsia. (21,24) Importantly, the earlier that gestational hypertension develops, the greater the likelihood of progression to preeclampsia. (21–23) While there is consensus that heightened surveillance is warranted, the optimal methods and frequency of such activities are unknown. See Table 8 for a list of common methods of surveillance in pregnancies complicated by HDP.

The goal of antepartum surveillance in those with preeclampsia is to detect end-organ dysfunction. Several potential surveillance activities have been investigated, such as monitoring for signs and symptoms of preeclampsia, laboratory tests and biomarkers; however, no single test is a strong independent predictor of adverse outcomes. (111) Multivariable models, such as the Preeclampsia Integrated Estimate of Risk Score (fullPIERS) that combine predictors have been successful at identifying those at risk for adverse outcomes after a diagnosis of preeclampsia. (130)

Home blood pressure monitoring

Home blood pressure monitoring (HBPM) has been found to be a convenient, effective tool for managing hypertension in the general population. (131) There has been growing interest in HBPM to manage blood pressure in pregnancy. A 2020 meta-analysis of six observational studies and RCTs investigated the safety and efficacy of HBPM in pregnancy compared with clinic monitoring. (132) Results show that among individuals being monitored for hypertension, HBPM:

- may reduce NICU admission (OR 0.53, 95% CI 0.27 to 1.07) [*low certainty of evidence*, n=444, two studies]
- may reduce the mean number of antenatal visits (standard mean difference -0.49, 95% CI -0.82 to -0.16) [*very low certainty of evidence*, n=738, five studies]
- may reduce induction of labour (OR 0.55, 95% CI 0.36 to 0.82) [*low certainty of evidence*, n=444, two studies]
- may reduce prenatal hospital admission (OR 0.31, 95% CI 0.19 to 0.49) [*low certainty of evidence*, n=416, three studies]

It is important to note that the current evidence on HBPM is limited, and the available studies have small sample sizes and low event numbers. Additionally, there is heterogeneity in the participants, interventions and outcomes included in these studies. This makes it difficult to understand the effects of HBPM, especially in the case of rare adverse events. More research is needed to confirm the findings from these studies, and to establish guidelines for the optimal methods and frequency of HBPM. It is also important to consider the accessibility of home blood pressure monitors. While these devices are available at a range of prices, they are not covered by OHIP and may not be accessible to all clients.

In discussions on implementing HBPM with clients, midwives may review the correct use of the device and how this may affect the accuracy of measurements. Midwives should also review normal BP ranges and when clients should contact their midwife if a reading is outside that range.

Antepartum fetal surveillance

There is limited research on specific surveillance activities that can be used to predict adverse fetal outcomes. Commonly used methods of fetal monitoring include ultrasound assessment of fetal growth and amniotic fluid volume, as fetal growth restriction and reduced amniotic fluid volume are both associated with adverse outcomes. (16) Umbilical artery Doppler ultrasound has been proposed as a useful method of monitoring fetal well-being, to detect those who would benefit from further intervention to prevent morbidity and mortality. (133)

TABLE 8. COMMON METHODS OF MONITORING WELLBEING IN THE PRESENCE OF HDP

Pregnant client	Fetus
• Monitoring for severe symptoms • Blood pressure measurement • Proteinuria • Platelet count • Liver function tests (ALT, AST) • Renal function tests (Serum creatinine) • Oxygen saturation	• Ultrasound • Biophysical profile • Fetal growth • Amniotic fluid • Umbilical artery Doppler • Fetal movement count • Non-stress test

(7,18)

Good Practice Statements

14. Midwives should monitor the hypertensive client and the fetus for exacerbation of disease using tools and methods (e.g., blood pressure measurement, hematological parameters, clinical symptoms and ultrasound findings) consistent with community standards. [new 2023]

    Good practice statement

    This good practice statement recognizes the limited evidence for the optimal methods and timing of surveillance and the importance of ongoing monitoring to the health of the client and the fetus.

Antihypertensive therapy

Severe hypertension is associated with significant adverse outcomes, and there is clear consensus that it should be treated with antihypertensive therapy. (134) The value of antihypertensive treatment in those with mild to moderate hypertension (defined as sBP 140-169 mmHg and/or dBP 90-109 mmHg) is less clear. (135) A 2018 Cochrane review (135) examined antihypertensive therapy compared with a placebo or no antihypertensive drugs in those with mild to moderate hypertension during pregnancy, and it found that the use of antihypertensive drugs:

- Probably reduces the risk of developing severe hypertension (RR 0.49, 95% CI 0.40-0.60) [*moderate certainty of evidence*, n = 2558, 20 RCTs].
- May result in little to no difference in the risk of developing preeclampsia (RR 0.92, 95% CI 0.75-1.14) [*low certainty of evidence*, n = 2851, 23 RCTs].
- Probably results in little to no difference in the risk of preterm birth (RR 0.96, 95% CI 0.83-1.12) [*moderate certainty of evidence*, n = 2141, 15 RCTs].

Of note, Ontario's Designated Drugs regulation stipulates that the pharmacopeia of registered midwives does not include antihypertensive medications. Midwives can refer to the SOGC's 2022 CPG (Guideline No. 426: Hypertensive Disorders of Pregnancy: Diagnosis, Prediction, Prevention, and Management) for further information about antihypertensives.

Induction of labour

Antenatal management of pregnancies complicated by HDP may involve weighing the risks and benefits of expedited delivery. Induction of labour has the potential to prevent complications associated with gestational hypertension and preeclampsia for the pregnant person. However, it may increase risk for the neonate, especially when HDP develops preterm. Thus, there has been research to examine the most effective management strategy to balance these risks.

The 2009 HYPITAT-I trial compared induction and expectant management from 36 weeks' (0 days) gestation and 41 weeks' (0 days) gestation in participants with gestational hypertension or mild preeclampsia. (136) Participants randomized to receive an induction were planned to be induced within 24 hours of randomization. The participants randomized to induction delivered at a mean gestational age of 38.7 weeks. The expectant management group delivered at a mean gestational age of 39.9. Almost half (46%) of the participants randomized to expectant management ended up being induced. Of this group, most (72%) had at least one medical reason for induction, and the rest chose to be induced.

Results from the study show that induction after 37 weeks' gestation:

- Lowers the risk of adverse outcomes in the birthing parent (a composite measure, described below) (RR 0.71, 95% CI 0.59-0.86) [*high certainty of evidence*, n = 756].
- Probably has little to no impact on the risk of adverse neonatal outcomes (RR 0.75, 95% CI 0.45-1.26) [*moderate certainty of evidence*, n = 756].
- Probably has little to no difference in the risk of C-section (RR 0.75, 95% CI 0.55-1.04) [*moderate certainty of evidence*, n = 756].

One concern with this trial is that a composite measure was used to indicate poor outcome for the birthing parent. (137) Progression to severe hypertension (sBP ≥ 170 mmHg or dBP ≥ 110 mmHg) and postpartum hemorrhage (≥ 1000 mL) comprised the majority of the morbidity experienced in both groups. Very few participants experienced any of the other outcomes included in the composite measure, and there were no differences in these outcomes between the two groups (the other outcomes included death, severe proteinuria, HELLP syndrome, eclampsia, lung edema, thromboembolic disease and placental abruption). There was no difference in rates of C-section or operative delivery between the two groups, nor any difference in any of the neonatal outcomes assessed: fetal death, Apgar score < 7 at five minutes, arterial pH < 7.05 or admission to NICU.

While the HYPITAT-I trial only involved a small number of participants, it is one of the few high-quality studies designed to explore management options available with HDP at term, and its findings have been cautiously embraced. The SOGC's 2022 CPG (Guideline No. 426: Hypertensive Disorders of Pregnancy: Diagnosis, Prediction, Prevention, and Management) states that for those with gestational hypertension at 37 weeks, initiation of delivery should be discussed with clients. For those with preeclampsia at 37 weeks or later, the SOGC recommends initiation of delivery. (7)

In 2015, a follow-up to the HYPITAT-I trial was conducted to investigate the effect of induction compared with expectant management on outcomes in the birthing parent and the neonate for participants with hypertensive disorders between 34 and 37 weeks' gestation. (138) HYPITAT-II included participants between 34+0 and 36+6 weeks' gestation with gestational hypertension, preeclampsia, deteriorating pre-existing hypertension or superimposed preeclampsia. Participants assigned to receive an induction were planned to be induced within 24 hours of randomization. Those assigned to expectant management were monitored until 37 weeks' gestation. Thirty-six percent (36%) of the participants in the expectant management group were induced before 37 weeks, due to indications in the birthing parent or the fetus

Results from the HYPITAT-II study show that induction between 34 and 37 weeks' gestation:

- Probably reduces the risk of adverse outcomes for the birthing parent (RR 0.36, 95% CI 0.12-1.13) [*moderate certainty of evidence*, n = 703].
- Probably increases the risk of respiratory distress syndrome (RR 3.32, 95% CI 1.35-8.18) [*moderate certainty of evidence*, n = 703].
- Probably increases the risk of NICU admission (RR 1.99, 95% CI 1.04-3.81) [*moderate certainty of evidence*, n = 702].
- Increases the risk of neonatal morbidity (RR 1.35, 95% CI 1.10-1.66) [*high certainty of evidence*, n = 512].
- Results in little to no difference on the risk of C-section (RR 0.94, 95% CI 0.75-1.16) [*high certainty of evidence*, n = 756].

The 2022 SOGC guideline recommends that for those with gestational hypertension, expectant management may be used until 37+0 weeks' gestation, unless there is an indication for birth. For those with preeclampsia, the SOGC recommends that initiation of delivery be discussed at 34+0 to 35+6 weeks' gestation, and that initiation of delivery be considered at 36+0 to 36+6 weeks' gestation. (7)

As the HYPITAT trials focus exclusively on immediate outcomes associated with timing of birth, additional studies have been done to examine long-term outcomes and quality of life measures.

One study was conducted alongside the HYPITAT-I trial to investigate participants' health-related quality of life after induction compared with expectant management. (139) Participants in the HYPITAT trial completed questionnaires to assess health-related quality of life at baseline, six weeks postpartum and six months postpartum. These included questions on background characteristics, condition-specific

issues and validated measures to assess self-reported health, anxiety, depression and physical and mental symptoms. This study found no difference in health-related quality of life postpartum in those with HDP who were induced compared with those who were expectantly managed.

Two additional studies investigated the long-term neonatal development and behavioural outcomes for the participants of HYPITAT-II. One study examined children at two years of age (140) and the other at five years (141), using the Ages and Stages Questionnaire (ASQ) to detect developmental delay. Results show an apparent increase in rates of developmental delay at two years of age among infants induced between 34 and 36 weeks' gestation; however, that increase did not persist to five years of age.

Midwives' ability to manage induction will differ depending on the clinical situation, community standards and individual knowledge, skills and judgment. If a transfer of care has occurred, the recommendations around induction and optimal timing for delivery would be made by the provider most responsible for the client. In these cases, midwives play an important role as part of the care team to support clients, facilitate discussion and advocate for client choices. The role of the midwife may include informing the client about their options and providing information about the recommendations for as well as the risks and benefits of induction and expectant management.

INTRAPARTUM MANAGEMENT

HDP and epidural use

There have been debates about the use of regional anaesthesia in individuals with hypertension, due to concerns about coagulopathy and hypotension associated with epidural use. However, evidence does not suggest that epidural anaesthesia has different effects in pregnancies complicated by hypertensive disorders compared with the general obstetric population. A small prospective cohort study (n = 60) (*very low certainty of evidence*) shows that the risk of hypotension may be reduced after epidural anaesthesia for caesarean delivery in those with preeclampsia compared with those without (OR 0.17, 95% CI 0.05-0.58). (142) Additional evidence suggests that epidural anaesthesia is not associated with increases in rates of caesarean delivery, pulmonary edema or renal failure among those with HDP. (143)

Due to its hypotensive effects, neuraxial anaesthesia has been proposed as a method to control blood pressure. It may reduce uterine artery resistance and prevent surges in blood pressure associated with pain in labour. (144) However, there is no research on using neuraxial anaesthesia to control blood pressure in those with HDP.

Intravenous fluid boluses are often given to prevent low blood pressure following regional analgesia in labour. (145) While optimal fluid management among those with preeclampsia is not well understood (146-148), studies in a non-hypertensive population have found that fluid boluses alone do not prevent hypotension. (146) Given the potential increase in risk of pulmonary edema with excessive intravenous fluid intake, the SOGC recommends that total fluid intake should be restricted to about 80 mL/h in those with preeclampsia. (7) NICE advises against pre-epidural fluid boluses in those with severe preeclampsia. (8) Hospitals may have policies concerning the use of anaesthesia in HDP. Neuraxial anaesthesia is contraindicated in the presence of coagulopathy. Therefore, some anaesthesiologists require a platelet count of 75-80 × 10^9/L before spinal anaesthesia is administered in clients with severe preeclampsia. (149) Midwives are encouraged to be familiar with policies in place at the hospitals where they have privileges, even when such policies may be specific to the provision of care by other providers, and to consult with anaesthesia staff according to hospital protocol.

Recommendation

15. For clients with HDP, epidural anesthesia is not contraindicated.
    - For clients interested in this pain relief method, the risks and benefits should be discussed. [2023]

    Weak recommendation: very low certainty of evidence

    This recommendation recognizes the client as the primary decision-maker.

Management of the third stage of labour

Individuals with HDP are at increased risk of coagulopathy and thrombocytopenia. Consequently, the risk of postpartum hemorrhage (PPH) is increased. (150-151) Due to this risk, active management of the third stage of labour should be offered to clients with HDP.

There are several uterotonic agents that can be used to prevent PPH, with oxytocin being the current standard. (152) A 2018 Cochrane review that included three studies (n = 1410) (*low certainty of evidence*) comparing ergometrine with oxytocin showed that ergometrine use in the third stage of labour may be associated with an increased risk of hypertension (RR 13.39, 95% CI 2.01-89.44); therefore, it should not be used in individuals with HDP. (152)

Recommendations

16. Active management of the third stage of labour is recommended and should be offered to clients with HDP. [2023]
17. As ergonovine maleate is associated with hypertension, it should be avoided in clients with HDP unless other suitable uterotonics are unavailable. [2023]

    Strong recommendation: low certainty of evidence

    These recommendations recognize the client as the primary decision-maker while balancing the increased risk of PPH.

POSTPARTUM MANAGEMENT

Postpartum hypertension can occur due to the persistence of high blood pressure that was present during pregnancy, or it can arise for the first time (de novo) in the postpartum period. (153) Similar to its antepartum manifestation, postpartum hypertension varies in its symptoms, signs and severity, and the incidence, natural progression and optimal management of postpartum hypertension is not well understood.

For both those who are normotensive and those with HDP, blood pressure typically falls after delivery, then rises, reaching a peak between three and six days postpartum. (153) This is thought to be because of the mobilization of extracellular fluid that accumulates during pregnancy, increasing intravascular volume and producing hypertension. In those with gestational hypertension or preeclampsia, hypertension can resolve after delivery, or it can persist for weeks or months postpartum. (154) The research on time to resolution is limited, and it can vary depending on the population. Those with chronic hypertension, higher blood pressure, higher BMI or preterm preeclampsia are more likely to have sustained hypertension. (153)

The true incidence of postpartum hypertension is difficult to determine, as research is typically limited to the immediate postpartum period or involves individuals readmitted due to severe hypertension. The reported prevalence of new-onset hypertension ranges from 0.3% to 28%. (153, 154)

There has been interest in using home blood pressure monitoring as a convenient way to monitor those with HDP in the postpartum period; however, the current evidence remains limited. One meta-analysis that included two studies with 297 participants (*very low certainty of evidence*) examined the safety and efficacy of HBPM in the postpartum period; it found that HBPM may reduce the risk of postpartum readmission for individuals who use it compared with those who receive conventional care (OR 0.58, 95% CI 0.03-9.59). (132) Additionally, a study examining participants' experiences with self-monitoring found that self-management increased clients' feelings of control and improved anxiety about their blood pressure. (8)

Clients who experienced HDP in the current pregnancy should be monitored closely in the postpartum period. Blood pressure should be measured at all regularly scheduled postpartum visits for the first two weeks postpartum or until blood pressure has returned to normal for two consecutive visits. Clients should be informed of the signs and symptoms of exacerbation of disease that can occur in the postpartum period, including headaches, epigastric pain, visual disturbances, nausea/vomiting and chest pain or shortness of breath.

Good Practice Statements

18. For clients who have experienced HDP, midwives should ensure that a postpartum follow-up plan is in place with an appropriate care provider. [2023]
19. Midwives should monitor blood pressure at all regularly scheduled visits in the first two weeks postpartum or until blood pressure has returned to normal for two consecutive visits. Home blood pressure monitoring can be incorporated into a monitoring plan, depending on the clinical situation, community standards and client preferences. [2023]
20. Following the birth, midwives should remind clients of the signs and/or symptoms of hypertension and advise them to page their midwife if these signs and/or symptoms develop in the postpartum period. [2023]

Good practice statements

These good practice statements recognize midwives' skill in providing health information to clients and their ability to identify emerging complications and work interprofessionally to provide safe, excellent care.

Postpartum antihypertensive therapy

There is considerably less research on the use of antihypertensive therapy in the postpartum period, yet there is general consensus that severe hypertension ought to be managed with antihypertensive treatment. Current research on antihypertensive therapy for mild to moderate hypertension is more limited. A 2013 Cochrane review concluded that there is insufficient evidence to determine whether antihypertensive therapy should be used in those with mild to moderate hypertension postpartum and, if so, which antihypertensive drug should be used. (155)

Postpartum pain management

Nonsteroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen have been demonstrated to be effective in providing postpartum pain relief. In the past, there have been concerns about the use of NSAIDs in those with HDP, as the vasoconstrictive effects of the medication may exacerbate postpartum hypertension. (156) However, recent research indicates that NSAIDs are not contraindicated in those with HDP.

A 2021 meta-analysis (157) that included four RCTs and three cohort studies to examine the risks of adverse outcomes associated with the use of NSAIDs in the postpartum period among those with HDP found that postpartum NSAID use:

- May result in little to no difference in the risk of having sBP ≥ 150 mmHg or dBP ≥ 100 mmHg (RR 1.21, 95% CI 0.89-1.64) [*very low certainty of evidence*, n = 537, three studies].
- May result in little to no difference in the need for antihypertensives (RR 1.03, 95% CI 0.82-1.30) [*low certainty of evidence*, n = 670, four studies].
- May result in little to no difference in the risk of readmission for blood pressure control (RR 0.83, 95% CI 0.35-1.98) [*very low certainty of evidence*, n = 738, four studies].
- May increase the length of postpartum stay (mean difference 0.21, 95% CI 0.04-0.38) [*low certainty of evidence*, n = 647, three studies].

Although this meta-analysis found that NSAID use might increase the length of postpartum stay, the difference was clinically small; the use of NSAIDs only increased hospital stay by 0.21 days.

Recommendation

21. For clients with HDP, NSAID use is not contraindicated in the postpartum period. [new 2023]

Weak recommendation: very low certainty of evidence

This recommendation recognizes the client as the primary decision-maker and acknowledges the variations in community standards across Ontario.

Chest/breast feeding

Some research has indicated that individuals with HDP face challenges in chest/breastfeeding. A 2005 retrospective cohort study conducted in Germany found that compared with normotensive parents, those with HDP were less likely to initiate chest/breastfeeding (RR 0.89, 95% CI 0.78-0.97) and to remain chest/breastfeeding at one month postpartum (RR 0.80, 95% CI 0.69-0.93). No differences were found

between the groups at three months postpartum. This study attributed the differences in chest/breastfeeding to increased prematurity in the HDP group. (158) A 2021 US retrospective study to assess lactation patterns among those with HDP found similar results. (159) Those with HDP were slightly less likely to chest/breastfeed (RR 0.94, 95% CI 0.90-0.97). The study found no statistically significant differences in the reasons for choosing not to nurse between those with HDP and those who were normotensive; however, more participants with HDP reported feeling sick or taking medicine (16.7% vs. 11.7%) and not liking chest/breastfeeding (41.3% vs. 36.5%) as reasons for choosing not to nurse.

Importantly, a large body of research indicates that lactation is associated with lower blood pressure in the postpartum period, as well as reduced cardiovascular risk later in life. (160–163) Most of this research has occurred in populations who were normotensive during pregnancy, but as those with HDP are at increased risk of hypertension and cardiovascular disease, there has been interest in examining the benefits of lactation in that specific population. One retrospective cohort study that included 147 participants with early-onset and late-onset preeclampsia (*low certainty of evidence*) found that those who were lactating at the first postpartum visit had both a lower mean sBP (mean difference -5.30, 95% CI -10.01 to -0.59) and a lower mean dBP (mean difference -3.60, 95% CI -6.94 to -0.26) compared with those who were not. (164)

Postpartum use of antihypertensives may be an additional consideration for chest/breastfeeding clients. (163) While all drugs are transferred into human milk to some degree, the amount transferred is typically small and unlikely to cause adverse effects in the infant. (166,167) Several antihypertensive agents are generally considered safe for use during lactation, including nifedipine, labetalol, methyldopa, captopril and enalapril. (168)

Summary Statement

Lactation support, provided by midwives as a standard of care, may be especially beneficial in the context of HDP.

Future pregnancies

It is important to share information with clients about the risks of developing HDP in subsequent pregnancies. A 2015 individual participant data meta-analysis (n = 99 415) found that those who experience gestational hypertension have a 14.5% risk of gestational hypertension and a 6% chance of preeclampsia in a subsequent pregnancy. Individuals with preeclampsia have a 7.1% chance of gestational hypertension and a 16% chance of preeclampsia in a subsequent pregnancy. (169) The more severe the symptoms and earlier the onset in the index pregnancy, the greater the likelihood of HDPs in a subsequent pregnancy. (169)

Long-term considerations

Clients who develop preeclampsia are at increased risk of hypertension, cardiovascular disease, heart failure, coronary heart disease, cardiovascular disease death, stroke and chronic kidney disease later in life. (170–172) The long-term risks of gestational hypertension are less established; however, multiple studies have shown that those with gestational hypertension are at increased risk of hypertension (173–174) and overall cardiovascular disease, stroke and chronic kidney disease. (170,175) See Table 9 below.

Evidence also suggests that experiencing hypertension in more than one pregnancy increases the risk of future cardiovascular disease. A 2018 meta-analysis (n = 52 544) examined the risk of cardiovascular disease in those who experienced preeclampsia in a single pregnancy compared with those who experienced preeclampsia in multiple pregnancies. (176) The studies included in this meta-analysis had follow-up times ranging from one to 45 years. Results indicate that recurrent preeclampsia is associated with an increased risk of hypertension (RR 2.33, 95% CI 1.86-2.92) and hospitalization due to cardiovascular disease later in life (RR 1.57, 95% CI 1.31-1.90).

Despite these potential risks, research indicates that it is common for individuals to be unaware of the long-term cardiovascular risk associated with preeclampsia. One UK study found that participants were aware of the risk of recurrence of preeclampsia in a future pregnancy, but half did not remember receiving information on the long-term risks of hypertension and cardiovascular disease in later life. (177) Another US study shows similar results, finding that most of the participants were unaware of the link between preeclampsia and future cardiovascular disease. (178) These findings stress the importance of sharing information with clients about the risks of HDP in subsequent pregnancies and later in life. Midwives can play an important role by discussing strategies that may help prevent hypertension later in life.

These strategies may include exercise and a heart-healthy diet (limiting saturated fats, cholesterol and sodium intake).

When discussing strategies with clients, it is essential to avoid blaming or shaming language. Midwives should be aware of how the social determinants of health affect the client's ability to implement these strategies, particularly for Indigenous, racialized and other equity-deserving communities, who are disproportionately affected by HDP. Recognizing the structural barriers clients may face that affect the ability to implement strategies – such as a lack of access to affordable groceries, gendered inequities in caregiving responsibilities, the time and financial costs associated with exercise and the costs of additional appointments or medication – is crucial in providing the best care for each individual.

Lastly, midwives should provide information about HDPs that have arisen during the perinatal period to the clinician providing ongoing care (if applicable). If the client does not have a family physician or a nurse-practitioner, the midwife should provide this information to the client in writing so they may pass it along to any future primary care provider

TABLE 9. RISK OF FUTURE DISEASE AFTER HDP

Future disease	Included studies	RR	Interpretation	Sources
Preeclampsia				
Hypertension	43 studies n=822 555	RR 3.13 (95% CI 2.51 to 3.89)	Increases likelihood	(171)
Cardiovascular disease	22 studies n>6.4 million	RR 2.50 (95% CI 1.43 to 4.37)	Increases likelihood	(172)
Cardiovascular mortality	22 studies n>6.4 million	RR 2.21 (95% CI 1.83 to 2.66)	Increases likelihood	(172)
Stroke	22 studies n>6.4 million	RR 1.81 (95% CI 1.29 to 2.55)	Increases likelihood	(172)
Chronic kidney disease	3 studies n=1 097 495	RR 2.11 (95% CI 1.72 to 2.59	Increases likelihood	(170)
Gestational Hypertension				
Cardiovascular disease	11 studies n=3 209 836	RR 1.45 (95% CI 1.17, 1.80)	Increases likelihood	(175)
Stroke	11 studies n=3 209 836	RR 1.26 (95% CI 0.96 to 1.65)	May increase liklihood	(175)
Chronic kidney disease	Two studies n= 25 165	RR 1.49 (95% CI 1.11 to 2.01)	Increases likelihood	(170)

Good Practice Statements

22. Prior to discharge, midwives should:
    - Advise the client that they are at increased risk of developing hypertension or cardiovascular disease in future pregnancies and later in life.
    - Discuss strategies to mitigate this risk. [2023]
23. Upon discharging the client from midwifery care, midwives should communicate information about the client's HDP to the primary care provider and/or the client. [2023]

Good practice statements

These good practice statements recognize continuity of care and acknowledge midwives' skill in providing health information to clients.

CLIENT EXPERIENCES

Receiving a diagnosis of HDP can be a stressful experience. Qualitative research has found that it is common for pregnant people to report feeling surprised by the diagnosis, as well as scared about their own health and that of their baby. (179–181) Pregnant individuals also reported feeling guilt and a loss of control. (179, 181) These feelings can persist postpartum, with some research finding that those who experience HDP, in particular those who experience severe HDP, may be at increased risk of postpartum depression, anxiety and PTSD. (182)

There are some factors that can improve the client's experience. Research suggests that feeling informed of what is happening at different stages in pregnancy and being included in decision-making increases a sense of safety. Continuity of carer and social support from friends and family was also identified as important. Lastly, consideration of the differences in people's lived experiences navigating the health-care system and how these affect trust in care providers is important. Informed choice discussions with clients should consider how to approach these discussions and build trust.

Practice points for communication during management of HDP

Based on the experiences of clients described in the literature, the practice points in Figure 1 outline strategies that may lessen the emotional and psychological impacts of HDP.

FIGURE 1: PRACTICE POINTS FOR COMMUNICATION BEFORE, DURING AND FOLLOWING THE MANAGEMENT OF HDP

Prior to diagnosis with HDP	• Provide information about hypertension including signs and symptoms, and when and how to contact the midwife • Discuss relevant risk factors • In early pregnancy, discuss relevant indications for ASA
During management of HDP	• Provide support and reassurance • Provide ample time to ask questions • Clearly identify most responsible provider, and clarify roles of all care providers involved • Provide information what to expect ongoing • Support informed choice and ensure clients are included in decision making. Facilitate discussion with other providers as needed
Upon discharge/follow up	• Offer the opportunity to debrief experiences • Discuss the short and long term risks of hypertension and cardiovascular disease • Offer referrals to mental health supports as needed

Conclusion

HDP includes a range of conditions of varying etiology, severity and symptoms. The onset of hypertension during pregnancy and postpartum has proven difficult to predict. For many of the clinical manifestations of HDP, optimal evidence-based strategies for detection, surveillance and management have yet to be determined. While these conditions rarely result in long-term harm for birthing parent or baby, HDP is a major contributor to morbidity and mortality, and it can be a stressful experience for clients.

While HDP can affect people of all races and ethnic origins, these conditions and their related harms are observed at higher rates in racialized communities. This disparity is the result of a myriad of complex socio-economic determinates, requiring that midwives address this health inequity with a nuanced understanding of each individual's unique lived experience.

Therefore, midwives play an important role in supporting clients whose pregnancies are complicated by hypertensive disorders; this includes the provision of culturally resonant care. Midwives can further support client decision-making within the context of their unique clinical picture, values and preferences. Where appropriate, midwives can contribute to the development of an individualized care plan with the client and other health-care providers.

SUMMARY OF GOOD PRACTICE STATEMENTS & RECOMMENDATIONS

1. Midwives should identify and discuss risk factors for preeclampsia with clients early in care. [2023]

Good practice statement

This good practice statement recognizes midwives' ability to develop a care plan and assess the need for interprofessional collaboration as the clinical picture requires.

2. Midwives should consider clients' clinical picture and consensus-based criteria (e.g., the SOGC or NICE risk factor stratification systems) to determine individuals' level of preeclampsia risk and offer preventive measures. [2023]

Strong recommendation: moderate certainty evidence

This recommendation recognizes midwives' ability to identify emerging complications and escalate care as the clinical picture requires.

3. Midwives may recommend low-dose acetylsalicylic acid (81-162 mg/day), administered at bedtime, to clients at increased risk of developing preeclampsia, beginning once the client's increased risk has been identified (ideally before 16 weeks' gestation) and continuing between 36 weeks' gestation and delivery. [new 2023]
This recommendation presupposes an absence of contraindications to low-dose ASA (see list of contraindications on page 14).

Weak recommendation: high certainty of evidence

This recommendation recognizes the client as the primary decision-maker and acknowledges the variations in community standards across Ontario.

4. Midwives may offer calcium supplementation (1000-2500 mg/day) to those at increased risk of preeclampsia and whose dietary intake is below recommended levels (< 1000 mg/day). [2023]

Weak recommendation: low certainty of evidence

This recommendation recognizes the client as the primary decision-maker and acknowledges midwives' skill in providing health information to clients.

5. Vitamin C and E supplementation is not recommended for the prevention of HDP. [new 2023]

Strong recommendation: moderate certainty of evidence

This recommendation recognizes the client as the primary decision-maker and acknowledges midwives' skill in providing health information to clients.

6. Taking a periconceptual multivitamin with folic acid has established benefits and may reduce the risk of HDP. [new 2023]

Weak recommendation: very low certainty of evidence

This recommendation recognizes the client as the primary decision-maker and acknowledges midwives' skill in providing health information to clients.

7. There is insufficient evidence to support the use of vitamin D, selenium, or l-arginine for the prevention of HDP. [new 2023]

No recommendation: low certainty of evidence

This recommendation recognizes the lack of high certainty evidence to support these measures although small benefits and no harms have been noted.

8. At least two BP measurements using the same arm should be recorded before a diagnosis of hypertension is made.

    - Midwives should use clinical judgment to determine an appropriate interval between measurements, based on the client's gestational age, risk factors and presence of other signs and/or symptoms of preeclampsia. Repeated measurements should be taken at least 15 minutes apart.

    - If initial sBP is greater than or equal to 140 mmHg but less than 160 mmHg and dBP is less than 90 mmHg, assess whether the client has risk factors for transiently elevated sBP (e.g., anxiety, stress, caffeine intake, recent exercise).

    - If white-coat hypertension is suspected or known, consider conducting the second BP measurement in the home environment.

    - Identify hypertension in pregnancy when systolic blood pressure (sBP) is greater than or equal to 140 mmHg and/or diastolic blood pressure (dBP) is greater than or equal to 90 mmHg, based on an average of at least two measurements, using the same arm. [new 2023]

The following good practice statements refer to management of persistently elevated sBP and/or dBP. Base management decisions on an average of at least two BP measurements:

9. For severe hypertension (sBP greater than or equal to 160 mmHg and/or dBP greater than or equal to 110 mmHg), and/or signs and symptoms of HDP, a prompt assessment in hospital or in a higher-level clinical setting is warranted, involving investigations and physician consultation as per community standards. [new 2023]

10. sPB less than 160 mmHg and dBP between 90-109 mmHg requires further investigation, which may include consultation as per community standards. [new 2023]

11. If sBP is 140-159 mmHg but dBP is less than 90 mmHg, reassess risk factors for transiently elevated sBP (e.g., anxiety, stress, caffeine intake, recent exercise). In determining when to reassess, use judgement, considering the clinical picture and risk factors. Advise the client to contact their midwife if any signs and/or symptoms of preeclampsia develop in the meantime. [new 2023]

Good practice statements

These good practice statements recognize midwives' ability to identify emerging complications and escalate care as the clinical picture requires.

12. Consider urinary dipstick testing when:

    - A client's sBP is greater than or equal to 140 mmHg or dBP is greater than or equal to 90 mmHg, based on the average of at least two readings, and/or
    - There are other signs and/or symptoms of preeclampsia.

    If a dipstick result greater than or equal to +1 is present, further investigation is warranted, which may include consultation as per community standards. [new 2023]

    ### Weak recommendation: low certainty of evidence

    This good practice statement recognizes midwives' ability to identify emerging complications and escalate care as the clinical picture requires.

13. Midwives should discuss the signs and/or symptoms of preeclampsia with clients during the prenatal period (see "Symptoms of Preeclampsia") and ensure that clients are aware of how to contact their midwife if these symptoms arise. [2023]

    ### Good practice statement

    This good practice statement recognizes midwives' ability to identify emerging risk factors for and complications of preeclampsia and the need for timely decision-making.

14. Midwives should monitor the hypertensive client and the fetus for exacerbation of disease using tools and methods (e.g., blood pressure measurement, hematological parameters, clinical symptoms and ultrasound findings) consistent with community standards. [new 2023]

    ### Good practice statement

    This good practice statement recognizes the limited evidence on the optimal methods and timing of surveillance and the importance of ongoing monitoring to the health of the client and the fetus.

15. For clients with HDP, epidural anaesthesia is not contraindicated. For clients interested in this pain-relief method, the risks and benefits should be discussed. [new 2023]

    ### Weak recommendation: very low certainty of evidence

    This recommendation recognizes the client as the primary decision-maker.

16. Active management of the third stage of labour is recommended and should be offered to clients with HDP. [2023]

17. As ergonovine maleate is associated with hypertension, it should be avoided in clients with HDP unless other suitable uterotonics are unavailable. [2023]

    ### Strong recommendation: low certainty evidence

    These recommendations recognize the client as the primary decision-maker while balancing the increased risk of PPH.

18. For clients who have experienced HDP, midwives should ensure that a postpartum follow-up plan is in place with an appropriate care provider. [2023]

19. Midwives should monitor blood pressure at all regularly scheduled visits in the first two weeks postpartum or until blood pressure has returned to normal for two consecutive visits. Home blood pressure monitoring can be incorporated into a monitoring plan, depending on the clinical situation, community standards and client preferences. [2023]

20. Following the birth, midwives should remind clients of the signs and/or symptoms of hypertension and advise them to page their midwife if signs and/or symptoms develop in the postpartum period. [2023]

Good practice statement

These good practice statements recognize midwives' skill in providing health information to clients and their ability to identify emerging complications and work interprofessionally to provide safe, and excellent care.

21. For clients with HDP, NSAID use is not contraindicated in the postpartum period. [new 2023]

Weak recommendation: very low certainty of evidence

This recommendation recognizes the client as the primary decision-maker and acknowledges the variations in community standards across Ontario.

22. Prior to discharge, midwives should:

    - Advise the client that they are at increased risk of developing hypertension or cardiovascular disease in future pregnancies and later in life.

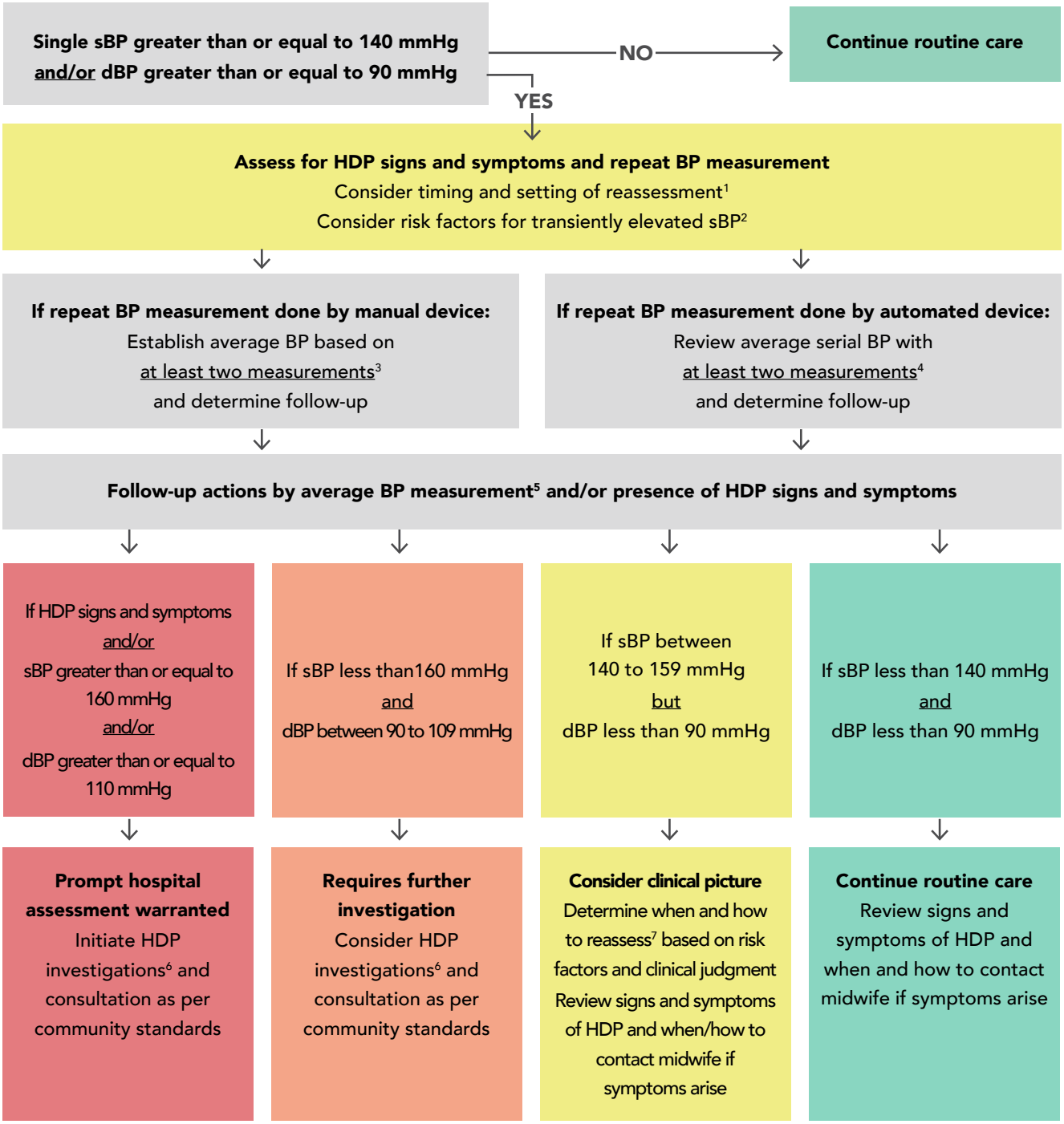
    - Discuss strategies to mitigate this risk. [2023]

23. Upon discharging clients from midwifery care, midwives should communicate information about the client's HDP to the primary care provider and/or the client. [2023]

Good practice statements

These good practice statements recognize continuity of care and acknowledge midwives' skill in providing health information to clients.

BLOOD PRESSURE MEASUREMENT ALGORITHM



Considerations

1. Use clinical judgment to determine appropriate interval between initial and repeat BP assessments. Consider gestational age, risk factors and signs and/or symptoms of preeclampsia.
2. If sBP greater than or equal to 140 mmHg but dBP less than 90 mmHg, consider risk factors for transiently elevated sBP, including anxiety, stress, caffeine intake and recent exercise.
3. To average BP measurements, add up the systolic and diastolic values separately, then divide by the number of readings (e.g., 148/88 mmHg + 136/92 mmHg = average BP 142/90 mmHg).
4. An automated device validated for use in pregnancy and/or with preeclampsia may calculate an average BP value based on a pre-programmed series of two or more measurements.
5. Based on the average of at least two measurements, using the same arm.
6. Investigations may include HDP blood work, proteinuria assessment and increased surveillance of the pregnant person and/or the fetus.
7. Reassessment may include HDP investigations if there is clinical suspicion of HDP and/or if HDP risk factors present.

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APPENDIX

Updated 2023 Recommendations, Good Practice Statements, Explanation of Changes		
Original Recommendation [2012]	Updated Recommendation [2023]	Explanation of Changes
Prediction of HDP		
1. Presence or absence of known risk factors for preeclampsia should be determined and communicated to clients early in care. Consultations should be arranged as indicated by the CMO's CTCS.	**1**. Midwives should identify and discuss risk factors for preeclampsia with their clients early in care. [2023] **Good practice statement** *This good practice statement recognizes midwives' ability to develop a care plan and assess the need for interprofessional collaboration as the clinical picture requires.*	Following GRADE methodology, this recommendation is now a good practice statement. Language changes only; no change required to content. Reference to consultations has been removed due to the rescinding of the CTCS.
2. In the absence of consensus and clear evidence about what criteria should be considered in determining a client's level of preeclampsia risk, midwives are encouraged to consider the client's clinical picture and consensus-based criteria in discussions related to client risk status and whether or not to undertake any potential preventive measures.	**2.** Midwives should consider clients' clinical picture and consensus-based criteria (e.g., the SOGC or NICE risk factor stratification systems) to determine individuals' level of preeclampsia risk and offer preventive measures. [2023] **Strong recommendation: moderate certainty evidence** *This recommendation recognizes midwives' ability to identify emerging complications and escalate care as the clinical picture requires.*	Language changes only; no change required to recommendation.

Original Recommendation [2012]	Updated Recommendation [2023]	Explanation of Change(s)
Prevention of HDP		
3. If consistent with community standards, offer low-dose aspirin (81 mg/day) to clients at increased risk of developing preeclampsia, beginning once the client's increased risk has been identified (ideally before 16 weeks' GA) and continuing until delivery.	**3.** Midwives may recommend low-dose acetylsalicylic acid (81-162 mg/day), administered at bedtime, to clients at increased risk of developing preeclampsia, beginning once the client's increased risk has been identified (ideally before 16 weeks' gestation) and continuing between 36 weeks' gestation and delivery. [new 2023] *This recommendation presupposes an absence of contraindications to low-dose ASA (see list of contraindications on page 14).* **Weak recommendation: high certainty of evidence** *This recommendation recognizes the client as the primary decision-maker and acknowledges the variations in community standards across Ontario.*	Recommendation has been updated to include: • a range of doses (81-162 mg/day), based on evidence that larger doses of ASA may be more effective for prevention of preeclampsia. • evidence that ASA is most effective when taken at bedtime. • advise discontinuing ASA between 36 weeks and delivery. This is based on evidence that continuing ASA until delivery may be associated with increased risk of PPH.
4. Inform clients whose dietary calcium intake is below recommend levels (< 1000 mg/day) and clients who are at increased risk of developing hypertension that calcium supplementation appears to reduce the risk of preeclampsia. Recommend increased calcium intake (1000-2500 mg/day) through calcium supplementation or by consuming additional servings of foods high in calcium (equivalent to 1000-2500 mg/day).	**4.** Midwives may offer calcium supplementation (1000-2500 mg/day) to those at increased risk of preeclampsia and whose dietary intake is below recommended levels (< 1000 mg/day). [2023] **Weak recommendation: low certainty of evidence** *This recommendation recognizes the client as the primary decision-maker and acknowledges midwives' skill in providing health information to clients.*	Language changes only; no change required to recommendation.
None	**5.** Vitamin C and E supplementation is not recommended for the prevention of HDP. [new 2023] **Strong recommendation: moderate certainty of evidence** *This recommendation recognizes the client as the primary decision-maker and acknowledges midwives' skill in providing health information to clients.*	A 2015 Cochrane meta-analysis found that vitamin C/E supplementation does not reduce the risk of preeclampsia or preterm birth, therefore a new recommendation was made.

Original Recommendation [2012]	Updated Recommendation [2023]	Explanation of Change(s)
None	**6.** Taking a periconceptual multivitamin with folic acid has established benefits and may reduce the risk of HDP. [new 2023] **Weak recommendation: very low certainty of evidence** *This recommendation recognizes the client as the primary decision-maker and acknowledges midwives' skill in providing health information to clients.*	Evidence from a 2018 meta-analysis of observational studies found that folic acid supplementation alone results in little to no difference in the risk of preeclampsia or gestational hypertension. However, a multivitamin containing folic acid may reduce the risk of preeclampsia. This new evidence prompted the formation of a recommendation.
None	**7.** There is insufficient evidence to support the use of vitamin D, selenium or l-arginine for the prevention of HDP. [new 2023] **No recommendation: low certainty of evidence** *This recommendation recognizes the lack of high certainty evidence to support these measures, although small benefits and no harms have been noted.*	Following GRADE methodology, a no recommendation statement has been created. Evidence from meta-analyses suggests that these measures may be effective in preventing HDP. However, evidence is limited, and more research is needed to recommend these interventions for the prevention of HDP.

Original Recommendation [2012]	Updated Recommendation [2023]	Explanation of Change(s)
Antenatal considerations: measurement of blood pressure		
6. For non-severe hypertension (dBP < 110 mmHg), at least two serial BP measurements using the same arm should be recorded before a diagnosis of hypertension is made. a. If dBP is ≥ 90 mmHg and < 110 mmHg and dipstick urine testing is negative for proteinuria, blood pressure should be reassessed by repeat measurement. Midwives will use their judgment to determine an appropriate interval between measurements, based on the client's gestational age, risk factors and presence of other signs and/or symptoms of preeclampsia. b. Conducting the second reading in the home environment is recommended, when possible, to rule out white coat hypertension. c. If an automated BP measurement device has been used for the first measurement, perform the second reading using a mercury sphygmomanometer or an aneroid device. d. Urinary protein should also be reassessed by dipstick at the time of the second BP measurement. e. Two successive readings of a dBP of ≥ 90 mmHg require a medical consultation.	**8.** At least two BP measurements using the same arm should be recorded before a diagnosis of hypertension is made. • Midwives should use clinical judgment to determine an appropriate interval between measurements, based on the client's gestational age, risk factors and presence of other signs and/or symptoms of preeclampsia. Repeated measurements should be taken at least 15 minutes apart. • If initial sBP is greater than or equal to 140 mmHg but less than 160 mmHg and dBP is less than 90 mmHg, assess whether the client has risk factors for transiently elevated sBP (e.g., anxiety, stress, caffeine intake, recent exercise). • If white-coat hypertension is suspected or known, consider conducting the second BP measurement in the home environment. • Identify hypertension in pregnancy when systolic blood pressure (sBP) is greater than or equal to 140 mmHg and/or diastolic blood pressure (dBP) is greater than or equal to 90 mmHg, based on an average of at least two measurements, using the same arm. [new 2023]	Following GRADE methodology, recommendations 6,7 and 8 were converted to good practice statements 8 to 11. The new good practice statements remain largely consistent with the originals with the following changes. • Management decisions should be based on the average of at least two blood pressure measurements, due to consensus that taking the average of two measurements is best practice. • Information on proteinuria was moved to its own section below. • The recommendation to use a mercury sphygmomanometer was removed, based on moving from using mercury sphygmomanometers due to concerns about the use of mercury in clinical settings. • References to consultation were removed due to the rescinding of the CTCS.

Original Recommendation [2012]	Updated Recommendation [2023]	Explanation of Change(s)
7. If sBP is ≥ 140 mmHg and < 160 mmHg and dBP < 90 mmHg, and dipstick urine testing is negative for proteinuria, assess whether the client has risk factors for transiently elevated sBP (e.g. stress, caffeine, recent exercise) and determine whether or not to reassess the client's BP within a shorter time interval based on the client's clinical picture, while advising the client to contact her midwife if any other signs and symptoms of preeclampsia develop in the meantime. As elevated sBP may be a precursor to the subsequent development of diastolic hypertension, a higher index of suspicion may be warranted for these clients. 8. For severe hypertension (dBP ≥ 110 mmHg, sBP ≥ 160 mmHg), with or without proteinuria, further investigation and/or prompt assessment in a hospital setting and consultation with an obstetrician is warranted (CTCS)	The following good practice statements refer to management of persistently elevated sBP and/or dBP. Base management decisions on an average of at least two BP measurements: **9.** For severe hypertension (sBP greater than or equal to 160 mmHg and/or dBP greater than or equal to 110 mmHg) and/or signs and symptoms of HDP, prompt assessment in hospital or in a higher-level clinical setting is warranted, involving investigations and physician consultation as per community standards. [new 2023] **10.** sPB less than 160 mmHg and dBP between 90-109 mmHg requires further investigation, which may include consultation as per community standards. [new 2023] **11.** If sBP is 140-159 mmHg but dBP is less than 90 mmHg, reassess risk factors for transiently elevated sBP (e.g., anxiety, stress, caffeine intake, recent exercise). In determining when to reassess, use judgement, considering the clinical picture and risk factors. Advise the client to contact their midwife if any signs and/or symptoms of preeclampsia develop in the meantime. [new 2023] **Good practice statements** *These good practice statements recognize midwives' ability to identify emerging complications and escalate care as the clinical picture requires.*	

Original Recommendation [2012]	Updated Recommendation [2023]	Explanation of Change(s)
Antepartum considerations: measurement of proteinuria		
9 a. If dBP is ≥ 90 mmHg and < 110 mmHg and proteinuria (equivalent to ≥ 0.3 g/L or more or ≥ +1 on urine dipstick) is present, midwives should use their clinical judgment to determine whether or not a reassessment should occur at home or in hospital the same day to confirm hypertension and presence of proteinuria. b. If hypertension and proteinuria are confirmed, further investigation and/or medical consultation and transfer of care is warranted. 10 a. For urine dipstick values equivalent to ≥ 0.3 g/L (≥ +1 on urine dipstick) in addition to other signs or symptoms of preeclampsia, further investigation and/or a prompt medical consult should be arranged. b. If a urine dipstick value equivalent to ≥ 0.3 g/L (≥ +1 on urine dipstick) is noted in the absence of elevated blood pressure or other signs and symptoms of preeclampsia, repeat the dipstick urinalysis. Midwives will use their judgment to determine an appropriate interval between measurements, based on the client's gestational age and risk factors. Midwives may suggest that clients use an obstetric towelette before producing the second sample to reduce the likelihood of a false-positive result. If urine dipstick reading remains equivalent to ≥ 0.3 g/L, further investigation and/or a medical consult is indicated.	**12.** Consider urinary dipstick testing when: • A client's sBP is greater than or equal to 140 mmHg or dBP is greater than or equal to 90 mmHg, based on the average of at least two readings, and/or • There are other signs and/or symptoms of preeclampsia. If a dipstick result greater than or equal to +1 is present, further investigation is warranted, which may include consultation as per community standards. [new 2023] **Weak recommendation: low certainty evidence** *This good practice statement recognizes midwives' ability to identify emerging complications and escalate care as the clinical picture requires.*	This statement has been updated based on new evidence on proteinuria testing and the current consensus that proteinuria is not an essential parameter for the diagnosis of preeclampsia.

Original Recommendation [2012]	Updated Recommendation [2023]	Explanation of Change(s)
Antepartum considerations: assessment of signs and symptoms		
5. Discuss signs and symptoms of preeclampsia during the prenatal period (see "Symptoms of Preeclampsia") and ensure that clients are aware of how to contact their midwife in the event these symptoms arise.	**13.** Midwives should discuss the signs and/or symptoms of preeclampsia with clients during the prenatal period (see "Symptoms of Preeclampsia") and ensure that clients are aware of how to contact their midwife if these symptoms arise. [2023] **Good practice statement** *This good practice statement recognizes midwives' ability to identify emerging risk factors for and complications of preeclampsia and the need for timely decision-making.*	Following GRADE methodology, this recommendation is now considered a good practice statement. Good practice statements in this CPG represent guidance that the committee deemed important but that were not appropriate for formal ratings of certainty of evidence. Good practice statements are made when the committee is confident that the action has net benefit to the client and that no sensible alternatives exist.
Antepartum management: surveillance		
None	**14**. Midwives should monitor the hypertensive client and the fetus for exacerbation of disease using tools and methods (e.g., blood pressure measurement, hematological parameters, clinical symptoms and ultrasound findings) consistent with community standards. [new 2023] **Good practice statement** *This good practice statement recognizes the limited evidence on the optimal methods and timing of surveillance and the importance of ongoing monitoring to the health of the client and the fetus.*	Following GRADE methodology, this recommendation is now considered a good practice statement. Good practice statements in this CPG represent guidance that the committee deemed important but that were not appropriate for formal ratings of certainty of evidence. Good practice statements are made when the committee is confident that the action has net benefit to the client and that no sensible alternatives exist.
Intrapartum management: epidural		
None	**15.** For clients with HDP, epidural anaesthesia is not contraindicated. For clients interested in this pain-relief method, the risks and benefits should be discussed. [new 2023] **Weak recommendation: very low certainty of evidence** *This recommendation recognizes the client as the primary decision-maker.*	The evidence on epidural use was GRADEd and a recommendation was made.

Original Recommendation [2012]	Updated Recommendation [2023]	Explanation of Change(s)
Intrapartum management: management of the third stage of labour		
11. Active management of the third stage of labour with oxytocin is recommended and should be offered to clients with HDP. 12. Ergonovine maleate should be avoided in the prevention and treatment of PPH in clients with HDP if other suitable uterotonic drugs are available.	**16.** Active management of the third stage of labour is recommended and should be offered to clients with HDP. [2023] **17.** As ergonovine maleate is associated with hypertension, it should be avoided in clients with HDP unless other suitable uterotonics are unavailable. [2023] **Strong recommendation: low certainty evidence** *These recommendations recognize the client as the primary decision-maker while balancing the increased risk of PPH.*	Language changes only; no change required to recommendations.
Postpartum management: surveillance		
13. For clients with HDP whose blood pressure remains elevated upon discharge from hospital, midwives should ensure that a plan is in place with the consulting physician for follow-up consultation in the postpartum period if the client's blood pressure remains elevated and/or increases. 14. Monitor blood pressure at all regularly scheduled postpartum visits for the first 2 weeks postpartum or until blood pressure has returned to normal for 2 consecutive visits for clients who have experienced HDP. 15. Following the birth, inform clients with HDP that their elevated blood pressure may take some time to resolve and that in some cases, gestational hypertension may worsen during the postpartum period (though this is relatively uncommon). Advise clients to page their midwife if signs and symptoms of preeclampsia develop in the postpartum period.	**18.** For clients who have experienced HDP, midwives should ensure that a postpartum follow-up plan is in place with an appropriate care provider. [2023] **19.** Midwives should monitor blood pressure at all regularly scheduled visits in the first two weeks postpartum or until blood pressure has returned to normal for two consecutive visits. HBPM can be incorporated into a monitoring plan, depending on the clinical situation, community standards and client preferences. [2023] **20.** Following the birth, midwives should remind clients of the signs and/or symptoms of hypertension and advise clients to page their midwife if signs and/or symptoms develop in the postpartum period. [2023] **Good practice statements** *These good practice statements recognize midwives' skill in providing health information to clients and their ability to identify emerging complications and work interprofessionally to provide safe, and excellent care.*	Following GRADE methodology, this recommendation is now considered a good practice statement. There have been some language changes and reorganization, but the content remains largely consistent beyond the addition of information on HBPM. Good practice statements in this CPG represent guidance that the committee deemed important but that were not appropriate for formal ratings of certainty of evidence. Good practice statements are made when the committee is confident that the action has net benefit to the client and that no sensible alternatives exist.

Original Recommendation [2012]	Updated Recommendation [2023]	Explanation of Change(s)
Postpartum management: pain management		
16. For clients with HDP, limit use of nonsteroidal anti-inflammatory drugs (ibuprofen, naproxen, diclofenac) for management of postpartum pain. Acetaminophen is an effective alternative, though available research provides only limited information about side effects.	**21.** For clients with HDP, NSAID use is not contraindicated in the postpartum period. [new 2023 **Weak recommendation: very low certainty evidence** *This recommendation recognizes the client as the primary decision maker and acknowledges the variations in community standards across Ontario.*	This statement has been updated to reflect current evidence that NSAID use is not contraindicated in those with HDP. A 2021 meta-analysis found that postpartum NSAID use results in little to no difference in: • The risk of sBP ≥ 150 mmHg or dBP ≥ 100 mmHg • The need for antihypertensives • The risk of readmission for blood pressure control This meta-analysis did find that NSAID use might increase the length of postpartum stay in hospital, but this difference was clinically small. The use of NSAIDs only increased hospital stay by 0.21 days.
Postpartum management: long-term considerations		
17. Clients who have had HDP should be advised that they may be at increased risk of developing hypertension or cardiovascular disease later in life. 18. Midwives should discuss the positive benefits of a heart healthy diet and lifestyle with clients who have had HDP, and how these factors may mitigate development of hypertension-related disease in later life. 19. Upon discharge from midwifery care, ensure information about a client's HDP is communicated to the primary care provider/family physician who will be providing ongoing care to the client, if applicable.	**22.** Prior to discharge, midwives should: • Advise the client that they are at increased risk of developing hypertension or cardiovascular disease in future pregnancies and later in life. • Discuss strategies to mitigate this risk. [2023] **23.** Upon discharging clients from midwifery care, midwives should ensure that information about the client's HDP is communicated to the primary care provider and/or the client. [2023] **Good practice statements** *These good practice statements recognize continuity of care and acknowledge midwives' skill in providing health information to clients.*	Following GRADE methodology, this recommendation is now considered a good practice statement. There have been some language changes and reorganization, but the context remains largely consistent. Good practice statements in this CPG represent guidance that the committee deemed important but that were not appropriate for formal ratings of certainty of evidence. Good practice statements are made when the committee is confident that the action has net benefit to the client and that no sensible alternatives exist.