

**BURDEN OF BACK PAIN AMONG POSTPARTUM WOMEN IN CANADA: A MIXED
METHODS STUDY OF THE PREVALENCE, RISK FACTORS, COMORBIDITIES
AND LIVED-EXPERIENCES**

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By

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ABSTRACT

Globally, back pain (BP) is considered a serious public health problem and is of particular concern among parous women. It is estimated that at least half of all pregnant women experience some type of BP during pregnancy, and a substantial number of these women may continue to have unresolved BP after childbirth or develop new symptoms postpartum that can persist for several months and even years after childbirth. When left unmitigated, persistent BP postpartum carries several short and long-term ramifications for affected women, their families, and the society, including resulting in chronic pain later in life. In Canada, chronic BP remains an ongoing and costly public health concern. It is possible that persistent BP postpartum contributes to this burden. However, BP occurring in the postpartum population is relatively underexamined and understudied within the Canadian back pain landscape. Importantly, there appears to be no known nationally representative studies on persistent BP postpartum, and no studies exist that explore in depth women's experiences of living with persistent BP after childbirth, using qualitative methods. This paucity of information for such a large susceptible subpopulation necessitated undertaking this research. Furthermore, gaining information on the breadth and depth of the burden of BP in the Canadian postnatal population is crucial to provide a basis for developing tailored healthcare services and policies that can better meet women's needs relating to BP management and optimize maternity care both during and after pregnancy. This can in the long run contribute to reducing the chronic back pain burden in Canada.

Using a convergent parallel mixed-methods research design, which entailed parallel analysis of nationally representative secondary quantitative data, as well as primary qualitative semi-structured interviews, this thesis examined the burden of persistent BP among postpartum mothers in Canada, covering aspects of disease burden relating to prevalence, risk factors, associated comorbidities, and lived-experiences, in order to uncover the impact on women's postnatal health and wellbeing.

The key findings of the studies presented in this thesis work are as follows:

Back pain is considerably prevalent among postpartum mothers in Canada. More than a third of mothers in Canada experienced some degree of problematic back pain up to three months after childbirth; 24% considered their BP to be somewhat problematic, while for 12% of mothers, BP was perceived to be a great deal of a problem. When examined at 5-14 months after childbirth,

almost half (46%) of the mothers reporting some degree of problematic BP in the early postnatal months continued to have ongoing or persistent BP symptoms.

A range of biopsychosocial factors were identified to be associated with an increased risk of having worse problematic BP during the first 3 months postpartum (i.e. younger maternal age; immigrant status; underweight or obese pre-pregnancy BMI; vaginal birth; lower self-rated health; higher perceived stress, higher number of stressful life events; inadequate social support after childbirth; history of violent abuse; pre-pregnancy depression; province of residence; lower educational attainment; lower household income; and having perceived inadequate information about BP during pregnancy), and persistence of BP up to 5-14 months postpartum (i.e. maternal age + degree of problematic BP in early postpartum, immigrant status, having other pain conditions, poorer self-rated health, inadequate social support postpartum, and history of violent abuse).

Both BP degree during the first three months postpartum and duration up to 5-14 months postpartum are associated with higher risk of reporting comorbid urinary incontinence (UI) and postpartum depression (PPD), in which women reporting the worse categories of BP (greatly problematic, and persistent duration) showed the highest probability of the outcomes (PPD and persistent UI). In addition to BP, a range of biopsychosocial factors were also associated with reporting PPD and UI at 5-14 months postpartum.

Semi-structured interviews with 11 postpartum women with BP revealed that persistent BP carries substantial negative impacts for affected mothers, making life more difficult during pregnancy and postpartum from physical, psychological, and social perspectives. Coping effectively with BP is a continuous process learned over time, in which being able to receive needed support from loved ones, and the ability to elicit self-management strategies enabled mothers to better cope with pain. However, saddled with the numerous responsibilities, many mothers may have no option but to push through the pain and/ or forgo care in order to keep up with their maternal, home, school or work demands. Unfortunately, there seems to be a lack of adequate support for mothers dealing with persistent BP postpartum from maternity care providers. Overall, the mothers experienced unmet healthcare needs regarding their persistent BP complaints postpartum, and their postpartum care in general (in terms of quality and duration of care), as well as several practical barriers in accessing needed care. Specifically, the mothers highlighted a ‘normalization’ and/or lack of

acknowledgement of BP among care providers, inadequate referral to appropriate services, and financial constraints as the main barriers to seeking and/or receiving needed care. As a result, the mothers call for greater support from healthcare providers, in terms of better education about BP and adequate referral to available services to better manage BP both during and after pregnancy. They also advocated for more holistic postpartum care, involving the provision of affordable routine individualized physiotherapy, as well as better societal attitudes and support for women with BP during pregnancy and beyond.

The final take-home message from this thesis is that persistent BP after childbirth, represents a considerable burden among postpartum mothers in Canada, and measures to address this ongoing burden calls for concerted efforts from clinical, policy and societal perspectives, as well as a coordinated holistic maternity care system that incorporates a biopsychosocial approach, deployed within a multidisciplinary care model. Furthermore, it is imperative to improve awareness and acknowledgement of BP among health care providers (HCPs) and potential mothers, promote effective referral to relevant services, and ensure affordability of available services in order to minimize barriers to early diagnosis and management of BP, prevent delayed care seeking, improve uptake of needed services and reduce individual suffering. These measures can in turn mitigate the prevalence of chronic BP and ultimately enhance the health and quality of life of women during pregnancy, postpartum and beyond.

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DEDICATION

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LIST OF ABBREVIATIONS

AIC	Akaike's Information Criterion
APR	Adjusted Prevalence Ratio
BP	Back Pain
BMI	Body Mass Index
BC	British Columbia
BPS	Biopsychosocial
BRR	Balanced Repeated Replication
CI	Confidence Interval
EPDS	Edinburgh Post-Partum Depression Scale
GP	General Practitioner
HCP	Health Care Providers
ICF	International Classification of Functioning, Disability and Health (ICF)
LBP	Low Back Pain
MES	Maternity Experiences Survey
MMR	Mixed Methods Research
OB/GYN	Obstetrician/Gynecologist
ODI	Oswestry Disability Index
OR	Odds Ratio
ORS	Odds Ratios
PPOM	Partial proportional odds models
PPD	Postpartum depression
PGP	Pelvic Girdle Back Pain
PHN	Public Health Nurse
PFM	Pelvic Floor Muscles
PLBP	Pregnancy-Related Low Back Pain
PR	Prevalence Ratio
RDC	Canada Research Data Center
REBs	Research Ethics Boards
SKY-RDC	Saskatchewan Statistics Canada Research Data Center
TENS	Transcutaneous Electrical Nerve Stimulation
UI	Urinary incontinence
VAS	Visual Analogue Scale
WHO	World Health Organization

CHAPTER 1

1. INTRODUCTION AND LITERATURE REVIEW

1.1 Background and significance of Back Pain (BP)

Back pain, particularly, low back pain (LBP) is considered a major health concern affecting all aspects of the population, irrespective of age, sex and geographical location.¹⁻³ In 2017, LBP emerged as the topmost cause of global years lived with disability in 126 out of 195 countries, with an estimated 577 million people living with LBP at any one point in time³—making it the most common musculoskeletal health problem globally. The problem of LBP remains a nuisance to individuals, and society and is associated with substantial economic burden, both in terms of direct healthcare costs and indirect costs of lost productivity and wages and reduced quality of life.¹⁻⁴

In general, higher LBP prevalence rates have consistently been reported among women than men.¹⁻⁴ Additionally, past studies⁵⁻⁷ suggest that among females, there is a higher likelihood to develop LBP while pregnant.⁸ Further, there is growing consensus to suggest that LBP burden disproportionately affects pregnant women compared to women in the general population with the same mean age. This is evident in study findings estimating the point prevalence of LBP to be 25% (22-63%) in pregnant women compared to 6.3% in the general population of women of the same mean age.^{5,8,9} LBP is also common postpartum, and may result from persistent pregnancy-related LBP, or may develop during childbirth, or the postpartum period.¹⁰ Hence, the pregnancy and postpartum states are considered important risk factors for onset of LBP and as well as chronic LBP later in life.¹¹

1.2 Burden of BP during pregnancy and postpartum

BP associated with pregnancy has been reported from all over the world,¹¹⁻¹⁸ and is considered to be the most common musculoskeletal complaint in puerperal women. It has been estimated that up to 20% - 90% of women experience some degree of low back pain and/or pelvic girdle pain during pregnancy,

depending on the definition used.¹⁹⁻²⁴ In general, pregnancy-related BP has a good prognosis, and the majority of women recover spontaneously within 3 months after delivery,^{8,25,26} however current evidence suggests that BP is not always completely resolved, and for a substantial number of women pain symptoms may continue postpartum.²⁵⁻²⁹ In a systematic review of 28 studies, the postpartum prevalence of any type of BP was estimated to be 25% (range= 0.3-67%), with 7 % reporting serious problems.²⁴ BP may also develop newly after childbirth,^{10,25,30} and has a high recurrence rate (up to 85-90%) in subsequent pregnancies.^{11,31}

Persistent BP after childbirth has extensive physical, psychological and economic ramifications for affected women, their families and the society.^{11,24,27,32-37} It has been reported to impede postnatal recovery, mothering role attainment and re-entry into the workforce.³⁷⁻⁴⁰ Persistent BP postpartum can also contribute to chronic pain later in life, whereby 10-30% of women with chronic BP in a general population have been reported to relate their pain onset to a previous pregnancy and /or childbirth.^{7,41}

Furthermore, published international studies suggests that there is limited understanding of pregnancy and postpartum-related BP among maternity care providers. As a result, BP in this population is often assumed to be a normal consequence of pregnancy and the childbirth, and thus a self-limiting condition which would resolve spontaneously delivery.⁴²⁻⁴⁴ As such, most women receive little or no treatment options for their complaints.^{14,39,40,45,46} Furthermore, a review of the literature indicates that there still exist uncertainties around the etiology, pathophysiology, prevalence and risk factors of BP which may further make it difficult for providers to proffer appropriate treatment and management options for the condition.²⁴ In this context, there is need to gain better understanding of persistent BP postpartum which may aid in improving the health outcomes for affected women. Moreover, reasons of the cause and persistence of BP postpartum, as well as obstetric and postpartum health care may differ across countries,⁴² thus necessitating the evaluation of country-specific national estimates (e.g., prevalence and risk factors) as well as contextual experiences of BP to inform relevant prevention and treatment strategies. Despite current evidence, persistent BP postpartum remains understudied in many parts of the world, including Canada. Even though chronic low back disorder is recognized to be an ongoing public health issue in the general population in Canada, the postpartum population may constitute a substantial, yet understudied subpopulation in the Canadian back pain landscape. Currently, there

are no known national level population-based studies evaluating persistent BP in the postpartum population. More so, no studies exist that explore women's experiences of living with BP that developed into more chronic states after childbirth, using qualitative methods. This dissertation attempts to fill these gaps in the knowledge base.

1.3 Review of existing literature on BP during Pregnancy and Postpartum

To assist in the understanding of BP occurring during pregnancy and postpartum and to guide the research process, a review of existing literature was carried out with specific focus on topics around terminology, etiology, epidemiology, risk factors, prognosis, consequences during pregnancy and postpartum, comorbidities, as well as prevention and management strategies. It should be noted that while this study specifically focusses on persistent BP postpartum, the existing literature makes us understand that most cases commence during pregnancy and only a small proportion develop BP newly at the birth or the postpartum period. In this context, the literature review presented here will cover studies examining BP both during pregnancy and postpartum to cover a broader spectrum of the problem, since symptoms can be experienced at any time during the entire perinatal period. Although, I acknowledge that BP may also have commenced before pregnancy and then exacerbated during the pregnancy, childbirth, or postpartum period, this premise is beyond the scope of the present study and was not considered in the present review.

1.3.1 Terminology

Despite the attempts to clarify terminology,^{21,24,29,47} it is challenging to find a consensus in the literature when describing BP during pregnancy and postpartum due to a variety of descriptions and diagnostic criteria that have been used in research studies.^{24,29} As a result, there remains a lack of understanding of the etiology, pathophysiology, and risk factors; as well as determination of appropriate treatment options for the condition. In recent years, several authors have suggested a localization-based classification system in which pregnancy and postpartum-related back pains are classified into two main categories: pregnancy-related low back pain (PLBP) and pregnancy-related pelvic girdle pain (PGP).^{24,29,48-50} PLBP is referred to as pain in the lumbar spinal region, and described to resemble LBP in non-pregnant women, whereas PGP is referred to as pain of musculoskeletal origin experienced between the posterior iliac crest and the gluteal fold, in the vicinage of the sacroiliac joints and the symphysis pubis. However, the majority of the literature does not distinguish between PGP and PLBP, and there are concerns that a clear delineation of the

lactonization of pain may not be possible.^{21,24} Furthermore, Wu et al²⁴ in their review concluded that the underlying mechanisms and prognosis of PLBP and PGP appear to be similar and both conditions may be experienced concurrently, and thus the term ‘lumbopelvic pain’ was proposed to represent the combination of both LBP and PGP. Whereas other studies broadly define PGP to include pain localized in the lower back, buttocks, groin, pubic symphysis, unilateral or bilateral sacroiliac joint.^{51,52} This evidence therefore suggests that there is still a need for standardization of terminology in order to improve knowledge about prevalence, etiology and management of these conditions.

As a result of the lack of consensus in terminology, and since it was not the aim of this study to classify pain according to type or location, this thesis adopted the broad term ‘back pain’ to mean pain or related symptoms experienced in the lumbar region, pelvic girdle, or both. Furthermore, since the specific focus of this dissertation is on BP that persists after childbirth (i.e., persistent BP postpartum), the specific onset of pain was not deemed important, since such pain may have commenced and/or was exacerbated by the pregnancy, childbirth and/or the postpartum period.^{10,24,25}

1.3.2 Etiology

From extant literature, the cause and pathophysiology of BP during pregnancy and postpartum remains largely unclear, although several theories involving biomechanical, hormonal and other processes have been proposed.^{9,43,52–54} For example, some authors suggest that postural adaptations, such as increased lumbar lordosis, and other physiological changes associated with the growing gravid uterus may create mechanical stress on the muscles and ligaments around spine and pelvis regions, which in turn results in pain.^{43,55–57} Other studies claimed that an increased release of the hormone, relaxin, during pregnancy increases ligamentous laxity and instability of the pelvic and sacroiliac joints.^{29,58–60} This laxity may lead to exaggerated range of motion in the otherwise rigid ligaments of the pelvic joints and cervix, which in combination with postural changes, may result in pain in the sacroiliac joints and the entire lower back regions.^{20,43,52} Other proposed factors include weakness in the abdominal muscles, fluid retention, vascular changes due to the growing uterus and genetic factors.^{15,29,43,54,57,61}

The effects of these physical changes during pregnancy are suggested to continue well into the postpartum period.^{10,24,53,62,63} Furthermore, trauma to the pelvis during labor and delivery, as well as physiological processes involved in postpartum recovery have also been proposed to influence onset and clinical presentation of BP postpartum.^{10,43,53,57}

1.3.3 Epidemiology

Although, the vast majority of studies on the prevalence of pregnancy-related BP (i.e., PLBP and/or PGP) has been carried out in Scandinavian countries and The Netherlands, cases have been reported from various countries and across all continents,^{14,15,24,58} demonstrating that BP is a universal problem in both pregnant and postpartum populations. Overall, a wide range of prevalence is reported in the literature for BP during pregnancy and postpartum due to varying definitions, diagnostic criteria, study designs and follow-up times of persistent BP employed in the different studies.^{9,24,29,49,64} The literature shows that between 20%-90% of all pregnant women experience some degree of BP at some point during their pregnancy^{8,9,16,55,64} and at least 50% present with lumbopelvic pain (combination of PLBP and PGP). Although the majority of women recover spontaneously soon after childbirth, however improvements become less apparent at about 3 months after childbirth. It is documented that 15-45% of women with any BP (low back pain, pelvic girdle pain, or both) during pregnancy continued to reported persistent pain between 1 and 3 months postpartum,^{9,24,65-68} whereas the corresponding estimate between 1-3 years postpartum was 8.5%-51%.^{17,65,69,70} Wu et al,²⁴ based on a systematic review of 28 studies which were considered to be reasonable quality, estimated the period prevalence of any type of BP to be on average 45% among pregnant women, and 25% among postpartum women. The review further showed that 25% of the included mothers had severe pain, while 8% had severe disability during pregnancy, whereas 7% had severe pain postdelivery.²⁴ Furthermore, a small number of women may develop BP newly during delivery or during the postpartum period.^{10,71} Of 817 women followed through pregnancy to a minimum of 12 months postpartum, 67% reported the presence of BP directly after delivery.²⁵ A recent review by Christopher et al.³⁰ estimated the pooled incidence of first onset lumbopelvic pain between 6 months and 11 years postpartum to be 32%.

Few studies were found that attempted to investigate the prevalence of BP in Canadian pregnant and postpartum populations.^{72,73} Weis et al⁷³ estimated the prevalence of any type of BP (LBP, PGP or combination pain) to be 76% among 287 pregnant women in Ontario, Canada. In the study

by Tavares and colleagues,⁷² the prevalence of postpartum BP in the same Ontarian population (n=46-64), was estimated to be about 54%, 41% and 52% at birth-1month, 1-3 months and 3-6 months postpartum, respectively. Other studies not specifically investigating prevalence reported similarly high (~ 42%-77%) proportions of women reporting BP during pregnancy and up to 12 months postpartum.⁷⁴⁻⁷⁶ However, reported estimates were based on a limited sample (convenience sampling, small sample size or limited to certain geographical settings). To the best of my knowledge, investigation of the prevalence of BP in a nationally representative sample of Canadian postpartum women has yet to be done.

1.3.4 Risk factors

Previous studies have evaluated a wide range of factors in association with the development and persistence of pregnancy-related BP, however no clear picture is provided in the literature.^{10,15,24,59} Among several potential factors, previous LBP, a history of LBP or PGP in a previous pregnancy and previous trauma to the pelvis seem to be widely accepted as strong predictors of BP both during pregnancy and its persistence postpartum.^{10,29,55,77}

There is, however, increasing evidence to suggest that psychosocial factors are also play a crucial role in the course of low back pain in pregnant and non-pregnant populations, especially in the transition from acute to chronic pain.^{61,78-83} Furthermore, given the multitude of factors that may influence the origin and course of BP, a multidimensional approach based on a biopsychosocial framework is recommended to better understand, evaluate and manage the condition.^{47,61,80,84} Studies of risk factors have reported several psychosocial risk factors, as well as individual and occupational risk factors to be contributing factors to the development and persistence/non-recovery of pregnancy-related BP. These factors include younger or older maternal age,^{24,85-88} non-white race,^{24,30} multiparity,^{24,67,89,90} high body mass index (BMI),^{67,77,91,92} caesarean section birth,^{93,94} duration of first stage of labour,⁹⁵ hypermobility,^{92,96} location of pain in the posterior or anterior aspect of the pelvis during pregnancy,^{60,67,97} higher disability scores,^{22,86} emotional distress,⁷⁹ strain in familial relationships,²⁷ depression in pregnancy,^{77,98,99} stress,⁸⁹ postpartum pain with turning in bed and weight-bearing,^{22,100} higher number of positive provocative tests during pregnancy,^{60,98,101} severe pain,^{24,92,102} decreased function,¹⁰¹ non-optimal breast feeding position,^{103,104} low endurance of the trunk flexors,^{67,86} work dissatisfaction,⁶⁷ strenuous work,²⁵ sick leave,¹⁰⁵ and low socioeconomic status.⁶⁴

However, within the Canadian context, studies examining risk factors for persistent BP postpartum have mostly focused on biomedical and socio demographic variables such as age, parity and pain before/during pregnancy etc.; however, none of the studies examined psychological factors in relation to BP.^{72,76} Current evidence suggest that BP is a complex health problem involving the interactive effects of physical, psychological, and social factors, yet, no studies to my knowledge have investigated a broad range of factors in association with persistent BP postpartum, using the biopsychosocial framework, at a national population level in Canada, or internationally.

1.3.5 Course and Prognosis

The onset of pregnancy-related BP varies considerably. For many women, symptoms typically start between 8-12th week of pregnancy and peaks around the 24th to 36th week into pregnancy.^{24,48,59,106} Other studies have recorded an earlier onset in the first trimester or up to the first month post-delivery.^{24,48} Notwithstanding, the prognosis of PGP is relatively good, with markedly decreased prevalence in the months after childbirth, however improvements are typically seen until about 3-6 months postpartum.^{25,26} In some studies recovery rate was as high as 93% within 3 months postpartum,¹⁵ whereas other studies record non-recovery in 43% of women (7% recurrent pain and 36% constant pain) at 6 months postpartum,¹⁰⁷ and in up to 21% of women at 2-3 years after the birth.^{69,70} Furthermore, BP has a high recurrence rate (85-90%) in subsequent pregnancies, in which case, symptoms appear earlier and are more severe.^{96,100}

Notably the risk of having longer term BP is increased in women still reporting BP at 3 months post-delivery.^{25,49} The severity of complaints and disability at baseline are also considered important prognostic factors, in which women with more severe complaints during pregnancy or postpartum and higher disability scores were more likely to report BP several years postpartum.^{27,50,52,102,107} Similarly, depressive symptoms have been shown to be negatively correlated with prognosis,^{99,108,109} as well as other factors relating to the patient's history, demographic, psychosocial and socioeconomic characteristics.^{50,65,67,70,78,107,110,111}

1.3.6 Consequences of BP during pregnancy and postpartum

1.3.6.1 Pain

Pain is an integral experience of people living with BP. Pain is conceptualized as both a complex and subjective experience that is influenced by varying interactions among sensory-discriminatory (e.g. pain intensity, localization), affective-motivational (e.g. emotions, behaviors) and cognitive-evaluative (e.g. beliefs, previous experiences) aspects of pain.^{112–115} Due to this complexity, no consensus exist on how pain should be measured or classified. With regards to pregnancy and/or postpartum-related BP, authors have assessed pain in terms of the nature, severity, duration, and localization of pain. With regards to the nature of pain, most women describe pain sensations to be a continuous dull pain, whereas others describe more intense symptoms, using descriptors such as sharp or stabbing pain.^{27,40,116} Pain-descriptors may also differ with the type of BP being reported. For example, some studies show that women described pain in the pelvic girdle pain as ‘stabbing’, whereas pain in the lower back was described as a ‘dull ache’, and thoracic spine pain as ‘burning’.^{116,117}

Pain severity entails measurements of pain intensity and activity interference. Assessments of pain intensity varies widely among studies during pregnancy^{9,20,26,101,116} as well as postpartum.^{9,49,118} For example, authors have assessed pain intensity ratings at one or multiple time points, using different questions including pain at the moment, during the last week, during peak episodes, on average, in the morning and evening, or in relation to interference with specific activities such as walking, or forward flexion of the trunk.^{9,22,24,60,101,116,118}

On average, pain intensity ratings are reported to be around 50-60mm on a visual analogue scale (VAS) during pregnancy, though ratings vary considerably throughout the course of the syndrome, ranging from bearable to very serious.^{9,24,49,69} In general, BP postpartum is considered to be less intense than pain during pregnancy.⁹ Wu et al²⁴ further described that 45% of all women reporting lumbopelvic pain during pregnancy were classified as having ‘mild’ complaints, 30% ‘moderate’ complaints and 25% ‘serious’ complaints. Whereas after pregnancy, 80% of women had mild complaints, while 13% and 7% had moderate and severe complaints, respectively.

Furthermore, pain intensity can vary over time and by pain location,^{9,27,40} whereby pain located in pelvic girdle is considered to be more intense during pregnancy, whereas the reverse is seen

postpartum where lumbar pain is considered to be more intense and more common.^{20,117} Pain intensity also appears to be higher in postpartum women who also experienced BP during pregnancy,⁵⁹ and in those with persistent pain postpartum compared to those with resolved symptoms.²⁷ In past studies, a high correlation is observed between pain intensity and greater disability,²² poorer health status,²⁷ higher degree of depressive symptoms,⁹⁹ and compromised emotional wellbeing.⁷⁹ Pain duration/persistency, on the other hand, is associated with an increased odds of reporting pain 12 years postpartum⁹⁷- making these constructs (i.e. pain severity and duration) important for assessment in women with BP during pregnancy, and especially postpartum, in order to facilitate early identification of women at risk of chronicity and poorer prognosis postpartum. Furthermore, some studies have highlighted grading back pain in terms of perceived degree of bother and/or duration to be useful classifications for assessing overall disease severity and associated sequelae^{119,119-122} which can inform targeting of health care resources and services to people who need them the most. There is a lack knowledge regarding the distribution of BP severity (assessed using the degree of bother and duration) and its associated biopsychosocial factors, as well as the influence on postpartum physical and mental health indicators among women reporting persistent BP postpartum.

1.3.6.2 Disability

Although BP is often believed to be a normal part of pregnancy,^{96,123} symptoms can range from just minor pregnancy discomforts²⁴ to more serious disabling conditions, whereby routine daily activities such as walking, standing, getting up from a sitting position turning over in bed, dressing and undressing, lifting and carrying objects or maintaining an extended sustained posture can become an ordeal for some women.^{27,62,100,107,124,125} In published studies, disabling problems were frequent in about one-third of women with lumbopelvic pain during pregnancy.^{8,9,123,126} In a postpartum study, a high proportion of women experienced problems with housework, exercise, activities with the children, employment, leisure/hobbies, and personal relationships or married life.¹²⁷ Problems with sleep and sexual life are also common.^{24,107,124,128,129} Some studies report that women with BP experienced considerably lower frequency of sleep at night.^{64,70,123,124,130,131} Mogren and colleagues¹⁰⁷ surveyed 1,071 immediate postpartum women, and found that women reporting pain scores of 7 or more out of 10 during pregnancy were more likely to have an unsatisfying sexual life during pregnancy compared to their counterparts without BP.

In other studies, women with more severe BP have required use of crutches, wheelchairs, cushions, a walking frame, a walking stick or even become bedridden.^{24,101,127} The extent of disability may also differ by BP type. For example, some studies suggest that women with PGP are more disabled than those who experience PLBP alone, while women who experienced combined PGP and PLBP suffered the greatest impairment and worse long-term outcomes.⁴⁸⁻⁵⁰ In a 3-year follow-up study, Noren et al⁶⁹ found that women with persistent combined PGP and LBP at 3 years postpartum reported on average a score of 50mm on the VAS for ‘difficulty’ in doing housework, walking more than 20 min, or doing exercise; whereas the corresponding scores were lower (37 mm, 21 mm, and 32 mm, respectively) in women with PGP alone and lowest (17 mm, 1 mm, and 15 mm) in those with PLBP alone.

Evaluation of consequences of postpartum BP in terms of pain severity and impact on daily life is important for identifying target areas in treatment and rehabilitation strategies. However, there is still a lack of knowledge on how Canadian postpartum women experience BP in terms of the impact on their daily lives and their perceived challenges in accessing relevant services for these complaints both during pregnancy and postpartum.

1.3.6.3 Psychological and emotional consequences

In addition to consequences of pain and disability, pregnancy-related BP can have significant emotional and psychological effects for women, especially those whose symptoms persist postnatally. Research has shown that the postpartum period is inherently challenging for many women, especially first-time mothers, who must adapt to the demands of motherhood and caring for the newborn, amidst evolving psychosocial contexts.¹³²⁻¹³⁴ Thus, delayed BP recovery after childbirth can cause additional strain on women, with implications for their mental and overall health, relationships and ability to optimally care for their young. Qualitative studies examining women’s experiences of BP during pregnancy and postpartum have uncovered feelings of sadness, frustration, helplessness and loss of identity relating to the impact of persistent pain on women’s daily lives and activities, especially those activities pertaining to caring for their newborn and participation in the workplace.^{36,40,135,136} Feelings of perpetual exhaustion and irritableness from continuous pain, as well as the consequent disruptions to maternal role, mother-child bonding, important relationships and participation at work caused by relentless pain have also been described in many studies.^{38,40,136}

Distress and disability caused by chronic BP are also increasingly recognized as issues of concern, requiring urgent attention, among pregnant and postpartum women. On the one hand, many women have expressed that a lack of awareness of BP prior to pregnancy, or of the likelihood that symptoms could persist after childbirth, including a lack of information on what to expect of their symptoms after childbirth, are major sources of anxiety and stress.^{38,46,137} This lack of awareness, coupled with the perception that their pain and disability often go unacknowledged by care providers, who appear to be either unequipped or reluctant to provide advice and support to mothers during this time,^{46,138} further contribute to the feelings of isolation, discouragement and loneliness among women still struggling with persistent pain after childbirth.^{36,40,46,138}

On the other hand, the feeling of physical inadequacy in engaging in various life aspects due to pain and disability contributes to psychological distress in women with persistent BP postpartum. For most women, the context of their pain experience encompasses their ability to meet their own and other's expectations of fulfilling the roles of being partners, colleagues, and mothers, whereby, failure to meet these expectations weighs on women's perceptions about their identities and roles as mothers, partners and professionals.^{36,139,140} These negative feelings may precipitate psychological distress, which can have significant health ramifications for both mother and child. For example, in studies by Elden et al.¹⁴¹ and Shepherd,¹³⁰ participants reported that they believed persistent pain from BP was the underlying cause of their antenatal and postpartum depression. Several quantitative studies have also demonstrated that women with persistent BP postpartum have a higher risk of postpartum depression,^{27,48} poorer health status,²⁷ and poorer self-rated quality of life¹²⁵ compared to women who do not have continuous pain postpartum. Other studies have documented the comorbidity of BP with postpartum depression and urinary incontinence in the first postpartum year, which have significant physical as well as mental health implications in women with co-morbid problems.^{76,142-147}

1.3.7 Comorbidities of BP

1.3.7.1 Postpartum depression (PPD)

PPD, defined as a major depressive episode with a 'postpartum' onset,¹⁴⁸ is considered one of the most common mental health disorder associated with childbirth, which can affect up to 13% of all postpartum women worldwide.¹⁴⁹ Global estimates measured using the Edinburgh Postnatal

Depression Scale (EPDS) showed prevalence of 21% for possible PPD (EPDS ≥ 10) and 16.7% for probable PPD (EPDS ≥ 13).¹⁵⁰ For most women, the onset of symptoms is reported to be within 4-6 weeks of delivery,^{151,152} however an earlier onset of 1 day postdelivery has also been recorded.¹⁵² Although symptoms typically last for 4-6 months, when left untreated, up to 25% of women may report persistence at 1 year postpartum¹⁵³ and recurrence rates can be as high as 50%.¹⁵⁴

According to the World Health Organization (WHO), PPD is considered to be one of the topmost contributor of disability among childbearing women.¹⁵⁵ PPD has significant consequences for the health and wellbeing of both mother and child¹⁵⁶ and has been associated with negative maternal attitudes, parental negligence, impaired mother-child bonding, non-optimal breastfeeding practices and disruptions in familial relationships.^{149,156-159} Furthermore, infants born to mothers with postpartum depression have been observed to have delayed cognitive, behavioral, and emotional developmental trajectories.^{156,157,159} Although the cost of PPD in Canada is unknown, depression in the general population of Canadians aged 15 and older has been associated with significant healthcare and social services costs, which translates to an excess spending of over \$12 billion annually.^{160,161}

The cause of PPD is complex, and several biological, psychosocial, obstetric and socioeconomic factors have been implicated in the disorder.^{148,149,156,162,163} Existing literature have also consistently associated back pain with depressive illness in the general population, with the association depicted to be potentially causal in nature.¹⁶⁴⁻¹⁶⁶ Similar findings have been reported in relation to pregnancy and postpartum-related BP, in which BP is hypothesized to contribute to the risk of postpartum depressive symptoms.^{99,145,147,167} For example, an Australian postal survey found BP to be associated with a 2.2 increased risk of PPD.¹⁶⁷ Similarly, a small Swedish study by Gutke et al⁹⁹ showed that women who reported lumbopelvic pain at three months postpartum were three times as likely to report PPD compared to those with no persistent lumbopelvic pain.

However, population-based studies investigating the relationship between BP and PPD in a national sample of postpartum women have not been previously examined and only few studies have examined longer postnatal periods beyond 3 months postpartum.¹⁴⁵ Furthermore, evaluating the graded severity of BP (in terms of degree of bother and duration) in relation to PPD would give

additional information regarding possible differences in depressive symptoms between severity levels of BP.

1.3.7.2 Urinary incontinence (UI)

Urinary incontinence (UI), broadly defined as the involuntary leakage of urine,¹⁶⁸ is reported to be a common complication in the female reproductive years. A recent meta-analysis documented the prevalence of any type of UI during pregnancy to be 41% (range 9-75%).¹⁶⁹ The condition is generally considered to be transient and most women recover within the first three months postpartum, however, symptoms may persist in some, or may newly develop as a result of trauma and damage in related body tissues and/or muscles during childbirth.^{170,171} The most recent figures for postpartum UI in western countries was documented at 31% between 6 weeks and 1 year postpartum, with most women reporting their symptoms to be mildly to moderately bothersome.¹⁷² Furthermore, among women with UI at three months postpartum, more than 70% reported persistent symptoms at 6 years¹⁷³ and 12 years postpartum.¹⁷⁴

UI affects every area of life for the affected women and their families, and has a high associated cost.^{109,175-177} The condition has also been associated with social stigma, embarrassment, social isolation, as well as impaired quality of life and psychological wellbeing.^{144,175-179} In Canada, approximately 1 million women above 15 years of age suffered from moderate to severe incontinence on a daily basis in 2011, accruing an estimated annual direct cost of about \$1.7 billion in related treatments.¹⁸⁰

Although UI is not a direct consequence of BP, increasing studies have hypothesized the co-existence of the two conditions during pregnancy and long into the postnatal period.^{63,176,181} Furthermore, there is some evidence in the general as well as pregnant populations of an association between UI and BP, in which the odds of incontinence was significantly increased in women with low back pain.¹⁸¹⁻¹⁸⁵ Proponents of the association between UI and BP in women have implicated injuries sustained during pregnancy and delivery on the pelvic floor muscles, which have a dual role of maintaining continence as well as lumbopelvic stability.¹⁸⁶⁻¹⁸⁸ This finding may be responsible for the increased risk of UI observed in women with low back pain and vice versa.^{181,184}

Only few studies^{176,189} have examined the link between BP and UI in postnatal women, albeit, none of these studies assessed a direct relationship between the two conditions using multivariable models. Chukwu et al¹⁸⁹ demonstrated that low back pain and UI are co-existent in 42.6% of postpartum women, compared to 35.9% in pregnant women. Similarly, Mannion et al¹⁷⁶ found 40% of postpartum women with comorbid UI and low back pain at one year after childbirth. To the authors' knowledge, a relationship between UI and BP has yet to be explored in postpartum women at a national population level in Canada. The high prevalence of these two, potentially comorbid, conditions after childbirth^{66,190,191} further supports this inquiry. Moreover, assessing the degree of bother and duration of BP in relation to persistent UI postpartum may provide further insight into the relationship between BP and UI than the general overall relationship presented in past studies.^{176,189}

1.3.8 Prevention and Management

Prevention of BP is difficult to achieve and a complete cure may not be feasible in some cases, however, early identification, diagnosis, and management during pregnancy and postpartum (before three months postpartum) seems to offer the best opportunity for recovery.^{10,192,193} Providing women with timely information and reassurance has been shown to minimize pain, worry and maladaptive behaviors that can exacerbate pain and lead to development of persistence.^{29,78,193-196} It is recommended that potential mothers be offered ample information about BP earlier during pregnancy, including relevant information about the anatomy of the lower back and pelvis, contributing factors for back pain, reassurance of resolution after delivery, as well as the potential for persistence and/or reoccurrence in a subsequent pregnancy.^{29,59,193} Women should also be educated on practical 'common sense' lifestyle measures to prevent stress/misalignment of the spine and muscle fatigue, such as maintaining proper posture, avoiding lifting of heavy weights, use of proper seats, cushions and beds, as well as techniques for getting in and out of bed.¹⁹² The importance of bed rest and reduction of stressful activities during an acute episode of BP has also been suggested.^{15,59,61} Furthermore, women are encouraged to maintain physical fitness before and during pregnancy since this has been shown to reduce the risk of developing BP in subsequent pregnancies.^{49,96}

Although, no single treatment modality has been recorded with success yet, a conservative treatment approach to BP management is preferred. It is advised that correct diagnosis or

classification of the condition be made with considerations for influencing physical, psychosocial, pathoanatomical, hormonal and neurophysiological factors which could serve as important moderators or determinants of the course and prognosis of BP.^{10,15,29,61,197} Furthermore, recommendation is made for treatment to be offered on a case-by-case basis, depending on the individual woman and pregnancy.^{10,195} Exercise appears to be the most common treatment method for managing BP during pregnancy. Different exercise programs, such as individualized physical therapy, supervised group exercise, yoga, and water aerobics, have been evaluated and showed improvements in pain, disability, muscle function and reduction in sick leave compared with groups receiving control or usual antenatal care.^{49,198–204} However, exercise programs are not to be administered alone, and may incorporate other cointerventions such as pelvic belts, stretching, pelvic floor training, manual therapy, nerve stimulation, physical therapy, home exercise program, education and functional training.^{29,197} Other treatment options that have been explored to manage BP during pregnancy include: acupuncture, support garment, pharmacological treatment, massage, relaxation, cold/hot packs, pelvic binders/castings/braces, bilateral traction, transcutaneous electrical nerve stimulation (TENS), and inter-symphyseal injection therapy.^{15,21,29,195,201,204}

During labor, there are suggestions for using all-four or lateral birthing positions, and minimizing the duration of lithotomy birthing position and hip abduction during delivery.^{15,21} Whereas, in managing BP postpartum, some studies suggest that interventions performed during pregnancy may aid in improving postpartum outcomes.^{26,199(p2),201,203} There is also significant evidence to suggest that individualized physical therapy that focuses on specific stabilizing exercises shows significant effects for managing postpartum complaints.^{197–199,201,203–209} However, it is recommended that treatment strategies for persistent BP should be adapted within a wider biopsychosocial and multidisciplinary framework for BP management postpartum.^{29,61,78,203,207,210} These studies highlight the importance of addressing psychosocial issues which may interfere with intervention outcomes, and that comprehensive BP care should involve both medical as well as psychological intervention strategies.

1.4 References

1. Hoy D, Bain C, Williams G, et al. A systematic review of the global prevalence of low back pain. *Arthritis Rheum.* 2012;64(6):2028-2037. doi:10.1002/art.34347
2. Maher C, Underwood M, Buchbinder R. Non-specific low back pain. *The Lancet.* 2017;389(10070):736-747. doi:10.1016/S0140-6736(16)30970-9

3. Wu A, March L, Zheng X, et al. Global low back pain prevalence and years lived with disability from 1990 to 2017: estimates from the Global Burden of Disease Study 2017. *Ann Transl Med.* 2020;8(6). doi:10.21037/atm.2020.02.175
4. Rapoport J, Jacobs P, Bell NR, Klarenbach S. Refining the measurement of the economic burden of chronic diseases in Canada. *Chronic Dis Can.* 2004;25(1):13-21.
5. Biering-Sorensen F. Low back trouble in a general population of 30-, 40-, 50-, and 60-year-old men and women. *Study Des Represent Basic Results Dan Med Bull Bibliogr Links.* 1982;29 SRC-GoogleScholar:289-299.
6. Biering-Sørensen F. A one-year prospective study of low back trouble in a general population. The prognostic value of low back history and physical measurements. *Dan Med Bull.* 1984;31(5):362-375.
7. Svensson H, Andersson G, Hagstad A, Jansson P. The relationship of low-back pain to pregnancy and gynecologic factors. *Spine Phila Pa 101097000076320500000006.* 1990;15 SRC-GoogleScholar:371-375.
8. Ostgaard HC, Andersson GBJ, Karlsson K. Prevalence of Back Pain in Pregnancy. *Spine.* 1991;16(5):549-552.
9. Kristiansson P, Svärdsudd K, von Schoultz B. Back Pain During Pregnancy: A Prospective Study. *Spine.* 1996;21(6):702-708.
10. Simonds AH, Abraham K, Spitznagle T. Clinical Practice Guidelines for Pelvic Girdle Pain in the Postpartum Population. *J Womens Health Phys Ther.* 2022;46(1):E1-E38. doi:10.1097/JWH.0000000000000236
11. Mens J, Vleeming A, Stoeckart R, Stam H, Snijders C. Understanding peripartum pelvic pain: Implications of a patient survey. *Spine Phila Pa Doi 101097000076320601000017 Discuss 13691370.* 1996;21(11 SRC-GoogleScholar):1363-1369.
12. Bastiaanssen JM, de Bie RA, Bastiaenen CHG, Essed GGM, van den Brandt PA. A historical perspective on pregnancy-related low back and/or pelvic girdle pain. *Eur J Obstet Gynecol Reprod Biol.* 2005;120(1):3-14. doi:10.1016/j.ejogrb.2004.11.021
13. Bjurlund K, Bergstrom S. Is pelvic pain in pregnancy a welfare complaint? *Acta Obstet Gynecol Scand.* 2000;79 SRC-GoogleScholar:24-30.
14. Gutke A, Boissonnault J, Brook G, Stuge B. The Severity and Impact of Pelvic Girdle Pain and Low-Back Pain in Pregnancy: A Multinational Study. *J Womens Health.* 2018;27(4):510-517. doi:10.1089/jwh.2017.6342
15. Kanakaris NK, Roberts CS, Giannoudis PV. Pregnancy-related pelvic girdle pain: an update. *BMC Med.* 2011;9(1):15. doi:10.1186/1741-7015-9-15
16. Mantle MJ, Greenwood RM, Currey HLF. BACKACHE IN PREGNANCY. *Rheumatology.* 1977;16(2):95-101. doi:10.1093/rheumatology/16.2.95
17. Padua L, Caliendo P, Aprile I, et al. Back pain in pregnancy: 1-year follow-up of untreated cases. *Eur Spine J.* 2005;14(2):151-154. doi:10.1007/s00586-004-0712-6
18. To WWK, Wong MWN. Factors associated with back pain symptoms in pregnancy and the persistence of pain 2 years after pregnancy. *Acta Obstet Gynecol Scand.* 2003;82(12):1086-1091. doi:10.1046/j.1600-0412.2003.00235.x
19. Bastiaanssen JM, de Bie RA, Bastiaenen CH, et al. Etiology and prognosis of pregnancy-related pelvic girdle pain; design of a longitudinal study. *BMC Public Health.* 2005;5(1). doi:10.1186/1471-2458-5-1
20. Ostgaard HC, Andersson GBJ. Previous Back Pain and Risk of Developing Back Pain in a Future Pregnancy. *Spine.* 1991;16(4):432-436.

21. Vermani E, Mittal R, Weeks A. Pelvic girdle pain and low back pain in pregnancy: a review. *Pain Pract Off J World Inst Pain*. 2010;10(1):60-71. doi:10.1111/j.1533-2500.2009.00327.x
22. Gutke A, Lundberg M, Östgaard HC, Öberg B. Impact of postpartum lumbopelvic pain on disability, pain intensity, health-related quality of life, activity level, kinesiophobia, and depressive symptoms. *Eur Spine J*. 2011;20(3):440-448. doi:10.1007/s00586-010-1487-6
23. Katonis P, Kampouroglou A, Aggelopoulos A, Kakavelakis K, Lykoudis S, Makrigiannakis A. Pregnancy-related low back pain. *Hippokratia*. 2011;15(3 SRC-GoogleScholar):205-210.
24. Wu WH, Meijer OG, Uegaki K, et al. Pregnancy-related pelvic girdle pain (PPP), I: Terminology, clinical presentation, and prevalence. *Eur Spine J*. 2004;13(7):575-589. doi:10.1007/s00586-003-0615-y
25. Ostgaard HC, Andersson GBJ. Postpartum Low-Back Pain. *Spine*. 1992;17(1):53-55.
26. Östgaard HC, Zetherström G, Roos-Hansson E. Back Pain in Relation to Pregnancy: A 6-Year Follow-Up. *Spine*. 1997;22(24):2945-2950.
27. Bergstrom C, Persson M, Mogren I, BMC. Pregnancy-related low back pain and pelvic girdle pain approximately 14 months after pregnancy-pain status, self-rated health and family situation. *Childbirth 48*. 2014;14 SRC-GoogleScholar.
28. Gausel AM, Kjærmann I, Malmqvist S, Dalen I, Larsen JP, Økland I. Pelvic girdle pain 3–6 months after delivery in an unselected cohort of Norwegian women. *Eur Spine J*. 2016;25(6):1953-1959. doi:10.1007/s00586-015-3959-1
29. Vleeming A, Albert H, Ostgaard H, Sturesson B, Stuge B. European guidelines for the diagnosis and treatment of pelvic girdle pain. *Eur Spine J Doi 101007s0058600806024*. 2008;17(6 SRC-GoogleScholar):794-819.
30. Christopher S, McCullough J, Snodgrass SJ, Cook C. Predictive Risk Factors for First-Onset Lumbopelvic Pain in Postpartum Women: A Systematic Review. *J Women's Health Phys Ther*. 2019;43(3):127. doi:10.1097/JWH.000000000000133
31. Mogren IM, Pohjanen AI. Low Back Pain and Pelvic Pain During Pregnancy: Prevalence and Risk Factors. *Spine*. 2005;30(8):983-991. doi:10.1097/01.brs.0000158957.42198.8e
32. Pierce H, Homer C, Dahlen H, King J. Pregnancy-related lumbopelvic pain: Listening to Australian women. *Nurs Res Pract J 387428*. 2012;2012 SRC-GoogleScholar.
33. Olsson C, Nilsson-Wikmar L. Health-related quality of life and physical ability among pregnant women with and without back pain in late pregnancy. *Acta Obstet Gynecol Scand J*. 2004;83(4 SRC-GoogleScholar):351-357.
34. Hansen A, Jensen DV, Wormslev M, et al. [Pregnancy associated pelvic pain. II: Symptoms and clinical findings]. *Ugeskr Laeger*. 2000;162(36):4813-4817.
35. Sabino J, Grauer JN. Pregnancy and low back pain. *Curr Rev Musculoskelet Med*. 2008;1(2):137-141. doi:10.1007/s12178-008-9021-8
36. Mackenzie J, Murray E, Lusher J. Women's experiences of pregnancy related pelvic girdle pain: A systematic review. *Midwifery*. 2018;56:102-111. doi:10.1016/j.midw.2017.10.011
37. van Beukering MDM. Work during pregnancy and postpartum period: research on sick leave (in Dutch;Werken tijdens zwangerschap en periode postpartum: onderzoek naar ziekteverzuim). *TBV – Tijdschr Voor Bedr- En Verzek*. 2002;10(1):2-8. doi:10.1007/BF03073675
38. Elden H, Lundgren I, Robertson E. Life's pregnant pause of pain: Pregnant women's experiences of pelvic girdle pain related to daily life: A Swedish interview study. *Sex Reprod Healthc*. 2013;4(1):29-34. doi:10.1016/j.srhc.2012.11.003

39. Engeset J, Stuge B, Fegran L. Pelvic girdle pain affects the whole life—a qualitative interview study in Norway on women’s experiences with pelvic girdle pain after delivery. *BMC Res Notes*. 2014;7(1):686. doi:10.1186/1756-0500-7-686
40. Wuytack F, Curtis E, Begley C. Experiences of First-Time Mothers With Persistent Pelvic Girdle Pain After Childbirth: Descriptive Qualitative Study. *Phys Ther*. 2015;95(10):1354-1364. doi:10.2522/ptj.20150088
41. Biering-Sørensen F. A prospective study of low back pain in a general population. I. Occurrence, recurrence and aetiology. *Scand J Rehabil Med*. 1983;15(2):71-79.
42. Ansari NN, Hasson S, Naghdi S, Keyhani S, Jalaie S. Low back pain during pregnancy in Iranian women: Prevalence and risk factors. *Physiother Theory Pract*. 2010;26(1):40-48. doi:10.3109/09593980802664968
43. MacEvilly M, Buggy D. Back pain and pregnancy: a review: *Pain*. 1996;64(3):405-414. doi:10.1016/0304-3959(95)00184-0
44. Malmqvist S, Kjaermand I, Andersen K, et al. The association between pelvic girdle pain and sick leave during pregnancy: A retrospective study of a Norwegian population. *Childbirth 237 Doi 10118606670*. 2015;15 SRC-GoogleScholar:s12884-015.
45. Wellock VK, Crichton MA. Symphysis pubis dysfunction: women’s experiences of care. *Br J Midwifery*. 2007;15(8):494-499. doi:10.12968/bjom.2007.15.8.24390
46. Wuytack F, Curtis E, Begley C. The health-seeking behaviours of first-time mothers with persistent pelvic girdle pain after childbirth in Ireland: A descriptive qualitative study. *Midwifery*. 2015;31(11):1104-1109. doi:10.1016/j.midw.2015.07.009
47. Mens JMA, Pool-Goudzwaard A, Stam HJ. Mobility of the Pelvic Joints in Pregnancy-Related Lumbopelvic Pain: A Systematic Review. *Obstet Gynecol Surv*. 2009;64(3):200-208. doi:10.1097/OGX.0b013e3181950f1b
48. Gutke A, Östgaard HC, Öberg B. Pelvic Girdle Pain and Lumbar Pain in Pregnancy: A Cohort Study of the Consequences in Terms of Health and Functioning: *Spine*. 2006;31(5):E149-E155. doi:10.1097/01.brs.0000201259.63363.e1
49. Ostgaard H, Zetherstrom G, Roos-Hansson E, Svanberg B. Reduction of back and posterior pelvic pain in pregnancy. *Spine*. 1994;19 SRC-GoogleScholar:894-900.
50. Ostgaard H, Roos-Hansson E, Zetherstrom G. Regression of back and posterior pelvic pain after pregnancy. *Spine*. 1996;21 SRC-GoogleScholar:2777-2780.
51. Robinson AM, Benzie KM, Cairns SL, Fung T, Tough SC. Who is distressed? A comparison of psychosocial stress in pregnancy across seven ethnicities. *BMC Pregnancy Childbirth*. 2016;16(1):1-11. doi:10.1186/s12884-016-1015-8
52. Brynhildsen J. Follow-Up of Patients With Low Back Pain During Pregnancy. *Obstet Gynecol*. 1998;91(2):182-186. doi:10.1016/S0029-7844(97)00630-3
53. Bullock JE, Jull GA, Bullock MI. The Relationship of Low Back Pain to Postural Changes During Pregnancy. *Aust J Physiother*. 1987;33(1):10-17. doi:10.1016/S0004-9514(14)60580-8
54. MacLennan A, Nicolson R, Green R. Serum relaxin and pelvic pain of pregnancy. *Lancet*. 1986;2:243-245.
55. Bastiaanssen JM, de Bie RA, Bastiaenen CH, et al. Etiology and prognosis of pregnancy-related pelvic girdle pain; design of a longitudinal study. *BMC Public Health*. 2005;5(1). doi:10.1186/1471-2458-5-1
56. Borg-Stein J, Dugan SA. Musculoskeletal Disorders of Pregnancy, Delivery and Postpartum. *Phys Med Rehabil Clin N Am*. 2007;18(3):459-476. doi:10.1016/j.pmr.2007.05.005

57. Fast A, Cole S, A. Low back pain during pregnancy. *AJ Herring Eds Low Back Pain Handb Pract Clin Hanley Belfus Inc Phila*. Published online 2003:405-412 SRC-GoogleScholar.
58. Björklund K, Bergström S. Is pelvic pain in pregnancy a welfare complaint? *Acta Obstet Gynecol Scand*. 2000;79(1):24-30. doi:10.1034/j.1600-0412.2000.079001024.x
59. Katonis P, Kampouroglou A, Aggelopoulos A, et al. Pregnancy-related low back pain. *Hippokratia*. 2011;15(3):205-210.
60. Vøllestad NK, Stuge B. Prognostic factors for recovery from postpartum pelvic girdle pain. *Eur Spine J*. 2009;18(5):718-726. doi:10.1007/s00586-009-0911-2
61. O'Sullivan PB, Beales DJ. Diagnosis and classification of pelvic girdle pain disorders--Part 1: a mechanism based approach within a biopsychosocial framework. *Man Ther*. 2007;12(2):86-97. doi:10.1016/j.math.2007.02.001
62. Sabino J, Grauer JN. Pregnancy and low back pain. *Curr Rev Musculoskelet Med*. 2008;1(2):137-141. doi:10.1007/s12178-008-9021-8
63. Wijnhoven HAH, de Vet HCW, Smit HA, Picavet HSJ. Hormonal and reproductive factors are associated with chronic low back pain and chronic upper extremity pain in women--the MORGEN study. *Spine*. 2006;31(13):1496-1502. doi:10.1097/01.brs.0000220706.96724.76
64. Orvieto R, Achiron A, Ben-Rafael Z, Gelernter I, Achiron R. Low back pain of pregnancy. *Acta Obstet Gynecol Scand*. 1994;73:209-214.
65. Albert H, Godskenen M, Westergaard J. Prognosis in four syndromes of pregnancy-related pelvic pain. *Acta Obstet Gynecol Scand 101080j16000412080006505x*. 2001;80 SRC-GoogleScholar:505-510.
66. Cooklin AR, Amir LH, Jarman J, Cullinane M, Donath SM. Maternal Physical Health Symptoms in the First 8 Weeks Postpartum Among Primiparous Australian Women. *Birth*. 2015;42(3):254-260. doi:10.1111/birt.12168
67. Gutke A, Östgaard HC, Öberg B. Predicting Persistent Pregnancy-Related Low Back Pain: *Spine*. 2008;33(12):E386-E393. doi:10.1097/BRS.0b013e31817331a4
68. Larsen E, Wilken-Jensen C, Hansen A, et al. Symptom-giving pelvic girdle relaxation in pregnancy, I: Prevalence and risk factors. *Acta Obstet Gynecol Scand*. 1999;78(2):105-110. doi:10.1080/j.1600-0412.1999.780206.x
69. Norén L, Östgaard S, Johansson G, Östgaard HC. Lumbar back and posterior pelvic pain during pregnancy: a 3-year follow-up. *Eur Spine J*. 2002;11(3):267-271. doi:10.1007/s00586-001-0357-7
70. To WWK, Wong MWN. Factors associated with back pain symptoms in pregnancy and the persistence of pain 2 years after pregnancy. *Acta Obstet Gynecol Scand*. 2003;82(12):1086-1091. doi:10.1046/j.1600-0412.2003.00235.x
71. Olsson CB, Nilsson-Wikmar L, Grooten WJA. Determinants for lumbopelvic pain 6 months postpartum. *Disabil Rehabil*. Published online January 15, 2012. Accessed June 14, 2020. <https://www.tandfonline.com/doi/abs/10.3109/09638288.2011.607212>
72. Tavares P, Barrett J, Hogg-Johnson S, et al. Prevalence of Low Back Pain, Pelvic Girdle Pain, and Combination Pain in a Postpartum Ontario Population. *J Obstet Gynaecol Can*. 2020;42(4):473-480. doi:10.1016/j.jogc.2019.08.030
73. Weis CA, Barrett J, Tavares P, et al. Prevalence of Low Back Pain, Pelvic Girdle Pain, and Combination Pain in a Pregnant Ontario Population. *J Obstet Gynaecol Can*. 2018;40(8):1038-1043. doi:10.1016/j.jogc.2017.10.032

74. Charpentier K, Leboucher J, Lawani M, Toumi H, Dumas GA, Pinti A. Back pain during pregnancy and living conditions – a comparison between Beninese and Canadian women. *Ann Phys Rehabil Med.* 2012;55(3):148-159. doi:10.1016/j.rehab.2012.02.003
75. Lardon E, St-Laurent A, Babineau V, Descarreaux M, Ruchat SM. Lumbopelvic pain, anxiety, physical activity and mode of conception: a prospective cohort study of pregnant women. *BMJ Open.* 2018;8(11):e022508. doi:10.1136/bmjopen-2018-022508
76. Mannion CA, Vinturache AE, McDonald SW, Tough SC. The Influence of Back Pain and Urinary Incontinence on Daily Tasks of Mothers at 12 Months Postpartum. *PLOS ONE.* 2015;10(6):e0129615. doi:10.1371/journal.pone.0129615
77. Wiezer M, Hage-Fransen MAH, Otto A, et al. Risk factors for pelvic girdle pain postpartum and pregnancy related low back pain postpartum; a systematic review and meta-analysis. *Musculoskelet Sci Pract.* 2020;48:102154. doi:10.1016/j.msksp.2020.102154
78. Bastiaenen CH, Bie RA de, Wolters PM, et al. Effectiveness of a tailor-made intervention for pregnancy-related pelvic girdle and/or low back pain after delivery: Short-term results of a randomized clinical trial [ISRCTN08477490]. *BMC Musculoskelet Disord.* 2006;7(1):1-13. doi:10.1186/1471-2474-7-19
79. Bjelland EK, Stuge B, Engdahl B, Eberhard-Gran M. The effect of emotional distress on persistent pelvic girdle pain after delivery: a longitudinal population study. *BJOG Int J Obstet Gynaecol.* 2013;120(1):32-40. doi:10.1111/1471-0528.12029
80. Gatchel RJ, Peng YB, Peters ML, Fuchs PN, Turk DC. The biopsychosocial approach to chronic pain: Scientific advances and future directions. *Psychol Bull.* 2007;133(4):581-624. doi:10.1037/0033-2909.133.4.581
81. Linton S, Boersma K, J. Early identification of patients at risk of developing a persistent back problem: the predictive validity of the Orebro Musculoskeletal Pain Questionnaire. *Clin Doi 101097000025080300000002.* 2003;19 SRC-GoogleScholar:80-86.
82. Linton SJ. A Review of Psychological Risk Factors in Back and Neck Pain. *Spine.* 2000;25(9):1148-1156.
83. Pincus T, Burton AK, Vogel S, Field AP. A Systematic Review of Psychological Factors as Predictors of Chronicity/Disability in Prospective Cohorts of Low Back Pain. *Spine.* 2002;27(5):E109.
84. Pincus T, Kent P, Bronfort G, Loisel P, Pransky G, Hartvigsen J. Twenty-Five Years With the Biopsychosocial Model of Low Back Pain—Is It Time to Celebrate? A Report From the Twelfth International Forum for Primary Care Research on Low Back Pain. *Spine.* 2013;38(24):2118-2123. doi:10.1097/BRS.0b013e3182a8c5d6
85. Breen TW, Ransil BJ, Groves PA, Oriol NE. Factors Associated with Back Pain after Childbirth. *Anesthesiol J Am Soc Anesthesiol.* 1994;18(1):29-34.
86. Sjødahl J, Gutke A, Öberg B. Predictors for long-term disability in women with persistent postpartum pelvic girdle pain. *Eur Spine J.* 2013;22(7):1665-1673. doi:10.1007/s00586-013-2716-6
87. Thorell E, Kristiansson P. Pregnancy related back pain, is it related to aerobic fitness? A longitudinal cohort study. *BMC Pregnancy Childbirth.* 2012;12(1):30. doi:10.1186/1471-2393-12-30
88. Turgut F, Turgut M, Çetinşahin M. A prospective study of persistent back pain after pregnancy|This study was presented in part at the 11th International Congress of Neurological Surgery, Amsterdam, The Netherlands, July 6–11, 1997.1. *Eur J Obstet Gynecol Reprod Biol.* 1998;80(1):45-48. doi:10.1016/S0301-2115(98)00080-3

89. Albert HB, Godskesen† M, Korsholm L, Westergaard JG. Risk factors in developing pregnancy-related pelvic girdle pain. *Acta Obstet Gynecol Scand.* 2006;85(5):539-544. doi:10.1080/00016340600578415
90. Bjelland EK, Eskild A, Johansen R, Eberhard-Gran M. Pelvic girdle pain in pregnancy: the impact of parity. *Am J Obstet Gynecol.* 2010;203(2):146.e1-146.e6. doi:10.1016/j.ajog.2010.03.040
91. Biering K, Nøhr EA, Olsen J, Andersen AMN, Hjøllund NH, Juhl M. Pregnancy-related pelvic pain is more frequent in women with increased body mass index. *Acta Obstet Gynecol Scand.* 2011;90(10):1132-1139. doi:10.1111/j.1600-0412.2011.01141.x
92. Mogren IM. BMI, pain and hyper-mobility are determinants of long-term outcome for women with low back pain and pelvic pain during pregnancy. *Eur Spine J.* 2006;15(7):1093-1102. doi:10.1007/s00586-005-0004-9
93. Bjelland EK, Stuge B, Vangen S, Stray-Pedersen B, Eberhard-Gran M. Mode of delivery and persistence of pelvic girdle syndrome 6 months postpartum. *Am J Obstet Gynecol.* 2013;208(4):298.e1-298.e7. doi:10.1016/j.ajog.2012.12.002
94. Mogren IM. Does caesarean section negatively influence the post-partum prognosis of low back pain and pelvic pain during pregnancy? *Eur Spine J.* 2007;16(1):115-121. doi:10.1007/s00586-006-0098-8
95. Loughnan BA, Carli F, Romney M, Doré CJ, Gordon H. Epidural analgesia and backache: a randomized controlled comparison with intramuscular meperidine for analgesia during labour. *Br J Anaesth.* 2002;89(3):466-472.
96. Mogren IM, Pohjanen AI. Low Back Pain and Pelvic Pain During Pregnancy: Prevalence and Risk Factors. *Spine.* 2005;30(8):983. doi:10.1097/01.brs.0000158957.42198.8e
97. Bergström C, Persson M, Nergård KA, Mogren I. Prevalence and predictors of persistent pelvic girdle pain 12 years postpartum. *BMC Musculoskelet Disord.* 2017;18:399. doi:10.1186/s12891-017-1760-5
98. Elden H, Gutke A, Kjellby-Wendt G, Fagevik-Olsen M, Ostgaard HC. Predictors and consequences of long-term pregnancy-related pelvic girdle pain: a longitudinal follow-up study. *BMC Musculoskelet Disord.* 2016;17(1):1-13. doi:10.1186/s12891-016-1154-0
99. Gutke A, Josefsson A, Oberg B. Pelvic girdle pain and lumbar pain in relation to postpartum depressive symptoms. *Spine J.* 2007;32(13 SRC-GoogleScholar):1430-1436.
100. Mens J, Vleeming A, Stoeckart R, Stam H, Snijders C. Understanding peripartum pelvic pain: Implications of a patient survey. *Spine Phila Pa Doi 101097000076320601000017 Discuss 13691370.* 1996;21(11 SRC-GoogleScholar):1363-1369.
101. Robinson HS, Mengshoel AM, Veierød MB, Vøllestad N. Pelvic girdle pain: Potential risk factors in pregnancy in relation to disability and pain intensity three months postpartum. *Man Ther.* 2010;15(6):522-528. doi:10.1016/j.math.2010.05.007
102. Röst CCM, Jacqueline J, Kaiser A, Verhagen AP, Koes BW. Prognosis of women with pelvic pain during pregnancy: a long-term follow-up study. *Acta Obstet Gynecol Scand.* 2006;85(7):771-777. doi:10.1080/00016340600626982
103. Bjelland EK, Owe KM, Stuge B, Vangen S, Eberhard-Gran M. Breastfeeding and pelvic girdle pain: a follow-up study of 10 603 women 18 months after delivery. *BJOG Int J Obstet Gynaecol.* 2015;122(13):1765-1771. doi:10.1111/1471-0528.13118
104. Mukkannavar P, Desai BR, Mohanty U, Kulkarni S, Parvatikar V, Daiwajna S. Pelvic girdle pain in Indian postpartum women: a cross-sectional study. *Physiother Theory Pract.* 2014;30(2):123-130. doi:10.3109/09593985.2013.816399

105. Ansara D, Cohen MM, Gallop R, Kung R, Schei B. Predictors of women's physical health problems after childbirth. *J Psychosom Obstet Gynecol.* 2005;26(2):115-125. doi:10.1080/01443610400023064
106. Zib M, Lim L, Walters W. Symptoms during the normal pregnancy: a prospective controlled study. *Aust N Z J Obstet Gynaecol.* 1999;39(4 SRC-GoogleScholar):401-410.
107. Mogren I. Perceived health, sick leave, psychosocial situation, and sexual life in women with low-back pain and pelvic pain during pregnancy. *Acta Obstet Gynecol Scand J.* 2006;85(6 SRC-GoogleScholar):647-656.
108. Bergström C, Persson M, Mogren I. Psychosocial and behavioural characteristics in women with pregnancy-related lumbopelvic pain 12 years postpartum. *Chiropr Man Ther.* 2019;27(1):34. doi:10.1186/s12998-019-0257-8
109. van de Pol G, van Brummen HJ, Bruinse HW, Heintz APM, van der Vaart CH. Is there an association between depressive and urinary symptoms during and after pregnancy? *Int Urogynecology J.* 2007;18(12):1409-1415. doi:10.1007/s00192-007-0371-3
110. Grotle M, Brox JI, Veierød MB, Glomsrød B, Lønn JH, Vøllestad NK. Clinical Course and Prognostic Factors in Acute Low Back Pain: Patients Consulting Primary Care for the First Time. *Spine.* 2005;30(8):976. doi:10.1097/01.brs.0000158972.34102.6f
111. Ronchetti I, Vleeming A, van Wingerden JP. Physical Characteristics of Women With Severe Pelvic Girdle Pain After Pregnancy: A Descriptive Cohort Study. *Spine.* 2008;33(5):E145-E151. doi:10.1097/BRS.0b013e3181657f03
112. Melzack R. From the gate to the neuromatrix. *Pain.* 1999;82(Supplement 1):S121-S126. doi:10.1016/S0304-3959(99)00145-1
113. Melzack R, Casey KL. Sensory motivational and central control determinants of pain a new conceptual model. In: *The Skin Senses.* Kenshalo D, editor. Thomas; 1968. <https://eurekamag.com/research/025/438/025438547.php>
114. Melzack R, Wall PD. Pain Mechanisms: A New Theory. *Science.* 1965;150(3699):971-979.
115. Williams AC de C, Craig KD. Updating the definition of pain. *Pain.* 2016;157(11):2420-2423. doi:10.1097/j.pain.0000000000000613
116. Stureson B, Udén G, Udén A. Pain Pattern in Pregnancy and "Catching" of the Leg in Pregnant Women With Posterior Pelvic Pain: *Spine.* 1997;22(16):1880-1883. doi:10.1097/00007632-199708150-00013
117. Östgaard HC. Assessment and treatment of low back pain in working pregnant women. *Semin Perinatol.* 1996;20(1):61-69. doi:10.1016/S0146-0005(96)80058-9
118. Nilsson-Wikmar L, Pilo C, Pahlbäck M, Harms-Ringdahl K. Perceived pain and self-estimated activity limitations in women with back pain post-partum. *Physiother Res Int.* 2003;8(1):23-35. doi:10.1002/pri.269
119. Dunn KM, Croft PR. Classification of Low Back Pain in Primary Care: Using "Bothersomeness" to Identify the Most Severe Cases: *Spine.* 2005;30(16):1887-1892. doi:10.1097/01.brs.0000173900.46863.02
120. Dunn KM, Croft PR. The importance of symptom duration in determining prognosis. *Pain.* 2006;121(1):126-132. doi:10.1016/j.pain.2005.12.012
121. Schmidt CO, Raspe H, Pflingsten M, et al. Back Pain in the German Adult Population: Prevalence, Severity, and Sociodemographic Correlates in a Multiregional Survey. *Spine.* 2007;32(18):2005-2011. doi:10.1097/BRS.0b013e318133fad8
122. Von Korff M, Ormel J, Keefe FJ, Dworkin SF. Grading the severity of chronic pain. *Pain.* 1992;50(2):133-149. doi:10.1016/0304-3959(92)90154-4

123. Fast A, Shapiro D, Ducommun EJ, Friedmann LW, Bouklas T, Floman Y. Low-back pain in pregnancy. *Spine*. 1987;12(4):368-371. doi:10.1097/00007632-198705000-00011
124. Hansen A, Jensen DV, Wormslev M, et al. [Pregnancy associated pelvic pain. II: Symptoms and clinical findings]. *Ugeskr Laeger*. 2000;162(36):4813-4817.
125. Olsson C, Nilsson-Wikmar L. Health-related quality of life and physical ability among pregnant women with and without back pain in late pregnancy. *Acta Obstet Gynecol Scand J*. 2004;83(4 SRC-GoogleScholar):351-357.
126. MANTLE MJ, GREENWOOD RM, CURREY HLF. BACKACHE IN PREGNANCY. *Rheumatology*. 1977;16(2):95-101. doi:10.1093/rheumatology/16.2.95
127. Maclennan AH, Maclennan SC. Symptom-giving pelvic girdle relaxation of pregnancy, postnatal pelvic joint syndrome and developmental dysplasia of the hip. *Acta Obstet Gynecol Scand*. 1997;76(8):760-764. doi:10.3109/00016349709024343
128. Mogren IM. Does caesarean section negatively influence the post-partum prognosis of low back pain and pelvic pain during pregnancy? *Eur Spine J*. 2007;16(1):115-121. doi:10.1007/s00586-006-0098-8
129. Rexelius N, Lindgren A, Torstensson T, Kristiansson P, Turkmen S. Sexuality and mood changes in women with persistent pelvic girdle pain after childbirth: a case-control study. *BMC Womens Health*. 2020;20(1):201. doi:10.1186/s12905-020-01058-7
130. Shepherd J. Symphysis pubis dysfunction: a hidden cause of morbidity. *Br J Midwifery*. 2005;13(5):301-307. doi:10.12968/bjom.2005.13.5.18092
131. Wang S, Dezinno P, Maranets I, Berman M, Caldwell-Andrews A, Kain Z. Low back pain during pregnancy: prevalence, risk factors, and outcomes. *Obstet Gynaecol*. 2004;104 SRC-GoogleScholar:65-70.
132. Barclay L, Everitt L, Rogan F, Schmied V, Wyllie A. Becoming a mother — an analysis of women’s experience of early motherhood. *J Adv Nurs*. 1997;25(4):719-728. doi:10.1046/j.1365-2648.1997.t01-1-1997025719.x
133. Nelson AM. Transition to Motherhood. *J Obstet Gynecol Neonatal Nurs*. 2003;32(4):465-477. doi:10.1177/0884217503255199
134. Rasmussen B, Hendriekx C, Clarke B, et al. Psychosocial issues of women with type 1 diabetes transitioning to motherhood: a structured literature review. *BMC Pregnancy Childbirth*. 2013;13(1):1-10. doi:10.1186/1471-2393-13-218
135. Crichton MA, Wellock VK. Pain, disability and symphysis pubis dysfunction: women talking. *Evid-Based Midwifery*. 2008;6(1):9-18.
136. Persson M, Winkvist A, Dahlgren L, Mogren I. “Struggling with daily life and enduring pain”: a qualitative study of the experiences of pregnant women living with pelvic girdle pain. *BMC Pregnancy Childbirth*. 2013;13(1):111. doi:10.1186/1471-2393-13-111
137. Engeset J, Stuge B, Fegran L. Pelvic girdle pain affects the whole life—a qualitative interview study in Norway on women’s experiences with pelvic girdle pain after delivery. *BMC Res Notes*. 2014;7:686. doi:10.1186/1756-0500-7-686
138. Wellock VK, Crichton MA. Understanding pregnant women’s experiences of symphysis pubis dysfunction: the effect of pain. *Evid-Based Midwifery*. 2007;5(2):40-47.
139. Ceprnja D, Chipchase L, Liamputtong P, Gupta A. “This is hard to cope with”: the lived experience and coping strategies adopted amongst Australian women with pelvic girdle pain in pregnancy. *BMC Pregnancy Childbirth*. 2022;22(1):96. doi:10.1186/s12884-022-04426-3
140. Srisopa P, Lucas R. Women’s Experience of Pelvic Girdle Pain After Childbirth: A Meta-Synthesis. *J Midwifery Womens Health*. 2021;66(2):240-248. doi:10.1111/jmwh.13167

141. Elden H, Lundgren I, Robertson E. The pelvic ring of pain: Pregnant women's experiences of severe pelvic girdle pain: An interview study. *Clin Nurs Stud.* 2014;2(2):p30. doi:10.5430/cns.v2n2p30
142. Fritel X, Tsegan YE, Pierre F, Saurel-Cubizolles MJ, "EDEN Mother-Child Cohort Study Group." Association of postpartum depressive symptoms and urinary incontinence. A cohort study. *Eur J Obstet Gynecol Reprod Biol.* 2016;198:62-67. doi:10.1016/j.ejogrb.2015.12.028
143. Gatchel RJ. Comorbidity of Chronic Pain and Mental Health Disorders: The Biopsychosocial Perspective. *Am Psychol.* 2004;59(8):795-805. doi:10.1037/0003-066X.59.8.795
144. Handa VL, Zyczynski HM, Burgio KL, et al. The impact of fecal and urinary incontinence on quality of life 6 months after childbirth. *Am J Obstet Gynecol.* 2007;197(6):636.e1-636.e6. doi:10.1016/j.ajog.2007.08.020
145. Long G, Yao ZY, Na Y, Ping Y, Wei S, Mingsheng T. Different types of low back pain in relation to pre- and post-natal maternal depressive symptoms. *BMC Pregnancy Childbirth.* 2020;20:551. doi:10.1186/s12884-020-03139-9
146. Virgara R, Maher C, Kessel GV. The comorbidity of low back pelvic pain and risk of depression and anxiety in pregnancy in primiparous women. *BMC Pregnancy Childbirth.* 2018;18(1):1-7. doi:10.1186/s12884-018-1929-4
147. Woolhouse H, Gartland D, Perlen S, Donath S, Brown SJ. Physical health after childbirth and maternal depression in the first 12 months post partum: Results of an Australian nulliparous pregnancy cohort study. *Midwifery.* 2014;30(3):378-384. doi:10.1016/j.midw.2013.03.006
148. Beck CT. Postpartum Depression: A Metasynthesis. *Qual Health Res.* 2002;12(4):453-472. doi:10.1177/104973202129120016
149. O'hara MW, Swain AM. Rates and risk of postpartum depression—a meta-analysis. *Int Rev Psychiatry.* 1996;8(1):37-54. doi:10.3109/09540269609037816
150. Hahn-Holbrook J, Cornwell-Hinrichs T, Anaya I. Economic and Health Predictors of National Postpartum Depression Prevalence: A Systematic Review, Meta-analysis, and Meta-Regression of 291 Studies from 56 Countries. *Front Psychiatry.* 2018;8:248. doi:10.3389/fpsy.2017.00248
151. Cooper PJ, Murray L. Postnatal depression. *BMJ.* 1998;316(7148):1884-1886. doi:10.1136/bmj.316.7148.1884
152. Dennis C. Can we identify mothers at risk for postpartum depression in the immediate postpartum period using the Edinburgh Postnatal Depression Scale? *J Affect Disord.* 2004;78(2):163-169. doi:10.1016/S0165-0327(02)00299-9
153. Wylie L, Hollins Martin CJ, Marland G, Martin CR, Rankin J. The enigma of post-natal depression: an update. *J Psychiatr Ment Health Nurs.* 2011;18(1):48-58. doi:10.1111/j.1365-2850.2010.01626.x
154. Nonacs R, Cohen LS. Postpartum Mood Disorders: Diagnosis and Treatment Guidelines. *J Clin Psychiatry.* 1998;59(suppl 2):34-40.
155. World Health Organization, ed. *International Classification of Functioning, Disability and Health: ICF.* World Health Organization; 2001.
156. O'Hara MW, McCabe JE. Postpartum Depression: Current Status and Future Directions. *Annu Rev Clin Psychol.* 2013;9(1):379-407. doi:10.1146/annurev-clinpsy-050212-185612
157. Canadian Perinatal Mental Health Collaborative. *Time for Action: Why Canada Needs A National Perinatal Mental Health Strategy Now More Than Ever.*; 2021. Accessed November 1, 2021. <https://cpmhc.ca/report>.

158. McCoy BS. Postpartum Depression: An Essential Overview for the Practitioner: *South Med J*. 2011;104(2):128-132. doi:10.1097/SMJ.0b013e318200c221
159. World Health Organization. *The World Health Report. 2001: Mental Health: New Understanding, New Hope.*; 2001.
160. Tanner JA, Hensel J, Davies PE, Brown LC, Dechairo BM, Mulsant BH. Economic Burden of Depression and Associated Resource Use in Manitoba, Canada. *Can J Psychiatry*. 2020;65(5):338-346. doi:10.1177/0706743719895342
161. Patten SB, Williams JVA, Lavorato DH, Wang JL, McDonald K, Bulloch AGM. Major Depression in Canada: What Has Changed over the Past 10 Years? *Can J Psychiatry*. 2016;61(2):80-85. doi:10.1177/0706743715625940
162. Robertson E, Grace S, Wallington T, Stewart DE. Antenatal risk factors for postpartum depression: a synthesis of recent literature. *Gen Hosp Psychiatry*. 2004;26(4):289-295. doi:10.1016/j.genhosppsych.2004.02.006
163. Yim IS, Tanner Stapleton LR, Guardino CM, Hahn-Holbrook J, Dunkel Schetter C. Biological and Psychosocial Predictors of Postpartum Depression: Systematic Review and Call for Integration. *Annu Rev Clin Psychol*. 2015;11(1):99-137. doi:10.1146/annurev-clinpsy-101414-020426
164. Currie SR, Wang J. More data on major depression as an antecedent risk factor for first onset of chronic back pain. *Psychol Med*. 2005;35(9):1275-1282. doi:10.1017/S0033291705004952
165. Fishbain DA, Cutler R, Rosomoff HL, Rosomoff RS. Chronic Pain-Associated Depression: Antecedent or Consequence of Chronic Pain? A Review. *Clin J Pain*. 1997;13(2):116-137.
166. Linton SJ, Shaw WS. Impact of Psychological Factors in the Experience of Pain. *Phys Ther*. 2011;91(5):700-711. doi:10.2522/ptj.20100330
167. Brown SJ, Conway LJ, FitzPatrick KM, et al. Physical and mental health of women exposed to intimate partner violence in the 10 years after having their first child: an Australian prospective cohort study of first-time mothers. *BMJ Open*. 2020;10(12):e040891. doi:10.1136/bmjopen-2020-040891
168. Abrams P, Cardozo L, Fall M, et al. The standardisation of terminology in lower urinary tract function: report from the standardisation sub-committee of the International Continence Society. *Urology*. 2003;61(1):37-49. doi:10.1016/S0090-4295(02)02243-4
169. Moosdorff-Steinhauser HFA, Berghmans BCM, Spaanderman MEA, Bols EMJ. Prevalence, incidence and bothersomeness of urinary incontinence in pregnancy: a systematic review and meta-analysis. *Int Urogynecology J*. 2021;32(7):1633-1652. doi:10.1007/s00192-020-04636-3
170. Serati M, Di Dedda MC, Bogani G, et al. Position in the second stage of labour and de novo onset of post-partum urinary incontinence. *Int Urogynecology J*. 2016;27(2):281-286. doi:10.1007/s00192-015-2829-z
171. Torrisi G, Minini G, Bernasconi F, et al. A prospective study of pelvic floor dysfunctions related to delivery. *Eur J Obstet Gynecol Reprod Biol*. 2012;160(1):110-115. doi:10.1016/j.ejogrb.2011.10.010
172. Moosdorff-Steinhauser HFA, Berghmans BCM, Spaanderman MEA, Bols EMJ. Prevalence, incidence and bothersomeness of urinary incontinence between 6 weeks and 1 year post-partum: a systematic review and meta-analysis. *Int Urogynecology J*. 2021;32(7):1675-1693. doi:10.1007/s00192-021-04877-w

173. Gartland D, Donath S, MacArthur C, Brown S. The onset, recurrence and associated obstetric risk factors for urinary incontinence in the first 18 months after a first birth: an Australian nulliparous cohort study: Urinary incontinence in the first 18 months after a first birth. *BJOG Int J Obstet Gynaecol.* 2012;119(11):1361-1369. doi:10.1111/j.1471-0528.2012.03437.x
174. MacArthur C, Wilson D, Herbison P, et al. Urinary incontinence persisting after childbirth: extent, delivery history, and effects in a 12-year longitudinal cohort study. *BJOG Int J Obstet Gynaecol.* 2016;123(6):1022-1029. doi:10.1111/1471-0528.13395
175. Coyne KS, Wein A, Nicholson S, Kvasz M, Chen CI, Milsom I. Comorbidities and personal burden of urgency urinary incontinence: a systematic review. *Int J Clin Pract.* 2013;67(10):1015-1033. doi:10.1111/ijcp.12164
176. Mannion CA, Vinturache AE, McDonald SW, Tough SC. The Influence of Back Pain and Urinary Incontinence on Daily Tasks of Mothers at 12 Months Postpartum. *PLOS ONE.* 2015;10(6):e0129615. doi:10.1371/journal.pone.0129615
177. Milsom I, Coyne KS, Nicholson S, Kvasz M, Chen CI, Wein AJ. Global Prevalence and Economic Burden of Urgency Urinary Incontinence: A Systematic Review. *Eur Urol.* 2014;65(1):79-95. doi:10.1016/j.eururo.2013.08.031
178. Mendes A, Hoga L, Gonçalves B, Silva P, Pereira P. Adult women's experiences of urinary incontinence: a systematic review of qualitative evidence. *JBIS Database Syst Rev Implement Rep.* 2017;15(5):1350-1408. doi:10.11124/JBISRIR-2017-003389
179. Sangsawang B, Sangsawang N. Stress urinary incontinence in pregnant women: a review of prevalence, pathophysiology, and treatment. *Int Urogynecology J.* 2013;24(6):901-912. doi:10.1007/s00192-013-2061-7
180. Camaron Institute. *Impacts of Incontinence in Canada: A Briefing Document for Policy Makers.* The Canadian Continence Foundation; 2014. Accessed October 25, 2021. <https://www.canadiancontinence.ca/pdfs/en-impact-of-incontinence-in-canada-2014.pdf>
181. Smith MD, Russell A, Hodges PW. Disorders of breathing and continence have a stronger association with back pain than obesity and physical activity. *Aust J Physiother.* 2006;52(1):11-16. doi:10.1016/S0004-9514(06)70057-5
182. Bush HM, Pagorek S, Kuperstein J, Guo J, Ballert KN, Crofford LJ. The Association of Chronic Back Pain and Stress Urinary Incontinence: A Cross-Sectional Study. *J Womens Health Phys Ther.* 2013;37(1):11-18. doi:10.1097/JWH.0b013e31828c1ab3
183. Eliasson K, Elfving B, Nordgren B, Mattsson E. Urinary incontinence in women with low back pain. *Man Ther.* 2008;13(3):206-212. doi:10.1016/j.math.2006.12.006
184. Kim JS, Kim SY, Oh DW, Choi JD. Correlation between the Severity of Female Urinary Incontinence and Concomitant Morbidities: A Multi-Center Cross-Sectional Clinical Study. *Int Neurourol J.* 2010;14(4):220-226. doi:10.5213/inj.2010.14.4.220
185. Smith MD, Russell A, Hodges PW. Do Incontinence, Breathing Difficulties, and Gastrointestinal Symptoms Increase the Risk of Future Back Pain? *J Pain.* 2009;10(8):876-886. doi:10.1016/j.jpain.2009.03.003
186. Connolly TJ, Litman HJ, Tennstedt SL, Link CL, McKinlay JB. The effect of mode of delivery, parity, and birth weight on risk of urinary incontinence. *Int Urogynecol J Pelvic Floor Dysfunct.* 2007;18(9):1033-1042. doi:10.1007/s00192-006-0286-4
187. Dasikan Z, Ozturk R, Ozturk A. Pelvic floor dysfunction symptoms and risk factors at the first year of postpartum women: a cross-sectional study. *Contemp Nurse.* 2020;56(2):132-145. doi:10.1080/10376178.2020.1749099

188. Davenport MH, Nagpal TS, Mottola MF, et al. Prenatal exercise (including but not limited to pelvic floor muscle training) and urinary incontinence during and following pregnancy: a systematic review and meta-analysis. *Br J Sports Med.* 2018;52(21):1397-1404. doi:10.1136/bjsports-2018-099780
189. Chukwu C. Correlation Between the Intensities of Pregnancy - Related Low Back Pain and Urinary Incontinence in Pregnant and Postpartum Women in Enugu, Nigeria. *Online J Health Allied Sci.* 2019;18(1). Accessed November 6, 2021. <https://www.ojhas.org/issue69/2019-1-11.html>
190. Åhlund S, Rothstein E, Rådestad I, Zwedberg S, Lindgren H. Urinary incontinence after uncomplicated spontaneous vaginal birth in primiparous women during the first year after birth. *Int Urogynecology J.* 2020;31(7):1409-1416. doi:10.1007/s00192-019-03975-0
191. Brown S, Lumley J. Maternal health after childbirth: results of an Australian population based survey. *Br J Obstet Gynaecol.* 1998;105(2):156-161. doi:10.1111/j.1471-0528.1998.tb10045.x
192. Perkins J, Hammer RL, Loubert PV. Identification and management of pregnancy-related low back pain. *J Nurse Midwifery.* 1998;43(5):331-340. doi:10.1016/S0091-2182(98)00032-9
193. Pierce H, Homer C, Dahlen H, King J. Pregnancy-related lumbopelvic pain: Listening to Australian women. *Nurs Res Pract J* 387428. 2012;2012 SRC-GoogleScholar.
194. Fredriksen EH, Moland KM, Sundby J. "Listen to your body." *Patient Educ Couns.* 2008;73(2):294-299. doi:10.1016/j.pec.2008.02.002
195. Katonis P, Kampouroglou A, Aggelopoulos A, et al. Pregnancy-related low back pain. *Hippokratia.* 2011;15(3):205-210.
196. Mantle MJ, Holmes J, Currey HLF. BACKACHE IN PREGNANCY II: PROPHYLACTIC INFLUENCE OF BACK CARE CLASSES. *Rheumatology.* 1981;20(4):227-232. doi:10.1093/rheumatology/20.4.227
197. Stuge B, Lærum E, Kirkesola G, Vøllestad N. The Efficacy of a Treatment Program Focusing on Specific Stabilizing Exercises for Pelvic Girdle Pain After Pregnancy: A Randomized Controlled Trial. *Spine.* 2004;29(4):351-359. doi:10.1097/01.BRS.0000090827.16926.1D
198. Cęprnja D, Chipchase L, Gupta A. The role of physiotherapy in managing pregnancy related pelvic girdle pain. *N Z J Physiother.* 2017;45(2):57-58. doi:http://dx.doi.org/10.15619/NZJP/45.2.01
199. Elden H, Ostgaard HC, Fagevik-Olsen M, Ladfors L, Hagberg H. Treatments of pelvic girdle pain in pregnant women: adverse effects of standard treatment, acupuncture and stabilising exercises on the pregnancy, mother, delivery and the fetus/neonate. *BMC Complement Altern Med.* 2008;8(1):34. doi:10.1186/1472-6882-8-34
200. Granath AB, Hellgren MSE, Gunnarsson RK. Water Aerobics Reduces Sick Leave due to Low Back Pain During Pregnancy. *J Obstet Gynecol Neonatal Nurs.* 2006;35(4):465-471. doi:10.1111/j.1552-6909.2006.00066.x
201. Haugland KS, Rasmussen S, Daltveit AK. Group intervention for women with pelvic girdle pain in pregnancy. A randomized controlled trial. *Acta Obstet Gynecol Scand.* 2006;85(11):1320-1326. doi:10.1080/00016340600780458
202. Mørkved S, Åsmund Salvesen K, Schei B, Lydersen S, Bø K. Does group training during pregnancy prevent lumbopelvic pain? A randomized clinical trial. *Acta Obstet Gynecol Scand.* 2007;86(3):276-282. doi:10.1080/00016340601089651

203. Nilsson-Wikmar L, Holm K, Öijerstedt R, Harms-Ringdahl K. Effect of Three Different Physical Therapy Treatments on Pain and Activity in Pregnant Women With Pelvic Girdle Pain: A Randomized Clinical Trial With 3, 6, and 12 Months Follow-up Postpartum: *Spine*. 2005;30(8):850-856. doi:10.1097/01.brs.0000158870.68159.d9
204. Pelvic Obstetric and Gynaecological Physiotherapy. Pregnancy-related Pelvic Girdle Pain-guidance for Health Professionals. Published online 2015. Accessed March 22, 2022. <http://pogp.csp.org.uk/publications/pregnancy-related-pelvic-girdle-pain-pgp-health-professionals>
205. Bastiaenen CH, de Bie RA, Vlaeyen JW, et al. Long-term effectiveness and costs of a brief self-management intervention in women with pregnancy-related low back pain after delivery. *BMC Pregnancy Childbirth*. 2008;8(1):19. doi:10.1186/1471-2393-8-19
206. Chaudhry S, Siddiqui FR, Shah IH. Effectiveness of core stabilization exercises along with postural correction in postpartum back pain -. *Rawal Med J*. 2013;38(3):256-259.
207. Gutke A, Sjødahl J, & Öberg B. Specific muscle stabilizing as home exercises for persistent pelvic girdle pain after pregnancy: A randomized, controlled clinical trial. *J Rehabil Med*. 2010;42(10):929-935. doi:10.2340/16501977-0615
208. Renard JA, Abraham-Justice K. Manual Therapy and Core Stabilization Exercises With Postpartum Pelvic Girdle Pain and Meralgia Paresthetica: A Case Report. *J Womens Health Phys Ther*. 2012;36(1):35-43. doi:10.1097/JWH.0b013e31824e0c1d
209. Stuge B, Holm I, Vøllestad N. To treat or not to treat postpartum pelvic girdle pain with stabilizing exercises? *Man Ther*. 2006;11(4):337-343. doi:10.1016/j.math.2005.07.004
210. Verstraete EH, Vanderstraeten G, Parewijck W. Pelvic Girdle Pain during or after Pregnancy: a review of recent evidence and a clinical care path proposal. *Facts Views Vis ObGyn*. 2013;5(1):33-43.

CHAPTER 2

2. RATIONALE, OBJECTIVES AND STUDY DESIGN

2.1 Context and Rationale for this Research

As with many western countries, chronic BP remains an ongoing and costly public health concern, in Canada.¹⁻⁵ Studies show that approximately 84% of the general adult population report BP at some point in their life^{6,7} and a considerable proportion (~20%) of the population go on to develop chronic BP that is long lasting and disabling.^{2,7} Chronic BP is the leading cause of activity limitation and work absenteeism in Canada and is associated with frequent healthcare utilization, with over 150,000 emergency department visits in 2010–2011.⁸ The consequent costs of chronic BP to the Canadian healthcare system was estimated to be \$6 to \$12 billion annually.⁹ Similar to the global picture, a higher burden of BP is recorded among Canadian women compared to men,^{1-5,10-12} and this burden may increase during pregnancy and potentially persist postpartum. According to a study by Weis et al,¹³ among 287 pregnant women in Ontario, Canada, about 52% of women reported having BP prior to pregnancy, which increased to 76.6% reporting some sort of BP during pregnancy. In a follow-up study, Tavares and colleagues,¹⁴ reported the prevalence of postpartum-related BP in the same Ontarian population (n=46-64), to be about 54%, 41% and 52% at birth-1 month, 1-3 months and 3-6 months postpartum, respectively. Some other studies have also reported similarly high (~ 42%-77%) proportions of women reporting BP at different times during pregnancy and up to 12 months postpartum.¹⁵⁻¹⁷ Hence, it is possible that BP during pregnancy and/or its persistence postpartum contributes to the chronic BP burden in Canada.

However, even though chronic low back disorder is recognized to be a significant public health issue in the general Canadian population, persistent BP after childbirth is relatively underexamined and understudied within the Canadian back pain landscape. Only few studies^{14,15} have specifically examined BP that persists among postpartum women. These studies show that a considerable proportion (ranging from 43% at 2 weeks to 77% at 12 months postpartum) of women report BP after childbirth. However, the reported estimates were based on a limited sample, and may not be considered nationally representative. Importantly, there appears to be no known country-wide

studies on the prevalence and associated factors of persistent BP postpartum within the Canadian context. This lack of information for such a large susceptible subpopulation forms the basis for this study.

Furthermore, the factors contributing to BP recovery or its persistence thereof, and the overall experience of women with pregnancy and postpartum-related BP are multifactorial and a biopsychosocial approach has been recommended to better evaluate BP and its impact on people's lives.¹⁸⁻²¹ However, studies explicitly evaluating the prevalence rates, risk factors, comorbidities and impact of persistent BP postnatally, using the biopsychosocial framework, has not been previously examined within a Canadian context. Furthermore, no studies exist that explore in depth women's experiences of living with BP, that developed into more chronic states (up to 18 months postpartum), in terms of the impact on various aspects of women's lives, coping response and access to healthcare, using qualitative methods. This information is crucial to better understand the burden of the BP in postpartum women and to inform relevant healthcare services and policies aimed at preventing and managing BP early before chronicity and longer-term disability sets in. This dissertation is an attempt to fill these gaps in the literature and situates itself within a broader body of knowledge to provide a better understanding of the burden of BP among postpartum women by evaluating the prevalence, risk factors, comorbidities and lived- experiences of the condition after childbirth. It is expected that the outcome of this research will expand the current knowledge base on BP to the postnatal population in Canada and help provide a better understanding of the burden of persistent pregnancy-related BP within this subpopulation. This knowledge can also inform the provision of more focused interventions, and policies that optimize maternity care both during and after pregnancy, which in the long run can contribute to reducing the prevalence of chronic back pain.

2.2 Research Aim and Objectives

The overarching aim of this dissertation was to examine the burden of persistent BP postpartum (including low back pain and/or pelvic girdle pain) among postpartum women in Canada, covering aspects of disease burden, including prevalence, risk factors, associated comorbidities, as well as lived experiences, to uncover the impact on affected women's postnatal health and wellbeing and to understand specific ways to better help them cope with the condition. The specific objectives of this thesis were to:

- i) To estimate the prevalence of BP, based on the perceived degree of problem, during the first 3 months postpartum and investigate the associated biopsychosocial risk factors in a national sample of postpartum women in Canada.
- ii) To evaluate the predictors of persistent BP at 5 to 14 months after childbirth in a nationally representative sample of postpartum women in Canada, based on the biopsychosocial framework.
- iii) To examine the association of persistent postpartum BP, based on perceived degree of problem and duration, and specific indicators of postnatal maternal morbidities, such as postpartum depression (PPD) and urinary incontinence (UI).
- iv) To explore recent mothers' (who have given birth within the last 18 months) experiences of living with BP that has persisted for more than 3 months postpartum, in terms of the perceived impact on various aspects of life, coping strategies, and perceived challenges to accessing needed healthcare and other resources to better manage back pain symptoms.

2.3 Methodology

2.3.1 Research design

A mixed methods research (MMR) design was employed to address the study objectives. In recent years, MMR has gained considerable acceptance among researchers, and is increasingly recognized as the third major research approach, along with quantitative and qualitative research.^{22–26} MMR is typically characterized by the systematic integration of both quantitative and qualitative research methods, within a single study at the design, methods, interpretation or reporting levels, with the aim of producing richer insights into the phenomenon being studied.^{22,26–32} Although the method is still the subject of several debates due to its complexity and relative newness, its contribution in various social and health sciences fields of research has been established in the literature.^{22,25–27} When properly designed, the approach is considered to be more advantageous over separate quantitative and qualitative studies because it allows a more synergistic use of data in a way that ameliorates the weaknesses inherent in each separate method, while maintaining their individual strengths³². It also allows a more holistic and contextualized insight into a research problem^{26,30,32,33} can contribute to the overall strength of the study through triangulation.^{26,31–33}

Within the context of this study, employing a mixed methods design enabled us to obtain representative data on persistent BP postpartum at a national population level in Canada, and at the same time, gain in-depth understanding into what living with persistent BP postpartum means for Canadian mothers who continue to have unresolved BP after childbirth. Our rationale is to produce a rich and robust account of BP occurrence and experiences in the postpartum; as such, the chosen methodology will allow me gain insight and knowledge that cannot be gained with one data source alone, while also ensuring that our study findings are grounded in participants' experiences.²² Ultimately, the overarching goal is to better understand the burden of BP in postpartum women in order to create knowledge that can be used in the future to inform maternity care practices and relevant policies that are more sensitive and targeted towards women's musculoskeletal needs both during and after pregnancy.

Specifically, in this study a convergent parallel MMR^{27,34} was used to quantitatively evaluate BP prevalence, biopsychosocial risk factors and comorbidities at a national level in Canada, as well as qualitatively explore in-depth recent mothers' experiences of living with persistent BP postpartum, including their perceived access to resources and healthcare for better management for their condition. In combination, the four studies/ manuscripts contained in this dissertation therefore provide breadth and depth of information about the burden of persistent or chronic BP among postpartum mothers in Canada and specific ways to better help them cope with this condition.

This thesis research work was completed in two parallel phases:

2.3.1.1 Phase I: Quantitative study— Secondary data analysis

Through secondary analysis of existing national level population-based survey from Statistics Canada, the Maternity Experiences Survey (MES 2005/2006), we addressed the first three objectives of this thesis. This entailed evaluation of aspects of disease burden relating to the prevalence rates of persistent BP during the first three months and at 5-14 months postpartum; the biopsychosocial risk factors associated with BP at these two postpartum periods (at birth-3 months and at 5-14 months); and the comorbidity of BP (based on degree of problem and duration postpartum) with select indicators of postpartum health and functioning such as postpartum depression (PPD) and urinary incontinence (UI).

2.3.1.2 Phase II: Qualitative study

In Phase II, we addressed the final objective of this thesis, which focused on additional aspects of disease burden that were not covered in the MES data. Through a descriptive phenomenological framework using semi-structured interviews, we qualitatively explored recent mothers' (within 18 months postpartum) experiences of living with persistent BP after childbirth, in terms of the perceived impact of BP on various aspects of their lives, coping strategies adopted, access to health care and other resources to manage persistent pain symptoms, including their opinions on how they and future mothers can be better supported to manage BP.

The emerging evidence from Phases I and II were then assessed for complementarity of information, following which, they were synthesized for a more holistic and meaningful interpretation of study results.

2.4 Study theoretical frameworks

This thesis was guided by the constructs of two theoretical frameworks commonly used in the study of chronic pain conditions, including chronic back pain, to gain a better understanding of the influences on postpartum BP and its impact among postpartum mothers in Canada: The biopsychosocial (BPS) model and WHO's International Classification of Functioning, Disability and Health (WHO-ICF).^{18,21}

2.4.1 The Biopsychosocial (BPS) framework

The Biopsychosocial (BPS) model was first proposed by Engel in 1977³⁵ and has since been advocated to be the approach of choice for a more holistic understanding, assessment and management of pain and pain-related disorders, such as chronic low back pain.^{18,20,21,36,37} The BPS model reflects the idea that pain is a multidimensional construct in which psychological and social factors are as equally important players as biological factors in the onset, severity and maintenance of pain and pain-related states.³⁸ Based on the BPS framework, BP and associated disability arise from dynamic inter-relationships among biological, psychological, and social components. In this way BP and chronic BP not only involve pathoanatomical changes, but also subjective experiences encompassing an individual's pain perceptions, beliefs, and responses—all of which, are influenced by social and environmental contexts in which the pain condition is experienced. As

such no clear boundaries are apparent between the biological, psychological, and social components, rather they interrelate and overlap with each other in determining the onset, severity, associated disability, and the transition from acute to chronic pain, as depicted in Figure 2.1.

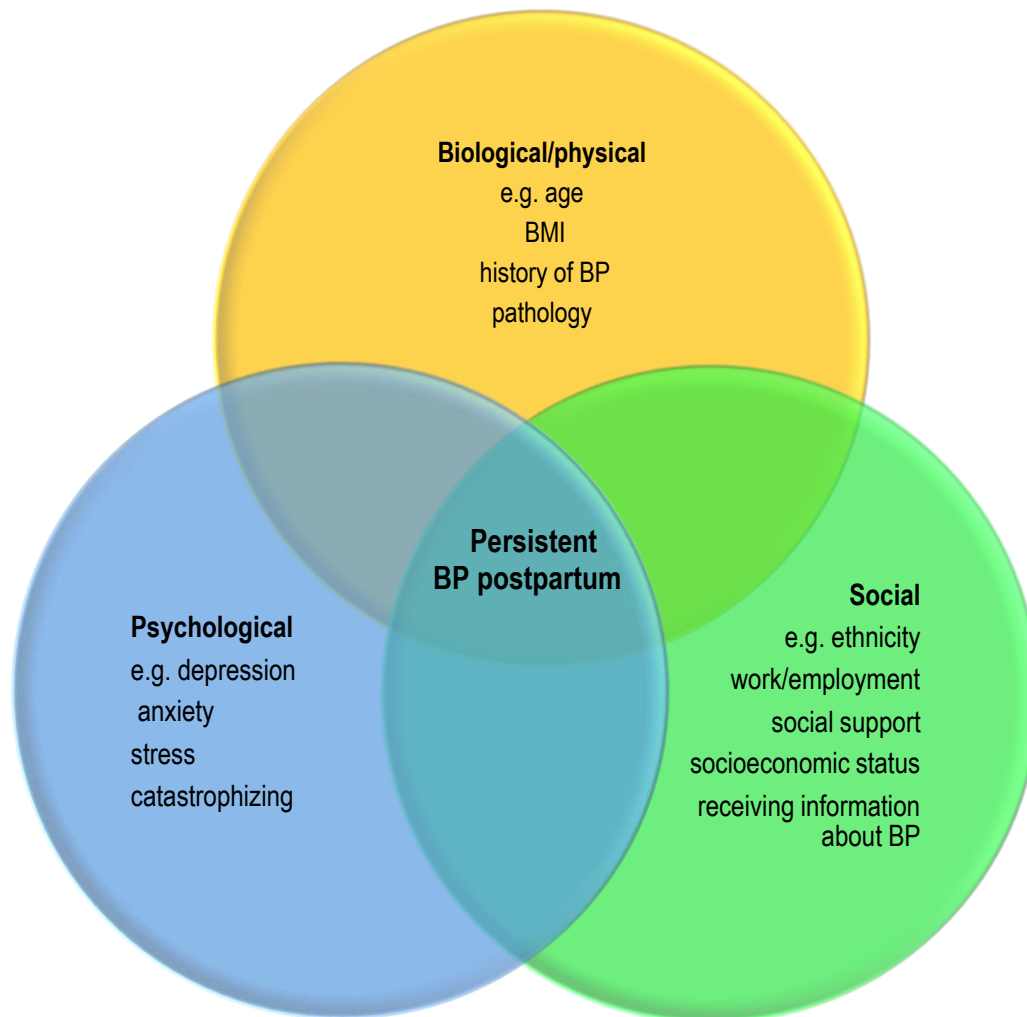


Figure 2.1: Conceptual framework for having persistent back pain postpartum. Adapted from (Waddell et al., 1987; Gatchel et al., 2007).^{18,20}

With regards to BP occurring in pregnant and postpartum populations, a variety of risk factors, including age, history of BP related or unrelated to pregnancy, pre-pregnancy BMI, muscular imbalances, joint stability, depression, anxiety, somatization, catastrophizing, passive coping strategies, faulty beliefs, social support, culture, socio economic status, heavy workload and comorbidities, have been linked to the onset and persistence of pain and disability.³⁹⁻⁴³ However,

studies examining a wide range in biopsychosocial factors in relation to persistent BP postpartum at a national population level are scarce. Within the Canadian context, only one prospective pilot study was found in which the prevalence of lumbopelvic pain up to 6 months postpartum was evaluated.⁴⁴ However, the study had limited statistical power (n= 58) and did not assess any psychosocial variables; having back pain during pregnancy was the only factor found to predict the persistent pain at both 3 and 6 months postpartum.⁴⁴ In the context of the present study, the BPS framework – in recognizing the complex nature of pain and accounting for the varying dimensions, including biological, psychological, and social influences on pain experience– situates itself as a valuable framework within which to conceptualize and describe postpartum BP and the impact it has on various aspects of women’s lives in Canada. Moreover, an evaluation of psychological and social variables, in addition to the biological factors influencing the persistence and chronicity of BP in postpartum populations, can provide information on potential targets for intervention, as well as inform more patient-centered care that focus on affected women’s unique pain experience.

2.4.2 International Classification of Functioning, Disability and Health (ICF)

The International Classification of Functioning, Disability and Health (ICF) was published by the WHO in 2001, to provide a uniform framework and comprehensive classification system to conceptualize and operationalize people’s experiences of a health condition.²¹ As a framework, the ICF acknowledges the complex interrelationships between biological, psychological, social and environmental variables involved in the creation of health and disability and reflects the interconnections between these components as bidirectional arrows, rather than unidirectional influences that assume disability to be a direct consequence of the presence of a health condition.^{21,45} (Figure 2.2).

Operationally, the ICF consists of essentially two components: a) *Functioning and Disability* which reflects interactions between body structures/functions, activity and participation; and b) *Contextual factors*, which comprise components of an individual’s environment and personal factors that influence their health experiences, and that may serve to either impede or facilitate overall health and wellness. According to the ICF framework, disability denotes the negative aspects of these dynamic interrelationships, and encompasses impairments in body function/structure, activity limitations (difficulties/inability to perform activities) and participation

restrictions (difficulties/inability to participate in life situations). In this way, the ICF reflects the biopsychosocial model of disability – integrating the bodily, psychosocial, and environmental influences on health and disability.^{46,47}

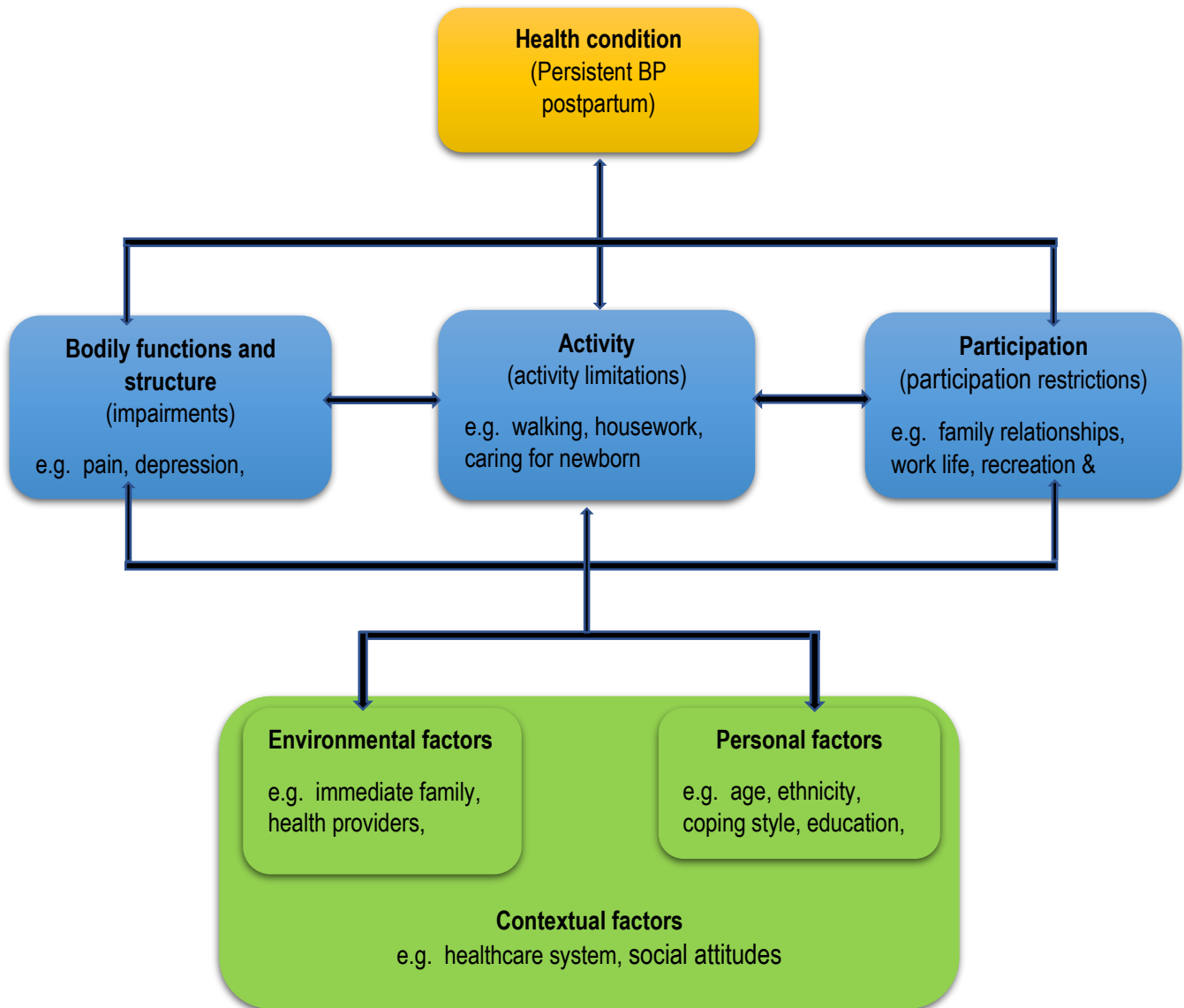


Figure 2.2: International Classification of Functioning, Disability and Health (ICF). Adapted from (World Health Organization, 2001).²¹

Applications of the ICF framework have been widely explored in various clinical and research fields⁴⁸⁻⁵⁰ and is now considered the gold standard in rehabilitation and disability studies related to chronic conditions, such as BP.⁵⁰⁻⁵³ Chronic back pain is considered a biopsychosocial phenomenon, where biological, psychological, social and environmental components interact to

influence the development and persistence of pain and disability.¹⁸ According to the ICF, people with chronic low back pain may experience varying levels of functional/ structural limitations e.g., pain sensation; activity limitations e.g., walking, bending, self-care; and participation restrictions e.g. participation in relationships, recreation or in the workplace. The contextual factors influencing functioning in chronic low back pain have also been described to include domains of the environment in which people live and conduct their lives, e.g., marital status and healthcare system; and personal factors e.g., educational level, age, fear of movement etc.^{51,54-57}

However, the impact of BP occurring in pregnant and postpartum populations and the nature of the kinds of challenges that women with persistent postpartum BP experience is yet to be described extensively within the Canadian context. No known studies exist in Canada that explore, from women's point of view, their experience of living with BP that developed into more chronic states and the impact it has on various aspects of their lives during and after pregnancy, coping strategies and challenges in accessing health care. This knowledge would allow us to gain a fuller understanding of the burden of persistent BP on women's postpartum health and wellbeing and the role of the multiple dimensions involved in recent mothers' experience of persistent BP in the immediate postpartum period and beyond. It will also provide insights into how to better support affected women to better manage persistent symptoms.

2.5 Thesis outline

Overall, this thesis is comprised of 7 distinct but interrelated chapters, to cover various aspects related to persistent BP postpartum and its impact on women's lives in Canada. Altogether, four manuscripts were produced: the first three papers, corresponding to Chapters 3, 4 & 5 of this thesis, present the results from the quantitative study, while the fourth paper, corresponding to Chapter 6, presents the qualitative results. An overview of the chapters is summarized below.

Chapter 1 provides a brief introduction to the problem of BP globally, and a review of the current literature on BP associated with pregnancy, childbirth and/or postpartum, highlighting important topics relating to the terminology, etiology, epidemiology, risk factors, comorbidities, consequences to health and functioning, course and prognosis and treatment modalities for BP.

Chapter 2 provides an overview of the rationale for this research work, including aims and objectives, overview of the chosen research methodology, theoretical frameworks guiding this thesis and ethical considerations and approvals to conduct this research.

Chapters 3 presents the results of a cross-sectional study that examines the prevalence and severity levels of self-reported BP among recent mothers in Canada, highlighting the biological, psychological, and social factors associated with BP problem status during the first three months postpartum.

Chapters 4 presents the results of the quantitative study examining the prevalence and biopsychosocial predictors associated with persistent BP at 5 to 14 months after childbirth among a national sample of mothers in Canada who had some degree of BP in the early postpartum period.

Chapter 5 presents the results of the quantitative study that assess the relationship between persistent BP and select outcome measures of postpartum health and wellbeing, such as postpartum depression (PPD) and persistent incontinence (UI). In addition to persistent BP, other associated risk factors of PPD and UI in the postpartum population in Canada were reported.

Chapter 6 presents the results of the qualitative study that examines recent mothers' experiences of living with persistent BP up to 18 months after childbirth, with emphasis on the perceived impact of persistent BP on various aspects of life, coping responses and experiences of accessing healthcare to manage pain post-delivery.

In the concluding chapter, **Chapter 7**, findings from the quantitative and qualitative analyses are synthesized for a more holistic and meaningful interpretation of the study results, while discussing the broader policy implications and recommendations based on the results. Also included in this section are discussions of potential avenues for further research.

2.6 Ethical considerations

Ethics approval was not required for Phase I (quantitative aspect) of our study as it is based on a secondary analysis of Statistics Canada's MES databases. Access to the MES microdata files were secured through the Saskatchewan Research Data Centre, a joint initiative between Statistics Canada, the Social Sciences and Humanities Research Council and the Canadian Institutes of

Health Research. The Ph.D. project approval (code number: Proj-18-SSH-SKY-5419) followed a rigorous security screening process, signing of the Oath of Office and Secrecy and the microdata research contract with Statistics Canada; and vetting procedure to ensure confidentiality and protection of survey participants' identities. See document in Appendix A.

For Phase II (qualitative part), the Behavioral and Biomedical Research Ethics Boards (REBs) at the University of Saskatchewan granted ethics approval to conduct the study with Project ID: 1126 (see appendix B). The right for informed consent was observed: participants in the semi-structured interviews were furnished with adequate information about the purpose and outcomes of the study; assurance of voluntary participation and/or withdrawal at any time during the study was stressed; and standard protocols was employed in ensuring data quality and confidentiality. Prospective participants were given the opportunity to ask as many questions as they desire until they fully understand the study goals and the implications of their participation. All participants provided oral informed consent to take part in the study.

2.7 References

1. Angarita-Fonseca A, Trask C, Shah T, Bath B. Stable prevalence of chronic back disorders across gender, age, residence, and physical activity in Canadian adults from 2007 to 2014. *BMC Public Health*. 2019;19(1):1121. doi:10.1186/s12889-019-7395-8
2. Bath B, Trask C, McCrosky J, Lawson J. A Biopsychosocial Profile of Adult Canadians with and without Chronic Back Disorders: A Population-Based Analysis of the 2009-2010 Canadian Community Health Surveys. *BioMed Res Int*. 2014;2014. doi:10.1155/2014/919621
3. Rapoport J, Jacobs P, Bell NR, Klarenbach S. Refining the measurement of the economic burden of chronic diseases in Canada. *Chronic Dis Can*. 2004;25(1):13-21.
4. Schopflocher D, Taenzer P, Jovey R. The prevalence of chronic pain in Canada. *Pain Res Manag J Can Pain Soc*. 2011;16(6):445-450.
5. Shupler MS, Kramer JK, Cragg JJ, Jutzeler CR, Whitehurst DGT. Pan-Canadian Estimates of Chronic Pain Prevalence From 2000 to 2014: A Repeated Cross-Sectional Survey Analysis. *J Pain*. 2019;20(5):557-565. doi:10.1016/j.jpain.2018.10.010
6. Gross DP, Ferrari R, Russell AS, et al. A Population-Based Survey of Back Pain Beliefs in Canada: *Spine*. 2006;31(18):2142-2145. doi:10.1097/01.brs.0000231771.14965.e4
7. Ramage-Morin P, Gilmour H. Chronic pain at ages 12 to 44. *Health Rep*. 2010;21(4 SRC-GoogleScholar):53-61.
8. Singer J. A snapshot of health care in Canada as demonstrated by top 10 lists, 2011. Toronto: Canadian Institute of Health Information. Published 2011. Accessed March 30, 2022. <https://fliphtml5.com/ebtr/rfyb/basic>
9. Bone and Joint Canada. Low Back Pain. Published November 10, 2015. Available from: <http://boneandjointcanada.com/low-back-pain/>

10. Currie SR, Wang J. Chronic back pain and major depression in the general Canadian population. *Pain*. 2004;107(1):54-60. doi:10.1016/j.pain.2003.09.015
11. Fournay DRM, Dettori JR, Hall HM, Hartl RM, McGirt MJM, Daubs MDM. A Systematic Review of Clinical Pathways for Lower Back Pain and Introduction of the Saskatchewan Spine Pathway. [Miscellaneous Article]. *Spine*. Published online October 2011. doi:10.1097/BRS.0b013e31822ef58f
12. Wong JJ, Côté P, Tricco AC, Watson T, Rosella LC. Effect of back problems on healthcare utilization and costs in Ontario, Canada: a population-based matched cohort study. *PAIN*. 2021;162(10):2521-2531. doi:10.1097/j.pain.0000000000002239
13. Weis CA, Barrett J, Tavares P, et al. Prevalence of Low Back Pain, Pelvic Girdle Pain, and Combination Pain in a Pregnant Ontario Population. *J Obstet Gynaecol Can*. 2018;40(8):1038-1043. doi:10.1016/j.jogc.2017.10.032
14. Tavares P, Barrett J, Hogg-Johnson S, et al. Prevalence of Low Back Pain, Pelvic Girdle Pain, and Combination Pain in a Postpartum Ontario Population. *J Obstet Gynaecol Can*. 2020;42(4):473-480. doi:10.1016/j.jogc.2019.08.030
15. Mannion CA, Vinturache AE, McDonald SW, Tough SC. The Influence of Back Pain and Urinary Incontinence on Daily Tasks of Mothers at 12 Months Postpartum. *PLOS ONE*. 2015;10(6):e0129615. doi:10.1371/journal.pone.0129615
16. Lardon E, St-Laurent A, Babineau V, Descarreaux M, Ruchat SM. Lumbopelvic pain, anxiety, physical activity and mode of conception: a prospective cohort study of pregnant women. *BMJ Open*. 2018;8(11):e022508. doi:10.1136/bmjopen-2018-022508
17. Charpentier K, Leboucher J, Lawani M, Toumi H, Dumas GA, Pinti A. Back pain during pregnancy and living conditions – a comparison between Beninese and Canadian women. *Ann Phys Rehabil Med*. 2012;55(3):148-159. doi:10.1016/j.rehab.2012.02.003
18. Gatchel RJ, Peng YB, Peters ML, Fuchs PN, Turk DC. The biopsychosocial approach to chronic pain: Scientific advances and future directions. *Psychol Bull*. 2007;133(4):581-624. doi:10.1037/0033-2909.133.4.581
19. Pincus T, Kent P, Bronfort G, Loisel P, Pransky G, Hartvigsen J. Twenty-Five Years With the Biopsychosocial Model of Low Back Pain—Is It Time to Celebrate? A Report From the Twelfth International Forum for Primary Care Research on Low Back Pain. *Spine*. 2013;38(24):2118-2123. doi:10.1097/BRS.0b013e3182a8c5d6
20. WADDELL G. 1987 Volvo Award in Clinical Sciences: A New Clinical Model for the Treatment of Low-Back Pain. *Spine*. 1987;12(7). https://journals.lww.com/spinejournal/Fulltext/1987/09000/1987_Volvo_Award_in_Clinical_Sciences__A_New.2.aspx
21. World Health Organization, ed. *International Classification of Functioning, Disability and Health: ICF*. World Health Organization; 2001.
22. Creswell JW. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. 4th ed. SAGE Publications; 2014.
23. Johnson RB, Onwuegbuzie AJ. Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educ Res*. 2004;33(7):14-26. doi:10.3102/0013189X033007014
24. Bryman A. *Social Research Methods*. 4th ed. Oxford University Press; 2012.
25. Tashakkori A, Teddlie C. *Mixed Methodology: Combining Qualitative and Quantitative Approaches*. Sage; 1998.

26. Tashakkori A, Johnson B, Teddlie C. *Foundations of Mixed Methods Research: Integrating Quantitative and Qualitative Approaches in the Social and Behavioral Sciences*. Second Edition. SAGE Publications, Inc; 2021.
27. Creswell JW, Plano Clark VL. *Designing and Conducting Mixed Methods Research*. Third Edition. SAGE; 2018.
28. Fetters MD. “Haven’t We Always Been Doing Mixed Methods Research?”: Lessons Learned From the Development of the Horseless Carriage. *J Mix Methods Res*. 2016;10(1):3-11. doi:10.1177/1558689815620883
29. Poth C, Munce SE. Commentary—Preparing today’s researchers for a yet unknown tomorrow: Promising practices for a synergistic and sustainable mentoring approach to mixed methods research learning. *Int J Mult Res Approaches*. 2020;(12(1)):56-64. doi:10.29034/ijmra.v12n1commentary
30. Maxwell JA. Expanding the History and Range of Mixed Methods Research. *J Mix Methods Res*. 2016;10(1):12-27. doi:10.1177/1558689815571132
31. Carter N, Bryant-Lukosius D, DiCenso A, Blythe J, Neville AJ. The Use of Triangulation in Qualitative Research. *Oncol Nurs Forum*. 2014;41(5):545-547. doi:10.1188/14.ONF.545-547
32. Plano Clark VL, Ivankova NV. *Mixed Methods Research: A Guide to the Field*. SAGE; 2016.
33. Venkatesh V, Brown SA, Bala H. Bridging the Qualitative-Quantitative Divide: Guidelines for Conducting Mixed Methods Research in Information Systems. *MIS Q*. 2013;37(1):21-54. doi:10.25300/MISQ/2013/37.1.02
34. Dawadi S, Shrestha S, Giri RA. Mixed-Methods Research: A Discussion on its Types, Challenges, and Criticisms. *J Pract Stud Educ*. 2021;2(2):25-36. doi:10.46809/jpse.v2i2.20
35. Engel G. The need for a new medical model: a challenge for biomedicine. *Science*. 1977;196(4286):129-136. doi:10.1126/science.847460
36. Gatchel RJ. Comorbidity of Chronic Pain and Mental Health Disorders: The Biopsychosocial Perspective. *Am Psychol*. 2004;59(8):795-805. doi:10.1037/0003-066X.59.8.795
37. Mescouto K, Olson RE, Hodges PW, Setchell J. A critical review of the biopsychosocial model of low back pain care: time for a new approach? *Disabil Rehabil*. Published online December 7, 2020:1-15. doi:10.1080/09638288.2020.1851783
38. Waddell G. Biopsychosocial analysis of low back pain. *Baillières Clin Rheumatol*. 1992;6(3):523-557. doi:10.1016/S0950-3579(05)80126-8
39. Wiezer M, Hage-Fransen MAH, Otto A, et al. Risk factors for pelvic girdle pain postpartum and pregnancy related low back pain postpartum; a systematic review and meta-analysis. *Musculoskelet Sci Pract*. 2020;48:102154. doi:10.1016/j.msksp.2020.102154
40. Wu W, Meijer O, Uegaki K, Spine J. Pregnancy-related pelvic girdle pain (PGP), I: terminology, clinical presentation, and prevalence. *Eur*. 2004;13 SRC-GoogleScholar:575-589.
41. Simonds AH, Abraham K, Spitznagle T. Clinical Practice Guidelines for Pelvic Girdle Pain in the Postpartum Population. *J Womens Health Phys Ther*. 2022;46(1):E1-E38. doi:10.1097/JWH.0000000000000236
42. O’Sullivan PB, Beales DJ. Diagnosis and classification of pelvic girdle pain disorders--Part 1: a mechanism based approach within a biopsychosocial framework. *Man Ther*. 2007;12(2):86-97. doi:10.1016/j.math.2007.02.001

43. Olsson CB, Grooten WJA, Nilsson-Wikmar L, Harms-Ringdahl K, Lundberg M. Catastrophizing During and After Pregnancy: Associations With Lumbopelvic Pain and Postpartum Physical Ability. *Phys Ther.* 2012;92(1):49-57. doi:10.2522/ptj.20100293
44. Tavares P, Barrett J, Hogg-Johnson S, et al. Prevalence of Low Back Pain, Pelvic Girdle Pain, and Combination Pain in a Postpartum Ontario Population. *J Obstet Gynaecol Can.* 2020;42(4):473-480. doi:10.1016/j.jogc.2019.08.030
45. Badley EM. Enhancing the conceptual clarity of the activity and participation components of the International Classification of Functioning, Disability, and Health. *Soc Sci Med.* 2008;66(11):2335-2345. doi:10.1016/j.socscimed.2008.01.026
46. Stucki G, Cieza A, Melvin J. The international classification of functioning, disability and health (ICF): A unifying model for the conceptual description of the rehabilitation strategy. *J Rehabil Med.* 2007;39(4):279-285. doi:10.2340/16501977-0041
47. Üstün TB, Chatterji S, Bickenbach J, Kostanjsek N, Schneider M. The International Classification of Functioning, Disability and Health: a new tool for understanding disability and health. *Disabil Rehabil.* 2003;25(11-12):565-571. doi:10.1080/0963828031000137063
48. Stucki G. International Classification of Functioning, Disability, and Health (ICF): A Promising Framework and Classification for Rehabilitation Medicine. *Am J Phys Med Rehabil.* 2005;84(10):733-740. doi:10.1097/01.phm.0000179521.70639.83
49. Stucki G, Cieza A, Ewert T, Kostanjsek N, Chatterji S, Üstün TB. Application of the International Classification of Functioning, Disability and Health (ICF) in clinical practice. *Disabil Rehabil.* 2002;24(5):281-282. doi:10.1080/09638280110105222
50. Ewert T, Üstün TB, Chatterji S, Kostanjsek N, Stucki G, Cieza A. Development of ICF Core Sets for patients with chronic conditions. *J Rehabil Med.* 2004;36(0):9-11. doi:10.1080/16501960410015353
51. Stier-Jarmer M, Cieza A, Borchers M, Stucki G. How to Apply the ICF and ICF Core Sets for Low Back Pain. *Clin J Pain.* 2009;25(1):29-38. doi:10.1097/AJP.0b013e31817bcc78
52. Cieza A, Stucki G. Understanding functioning, disability, and health in rheumatoid arthritis: the basis for rehabilitation care. *Curr Opin Rheumatol.* 2005;17(2):183-189. doi:10.1097/01.bor.0000151405.56769.e4
53. World Health Organization, ed. *The Burden of Musculoskeletal Conditions at the Start of the New Millennium: Report of a WHO Scientific Group ; [a WHO Scientific Group on the Burden of Musculoskeletal Conditions at the Start of the New Millennium Met in Geneva from 13 to 15 January 2000]*. World Health Organization; 2003.
54. Manek NJ, MacGregor AJ. Epidemiology of back disorders: prevalence, risk factors, and prognosis. *Curr Opin Intern Med.* 2005;4(3):324-330. doi:10.1097/01.bor.0000154215.08986.06
55. Cieza A, Weigl M, Disler P, et al. ICF Core Sets for low back pain. *J Rehabil Med.* 2004;36(0):69-74. doi:10.1080/16501960410016037
56. Pincus T, Burton AK, Vogel S, Field AP. A Systematic Review of Psychological Factors as Predictors of Chronicity/Disability in Prospective Cohorts of Low Back Pain. *Spine.* 2002;27(5):E109.
57. Fishbain DA, Cutler R, Rosomoff HL, Rosomoff RS. Chronic Pain-Associated Depression: Antecedent or Consequence of Chronic Pain? A Review. *Clin J Pain.* 1997;13(2):116-137.

CHAPTER 3

3. MANUSCRIPT 1

3.1 General Information

3.1.1 Title

Prevalence and associated biopsychosocial factors of back pain during the first three months postpartum among postpartum mothers in Canada: a population-based survey.

3.1.2 Citation

Awe O., Bath B., Farag M. Prevalence and associated biopsychosocial factors of back pain during the first three months postpartum among postpartum mothers in Canada: a population-based survey. *Manuscript in preparation for submission.*

The PhD candidate, Awe O, contributed to conceiving and designing the study. She led and completed the RDC project approval submissions, conducted the data analysis and results interpretation, and prepared the manuscript.

3.2 Abstract

Background: Back pain (BP) is common among postpartum women and is a significant public health concern. The country-wide prevalence of back pain in the Canadian postpartum population remains unknown. This study aimed to determine the prevalence of back pain during the first three months postpartum and associated biopsychosocial factors at a national population level in Canada.

Methods: We used data from the 2006 Maternity Experiences Survey (MES; n=5,925; weighted N=70,320). Weighted estimates of prevalence were calculated, and partial proportional odds models (PPOMs) were developed to investigate the relationship between back pain status and select biopsychosocial factors.

Results: Overall, 36% (24.3% “somewhat of a problem”; 11.7% “a great deal of a problem”) of mothers reported back pain to be a problem during the first three months postpartum. The PPOM showed that factors associated with reporting more problematic pain status were: younger maternal age; immigrant status; underweight or obese pre-pregnancy BMI; vaginal birth; lower self-rated health; higher perceived stress; higher number of stressful life events; inadequate social support after childbirth; history of violent abuse; pre-pregnancy depression; province of residence; lower educational attainment; lower household income; and perceived inadequate information about BP during pregnancy.

Conclusion: More than a third of mothers continue to experience problematic back pain for up to 3 months after giving birth. Several biopsychosocial factors were associated with prevalent problematic pain, highlighting the need for maternity care services and policies in Canada to employ multidimensional strategies to identify and manage perinatal back problems early to avoid chronicity of symptoms, especially among vulnerable groups.

Keywords: low back pain, pelvic girdle pain, pregnancy, postpartum, biopsychosocial

3.3 Introduction

Globally, back pain (BP), particularly, low back pain (LBP) is considered a major public health concern and remains a nuisance to individuals, and the society and is associated with significant economic burden, both in terms of direct healthcare costs and indirect costs of lost productivity and wages and reduced quality of life.¹⁻⁴ In general, higher LBP prevalence rates is consistently reported among women than men.¹⁻⁴ However, it has been reported that among females, there is a higher likelihood to develop LBP while pregnant and that LBP burden disproportionately affects pregnant and parous women compared to women in the general population with the same mean age.⁵⁻⁷ Hence, the pregnancy and postpartum states are considered significant risk factors for onset of LBP and as well as chronic LBP later in life.⁸

BP during pregnancy and postpartum has been reported globally,⁹⁻¹² and is considered the most common musculoskeletal complaint in puerperal women. Overall, it is estimated that at least 50% of all pregnant women experience some level of BP, including pelvic girdle pain, low back pain or a combination of both pains, at some point during their pregnancy.¹²⁻¹⁵ BP generally has a good prognosis and the majority of women recover spontaneously within 3 months after

delivery;^{10,12,16,17} however, a substantial number of women (2%-75%) continue to have persistent pain for several months or even years postpartum.^{12,18-23} Furthermore, some women may develop BP newly immediately after childbirth, or during the postpartum period, partly in relation to repeated body movements such as lifting, bending, and carrying associated with caring for a new baby.^{17,24-28} The etiology of BP remains unclear, and several risk factors are proposed to contribute to its persistence/non-recovery after childbirth.^{12,24,29-31} Persistent BP after childbirth can have significant physical, psychological and economic ramifications for affected women, their families and the society. Moreover, the early postpartum period is inherently challenging for many women, especially first-time mothers, who must adjust to the demands of motherhood and caring for their newborn, amidst evolving psychosocial and social contexts.^{32,33} Thus, delayed back pain recovery after childbirth can place additional strain on women, with implications for their mental and overall health, their relationships, and the ability to optimally care for their children.³⁴⁻³⁶ Studies show that persistent BP, besides interfering with daily life,^{34,35,37} is associated with a greater risk of postpartum depression,^{38,39} poorer health status,^{38,40} poorer self-rated quality of life^{40,41} sexual dissatisfaction,^{40,42} loss of work productivity, and higher healthcare use.⁴³⁻⁴⁵ Persistent BP postpartum can also contribute to chronic pain later in life, whereby 10-30% of women with chronic BP in a general population have been reported to relate their pain onset to a previous pregnancy and /or childbirth.^{6,46}

In Canada, recurrent/chronic back disorder continues to be a common and costly health issue, with an estimated \$6 to \$12 billion spent on back pain-related disorders annually.^{3,47-56} Persistent BP postpartum may contribute to this burden, however, BP that persists postpartum is relatively underexamined and understudied within the Canadian back pain research landscape. Only few studies were found to have examined BP after childbirth,^{23,57} with prevalence rates as high as 52% reported up to 6 months postpartum,²³ and 77% at one year after childbirth.⁵⁷ However, these studies used a limited sample (small sample size, convenience sampling or considered a specific geographical setting), making it problematic to generalize their findings. Furthermore, none of the studies examined psychological factors in relation to persistent BP, despite a growing evidence that such factors play a critical role in the onset and maintenance of BP in general and pregnant populations, and especially in the transition from acute to chronic pain.⁵⁸⁻⁶³ The biopsychosocial (BPS) model has been recommended as a robust conceptual framework to better understand and

manage chronic back problems, since it recognizes that BP and associated disability result from dynamic inter-relationships among biological, psychological, and social factors, which therefore should be considered when planning and implementing interventions.^{61,62,64–66} Thus, examining both BP prevalence in the early postnatal period and a wide range of associated risk factors, using the BPS framework, at a national population level in Canada is crucial to gain a better understanding of BP in early postpartum and also inform relevant programs and policies to identify and address back problems early before symptoms become chronic. This study aims to determine the prevalence and potential biological, psychological, and social factors associated with reporting BP in the first three months postpartum, among a nationally representative sample of postpartum mothers in Canada.

3.4 Methods

3.4.1 Data source

Secondary data from the 2005/2006 Canadian Maternity Experiences Survey (MES) was used in this study. The MES is a national cross-sectional survey conducted by Statistics Canada in partnership with the Public Health Agency of Canada as part of the Canadian Perinatal Surveillance System.⁶⁷ The MES enrolled respondents from the 2006 census using simple stratified random sampling based on province/ territory of residence, maternal age (<20 or >20), and urban/rural dwelling to ensure vulnerable groups were adequately represented. Overall, 6,421 respondents representing 76,508 Canadian mothers aged 15 years or older who had a singleton live birth in Canada and were living with their baby at the time of the survey responded to the MES, and agreed to share their data, yielding a usable response rate of 78%.^{67,68} Data collection was conducted using structured computer-assisted telephone interview by female Statistics Canada interviewers between 5 to 14 months postpartum, with most women (96.9%) interviewed at five to 9 months postpartum. The MES is the only nationally representative data source in Canada that collected comprehensive information on women's experiences during pregnancy, birth, and the postpartum period, including representative information on various psychosocial, socio-demographic characteristics and postpartum health indicators. Details of the study design and methodology are presented elsewhere.^{67,68}

3.4.2 Variables

The outcome of interest was the degree to which respondents perceived their back pain to be a problem during the first three months postpartum, using the MES question: *During the first three months after the birth of your baby, how much of a problem was back pain: ... 1) not a problem, 2) somewhat of a problem, and 3) a great deal of a problem?*

Independent variables for this study were chosen based on availability within the MES dataset and aligned with the biopsychosocial model.^{12,17,31,61,64,69} For meaningful interpretation of results, selected variables were grouped into three main clusters reflecting the biopsychosocial model: a) biological/ physical factors, b) psychological factors, and c) social factors. See selected variables and their categories in Table 1. See full description of the study variables in Appendix C.

Table 3.1. Variables included in the analysis	
Variable cluster	Variable
Biological/physical factors	Maternal age in years (below 20, 20-29, ≥ 30+) Current BMI (underweight, normal weight, overweight, obese) Parity (primiparous, multiparous) Final mode of delivery (vaginal, caesarean) Health problems during pregnancy (no, yes)
Psychological factors	Maternal self-rated health (good-to-excellent, fair-to-poor) Perceived stress on most days (not stressed, somewhat/very stressed) Perceived social support during pregnancy (adequate, inadequate) Perceived social support postpartum (adequate, inadequate) History of violent abuse (no, yes) Pre-pregnancy depression (no, yes)
Social factors	Marital status (has a partner, no partner) Immigrant status (Canadian-born, immigrant) Aboriginal status (no, yes) Maternal region of residence (Atlantic, Quebec, Ontario, Prairies, British Columbia, Territories) Place of residence (rural, urban ≤ 499,999, urban ≥ 500,000) Maternal level of education (Less than high school cert., high school graduate, some post-secondary, bachelor's degree or higher) Household annual income (less than \$20,000, \$20,000 to \$39,999, \$40,000 to \$59,999, \$60,000 to \$79,999, \$80,000 to \$99,999, \$100,000 or more, unknown)

	Worked paid job during pregnancy (no, yes)
	Prenatal class attendance (no, yes)
	Perceived inadequate information about BP during pregnancy (no, yes)
	Cigarette smoking during pregnancy (no, yes)
	Alcohol consumption during pregnancy (no, yes)
	Use of street drugs during pregnancy (no, yes)

3.4.3 Statistical analysis

The prevalence of degree of back pain problem (not a problem, somewhat of a problem, and a great deal of a problem) were calculated using population weights. Also, chi-squared tests were used to assess the differences in the independent variables' distribution across the reported back problems groups.

Given the ordinal nature of the outcome variable, partial proportional odds models (PPOM) were used to evaluate prevalent back problem status associations with selected biological/physical, psychological, and social factors. The PPOM is a generalized ordered logit model that serves as a bridge between the restrictive ordered logit model, which requires independent variables to have the same or comparable effect across the outcome categories (i.e., the proportional odds assumption); and the multinomial model, which ignores the ordinal nature of the dependent variable, leading to loss of information.^{70,71} The PPOM allows the possibility for some explanatory variables to vary in their effect (i.e., regression coefficient) if the proportional odds assumption is violated while maintaining the constraint for those variables that satisfy the assumption.^{70,71}

For this study, the proportional odds assumption was tested for each independent variable, using the `gologit2` package (with `AUTOFIT` option) in STATA; an insignificant test statistic ($P > 0.05$) indicates that a variable does not violate the proportional odds assumption.⁷² Manual backward model selection strategy was then employed to build the final multivariable model ($p < 0.05$), starting with the full model comprising all eligible variables that had a significant relationship with back problem status at the $p < 0.25$ level in the univariable analysis and excluding variables one at a time starting from the highest p-value based on a significance level of $p < 0.05$.^{70,73} As variables were excluded, confounding was assessed at each step using a change of at least 20% in the regression coefficient of any model variable caused by an excluded variable. All possible two-way interactions between significant variables in the final main effects model were also explored using

a 0.05 significance level.⁷³ To assess the robustness of the PPOM, the adjusted model was compared (using *gologit2* package) to a fully constrained model in which the proportional odds assumption was imposed for all variables (same as ordered logit model) and an unconstrained model in which the proportional odds assumption was fully relaxed for all variables (same as multinomial model).⁷⁴ The model with the smallest Akaike's Information Criterion (AIC) was selected as most parsimonious, and providing the best fit for the data. Furthermore, model specification link test was done to detect model specification errors, while threshold parameter test assessed if the cut points or thresholds dividing the outcome variable are well-placed along the continuous scale of the unobserved propensity to report back problem, which would indicate that the outcome categories are indeed ordinal in nature.^{73,75} For all analysis probability weights and bootstrap weights (n=1000) provided by Statistics Canada were applied to account for the unequal probability of selection, as well as the complex survey design of the MES.⁷⁶ Missing data for the selected variables, including responses of 'not stated', 'do not know', 'refusal', and 'not applicable' (total n=7.7%) were excluded from the analysis, except for income for which a separate category "missing" was generated to minimize significant drop in sample size. All analyses were carried out using the STATA 15 software.

3.4.4 Ethics

Approval to conduct secondary analysis of the confidential MES microdata files was granted through the Saskatchewan Statistics Canada Research Data Center (SKY-RDC), following a rigorous security screening process, approval of the research proposal, and vetting procedure to ensure confidentiality and protection of survey participants' identities. Research conducted using SKY-RDC data is exempt from institutional Research Ethics Board review.

3.5 Results

After excluding missing data, the final analytical sample comprised 5,925 mothers, weighted to represent 70,320 private-dwelling Canadian mothers aged 15 years and over. Majority (51%) of the mothers were aged 30 years and above and 66.3% have had more than one pregnancy (multiparous).

3.5.1 Prevalence of BP in the first 3 months postpartum

Overall, 36% of the sample, weighted to represent 25,321 Canadian mothers, reported some degree of back problem; 24.3% described their pain as being “somewhat of a problem” and 11.7% as “a great deal of a problem” (Figure 3.1). There were significant differences in the distribution of the selected biopsychosocial variables by back problem status ($p < 0.05$), except for maternal parity ($p = 0.49$) and alcohol consumption during pregnancy ($p = 0.33$). A summary of participant attributes and data on the distribution of back problem status according to the selected biopsychosocial factors are presented below in Tables 3.2-3.4.

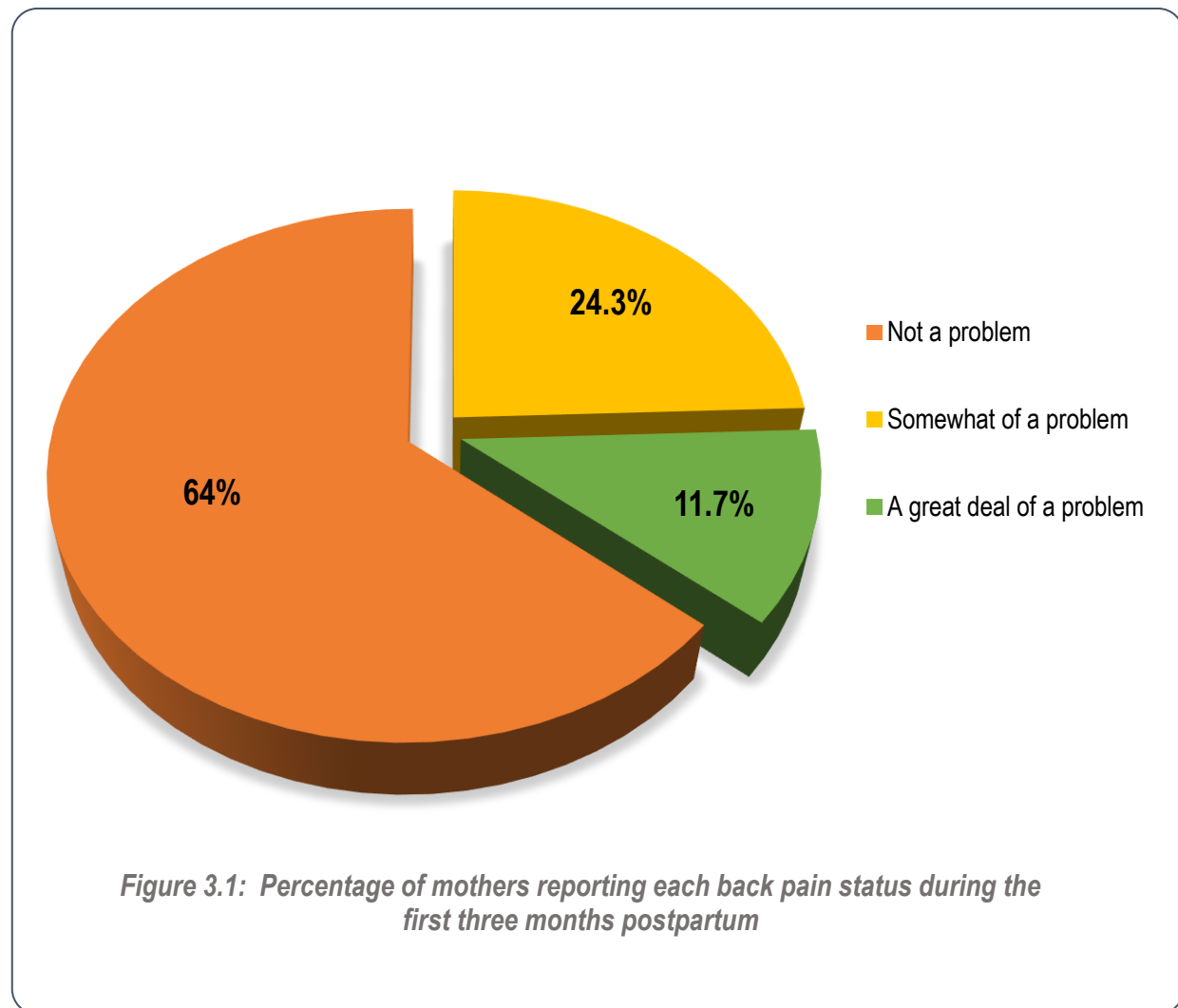


Table 3.2: Sample characteristics and distribution of selected biological/physical factors according to reported back problem status (MES 2005/06; Weighted N =70,320)

	Respondents	Degree of problem with back pain in the first 3 months postpartum			
	N (%) *	None (%) *	Somewhat (%) *	A great deal (%) *	χ ² test (p-value) †
Overall	70,320 (100.0)	n= 44,999 (64.0)	n= 17,103 (24.3)	n= 8,218 (11.7)	
Maternal age at selected birth (years)					0.001
<20	1,957 (2.8)	1,025 (52.4)	516 (26.4)	416 (21.2)	
20 to 29	32,511 (46.2)	20,644 (63.5)	7,922 (24.4)	3,945 (12.1)	
≥ 30	35,852 (51.0)	23,329 (65.1)	8,665 (24.2)	3,857 (10.8)	
Maternal pre-pregnancy BMI (kg/m ²)					0.01
Underweight	4,201 (6.0)	2,273 (54.1)	1,242 (29.6)	686 (16.3)	
Normal weight	41,591 (59.1)	27,378 (65.8)	9,808 (23.6)	4,405 (10.6)	
Overweight	14,764 (21.0)	9,641 (65.3)	3,463 (23.5)	1,660 (11.2)	
Obese	9,764 (13.9)	5,706 (58.4)	2,591 (26.5)	1,467 (15)	
Maternal parity (missing= 52)					0.49
Primiparous	23,624 (33.6)	15,294 (64.7)	5,509 (23.3)	2,821 (11.9)	
Multiparous	46,644 (66.3)	29,684 (63.6)	11,564 (24.8)	5,397 (11.6)	
Final mode of delivery					0.02
Vaginal	51,800 (73.7)	32,604 (62.9)	13,064 (25.2)	6,132 (11.8)	
Cesarean	18,520 (26.3)	12,395 (66.9)	4,039 (21.8)	2,086 (11.3)	
Health problems during pregnancy (missing= 33)					0.005
No	53,099 (75.5)	34,315 (64.6)	13,026 (24.5)	5,758 (10.8)	
Yes	17,188 (24.4)	10,672 (62.1)	4,078 (23.7)	2,439 (14.2)	

* Sample size is estimated using population weights. BMI: body mass index

† Chi-squared test comparing the categorical independent variables according to back pain status.

Table 3.3: Sample characteristics and distribution of selected psychological factors according to reported back problem status (MES 2005/06; Weighted n =70,320)

	Respondents	Degree of problem with back pain in the first 3 months postpartum			
	N (%) *	None (%) *	Somewhat (%) *	A great deal (%) *	χ^2 test (p-value) †
Overall	70,320 (100.0)	n= 44,999 (64.0)	n= 17,103 (24.3)	n= 8,218 (11.7)	
Maternal self-rated health					0.000
Good to excellent	66,697 (94.8)	43,264 (64.9)	16,196 (24.3)	7,237 (10.9)	
Fair to poor	3,623 (5.2)	1,735 (47.9)	907 (25.0)	981 (27.1)	
Perceived stress on most days					0.000
Not stressed	30,186 (42.9)	20,950 (69.4)	6,412 (21.2)	2,823 (9.4)	
Somewhat/very stressed	40,134 (57.1)	24,049 (59.9)	10,691 (26.6)	5,394 (13.4)	
Number of stressful life events					0.000
None	27,565 (39.2)	18,895 (68.6)	6,038 (21.9)	2,632 (9.5)	
One	19,912 (28.3)	12,622 (63.4)	5,164 (25.9)	2,126 (10.7)	
Two	11,087 (15.8)	7,073 (63.8)	2,676 (24.1)	1,338 (12.1)	
Three or more	11,756 (16.7)	6,409 (54.5)	3,225 (27.4)	2,122 (18.1)	
Perceived social support during pregnancy (missing=169)					0.003
Adequate	66,692 (94.8)	42,966 (64.4)	16,129 (24.2)	7,597 (11.4)	
Inadequate	3,459 (4.9)	1,885 (54.5)	960 (27.7)	614 (17.7)	
Perceived social support postpartum					0.000
Adequate	66540 (94.6)	43193 (64.9)	15995 (24.0)	7352 (11.1)	
Inadequate	3780 (5.4)	1806 (47.8)	1109 (29.3)	866 (22.9)	
History of violent abuse					0.000
No	62,662 (89.1)	40,523 (64.7)	15,326 (24.5)	6,814 (10.9)	
Yes	7,657 (10.9)	4,476 (58.5)	1,778 (23.2)	1,404 (18.3)	
Previous depression diagnosis					0.001
No	59,453 (84.5)	38,542 (64.8)	14,341 (24.1)	6,570 (11.1)	
Yes	10,867 (15.5)	6,457 (59.4)	2,763 (25.4)	1,647 (15.2)	

* Sample size is estimated using population weights. BMI: body mass index

† Chi-squared test comparing the categorical independent variables according to back pain status.

Table 3.4: Sample characteristics and distribution of selected social factors according to reported back problem status (MES 2005/06; Weighted n =70,320)

	Respondents	Degree of problem with back pain in the first 3 months postpartum			
	N (%) *	None (%) *	Somewhat (%) *	A great deal (%) *	χ^2 test (p-value) †
Overall	70,320 (100.0)	n= 44,999 (64.0)	n= 17,103 (24.3)	n= 8,218 (11.7)	
Marital status (missing= 16)					0.000
Has a partner	64,705 (92.0)	41,729 (64.5)	15,757(24.4)	7,219 (11.2)	
No partner	5,598 (8.0)	3,270 (58.4)	1,346 (24.0)	983 (17.6)	
Immigrant status					0.000
No	54,152 (77.0)	36,820 (68.0)	11,532 (21.3)	5,800 (10.7)	
Yes	16,168 (23.0)	8,179 (50.6)	5,572 (34.5)	2,418 (15.0)	
Maternal Aboriginal status (missing= 93)					0.05
No	67,300 (95.7)	43,133 (64.1)	16,445 (24.4)	7,722 (11.5)	
Yes	2,926 (4.2)	1,821 (62.2)	626 (21.4)	479 (16.4)	
Maternal region of residence					0.000
Atlantic	4,312 (6.1)	2,978 (69.1)	897 (20.8)	437 (10.1)	
Quebec	16,320 (23.2)	10,339 (63.4)	3,856 (23.6)	2,124 (13.0)	
Ontario	27,459 (39.0)	16,641 (60.6)	7,483 (27.3)	3,335 (12.1)	
Prairies	13,559 (19.3)	9,104 (67.2)	3,070 (22.6)	1,385 (10.2)	
British Columbia	8,353 (11.9)	5,725 (68.6)	1,713 (20.5)	914 (11.0)	
Territories	318 (0.5)	211 (66.2)	84 (26.5)	23 (7.4)	
Place of residence					0.000
Rural area	12,751 (18.1)	8,553 (67.1)	2,744(21.5)	1,453 (11.4)	
Urban population ≤499,999	26,286 (37.4)	17,678 (67.3)	5,896 (22.4)	2,711 (10.3)	
Urban population ≥ 500,000	31,284 (44.5)	18,767 (60.0)	8,463 (27.0)	4,053 (13.0)	
Maternal level of education					0.000
Less than high school cert.	5,100 (7.3)	2,764 (54.2)	1,331 (26.1)	1,005 (19.7)	
High school graduate	9,467 (13.5)	5,774 (61.0)	2,390 (25.2)	1,304 (13.8)	
Some post-secondary	30,480 (43.3)	19,415 (63.7)	7,526 (24.7)	3,540(11.6)	
Bachelor's degree and higher	25,272 (35.9)	17,047 (67.5)	5,857 (23.2)	2,368 (9.4)	

Household annual income					0.000
Less than \$20,000	5,818 (8.3)	3,036 (52.2)	1,680 (28.9)	1,102 (18.9)	
\$20,000 to \$39,999	11,941 (17.0)	6,861 (57.5)	3,448 (28.9)	1,633 (13.7)	
\$40,000 to \$59,999	13,543 (19.3)	8,534 (63.0)	3,157 (23.3)	1,853 (13.7)	
\$60,000 to \$79,999	12,786 (18.2)	8,440 (66.0)	3,000 (23.5)	1,345 (10.5)	
\$80,000 to \$99,999	9,139 (13.0)	6,361 (69.6)	2,032 (22.2)	747 (8.2)	
\$100,000 or more	13,676 (19.4)	9,722 (71.0)	2,865 (21.0)	1,089 (8.0)	
Unknown	3,416 (4.9)	2,046 (59.9)	922 (27.0)	448 (13.1)	
Worked paid job during pregnancy (missing=289)					0.000
No	21,180 (30.1)	12,778 (60.3)	5,508 (26.0)	2,894 (13.7)	
Yes	48,851 (69.5)	32,037 (65.6)	11,530 (23.6)	5,284 (10.8)	
Prenatal class attendance (missing= 28)					0.003
No	47,311 (67.3)	29,529 (62.4)	11,977(25.3)	5,805 (12.3)	
Yes	22,981 (32.7)	15,442 (67.2)	5,127 (22.3)	2,412 (10.5)	
Perceived inadequate information about BP during pregnancy					0.000
No	4,718 (6.7)	2,517 (53.4)	1,325 (28.0)	876 (18.6)	
Yes	65,602 (93.3)	42,482 (64.8)	15,778 (24.0)	7,342 (11.2)	
Cigarette smoking during pregnancy					0.000
No	63034 (89.6)	40430 (64.1)	15636 (24.8)	6968 (11.1)	
Yes	7286 (10.4)	4569 (62.7)	1467 (20.1)	1250 (17.2)	
Alcohol consumption during pregnancy (missing= 197)					0.33
No	62,636 (89.1)	40,038 (63.9)	15,385 (24.6)	7,213 (11.5)	
Yes	7,486 (10.6)	4,837 (64.6)	1,668 (22.3)	981 (13.1)	
Use of street drugs during pregnancy (missing= 14)					0.04
No	69,650 (99.0)	44,642 (64.1)	16,949 (24.3)	8,058 (11.6)	
Yes	656 (0.9)	342 (52.2)	154 (23.5)	159 (24.3)	

* Sample size is estimated using population weights. BMI: body mass index

† Chi-squared test comparing the categorical independent variables according to back pain status.

3.5.2 The PPOM

The proportional odds assumption was violated for 11 of the 25 selected independent variables (i.e., Wald chi-square tests p-values <0.05), including: immigrant status, aboriginal status, health problem during pregnancy, maternal perceived health, history of abuse, cigarette smoking, marital status, residing in the Territories, less than high school education, and income bracket \$40,000 to \$59,999.

Table 3.5 presents the results from the univariable and multivariable analysis, and assessment of the proportional odds assumption. Given the three categories of our outcome variable, two panels of results were produced. For variables that violated the proportional odds assumption (listed above), i.e., their effects differ at different levels of the outcome, two odds ratios are presented; while for the remaining variables that conformed to the proportional odds assumption, only one odds ratio is displayed. When assessing model fit, the PPOM (AIC= 9892.7324) was found to perform better with lower AIC, when compared to the fully constrained (AIC= 9910.718) and fully relaxed (AIC= 9929.508) models. The global Wald test indicates that the final model does not violate the proportional odds assumption (p= 0.0000). Furthermore, the result of the link test indicated that the model was specified correctly (p>0.05), whereas the threshold parameter test indicated that the cut points or threshold parameters (cut_1 & cut_2 given the three outcome categories) are relevant to the model (p<0.05) and the three outcome categories are indeed ordinal in nature, hence collapsing into 2 categories can erode valuable information. No significant interactions were found in the analysis.

3.5.3 Association of selected biopsychosocial factors with BP status

3.5.3.1 Biological factors

Of the variables considered in the biological domain, only maternal age, pre-pregnancy BMI, and mode of delivery, remained significant in the final model. When compared to mothers aged 30 years and above, teenage mothers (<20 years) were 1.38 times more likely to be in a more problematic BP category (OR=1.38, 95% CI= 1.02 - 1.89). With regards to pre-pregnancy BMI, both underweight (OR=1.34, 95%CI=1.04 - 1.71) and obese (OR= 1.31, 95%CI= 1.11 - 1.55) mothers were more likely report some level of problem with back pain when compared to normal weight women. Similarly, odds of problematic BP were slightly increased in mothers who had

vaginal delivery (OR=1.16, 95% CI= 1.01 - 1.32) than in caesarean-births mothers. Maternal parity and health problems during pregnancy were not found to be statistically significant (Table 3.5).

3.5.3.2 Psychological factors

Except for perceived social support during pregnancy, all psychological factors examined, including self-rated health, perceived stress, number of stressful life events, history of violent abuse, pre-pregnancy depression diagnosis, and social support post-delivery were positively associated with the odds of having problematic BP in the final model (Table 3.5). Self-rated health displayed non-proportional odds: the first result panel shows that compared to mothers in good-to-excellent health, those in perceived poorer health were more likely (OR= 1.48, 95% CI=1.13 - 1.94) to experience problematic BP, however the magnitude of the association was stronger for being in the extreme category (“a great deal” problem) compared to milder categories (OR= 2.20, 95% CI= 1.63 – 2.96) (result panel 2). Highly stressed mothers were 1.43 times more likely to report problematic BP compared to those who were less stressed (OR= 1.43, 95% CI= 1.27 - 1.62). Similarly, having higher number of stressful life events (three or more) was associated with a higher odds of reporting problematic BP (OR= 1.33, 95% CI= 1.12 - 1.59). Having pre-pregnancy depression compared to no depression was associated with a higher likelihood (OR= 1.20, 95% CI= 1.04 - 1.40). History of violent abuse showed non-proportional effects, whereby no significant difference was seen between the BP groups by abuse history (OR=1.02, 95% CI=0.84 - 1.24); however, the second panel of results showed that mothers with abuse history were significantly more likely to report worse BP status (“a great deal”) than those without abuse history (OR=1.35, 95% CI=1.06 - 1.73). When considering perceived available social support postpartum, the odds of reporting problematic BP was found to increase for mothers with little or no social support (OR= 1.52, 95% CI= 1.18 - 1.95) compared to mothers with perceived adequate support.

3.5.3.3 Social factors

Among examined social factors, immigrant status, province of residence, maternal education, household income, and having perceived inadequate information about BP during pregnancy, were the significant predictors of having problematic BP (Table 3.5). Immigrant status increased the odds of reporting problematic BP, though non-proportionally. Compared to Canadian-born mothers, immigrant mothers were at about two times more likely to experience problems with BP (Panel 1: OR= 2.11, 95% CI= 1.82 - 2.45; Panel 2: OR= 1.63, 95% CI= 1.32 - 2.00). Respondents

residing in the Atlantic Provinces (OR=0.80, 95% CI= 0.68 - 0.93), the Prairies (OR=0.82, 95% CI= 0.70 - 0.96), and British Columbia (OR= 0.77, 95% CI= 0.62 - 0.94) were 20%, 32%, and 23%, respectively less likely to report problematic BP compared to mothers residing in Ontario; whereas residents of the Territories (OR= 0.51, 95% CI= 0.36 - 0.73) have even lower odds of reporting the extreme status, “a great deal” pain. Mothers with less than high school education were more likely to report worse BP status than similar mothers who have a bachelor’s degree or higher (OR= 1.32; 95% CI= 1.02 - 1.72). Similarly, mothers who fell in income brackets of below \$20,000 (OR= 1.50, 95% CI= 1.16 - 1.95), \$20,000 to \$39,999 (OR= 1.40, 95% CI= 1.13 - 1.73), and \$40,000 to \$59,999 (OR= 1.27, 95% CI= 1.04 - 1.55) were more likely to report worse BP status when compared to those in income bracket \$100,000 or more. Lastly, having perceived inadequate information about BP during pregnancy was significantly associated with reporting some level of problematic BP (OR=1.27, 95% CI= 1.01 - 1.60). Maternal Aboriginal status, marital status, place of residence, worked paid job during pregnancy, prenatal class attendance, and cigarette, alcohol and drug use during pregnancy were all not found to be statistically significant (Table 3.5).

Table 3.5: Unadjusted and adjusted association of biopsychosocial factors and perinatal back pain during the first 3 months postpartum- results based on the PPOM

Independent variables	Univariable results			Multivariable results	
	“Somewhat or a great deal” ^a OR (95% CI) †	“A great deal” ^b OR (95% CI) †	Wald χ^2 test (p-value) [§]	“Somewhat or a great deal” ^a AOR (95% CI) †	“A great deal” ^b AOR (95% CI) †
Maternal age					
≥ 30 years (ref)	ref			ref	
<20	1.82 (1.39 - 2.38)		0.4005	1.38 (1.02 - 1.89)	
20 to 29	1.08 (0.97 - 1.21)		0.0981	1.01 (0.89 - 1.15)	
Maternal pre-pregnancy BMI (kg/m ²)					
Normal weight (ref)	ref			ref	
Underweight	1.63 (1.30 - 2.06)		0.9567	1.34 (1.04 - 1.71)	
Overweight	1.03 (0.90 - 1.18)		0.6672	1.05 (0.91 - 1.22)	
Obese	1.39 (1.19 - 1.62)		0.4703	1.31 (1.15 - 1.55)	
Maternal parity					
Primiparous (ref)	ref			-	-
Multiparous	1.03 (0.92 - 1.17)		0.2907		
Final mode of birth					
Cesarean birth (ref)	ref			ref	
Vaginal	1.17 (1.03 - 1.33)		0.1746	1.16 (1.01 - 1.32)	
Health problems during pregnancy					
No (ref)	ref	ref		-	-
Yes	1.12 (0.98 - 1.27)	1.36 (1.14 - 1.63)	0.01577		
Maternal self-rated health					
Good-to-excellent (ref)	ref	ref		ref	1
Fair-to-poor	2.01 (1.56 - 2.58)	3.05 (2.30 - 4.05)	0.00066	1.48 (1.13 - 1.94)	2.20 (1.63 - 2.96)
Perceived stress on most days					
Not stressed (ref)	ref			ref	
Stressed	1.52 (1.35 - 1.70)		0.9206	1.43 (1.27 - 1.62)	
Number of stressful life events					
None (ref)	ref			ref	
One	1.24 (1.08 - 1.42)		0.6603	1.10 (0.96 - 1.27)	

Two	1.25 (1.06 - 1.47)		0.1839	1.05 (0.88 - 1.25)	
Three or more	1.88 (1.61 - 2.20)		0.0539	1.33 (1.1 - 1.59)	
Perceived social support during pregnancy				-	-
Adequate (ref)	ref				
Inadequate	1.55 (1.20 - 2.00)		0.499		
Perceived social support postpartum					
Adequate (ref)	ref			ref	
Inadequate	2.13 (1.67 - 2.71)		0.244	1.54 (1.20 - 1.98)	
History of violent abuse					
No (ref)	ref	ref		ref	1
Yes	1.30 (1.09 - 1.55)	1.84 (1.47 - 2.31)	0.00072	1.02 (0.84 - 1.24)	1.35 (1.05 - 1.72)
Previous depression diagnosis					
No	ref			ref	
Yes	1.29 (1.12 - 1.49)		0.1554	1.20 (1.03 - 1.39)	
Marital status					
Has a partner	ref	ref		-	-
No partner	1.29 (1.06 - 1.58)	1.70 (1.32 - 2.18)	0.01521		
Immigrant status					
No (ref)	ref	ref		ref	1
Yes	2.08 (1.81 - 2.38)	1.47 (1.21 - 1.77)	0.00019	2.11 (1.82 - 2.45)	1.52 (1.23 - 1.86)
Maternal aboriginal status					
No (ref)	ref	ref		-	-
Yes	1.08 (0.85 - 1.38)	1.51 (1.08 - 2.12)	0.02142		
Maternal region of residence					
Ontario (ref)	ref			ref	
Atlantic	0.71 (0.61 - 0.82)		0.4141	0.81 (0.69 - 0.94)	
Quebec	0.92 (0.79 - 1.07)		0.1399	1.05 (0.89 - 1.23)	
Prairies	0.76 (0.66 - 0.89)		0.1143	0.82 (0.70 - 0.96)	
British Columbia	0.73 (0.60 - 1.89)		0.1293	0.77 (0.63 - 0.95)	
Territories	0.80 (0.65 - 0.98)	0.53 (0.38 - 0.74)	0.01239	0.83 (0.68 - 1.07)	0.51 (0.36 - 0.73)
Size of residence					
Rural (ref)	ref				
Urban population ≤499,999	0.98 (0.84 - 1.14)		0.3213	-	-
Urban population ≥ 500,000	1.33 (1.14 - 1.54)		0.2506		

Maternal level of education					
Bachelor's degree or higher (ref)	ref			ref	
Less than high school	1.77 (1.41 - 2.22)	2.25 (1.69 - 3.0)	0.0441	1.32 (1.02 - 1.72)	
High school graduate	1.36 (1.14 - 1.62)		0.2981	1.17 (0.96 - 1.42)	
Some post-secondary	1.19 (1.05 - 1.35)		0.4310	1.11 (0.97 - 1.27)	
Household annual income					
\$100,000 or more (ref)	ref			ref	
Less than \$20,000	2.35 (1.86 - 2.95)		0.1536	1.50 (1.16 - 1.95)	
\$20,000 to \$39,999	1.82 (1.50 - 2.20)		0.9677	1.40 (1.13 - 1.73)	
\$40,000 to \$59,999	1.45 (1.21 - 1.74)	1.76 (1.39 - 2.24)	0.03510	1.27 (1.04 - 1.55)	1.58 (1.23 - 2.03)
\$60,000 to \$79,999	1.28 (1.06 - 1.53)		0.5181	1.20 (0.99 - 1.45)	
\$80,000 to \$99,999	1.07 (0.86 - 1.33)		0.7001	1.08 (0.87 - 1.34)	
Unknown	1.66 (1.26 - 2.19)		0.7653	1.14 (0.84 - 1.54)	
Worked a paid job during pregnancy					
Yes (ref)	ref			-	-
No	1.26 (1.12 - 1.42)		0.6073		
Prenatal class attendance					
Yes (ref)	ref			-	-
No	1.23 (1.09 - 1.38)		0.6865		
Perceived inadequate information about BP during pregnancy					
Yes (ref)	ref			ref	
No	1.65 (1.33 - 2.05)		0.367	1.27 (1.01 - 1.60)	
Cigarette smoking during pregnancy					
No (ref)	ref	ref		-	-
Yes	1.06 (0.89 - 1.27)	1.67 (1.32 - 2.10)	0.00001		
Alcohol consumption during pregnancy					
No (ref)	ref			-	-
Yes	1.00 (0.83 - 1.20)		0.1402		
Use of street drugs during pregnancy					
No (ref)	ref			-	-
Yes	1.84 (1.02 - 3.32)		0.1702		

BMI: body mass index; OR: odds ratio; AOR: adjusted odds ratio.

† 95% CI was estimated using bootstrapping technique. ^a: Reference category is "Not a problem" ^b: Reference categories are "Not a problem + Somewhat of a problem" Bold: significant at 5% level. -: not significant in the final adjusted model. [§] Wald test examining the proportional odds assumption for each independent variable. Significant tests indicate violation of the assumption, indicating different effect across all problem levels of BP; hence two ORs are produced.

3.6 Discussion

3.6.1 Prevalence of BP in early postpartum

To the best of the authors' knowledge, this is the first national-level study to determine the prevalence of back problem status and a wide range of related factors in the early postnatal period in Canada. Our study revealed that 36% of respondents, representing 25,321 postnatal Canadian mothers (aged 15+), still experienced back pain that was deemed 'problematic' to some degree up to 3 months after giving birth; for about 24% of the mothers BP was 'somewhat of a problem' while for about 12% BP was deemed to be a 'great deal of a problem'. It is challenging to compare prevalence studies of BP generally and essentially among postpartum women, given heterogeneity across research methods, criteria used to classify types and severity of pain and different postpartum periods being examined. Notwithstanding, the results of this study falls within the range of 9% to 54% reported between 1 and 3 months postpartum in the published literature,^{30,77-81} but shows higher proportion of women reporting significant problems with pain.¹² Only one other study was found to have investigated the prevalence of lumbopelvic pain in the early postnatal period in a Canadian population.²³ The study found that 54.3%, and 41.4% of pregnant women examined continued to have back pain between 0 to 1 months, and 1 to 3 months, respectively. The lower prevalence reported in our study (36%) relative to the earlier study²³ may be due to recall bias since mothers in the present study were asked to recall early postnatal back problems at an average of 7.3 months postpartum. However, the earlier study suffered from a limited small (n=58; and was one of convenience),²³ and thus may not be generalizable to the wider Canadian postnatal population. Hence, the findings from the present large representative population-based survey (n= 5,295; weighted n: 70,320) may represent a truer picture of the prevalence of back pain in the immediate postpartum period among Canadian mothers.

3.6.2 Biopsychosocial predictors associated with BP in the early postpartum period

Several biological/physical, psychological, and social factors were associated with the likelihood of reporting worse problematic back pain status in the early postnatal period. Most of these findings are generally consistent with previous publications that explored similar risk factors,^{12,25,31,82} while others are not.

When examining factors in the biological/physical domain, the significantly higher likelihood of reporting worse BP status observed among teenage mothers is consistent with some past studies,^{12,17,83-85} however a recent systematic review did not find maternal age to be a risk factor for BP postpartum.²⁹ It has been suggested that a bimodal relationship may exist between maternal age and persistent back pain, whereby very young (<20 years) and much older (>35 years) mothers may be more likely to have BP.¹² On one hand younger parents tend to be first-time mothers, and their system may not yet be used to or prepared for pregnancy. Moreover, young maternal age has also been linked with worse economic and psychosocial circumstances, and worse expectations about the pregnancy and birth,⁸⁶⁻⁸⁹ which in turn may contribute to higher perceived pain in this group. Older mothers on the other hand, may suffer more complicated pregnancy and delivery due to biological disadvantage associated with higher maternal age.⁸⁶ These mothers may also sustain tissue damage from previous pregnancies and births.

Our study shows a u-shape relationship between pre-pregnancy BMI and back pain in which underweight and obese mothers had a higher odds of reporting back pain compared to those in central BMI categories. This finding is somewhat consistent with past studies finding pain to be related to higher BMI;^{78,90,91} however, a relationship between low BMI and back pain postpartum has not been previously reported. Furthermore, our study found vaginal delivery rather than cesarean birth to be associated with worse back pain postpartum, contrary to past studies.^{92,93} The reason for this observation is not clear since reasons for vaginal or cesarean delivery were not explored in this study, making it difficult to draw definite conclusions from these findings.

When examining the psychological domain, our findings are consistent with an increasing body of literature suggesting that psychological distress is predictive of maintenance of back pain after childbirth,^{38,40,69} and that mothers with persistent pain postpartum tend to report more psychological and emotional problems than those without persistent symptoms.^{36,39,58,94} Interestingly, this study showed a significant difference in reported pain status as a function of mother's perceived health status, whereby mothers with perceived fair-to-poor health showed a greater odds of reporting worse level problematic pain compared to mothers in good-to-excellent health. This finding is in line with two Swedish studies that found a more impaired self-rated health pattern among the group of mothers reporting 'continuous pain' at six months⁴⁰ and 14 months

postpartum³⁸ relative to the groups reporting ‘recurrent pain’ and ‘no pain’ respectively. It is also possible that mothers with more severe BP postpartum may report poorer health status than those with less severe pain.³⁸

Furthermore, we identified perceived social support after delivery rather than during pregnancy to be a significant predictor associated with worse back problem. The postpartum period is a sensitive and often difficult time for many mothers, in which physical and psychosocial vulnerabilities during pregnancy can become accentuated with the demands of caring for a newborn. Previous studies show that having perceived or expected sufficient support during this time can facilitate mothers’ maternal role adjustment, ameliorate the negative effect of peripartum psychosocial stressors, and contribute to an overall positive experience and satisfaction with the pregnancy, birth, and postpartum period.^{95–99} It is possible that the mothers in our study with minimal social support postpartum lack access to necessary psychosocial and instrumental resources needed to adjust to parenthood - this situation may be further aggravated by the presence of pain,^{34,63,100} which may explain worse problematic pain status in these mothers. Thus, developing interventions that facilitate and promote increased support for mothers during pregnancy, particularly in the immediate postpartum period, may yield significant health gains. This is especially important in light of the high proportion of Canadian mothers reporting daily stress (57.1%), at least one stressful life event (60.3%) before or during pregnancy, and pre-pregnancy depression (15.5%) since these mothers were also more likely to report greater problems with back pain in the postpartum period. Furthermore, the finding that history of violent abuse increases the odds of reporting worse problematic pain status further highlights the need to screen and address psychological problems early in the antenatal period, as this may help prevent persistent pain problems after childbirth.^{63,101–103}

When examining social factors, immigrant mothers were more likely to report back problems when compared to their Canadian-born counterparts, though the effect was stronger for being in a lower problem category than being in the most extreme one. The evidence linking ethnicity and immigrant statuses to back pain persistence after delivery is conflicting as of yet,^{12,25} though the wider literature in non-pregnant populations suggests that cultural groups differ in how they perceive and report pain.^{104–107} Moreover, migrant and minority ethnic groups may experience

more psychological health problems, unmet healthcare needs, and greater difficulties maneuvering the healthcare system, both generally,¹⁰⁸ and during pregnancy^{104,106,107,109–112} than more dominant ethnic groups. Thus, this study's findings raise the need to better understand the specific needs of immigrant and minority ethnic groups regarding management and treatment of low back pain both during and after the pregnancy. Furthermore, a decreasing prevalence of problematic back pain was observed with educational attainment and household income. This finding is consistent with studies that show that poor social conditions and low educational attainment correlate positively with the occurrence and severity of low back pain.^{109,113,114} These studies argue that non-beneficial health-promoting factors such as lower perceived health control, physical inactivity, suboptimal antenatal care uptake, and lower nutritional intake tend to cluster in individuals with low socioeconomic situations and may precipitate health problems such as back pain both during and after pregnancy.^{109,114} Similarly, mothers with perceived inadequate information about BP during pregnancy were at higher odds of reporting worse back problems after the birth. Increasing evidence suggests that providing mothers with adequate information on back pain earlier in pregnancy reduces pain-related worry and promotes reasonable expectations about postnatal recovery, which in turn can curtail the persistence of symptoms.^{34,35,101,115} Our findings thus raise the need for increased community health education on pregnancy-related back pain early in the antenatal period and after delivery to reduce the prevalence and persistence of symptoms both during and after pregnancy.

3.6.3 Strengths and limitations of the study

The major strength of this study is the use of a nationally representative sample recruited from all 10 Canadian provinces and 3 Territories and the evaluation of a wide range of biopsychosocial variables on a national scale. As recommended by Croft & Raspe,¹¹⁶ this study used a graded measure to assess back pain, compared to most previous studies that often used presence or absence of back pain, which do not reflect the degree of perceived impacts of back pain on the quality of life. Moreover, the PPOM used in this study allowed more efficient use of data by preventing loss of information via arbitrary dichotomization and also allowed us to uncover more complex relationships between the examined variables than would be possible with estimating a logistic regression.⁷¹

Despite these strengths, several limitations need to be considered when interpreting the results of this study. The cross-sectional design used precludes drawing causal conclusions, thus the study findings refer to potential associations. Furthermore, since the study variables were measured at the same time, the direction of the observed associations could not be ascertained, therefore reverse causality bias may offer alternative explanations for some of the characteristics assessed. For example, self-rated health could be a predictor of persistent BP; it can also be a consequence of the fact. Moreover, assessments of pregnancy-related back problem status were based on self-reported accounts and thus may be subject to recall bias and variable interpretations by respondents. It was impossible to tell if back pain started pre-pregnancy or were new-onset cases during pregnancy since information on when back pain started was not captured in the survey. More so, it was not possible to make distinctions between LBP originating from the pelvic girdle or the lumbar region as recommended in the literature^{12,31,117} given the broad language of “back pain” used in the MES, which did not include PGP.

Finally, the data used was more than a decade old and may not reflect current patterns of back problems and biopsychosocial characteristics in today’s postnatal population.

Nevertheless, the MES remains the only available national-level data source on back pain in Canada's puerperal population, which highlights the need for more population-based surveys addressing pregnancy-related musculoskeletal problems given their high prevalence both during and after pregnancy. However, our study can serve as a platform for future research to further elucidate the complex relationships found in this study. It can also provide valuable information for healthcare providers, policymakers, and the patient community in Canada.

3.7 Conclusion

The findings of this nationally representative cross-sectional study demonstrate a high prevalence of problematic BP in Canadian mothers during the first three months postpartum. Additionally, the likelihood of reporting worse problematic BP status was predicted by biological, social, and psychological factors, confirming the multidimensional nature of back pain and supporting the use of the biopsychosocial model to better understand the condition and design appropriate management options. Given that mothers still reporting pain at three months postpartum may be at a higher risk of developing chronic symptoms,^{19,77,83} the findings of this study highlight the need

to extend maternity care services and policies in Canada to include early screening and management of back problems both during and after pregnancy. Such interventions can reduce individual suffering and decrease the risk of transition into chronicity, especially among vulnerable groups.

3.8 References

1. Hoy D, Bain C, Williams G, et al. A systematic review of the global prevalence of low back pain. *Arthritis Rheum.* 2012;64(6):2028-2037. doi:10.1002/art.34347
2. Maher C, Underwood M, Buchbinder R. Non-specific low back pain. *The Lancet.* 2017;389(10070):736-747. doi:10.1016/S0140-6736(16)30970-9
3. Rapoport J, Jacobs P, Bell NR, Klarenbach S. Refining the measurement of the economic burden of chronic diseases in Canada. *Chronic Dis Can.* 2004;25(1):13-21.
4. Wu A, March L, Zheng X, et al. Global low back pain prevalence and years lived with disability from 1990 to 2017: estimates from the Global Burden of Disease Study 2017. *Ann Transl Med.* 2020;8(6). doi:10.21037/atm.2020.02.175
5. Smith MD, Russell A, Hodges PW. Is there a relationship between parity, pregnancy, back pain and incontinence? *Int Urogynecology J.* 2008;19(2):205-211. doi:10.1007/s00192-007-0421-x
6. Svensson H, Andersson G, Hagstad A, Jansson P. The relationship of low-back pain to pregnancy and gynecologic factors. *Spine Phila Pa* 101097000076320500000006. 1990;15 SRC-GoogleScholar:371-375.
7. Biering-Sorensen F. Low back trouble in a general population of 30-, 40-, 50-, and 60-year-old men and women. *Study Des Represent Basic Results Dan Med Bull Bibliogr Links.* 1982;29 SRC-GoogleScholar:289-299.
8. Mens J, Vleeming A, Stoeckart R, Stam H, Snijders C. Understanding peripartum pelvic pain: Implications of a patient survey. *Spine Phila Pa Doi* 101097000076320601000017 Discuss 13691370. 1996;21(11 SRC-GoogleScholar):1363-1369.
9. Björklund K, Bergström S. Is pelvic pain in pregnancy a welfare complaint? *Acta Obstet Gynecol Scand.* 2000;79(1):24-30. doi:10.1034/j.1600-0412.2000.079001024.x
10. Gutke A, Boissonnault J, Brook G, Stuge B. The Severity and Impact of Pelvic Girdle Pain and Low-Back Pain in Pregnancy: A Multinational Study. *J Womens Health.* 2018;27(4):510-517. doi:10.1089/jwh.2017.6342
11. Kanakaris NK, Roberts CS, Giannoudis PV. Pregnancy-related pelvic girdle pain: an update. *BMC Med.* 2011;9(1):15. doi:10.1186/1741-7015-9-15
12. Wu WH, Meijer OG, Uegaki K, et al. Pregnancy-related pelvic girdle pain (PPP), I: Terminology, clinical presentation, and prevalence. *Eur Spine J.* 2004;13(7):575-589. doi:10.1007/s00586-003-0615-y
13. Sabino J, Grauer JN. Pregnancy and low back pain. *Curr Rev Musculoskelet Med.* 2008;1(2):137-141. doi:10.1007/s12178-008-9021-8
14. Mogren IM, Pohjanen AI. Low Back Pain and Pelvic Pain During Pregnancy: Prevalence and Risk Factors. *Spine.* 2005;30(8):983. doi:10.1097/01.brs.0000158957.42198.8e
15. Han IH. Pregnancy and spinal problems. *Curr Opin Obstet Gynecol.* 2010;22(6):477-481. doi:10.1097/GCO.0b013e3283404ea1

16. Östgaard HC, Zetherström G, Roos-Hansson E. Back Pain in Relation to Pregnancy: A 6-Year Follow-Up. *Spine*. 1997;22(24):2945-2950.
17. Ostgaard HC, Andersson GBJ. Postpartum Low-Back Pain. *Spine*. 1992;17(1):53-55.
18. Norén L, Östgaard S, Johansson G, Östgaard HC. Lumbar back and posterior pelvic pain during pregnancy: a 3-year follow-up. *Eur Spine J*. 2002;11(3):267-271. doi:10.1007/s00586-001-0357-7
19. Östgaard HC, Zetherström G, Roos-Hansson E. Back Pain in Relation to Pregnancy: A 6-Year Follow-Up. *Spine*. 1997;22(24):2945-2950.
20. Robinson HS, Vøllestad NK, Veierød MB. Clinical course of pelvic girdle pain postpartum – Impact of clinical findings in late pregnancy. *Man Ther*. 2014;19(3):190-196. doi:10.1016/j.math.2014.01.004
21. Sjødahl J, Gutke A, Öberg B. Predictors for long-term disability in women with persistent postpartum pelvic girdle pain. *Eur Spine J*. 2013;22(7):1665-1673. doi:10.1007/s00586-013-2716-6
22. Bergström C, Persson M, Nergård KA, Mogren I. Prevalence and predictors of persistent pelvic girdle pain 12 years postpartum. *BMC Musculoskelet Disord*. 2017;18:399. doi:10.1186/s12891-017-1760-5
23. Tavares P, Barrett J, Hogg-Johnson S, et al. Prevalence of Low Back Pain, Pelvic Girdle Pain, and Combination Pain in a Postpartum Ontario Population. *J Obstet Gynaecol Can*. 2020;42(4):473-480. doi:10.1016/j.jogc.2019.08.030
24. Simonds AH, Abraham K, Spitznagle T. Clinical Practice Guidelines for Pelvic Girdle Pain in the Postpartum Population. *J Womens Health Phys Ther*. 2022;46(1):E1-E38. doi:10.1097/JWH.0000000000000236
25. Christopher S, McCullough J, Snodgrass SJ, Cook C. Predictive Risk Factors for First-Onset Lumbopelvic Pain in Postpartum Women: A Systematic Review. *J Women's Health Phys Ther*. 2019;43(3):127. doi:10.1097/JWH.0000000000000133
26. Mogren IM. Physical activity and persistent low back pain and pelvic pain post partum. *BMC Public Health*. 2008;8(1):417. doi:10.1186/1471-2458-8-417
27. Mukkannavar P, Desai BR, Mohanty U, Kulkarni S, Parvatikar V, Daiwajna S. Pelvic girdle pain in Indian postpartum women: a cross-sectional study. *Physiother Theory Pract*. 2014;30(2):123-130. doi:10.3109/09593985.2013.816399
28. Bjelland EK, Owe KM, Stuge B, Vangen S, Eberhard-Gran M. Breastfeeding and pelvic girdle pain: a follow-up study of 10 603 women 18 months after delivery. *BJOG Int J Obstet Gynaecol*. 2015;122(13):1765-1771. doi:10.1111/1471-0528.13118
29. Wiezer M, Hage-Fransen MAH, Otto A, et al. Risk factors for pelvic girdle pain postpartum and pregnancy related low back pain postpartum; a systematic review and meta-analysis. *Musculoskelet Sci Pract*. 2020;48:102154. doi:10.1016/j.msksp.2020.102154
30. Gausel AM, Malmqvist S, Andersen K, et al. Subjective recovery from pregnancy-related pelvic girdle pain the first 6 weeks after delivery: a prospective longitudinal cohort study. *Eur Spine J*. 2020;29(3):556-563. doi:10.1007/s00586-020-06288-9
31. Vleeming A, Albert H, Ostgaard H, Sturesson B, Stuge B. European guidelines for the diagnosis and treatment of pelvic girdle pain. *Eur Spine J Doi 101007s0058600806024*. 2008;17(6 SRC-GoogleScholar):794-819.

32. Barclay L, Everitt L, Rogan F, Schmied V, Wyllie A. Becoming a mother — an analysis of women's experience of early motherhood. *J Adv Nurs*. 1997;25(4):719-728. doi:10.1046/j.1365-2648.1997.t01-1-1997025719.x
33. Rogan F, Shimed V, Barclay L, Everitt L, Wylli A. 'Becoming a mother'— developing a new theory of early motherhood. *J Adv Nurs*. 1997;25(5):877-885. doi:10.1046/j.1365-2648.1997.1997025877.x
34. Mackenzie J, Murray E, Lusher J. Women's experiences of pregnancy related pelvic girdle pain: A systematic review. *Midwifery*. 2018;56:102-111. doi:10.1016/j.midw.2017.10.011
35. Wuytack F, Curtis E, Begley C. Experiences of first-time mothers with persistent pelvic girdle pain after childbirth: Descriptive qualitative study. *Phys Ther*. 2015;95:1354-1364.
36. Elden H, Gutke A, Kjellby-Wendt G, Fagevik-Olsen M, Ostgaard HC. Predictors and consequences of long-term pregnancy-related pelvic girdle pain: a longitudinal follow-up study. *BMC Musculoskelet Disord*. 2016;17(1):1-13. doi:10.1186/s12891-016-1154-0
37. Srisopa P, Lucas R. Women's Experience of Pelvic Girdle Pain After Childbirth: A Meta-Synthesis. *J Midwifery Womens Health*. 2021;66(2):240-248. doi:10.1111/jmwh.13167
38. Bergstrom C, Persson M, Mogren I, BMC. Pregnancy-related low back pain and pelvic girdle pain approximately 14 months after pregnancy-pain status, self-rated health and family situation. *Childbirth* 48. 2014;14 SRC-GoogleScholar.
39. Gutke A, Josefsson A, Öberg B. Pelvic Girdle Pain and Lumbar Pain in Relation to Postpartum Depressive Symptoms: *Spine*. 2007;32(13):1430-1436. doi:10.1097/BRS.0b013e318060a673
40. Mogren I. Perceived health, sick leave, psychosocial situation, and sexual life in women with low-back pain and pelvic pain during pregnancy. *Acta Obstet Gynecol Scand J*. 2006;85(6 SRC-GoogleScholar):647-656.
41. Olsson C, Nilsson-Wikmar L. Health-related quality of life and physical ability among pregnant women with and without back pain in late pregnancy. *Acta Obstet Gynecol Scand J*. 2004;83(4 SRC-GoogleScholar):351-357.
42. Rexelius N, Lindgren A, Torstensson T, Kristiansson P, Turkmen S. Sexuality and mood changes in women with persistent pelvic girdle pain after childbirth: a case-control study. *BMC Womens Health*. 2020;20(1):201. doi:10.1186/s12905-020-01058-7
43. Bergström C, Persson M, Mogren I. Sick leave and healthcare utilisation in women reporting pregnancy related low back pain and/or pelvic girdle pain at 14 months postpartum. *Chiropr Man Ther*. 2016;24(1):1-11. doi:10.1186/s12998-016-0088-9
44. van Beukering MDM. Work during pregnancy and postpartum period: research on sick leave (in Dutch;Werken tijdens zwangerschap en periode postpartum: onderzoek naar ziekteverzuim). *TBV – Tijdschr Voor Bedr- En Verzek*. 2002;10(1):2-8. doi:10.1007/BF03073675
45. Engeset J, Stuge B, Fegran L. Pelvic girdle pain affects the whole life—a qualitative interview study in Norway on women's experiences with pelvic girdle pain after delivery. *BMC Res Notes*. 2014;7(1):686. doi:10.1186/1756-0500-7-686
46. Biering-Sørensen F. A one-year prospective study of low back trouble in a general population. The prognostic value of low back history and physical measurements. *Dan Med Bull*. 1984;31(5):362-375.

47. Angarita-Fonseca A, Trask C, Shah T, Bath B. Stable prevalence of chronic back disorders across gender, age, residence, and physical activity in Canadian adults from 2007 to 2014. *BMC Public Health*. 2019;19(1):1121. doi:10.1186/s12889-019-7395-8
48. Bath B, Trask C, McCrosky J, Lawson J. A Biopsychosocial Profile of Adult Canadians with and without Chronic Back Disorders: A Population-Based Analysis of the 2009-2010 Canadian Community Health Surveys. *BioMed Res Int*. 2014;2014. doi:10.1155/2014/919621
49. Currie SR, Wang J. Chronic back pain and major depression in the general Canadian population. *Pain*. 2004;107(1):54-60. doi:10.1016/j.pain.2003.09.015
50. Fourny DRM, Dettori JR, Hall HM, Hartl RM, McGirt MJM, Daubs MDM. A Systematic Review of Clinical Pathways for Lower Back Pain and Introduction of the Saskatchewan Spine Pathway. [Miscellaneous Article]. *Spine*. Published online October 2011. doi:10.1097/BRS.0b013e31822ef58f
51. Schopflocher D, Taenzer P, Jovey R. The prevalence of chronic pain in Canada. *Pain Res Manag J Can Pain Soc*. 2011;16(6):445-450.
52. Shupler MS, Kramer JK, Cragg JJ, Jutzeler CR, Whitehurst DGT. Pan-Canadian Estimates of Chronic Pain Prevalence From 2000 to 2014: A Repeated Cross-Sectional Survey Analysis. *J Pain*. 2019;20(5):557-565. doi:10.1016/j.jpain.2018.10.010
53. Wong JJ, Côté P, Tricco AC, Watson T, Rosella LC. Effect of back problems on healthcare utilization and costs in Ontario, Canada: a population-based matched cohort study. *PAIN*. 2021;162(10):2521-2531. doi:10.1097/j.pain.0000000000002239
54. Singer J. A snapshot of health care in Canada as demonstrated by top 10 lists, 2011. Toronto: Canadian Institute of Health Information. Published 2011. Accessed March 30, 2022. <https://fliphtml5.com/ebtr/rfyb/basic>
55. Ramage-Morin P, Gilmour H. Chronic pain at ages 12 to 44. *Health Rep*. 2010;21(4 SRC-GoogleScholar):53-61.
56. Bone and Joint Canada. Low Back Pain. Published November 10, 2015. Available from: <http://boneandjointcanada.com/low-back-pain/>
57. Mannion CA, Vinturache AE, McDonald SW, Tough SC. The Influence of Back Pain and Urinary Incontinence on Daily Tasks of Mothers at 12 Months Postpartum. *PLOS ONE*. 2015;10(6):e0129615. doi:10.1371/journal.pone.0129615
58. Bjelland EK, Stuge B, Engdahl B, Eberhard-Gran M. The effect of emotional distress on persistent pelvic girdle pain after delivery: a longitudinal population study. *BJOG Int J Obstet Gynaecol*. 2013;120(1):32-40. doi:10.1111/1471-0528.12029
59. Pincus T, Burton AK, Vogel S, Field AP. A Systematic Review of Psychological Factors as Predictors of Chronicity/Disability in Prospective Cohorts of Low Back Pain. *Spine*. 2002;27(5):E109.
60. Linton SJ. A Review of Psychological Risk Factors in Back and Neck Pain. *Spine*. 2000;25(9):1148-1156.
61. O'Sullivan PB, Beales DJ. Diagnosis and classification of pelvic girdle pain disorders—Part 1: A mechanism based approach within a biopsychosocial framework. *Man Ther*. 2007;12(2):86-97. doi:10.1016/j.math.2007.02.001
62. Gatchel RJ, Peng YB, Peters ML, Fuchs PN, Turk DC. The biopsychosocial approach to chronic pain: Scientific advances and future directions. *Psychol Bull*. 2007;133(4):581-624. doi:10.1037/0033-2909.133.4.581

63. Linton SJ, Shaw WS. Impact of Psychological Factors in the Experience of Pain. *Phys Ther.* 2011;91(5):700-711. doi:10.2522/ptj.20100330
64. Linton S, Boersma K, J. Early identification of patients at risk of developing a persistent back problem: the predictive validity of the Orebro Musculoskeletal Pain Questionnaire. *Clin Doi* 101097000025080300000002. 2003;19 SRC-GoogleScholar:80-86.
65. Waddell G. Biopsychosocial analysis of low back pain. *Baillières Clin Rheumatol.* 1992;6(3):523-557. doi:10.1016/S0950-3579(05)80126-8
66. World Health Organization, ed. *International Classification of Functioning, Disability and Health: ICF.* World Health Organization; 2001.
67. Public Health Agency of Canada. *What Mothers Say: The Canadian Maternity Experiences Survey.* Public Health Agency of Canada; 2009.
68. Dzakpasu S, Kaczorowski J, Chalmers B, Heaman M, Duggan J, Neusy E. The Canadian Maternity Experiences Survey: Design and Methods. *J Obstet Gynaecol Can.* 2008;30(3):207-216. doi:10.1016/S1701-2163(16)32757-8
69. Bergström C, Persson M, Mogren I. Psychosocial and behavioural characteristics in women with pregnancy-related lumbopelvic pain 12 years postpartum. *Chiropr Man Ther.* 2019;27(1):1-12. doi:10.1186/s12998-019-0257-8
70. Freese J author, Long JS author. *Regression Models for Categorical Dependent Variables Using Stata.* Third edition.; 2014.
71. Williams R. Understanding and interpreting generalized ordered logit models. *J Math Sociol.* 2016;40(1):7-20. doi:10.1080/0022250X.2015.1112384
72. Williams R. Generalized Ordered Logit/Partial Proportional Odds Models for Ordinal Dependent Variables. *Stata J Promot Commun Stat Stata.* 2006;6(1):58-82. doi:10.1177/1536867X0600600104
73. Hosmer D, Lemeshow S, Sturdivant RX. *Applied Logistic Regression. 3rd Edition Ed.* New York: John Wiley & Sons; 2013.
74. Williams R. Review of Regression Models for Categorical Dependent Variables Using Stata, Second Edition, by Long and Freese. *Stata J.* 2006;6(2):273-278. doi:10.1177/1536867X0600600208
75. Soon JJ. The determinants of students' return intentions: A partial proportional odds model. *J Choice Model.* 2010;3(2):89-112. doi:10.1016/S1755-5345(13)70037-X
76. Government of Canada SC. Maternity Experiences Survey (MES). Published October 24, 2007. Accessed August 1, 2020. <http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5019#a4>
77. Albert H, Godsken M, Westergaard J. Prognosis in four syndromes of pregnancy-related pelvic pain. *Acta Obstet Gynecol Scand* 101080j16000412080006505x. 2001;80 SRC-GoogleScholar:505-510.
78. Gutke A, Östgaard HC, Öberg B. Predicting Persistent Pregnancy-Related Low Back Pain: *Spine.* 2008;33(12):E386-E393. doi:10.1097/BRS.0b013e31817331a4
79. Cooklin AR, Amir LH, Jarman J, Cullinane M, Donath SM. Maternal Physical Health Symptoms in the First 8 Weeks Postpartum Among Primiparous Australian Women. *Birth.* 2015;42(3):254-260. doi:10.1111/birt.12168
80. Robinson HS, Mengshoel AM, Veierød MB, Vøllestad N. Pelvic girdle pain: Potential risk factors in pregnancy in relation to disability and pain intensity three months postpartum. *Man Ther.* 2010;15(6):522-528. doi:10.1016/j.math.2010.05.007

81. Terzi H, Terzi R, Altinbilek T. Pregnancy-related lumbopelvic pain in early postpartum period and risk factors. *Int J Res Med Sci*. Published online 2015:1617-1621. doi:10.18203/2320-6012.ijrms20150239
82. Vermani E, Mittal R, Weeks A. Pelvic girdle pain and low back pain in pregnancy: A review. *Pain Pract Doi 101111j1533250000327x*. 2009;10(1 SRC-GoogleScholar):60-71.
83. Kristiansson P, Svärdsudd K, von Schoultz B. Back Pain During Pregnancy: A Prospective Study. *Spine*. 1996;21(6):702-708.
84. Breen TW, Ransil BJ, Groves PA, Oriol NE. Factors Associated with Back Pain after Childbirth. *Anesthesiol J Am Soc Anesthesiol*. 1994;18(1):29-34.
85. Turgut F, Turgut M, Çetinşahin M. A prospective study of persistent back pain after pregnancy! This study was presented in part at the 11th International Congress of Neurological Surgery, Amsterdam, The Netherlands, July 6–11, 1997.1. *Eur J Obstet Gynecol Reprod Biol*. 1998;80(1):45-48. doi:10.1016/S0301-2115(98)00080-3
86. Zasloff E, Schytt E, Waldenström U. First time mothers' pregnancy and birth experiences varying by age. *Acta Obstet Gynecol Scand*. 2007;86(11):1328-1336. doi:10.1080/00016340701657209
87. Allen E, Bonell C, Strange V, et al. Does the UK government's teenage pregnancy strategy deal with the correct risk factors? Findings from a secondary analysis of data from a randomised trial of sex education and their implications for policy. *J Epidemiol Community Health*. 2007;61(1):20-27. doi:10.1136/jech.2005.040865
88. Baş EK, Bülbül A, Uslu S, Baş V, Elitok GK, Zubarioğlu U. Maternal Characteristics and Obstetric and Neonatal Outcomes of Singleton Pregnancies Among Adolescents. *Med Sci Monit Int Med J Exp Clin Res*. 2020;26:e919922. doi:10.12659/MSM.919922
89. Rich-Edwards JW, Kleinman K, Abrams A, et al. Sociodemographic predictors of antenatal and postpartum depressive symptoms among women in a medical group practice. *J Epidemiol Community Health*. 2006;60(3):221-227. doi:10.1136/jech.2005.039370
90. Biering K, Nøhr EA, Olsen J, Andersen AMN, Hjøllund NH, Juhl M. Pregnancy-related pelvic pain is more frequent in women with increased body mass index. *Acta Obstet Gynecol Scand*. 2011;90(10):1132-1139. doi:10.1111/j.1600-0412.2011.01141.x
91. Mogren IM. BMI, pain and hyper-mobility are determinants of long-term outcome for women with low back pain and pelvic pain during pregnancy. *Eur Spine J*. 2006;15(7):1093-1102. doi:10.1007/s00586-005-0004-9
92. Bjelland EK, Stuge B, Vangen S, Stray-Pedersen B, Eberhard-Gran M. Mode of delivery and persistence of pelvic girdle syndrome 6 months postpartum. *Am J Obstet Gynecol*. 2013;208(4):298.e1-298.e7. doi:10.1016/j.ajog.2012.12.002
93. Mogren IM. Does caesarean section negatively influence the post-partum prognosis of low back pain and pelvic pain during pregnancy? *Eur Spine J*. 2007;16(1):115-121. doi:10.1007/s00586-006-0098-8
94. Pol GVD, Brummen HJV, Bruinse HW, Heintz APM, Vaart CHVD. Pregnancy-related pelvic girdle pain in the Netherlands. *Acta Obstet Gynecol Scand*. 2007;86(4):416-422. doi:10.1080/00016340601151683
95. Elsenbruch S, Benson S, Rütcke M, et al. Social support during pregnancy: effects on maternal depressive symptoms, smoking and pregnancy outcome. *Hum Reprod Oxf Engl*. 2007;22(3):869-877. doi:10.1093/humrep/del432

96. Emmanuel E, Creedy DK, John WS, Gamble J, Brown C. Maternal role development following childbirth among Australian women. *J Adv Nurs*. 2008;64(1):18-26. doi:10.1111/j.1365-2648.2008.04757.x
97. Negron R, Martin A, Almog M, Balbierz A, Howell EA. Social Support During the Postpartum Period: Mothers' Views on Needs, Expectations, and Mobilization of Support. *Matern Child Health J*. 2013;17(4):616-623. doi:10.1007/s10995-012-1037-4
98. Surkan PJ, Peterson KE, Hughes MD, Gottlieb BR. The Role of Social Networks and Support in Postpartum Women's Depression: A Multiethnic Urban Sample. *Matern Child Health J*. 2006;10(4):375-383. doi:10.1007/s10995-005-0056-9
99. Tarkka MT, Paunonen M. Social support and its impact on mothers' experiences of childbirth. *J Adv Nurs*. 1996;23(1):70-75. doi:10.1111/j.1365-2648.1996.tb03137.x
100. Shepherd J. Symphysis pubis dysfunction: a hidden cause of morbidity. *Br J Midwifery*. 2005;13(5):301-307. doi:10.12968/bjom.2005.13.5.18092
101. Bastiaenen CH, Bie RA de, Wolters PM, et al. Effectiveness of a tailor-made intervention for pregnancy-related pelvic girdle and/or low back pain after delivery: Short-term results of a randomized clinical trial [ISRCTN08477490]. *BMC Musculoskelet Disord*. 2006;7(1):1-13. doi:10.1186/1471-2474-7-19
102. Kendall NAS. Psychosocial approaches to the prevention of chronic pain: the low back paradigm. *Best Pract Res Clin Rheumatol*. 1999;13(3):545-554. doi:10.1053/berh.1999.0044
103. Nicholas MK, George SZ. Psychologically Informed Interventions for Low Back Pain: An Update for Physical Therapists. *Phys Ther*. 2011;91(5):765-776.
104. Lansakara N, Brown SJ, Gartland D. Birth Outcomes, Postpartum Health and Primary Care Contacts of Immigrant Mothers in an Australian Nulliparous Pregnancy Cohort Study. *Matern Child Health J*. 2010;14(5):807-816. doi:10.1007/s10995-009-0514-x
105. Lindström I, Areskoug B, Allebeck P. Do Immigrant Patients Differ From Native Swedish Patients With Back Pain When Entering Rehabilitation? *Adv Physiother*. 2002;4(2):74-84. doi:10.1080/140381902320141470
106. Ménard V, Sotunde OF, Weiler HA. Ethnicity and Immigration Status as Risk Factors for Gestational Diabetes Mellitus, Anemia and Pregnancy Outcomes Among Food Insecure Women Attending the Montreal Diet Dispensary Program. *Can J Diabetes*. 2020;44(2):139-145.e1. doi:10.1016/j.cjcd.2019.05.004
107. Robinson AM, Benzie KM, Cairns SL, Fung T, Tough SC. Who is distressed? A comparison of psychosocial stress in pregnancy across seven ethnicities. *BMC Pregnancy Childbirth*. 2016;16(1):1-11. doi:10.1186/s12884-016-1015-8
108. Pottie K, Greenaway C, Feightner J, et al. Evidence-based clinical guidelines for immigrants and refugees. *Can Med Assoc J CMAJ Ott*. 2011;183(12):E824-925.
109. Baron R, Manniën J, Velde SJ te, Klomp T, Hutton EK, Brug J. Socio-demographic inequalities across a range of health status indicators and health behaviours among pregnant women in prenatal primary care: a cross-sectional study. *BMC Pregnancy Childbirth*. 2015;15(1):1-11. doi:10.1186/s12884-015-0676-z
110. Mumtaz Z, O'Brien B, Higginbottom G. Navigating maternity health care: a survey of the Canadian prairie newcomer experience. *BMC Pregnancy Childbirth*. 2014;14(1):1-9. doi:10.1186/1471-2393-14-4

111. Sword W, Watt S, Krueger P. Postpartum Health, Service Needs, and Access to Care Experiences of Immigrant and Canadian-Born Women. *J Obstet Gynecol Neonatal Nurs*. 2006;35(6):717-727. doi:10.1111/j.1552-6909.2006.00092.x
112. Urquia ML, O'Campo PJ, Heaman MI. Revisiting the immigrant paradox in reproductive health: The roles of duration of residence and ethnicity. *Soc Sci Med*. 2012;74(10):1610-1621. doi:10.1016/j.socscimed.2012.02.013
113. Chang HY, Yang YL, Jensen MP, Lee CN, Lai YH. The Experience of and Coping with Lumbopelvic Pain among Pregnant Women in Taiwan. *Pain Med*. 2011;12(6):846-853. doi:10.1111/j.1526-4637.2011.01151.x
114. Huang HC, Chang HJ, Lin KC, Chiu HY, Chung JH, Tsai HC. A Closer Examination of the Interaction among Risk Factors for Low Back Pain. *Am J Health Promot*. 2014;28(6):372-379. doi:10.4278/ajhp.120329-QUAN-171
115. Mantle MJ, Holmes J, Currey HLF. BACKACHE IN PREGNANCY II: PROPHYLACTIC INFLUENCE OF BACK CARE CLASSES. *Rheumatology*. 1981;20(4):227-232. doi:10.1093/rheumatology/20.4.227
116. Croft P, Raspe H. Back pain. *Baillières Clin Rheumatol*. 1995;9(3):565-583. doi:10.1016/S0950-3579(05)80259-6
117. Ostgaard H, Zetherstrom G, Roos-Hansson E, Svanberg B. Reduction of back and posterior pelvic pain in pregnancy. *Spine*. 1994;19 SRC-GoogleScholar:894-900.

Transition to Chapter 4

Findings from Chapter 3 demonstrated that a significant proportion (36%) of recent mothers in Canada report some degree of problematic BP up to three months postpartum. Given that the published literature suggests that women who still have back pain complaints at three months postpartum may have a poorer prognosis and were more likely to develop persistent and longer-term BP, the next manuscript (Chapter 4) will examine the prevalence and biopsychosocial factors influencing persistent BP lasting up to 5-14 months postpartum among Canadian mothers with back pain at three months postpartum.

CHAPTER 4

4. MANUSCRIPT 2

4.1 General Information

4.1.1 Title

Persistence of back pain up to 5-14 months postpartum in Canada: a biopsychosocial perspective.

4.1.2 Citation

Awe O., Bath B., Angarita-Fonseca A., Farag M. Persistence of back pain up to 5-14 months postpartum in Canada: a biopsychosocial perspective. *Manuscript in preparation for submission.*

The contributions of the PhD candidate, Awe O, to this manuscript included conceiving and designing the study, completing the RDC project approval submissions, conducting data analysis and results interpretation, and preparing the manuscript.

4.2 Abstract

Background: Back pain (BP) can persist postnatally. The aim of this study was to investigate the occurrence of persistent BP lasting up to 5-14 months and the associated biopsychosocial factors among a national sample of postpartum mothers in Canada.

Methods: Data from the Canadian Maternity Experiences Survey (MES) was analyzed. The sample included women who reported some degree of BP during the first 3 months postpartum (n=2,226). Persistent BP was defined as reporting ongoing symptoms (yes/no) at 5-14 months after childbirth among a sample of women who had some degree of symptoms during the first 3 months.

Results: Of the mothers studied, 46% reported ongoing BP at 5-14 months after childbirth. The multivariable logistic regression model identified one significant two-way interaction effect that was associated with persistent BP: maternal age + degree of problematic BP in early postpartum. In addition, being an immigrant, having other pain conditions, poorer self-rated health, inadequate social support postpartum, and history of violent abuse (all $p < 0.05$) were all independently associated with a higher likelihood of reporting persistent BP at 5-14 months postpartum.

Conclusion: Persistent BP (up to 5-14 months postpartum) was highly prevalent (46%) among mothers who still had symptoms at three months postpartum. Having greatly problematic pain in early postpartum and psychological factors were the main factors associated with persistence of symptoms. These findings highlight the need to identify women at risk of persistent symptoms early in pregnancy and postpartum and administer appropriate and targeted interventions, paying special attention to biopsychosocial factors that may influence delayed recovery postpartum.

Keywords: back pain, low back pain, pelvic girdle pain, prevalence, postpartum, biopsychosocial

4.3 Introduction

Back pain (BP) is common among postpartum women,¹⁻⁴ and may result from persistence of pregnancy-related BP,^{2,5-8} or may newly develop during labor⁹⁻¹² or in the postpartum period.^{1,13-15} It was estimated that up to 75% of women who had BP during pregnancy may still report persistent pain for varying periods postpartum.^{13,16-19} Ostgaard et al³ followed 817 women through pregnancy to a minimum of 12 months postpartum, and found that 67% reported the presence of BP directly after delivery, while 37% still have symptoms at 18 months postpartum. Furthermore, a recent review showed new-onset postpartum back pain was incident in 19%-53% of women between 6 months and 11 years postpartum.¹ While the majority of women recover within 3 months postpartum,³ up to a third women still report symptoms after this period.^{3,14,20} Notably, the risk of having longer term BP have been shown to be increased in women still reporting BP at 3 months after childbirth.^{3,17,21-23} The severity of complaints is also considered an important prognostic factor, in which women reporting a higher degree of pain intensity during pregnancy or postpartum were shown to be more likely to report higher disability scores and persistent BP several years postpartum.^{2,12,13,24-26}

Persistent BP after childbirth can have far reaching impacts for affected women, their families, and the society. It has been linked with significant disability,^{13,23} reduced quality of life,^{13,27} poorer self-rated health,^{24,28} worse emotional and psychological health,²⁹⁻³³ and impaired sexual life.³⁴ Persistent BP can also impede postnatal recovery, mothering role attainment, re-entry into the workforce, job productivity and is associated with increased healthcare utilization.^{20,26,35-38} The condition has also been associated with chronic pain later in life,^{39,40} and more recently, BP in the general population was linked with mortality in women,⁴¹ which further indicate that BP is a

significant public health concern in childbearing women, especially among those who develop long-term problems.²⁴

In Canada, information on persistent BP postpartum is scarce in general, however existing studies indicate a high proportion of mothers (41-77%) reporting back problems in the first postpartum year.^{42,43} Our own research (not yet published) revealed that about 36% of mothers reported some degree of problematic BP during the first three months postpartum. Furthermore, we found a wide range of biopsychosocial factors were associated with reporting worse BP status, including: younger maternal age; immigrant status; higher pre-pregnancy BMI; pre-pregnancy depression; vaginal birth; lower self-rated health; higher perceived stress, higher number of stressful life events; inadequate social support after childbirth; province of residence; lower educational attainment; lower household income; and perceived inadequate information about BP during pregnancy. However, it is not known if these factors also contribute to persistence of BP up to 5-14 months postpartum. There is need for increased knowledge on the possible factors that influence pain persistence in this sub-population of Canadian mothers, as this information can help to inform early detection and targeted prevention and/or rehabilitation interventions before longer-term problems develop. Moreover, current evidence suggests the need to understand persistent/chronic back problems within a biopsychosocial framework that reflects the interaction between biological/physical, psychological and social influences.⁴⁴⁻⁴⁸ The aim of this study was therefore to evaluate the prevalence and predictors associated with persistent BP lasting up to 5 to 14 months postpartum, using the biopsychosocial framework, among a nationally representative sample of mothers who reported some degree of problematic BP during the first three months postpartum in Canada.

4.4 Methods

4.4.1 Data source

Data was accessed from the Maternity Experiences Survey (MES), a national cross-sectional household survey conducted by Statistics Canada in partnership with the Public Health Agency of Canada to survey mothers 15 years and older (N= 6,421; weighted N= 76,508) on their experiences of pregnancy, birth, and the postpartum period. A simple random stratified sampling process was used to select mothers based on province and territory, maternal age (<20 years and > 20 years)

and place of dwelling (rural/urban). Mothers were interviewed between 5 and 14 months postpartum. Mothers residing in institutions and on First Nations reserves were excluded. Details regarding sampling design, data collection and calculation of response rates are available elsewhere.^{49,50} Only, mothers who reported some degree of BP during the first 3 months postpartum and responded to the question regarding persistent back pain were included in the present study (n=2,226; weighted n=27,558). The flowchart of the study sample selection is depicted in Figure 4.1.

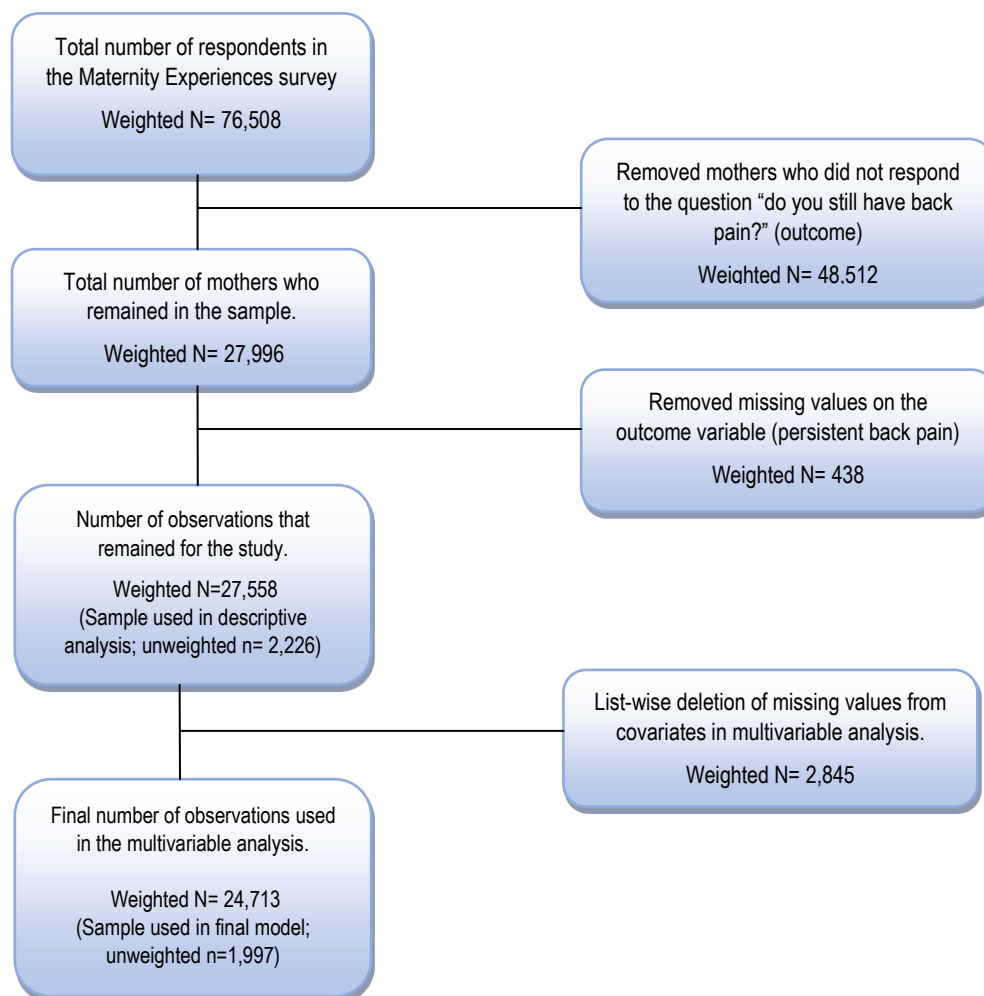


Figure 4.1: Flow chart to describe sample selection from the original Maternity Experiences Survey (MES) study population.

4.4.2 Study variables

Presence of back pain at 5 to 14 months postpartum (yes/no) was the outcome variable. MES respondents who reported some degree (“somewhat” or “a great deal”) of problem with back pain during the first three months postpartum were asked the follow-up question: “*Do you still have back pain (yes/no)?*”

Independent variables that were investigated in this study were selected and grouped to align with the bio-psycho-social framework. Also, other factors (e.g., current pregnancy) were included since they could potentially confound the associations of interest (Table 4.1). Degree of problematic back pain during the first three months postpartum was recorded in the MES as: not a problem; somewhat of a problem; and great deal of a problem. Women who responded as ‘not a problem’ were skipped in the MES on the follow-up question on persistent BP. Respondents who reported other persistent pain conditions other than back pain, such as vaginal/cesarean incision site pain, breasts pain, or severe headaches at 5-14 months postpartum were categorized as ‘yes’; otherwise as ‘no’. Detailed description of the included variables can be found in Appendix C.

Table 4.1. Description of variables included in the analysis	
Variable cluster	Variable
Biological/physical	Maternal age in years (below 20, 20-29, ≥ 30+) Current BMI (under/normal weight, overweight, obese) Parity (primiparous, multiparous) Mode of delivery (vaginal, caesarean) Degree of problematic back pain in early postpartum (somewhat problematic, greatly problematic) Other persistent pain conditions (no, yes)
Psychological	Self-rated health (good-to-excellent, fair-to-poor) Daily stress (not stressed, somewhat/very stressed) Perceived social support postpartum (adequate, inadequate) Pre-pregnancy depression (no, yes) History of violent abuse (no, yes)
Social	Marital status (partnered, not partnered) Immigrant status (Canadian-born, immigrant) Aboriginal status (no, yes) Province of residence (Eastern Atlantic, Eastern Central, Western Prairies, Western BC, Northern Territories) Place of residence (rural, urban ≤ 49,999, urban ≥ 500,000)

	Level of education (below high school/high school, some post-secondary, bachelor's or higher) Annual household income (below \$40,000, \$40,000-below \$80,000, \$80,000 or mor, unknown) Work status during pregnancy (paid job, no paid job) Substance use during pregnancy (no, yes) Perceived inadequate information about BP during pregnancy (no, yes)
Other factors	Current pregnancy (no, yes) Postpartum period after childbirth (early postpartum, mid postpartum, late postpartum).

4.4.3 Statistical Analysis

All analyses were conducted using Stata v.15. Based on Statistics Canada's guidelines, sample weights and bootstrap weights (n=1000) provided by Statistics Canada were used to account for unequal probability of selection, as well as to estimate accurate 95% confidence intervals using balanced repeated replication technique.^{50,51} For the descriptive analysis, frequencies and proportions were calculated for each independent variable (all categorical) relative to persistent BP using Pearson Chi-square test. Furthermore, univariable and multivariable logistic regression models were computed to examine the association between the selected biological, psychological, and social factors and persistent BP at 5 to 14 months postpartum.

Model building followed steps provided by Hosmer et al.⁵² Variables that showed significant association with persistent back pain in the univariable analysis at $p < 0.20$ were selected for further analysis in the multivariable model. The final parsimonious model was fitted using manual backward selection method, starting with the full model and excluding variables starting from the highest p-value based on a significance level of $p < 0.05$. Confounding was assessed at each step using a $> 20\%$ change in the regression coefficients between the crude and adjusted model caused by any eliminated variable. Also, possible two-way interactions of the independent variables with degree of back pain in the first 3 months postpartum and maternal age were explored (at $\alpha = 0.05$). When a confounder or a significant interaction term was identified, it was retained in the final model. Strength of association were presented as prevalence ratios (PR) instead of odds ratios because odds ratios can produce inflated estimates of the effects of the independent variables when the disease prevalence is high.^{53,54} Crude PRs were computed by dividing the prevalence of persistent back pain in one response category of a variable by the prevalence in the reference category of that variable. Adjusted PRs were computed using marginal predicted probabilities

computed from the final logistic regression models. Akaike information criteria (AIC), was used to select a parsimonious model, whereby a smaller AIC indicated the better model.⁵⁵ In addition, receiver-operating characteristics (ROC) was used to examine the discriminative ability of the final model. Finally, link test and Hosmer-Lemeshow goodness-of-fit test for survey data⁵⁶ were computed to check for specification errors and assess fit of the final model, respectively. Missing responses on the outcome variable (persistent pain) were excluded from the analysis. Additional missing values from the covariates (except for income) deemed missing at random and were handled using list-wise deletion in STATA. Missing data for income was coded as a separate category ('missing') to ensure respondents remained in the analysis, thus preventing considerable drop in sample size.

4.4.4 Ethics

Access to the confidential MES microdata files was granted through the Saskatchewan Statistics Canada Research Data Center (SKY-RDC), following a rigorous security screening process, approval of the research proposal, and vetting procedure to ensure confidentiality and protection of survey participants' identities.

4.5 Results

4.5.1 Prevalence of persistent BP lasting up 5-14 months postpartum

Of the mothers who reported some degree of problematic back pain problem during the first three months postpartum, there were 14,808 (53.7%; 95% CI=53.1% - 54.3%) mothers who had recovered at 5-14 months after childbirth, while 12,750 (46.3%; 95% CI=45.7% - 46.9%) continued to have un-resolved symptoms (i.e., persistent BP). Overall, 6,741 of 18,366 of participants who experienced 'somewhat' problematic back pain during the first three months postpartum responded to having persistent pain at 5-14 months postpartum. Conversely, 6,008 of 9,192 of mothers who described their back pain as being 'a great deal' problematic during the first three months postpartum responded to having persistent back pain postpartum (Table 4.2).

Table 4.2: Responses of mothers with regards to back pain reported at 5-14 months after childbirth by degree of back problem experienced during the first three months postpartum.			
3 months postpartum: <i>During the first 3 months after the birth of baby's name, how much of a problem was... back pain due to the birth?</i>	5-14 months postpartum: <i>Do you still have back pain?</i>		
	No	Yes	Total
Not a problem (n= 48,512) ‡	-	-	-
Somewhat of a problem	11,625	6,741	18,366
A great deal of a problem	3,183	6,008	9,192
Total	14,808	12,759	27,558

‡Mothers who reported no problematic back pain at three months postpartum were not asked the follow-up question regarding persistent pain.

Tables 4.3-4.5 depicts the distribution of selected biological, psychological, and social factors by persistent BP at 5-14 months postpartum.

4.5.1.1 Biological/physical factors

The majority of mothers fell within the 30-34 years age group (34.3%), while younger mothers aged below 20 years constituted the minority group at 2.6%. For these younger mothers, persistent BP was remarkably more frequent (61.2%) when compared to older mothers (Figure 4.2 and Table 4.3). Persistent BP varied significantly by the degree of BP reported during the first three months postpartum, whereby 65.4% of mothers who had ‘greatly’ problematic pain in early postpartum reported persistent BP compared to a rate of 36.7% among those who only had somewhat problematic pain. Similarly, persistent BP prevalence was higher for mothers who reported other persistent pain problems than those who did not (60.1% vs 42.2%). On the other hand, no substantial differences were found among aboriginal versus non-aboriginal mothers (45.3% vs 46.3), nulliparous versus multiparous mothers (45.7% vs 47.6%), and mothers who had vaginal versus caesarean delivery (46.0% vs 47.0%) (Table 4.3).

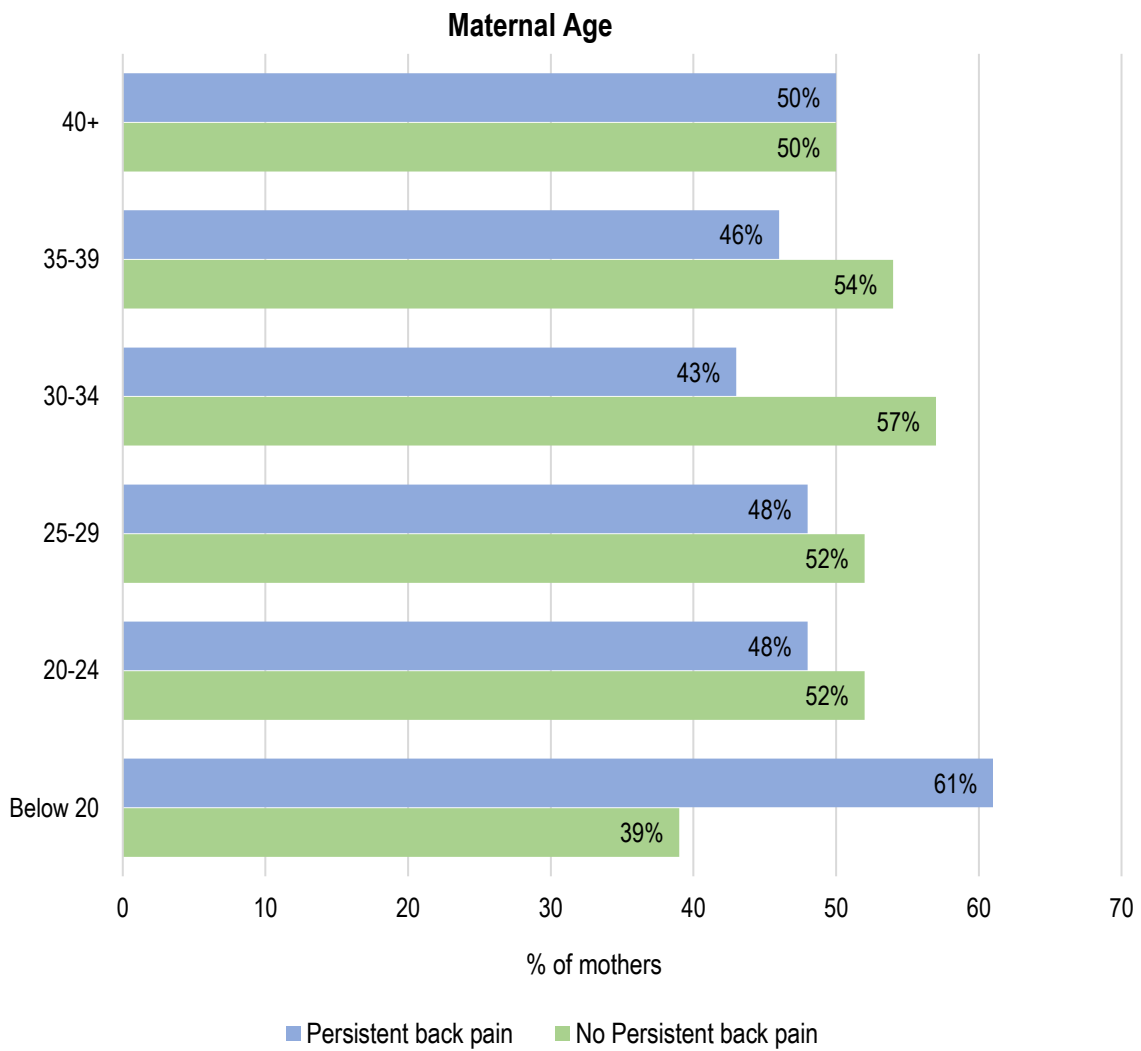


Figure 4.2: Percentage of mothers with or without persistent BP by maternal age (years) ($p < 0.1$)

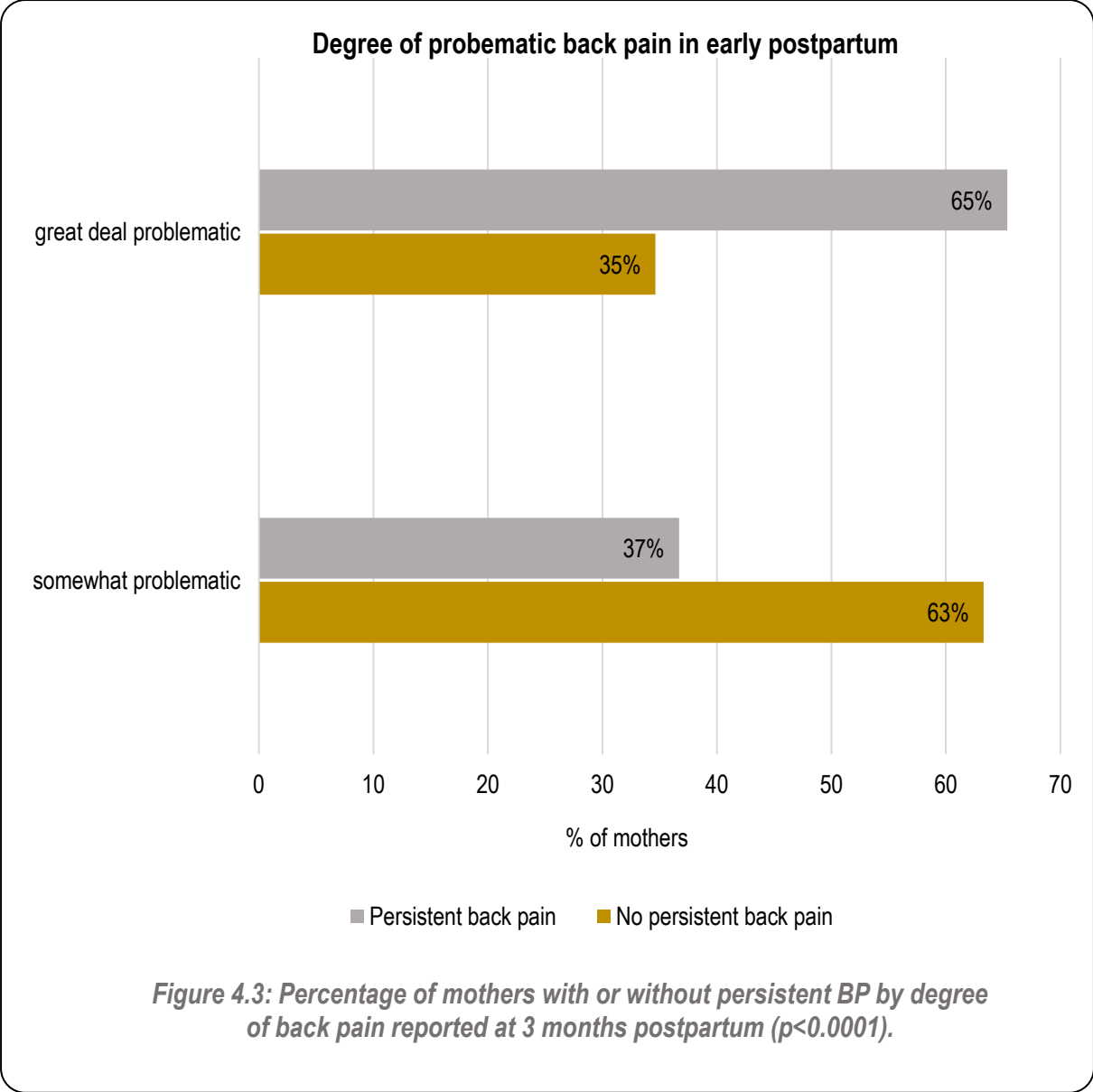


Table 4.3: Distribution of biological/physical factors by persistent BP, and crude prevalence ratios (PR) and 95% confidence Interval (CI) for reporting persistent BP at 5 to 14 months postpartum in univariable analysis.				
Independent variables	Study sample (weighted N= 27,558; 100%) *	Persistent BP prevalence (%) ^a	Crude PR (95% CI) *†	p-value (Chi-sq)
Maternal age at time of interview (years)				0.013
30+	15,115 (54.9)	44.35	ref	
Below 20	714 (2.6)	61.24	1.38 (1.13, 1.63)	
20 to 29	11,728 (42.6)	47.82	1.08 (0.97, 1.18)	
Current BMI (kg/m2)				0.163
Under/Normal weight	14,374 (52.2)	44.23	ref	
Overweight	6,576 (23.9)	48.71	1.10 (0.97, 1.23)	
Obese	5,457 (19.8)	48.27	0.96 (0.86, 1.05)	
Missing	1,150 (4.2)			
Parity (number of previous pregnancies)				0.420
Primiparous	9,118 (33.1)	47.59	ref	
Multiparous	18,333 (66.5)	45.68	0.96 (0.86, 1.05)	
Missing	106 (0.4)			
Mode of birth				0.714
Vaginal	20,866 (75.7)	46.03	ref	
Caesarean	6,692 (24.3)	46.99	1.02 (0.91, 1.13)	
Degree of back pain during the first 3 months postpartum				<0.0001
Somewhat problematic	18,366 (66.6)	36.71	ref	
Greatly problematic	9,192 (33.4)	65.37	1.78 (1.62, 1.94)	
Other pain conditions in the postpartum period				<0.0001
No	21,551 (78.2)	42.21	ref	
Yes	5,797 (21.0)	60.07	1.42 (1.28, 1.56)	
Missing	209 (0.8)			

BMI: body mass index; n: number of observations; %: percent; ref: reference category

* Weighted estimates, n and %, were computed using population weights; BRR 95% CI were computed using bootstrap weights (n=1000).

†Crude PRs were computed by dividing the prevalence of persistent back pain in one response category of a variable by the prevalence in the reference category of that variable. ^a Persistent BP denotes respondents who reported some degree of problematic back pain during the first three months postpartum and still has ongoing at the time of the survey (5-14 months postpartum)

4.5.1.2 Psychological factors

Table 4.3 shows that healthier mothers reported persistent BP to a lower extent compared to mothers in poorer perceived health (44.5% vs 67.2%). About three out of 5 mothers (63.4%) reported being somewhat or very stressed on most days. For those who were often stressed, the proportion of persistent BP was 48.5% compared to 42.3% among mothers who reported no stress. Similarly, mothers with perceived inadequate support post-delivery (62.1% vs 44.9%) or had a history of violent abuse (56.1% vs 44.8%) showed a higher pain persistence when compared to their counterparts with adequate social support postpartum and no abuse history, respectively.

However, there was no significant difference between previously depressed versus non-depressed mothers with regards to persistent BP prevalence (45.0 % vs 46.6%) (Table 4.4).

Table 4.4: Distribution of psychological factors by persistent BP, and crude prevalence ratios (PR) and 95% Confidence Interval (CI) for reporting persistent BP at 5 to 14 months postpartum in univariable analysis.				
Independent variables	Study sample (weighted N= 27,558; 100%) *	Persistent BP prevalence (%) ^a	Crude PR (95% CI) ^{*†}	p-value (Chi-sq)
Self-rated health				<0.0001
Good-to-excellent	25,394 (92.1)	44.5	ref	
Fair-to-poor	2,134 (7.7)	67.2	1.51 (1.33, 1.70)	
Missing	30 (0.1)			
Stress on most days				0.007
No stress	9,951 (36.1)	42.3	ref	
Somewhat/very stressful	17,483 (63.4)	48.5	1.15 (1.03, 1.26)	
Missing	124 (0.4)			
Perceived social support postpartum				<0.0001
Adequate	25,351 (92.0)	44.9	ref	
Inadequate	2,170 (7.9)	62.1	1.38 (1.19, 1.58)	
Missing	37 (0.1)			
Pre-existing depression				0.587
No	22,729 (82.5)	46.6	ref	
Yes	4,733 (17.2)	45	0.97 (0.84, 1.09)	
Missing	96 (0.3)			
History of violent abuse				0.001
No	23,945 (86.9)	44.8	ref	
Yes	3,422 (12.4)	56.1	1.25 (1.11, 1.140)	
Missing	191 (0.7)			

n: number of observations; %: percent; ref: reference category

* Weighted estimates, n and %, were computed using population weights; BRR 95% CI were computed using bootstrap weights (n=1000).

†Crude PRs were computed by dividing the prevalence of persistent back pain in one response category of a variable by the prevalence in the reference category of that variable. ^aPersistent BP denotes respondents who reported some degree of problematic back pain during the first three months postpartum and still has ongoing at the time of the survey (5-14 months postpartum)

4.5.1.3 Social factors

For immigrant status, the proportion of immigrant mothers who had persistent pain was 50.9% whereas the prevalence in Canadian-born mothers was 44%. Table 4.3, which depicts the distribution of respondents according to social factors, and persistent back pain, revealed significant differences in persistent back pain prevalence with regards to women's province of residence, with the highest rate observed in the Eastern central provinces (48.7%) while the Northern territories recoded the lowest rate at 36%. An inverse relationship was seen between mother's annual household income and back pain persistence. Prevalent persistent back pain

decreases as income increases from 49.5% in those who earned below \$40,000 to 46.3% (\$40,000- >\$80,000) and 40.6% (\$80,000 and more). Those who did not report their income recorded a prevalence of 52%. For mothers who used substances such as alcohol, cigarette or drug during their pregnancy, the proportion of persistent back pain was 51.5% compared to 45% among those who did not. Although only 9.1% of mothers reported not receiving information on back pain during pregnancy; for these women, about 60% reported persistent back pain whereas the prevalence of pain persistence among those who had back pain education was 44.9% (Table 4). However, no differences in persistent pain prevalence were found with regards to mother’s marital status, place of residence, level of education, type of work during pregnancy, and postpartum period after childbirth ($p>0.05$). Finally, 452 (1.6%) mothers were pregnant again at the time of the survey, however there was no significant difference between these mothers (54.7% vs 46.1%) and non-pregnant mothers with regards to persistent back pain prevalence ($p= 0.293$).

Table 4.5: Distribution of social factors by persistent BP, and crude prevalence ratios (PR) and 95% Confidence Interval (CI) for reporting persistent BP at 5 to 14 months postpartum in univariable analysis.				
Independent variables	Study sample (weighted N= 27,558; 100%) *	Persistent BP prevalence (%) *a	Crude PR (95% CI) *†	p-value (Chi-sq)
Marital status				0.181
Partner	24,770 (89.9)	45.7	ref	
No partner	2,664 (9.7)	50.5	1.11 (0.95, 1.26)	
Missing	123 (0.4)			
Immigrant status				0.006
Canada-born	18,452 (67.0)	43.96	ref	
Immigrant	8,952 (32.5)	50.91	1.16 (1.04, 1.28)	
Missing	154 (0.6)			
Aboriginal status				0.849
No	26,158 (94.9)	46.27	ref	
Yes	1,245 (4.5)	45.34	0.98 (0.77, 1.88)	
Missing	155 (0.6)			
Province of residence				0.004
Eastern Atlantic	1,382 (5.0)	43.5	ref	
Eastern Central	18,318 (66.5)	48.7	1.12 (0.98, 1.26)	
Western Prairies	4,851 (17.6)	42.1	0.97 (0.82, 1.12)	
Western BC	2,773 (10.1)	38.8	0.89 (0.71, 1.08)	
Northern Territories	117 (0.4)	36	0.83 (0.65, 1.01)	
Missing	117 (0.4)			
Place of residence				0.117
Urban<=499,999	8,828 (32)	43.4	ref	
Rural	4,357 (15.8)	49.8	1.14 (1.00, 1.29)	

Urban>=500,000 Missing	13,370 (48.5) 1,003 (3.6)	46.6	1.07 (0.96, 1.87)	
Level of education				0.191
Bachelor's/Higher	8,714 (31.6)	44	ref	
Below HS/HS	6,613 (24)	49.3	1.12 (0.98, 1.26)	
Some Postsecondary	11,763 (42.7)	45.9	1.04 (0.93, 1.16)	
Missing	468 (1.7)			
Annual household income				0.009
\$80,000 or more	7,015 (25.5)	40.6	ref	
\$40,000-below \$80,000	9,959 (36.1)	46.3	1.14 (0.99, 1.30)	
Below \$40,000	8,779 (31.9)	49.5	1.22 (1.07, 1.37)	
Unknown	1,804 (6.5)	52.2	1.29 (1.04, 1.53)	
Work during pregnancy				0.334
Yes	18,008 (65.3)	45.4	ref	
No	9,317 (33.8)	47.7	1.05 (0.94, 1.15)	
Missing	232 (0.8)			
Substance (cigarette, alcohol, or drug) use during pregnancy				0.022
No	22,114 (80.2)	45	ref	
Yes	5,286 (19.2)	51.5	1.14 (1.02, 1.27)	
Missing	157(0.6)			
Perceived inadequate information about BP during pregnancy				<0.0001
Yes	2,514 (9.1)	60	ref	
No	25,030 (90.8)	44.9	1.34 (1.16, 1.51)	
Missing	14 (0.1)			
Other factors				
Currently pregnant				0.293
No	26,881 (97.5)	46.1	ref	
Yes	452 (1.6)	54.7	1.19 (0.83, 1.54)	
Missing	225 (0.8)			
Postpartum period from birth of baby				0.375
Early Postpartum	7,390 (26.8)	44.9	ref	
Mid Postpartum	6,146 (22.3)	44.4	1.06 (0.95, 1.18)	
Late Postpartum	13,962 (50.7)	47.7	0.99 (0.85, 1.13)	
Missing	60 (0.2)			

HS: high school; Eastern Atlantic: Newfoundland and Labrador, Prince Edward Island, Nova scotia, and New Brunswick; Eastern central: Quebec and Ontario; Western Prairies: Manitoba, Saskatchewan, and Alberta; Western BC: British Columbia; Northern Territories: Yukon, Northwest territories, and Nunavut. n: number of observations; %: ref: reference category

* Weighted estimates, n and %, were computed using population weights; BRR 95% CI were computed using bootstrap weights (n=1000).

†Crude PRs were computed by dividing the prevalence of persistent back pain in one response category of a variable by the prevalence in the reference category of that variable. ^a Persistent BP denotes respondents who reported some degree of problematic back pain during the first three months postpartum and still has ongoing at the time of the survey (5-14 months postpartum)

4.5.2 Univariable results

Based on the univariable analysis (Tables 4.3-4.5), all selected factors showed association with persistent BP and were considered for further analysis in the multivariable model at p= 0.20 except

for maternal aboriginal status, parity, mode of delivery, pre-existing depression, work during pregnancy, current pregnancy status and postpartum period after childbirth.

4.5.3 Multivariable results

Table 4.6 displays the adjusted prevalence ratios for the association between biopsychosocial factors and persistent BP at 5-14 months postpartum. Adjusted PRs were derived from marginal predicted probabilities computed from the final logistic regression model adapting the steps provided by Muller & MacLehose.⁵⁴ (See Appendix D for the results of the final logistic regression model). When examining the model diagnosis, the ROC curve showed that the final model correctly classified 70% of mothers with persistent BP indicating that the final model has sufficient discriminatory accuracy. When comparing the model with interaction and the model without interaction, the model containing the interaction between back problem degree during the first 3 months postpartum and maternal age had lower AIC than the model without interaction (2,534 vs 2,539), and therefore, was preferred. Finally, the p-values generated from the link test ($p= 0.46$) showed the final model was correctly specified, whereas the result from the Hosmer and Lemeshow goodness-of-fit test indicates the final model fits well to the data ($p= 0.93$).

In the adjusted model, maternal marital status and daily stress during pregnancy did not show statistical significance at $p=0.05$. Also, BMI, substance use, whether mother received back pain information during pregnancy, province of residence, place of residence, maternal education and annual household income were forced in the final model as confounders because these variables caused a change of $> 20\%$ in the effect of other variables in the main effect model. Moreover, one two-way interaction (back problem degree in early postpartum x maternal age) was detected in the final model ($p< 0.05$).

4.5.3.1 Biological factors associated with persistent BP

In the biological domain (Table 4.6), only degree of back pain at three months postpartum and other pain conditions maintained independent association with persistent BP in the final model, while maternal age was only significant as part of an interaction term. Mothers who had greatly problematic BP in early postpartum were 1.69 (95% CI=1.53, 1.85) times more likely to have persistent BP than those who had milder pain. Similarly, mothers who had other persistent pain

conditions such as vaginal/cesarean incision site pain, breasts pain, or severe headaches were 1.34 (95% CI= 1.21, 1.47) times more likely to report persistent BP than those who did not have these pain problems. Finally, maternal age moderated the association between back problem degree in early postpartum and persistent BP ($p < 0.05$). Older mothers (30+ years) who had greatly problematic BP in early postpartum had a significantly higher probability of reporting persistent BP when compared to mothers aged 20-29 years and those who had milder early postpartum pain, but they did not differ significantly from similar mothers aged below 20 years. Figure 4 depicts the interactions in the model.

4.5.3.2 Psychological factors associated with persistent BP

Mothers who reported poorer self-rated health were more (APR=1.26; 95% CI= 1.05, 1.47) likely to have persistent BP relative to mothers in good to excellent health. Similarly, the likelihood of reporting persistent BP was increased (APR=1.30; 95% CI= 1.08, 1.51) among mothers who had inadequate social support postpartum compared to those who had adequate social support. Finally, mothers who had a history of violent abuse were 1.17 (95% CI= 1.02, 1.33) times more likely to report persistent symptoms compared to mothers without abuse history (Table 4.6).

4.5.3.3 Social factors associated with persistent BP

In the social domain (Table 4.6), besides immigrant status, no other factor achieved statistical significance in the final model. Immigrant mothers were 1.20 (95% CI=1.06, 1.33) times more likely to report persistent BP when compared to their Canadian-born counterparts. Marginal association was observed for whether mothers had adequate information about BP during pregnancy, whereby mothers who reported not having enough BP information (APR=1.19; 95% CI=1.00, 1.38), showed higher likelihood of reporting persistent BP than mothers who did not have these characteristics.

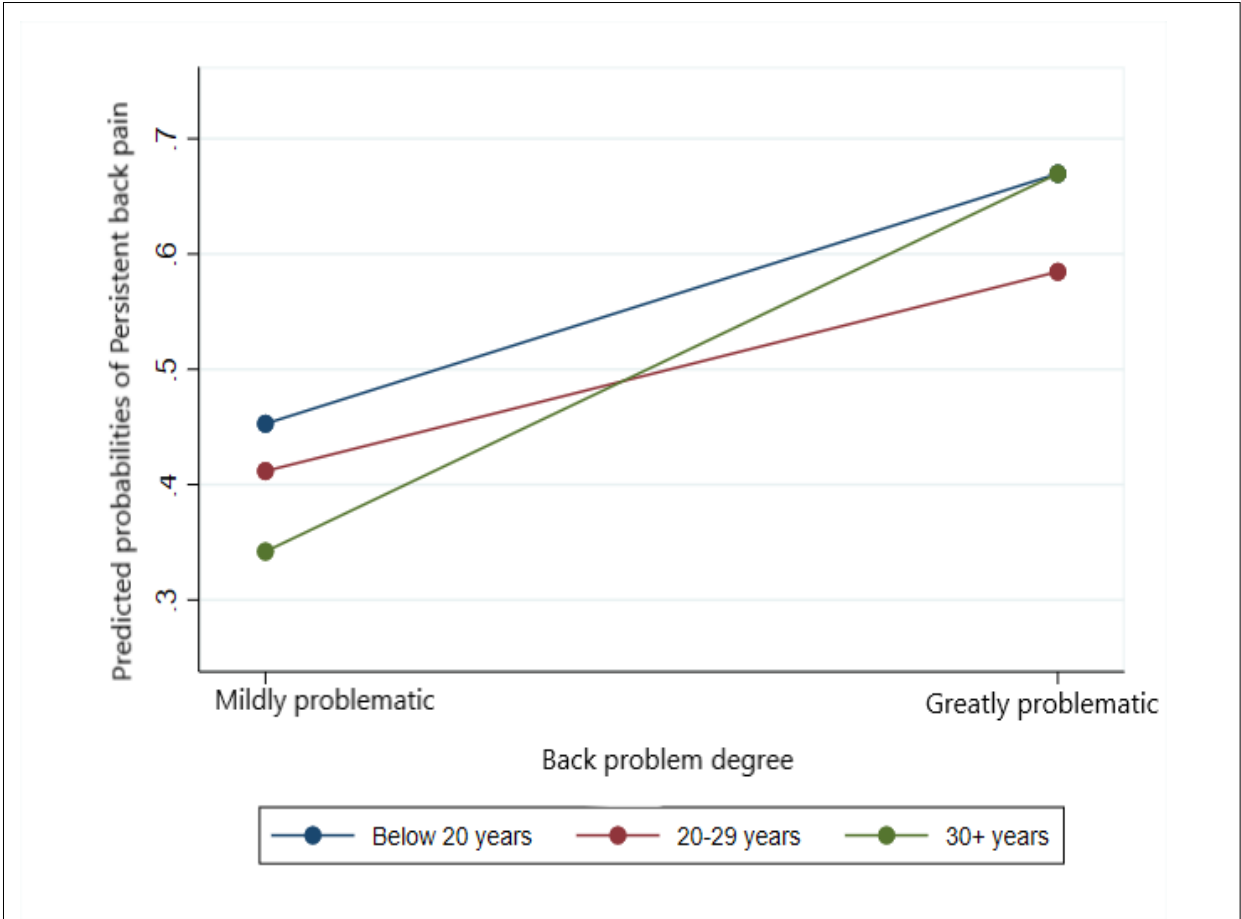


Figure 4.4: Predicted probabilities of reporting persistent back pain by degree of problematic back pain experienced during the first three months postpartum and maternal age.

Table 4.6. Adjusted prevalence ratios (APR) and corresponding 95% Confidence Interval (CIs) for having Persistent BP at 5-14 months postpartum according to selected biopsychosocial factors.		
Variable	Final Multivariable model (weighted N=24,713)	
	APR (95% CI) §	p-value
Biological factors		
Maternal age at time of interview (years)	ref	
30+	1.17 (0.87, 1.46)	0.272
Below 20	1.04 (0.93, 1.15)	0.432
Current BMI (kg/m2)	ref	
Under/Normal weight	1.07 (0.95, 1.19)	0.267
Overweight	1.09 (0.95, 1.22)	0.199
Degree of problematic back pain in early postpartum	ref	
Somewhat problematic	1.69 (1.54, 1.85)	<0.0001
Greatly problematic		
Other pain conditions in the postpartum period	ref	
No	1.34 (1.21, 1.47)	<0.0001
Yes		
Interaction: Degree of back pain in early postpartum*maternal age	ref	
Greatly problematic*30+	1.00 (0.72, 1.28)	0.999
Greatly problematic*below 20	0.87 (0.76, 0.98)	0.025
Greatly problematic*20-29		
Psychological factors		
Self-rated health	ref	
Good-to-excellent	1.26 (1.05, 1.47)	0.013
Fair-to-poor		
Perceived social support postpartum	ref	
Adequate	1.30 (1.08, 1.51)	0.007
Inadequate		
History of violent abuse	ref	
No	1.17 (1.02, 1.33)	0.029
Yes		
Social factors		
Immigrant status	ref	
Canada-born	1.20 (1.06, 1.33)	0.004
Immigrant		
Province of residence	ref	
Eastern Atlantic	1.12 (0.97, 1.27)	0.115
Eastern Central	0.99 (0.83, 1.14)	0.875
Western Prairies	0.91 (0.71, 1.11)	0.365
Western BC	0.85 (0.65, 1.05)	0.152
Northern Territories		
Place of residence	ref	
Urban<=499,999	1.13 (0.99, 1.27)	0.066
Rural	1.02 (0.90, 1.13)	0.755
Urban>=500,000		
Level of education		

Bachelor's/Higher	ref	
Below HS/HS	0.96 (0.82, 1.10)	0.544
Some Postsecondary	0.98 (0.87, 1.09)	0.716
Annual household income	ref	
\$80,000 or more	1.05 (0.91, 1.20)	0.475
Below\$40,000	1.08 (0.94, 1.22)	0.283
\$40,000 – below \$80,000	1.03 (0.79, 1.27)	0.806
Unknown		
Substance (cigarette, alcohol, drug) use during pregnancy	ref	
No	1.13 (0.99, 1.26)	0.064
Yes		
Received information on backpain during pregnancy	ref	
Yes	1.19 (1.00, 1.38)	0.05
No		

BMI: body mass index; HS: high school; ref: reference category. Eastern Atlantic: Newfoundland and Labrador, Prince Edward Island, Nova scotia, and New Brunswick; Eastern central: Quebec and Ontario; Western Prairies: Manitoba, Saskatchewan, and Alberta; Western BC: British Columbia; Northern Territories: Yukon, Northwest territories, and Nunavut. §Adjusted PRs were derived from marginal predicted probabilities computed from the final logistic regression model adapting the steps provided by Muller & MacLehose, 2014 ⁵⁴

4.6 Discussion

The findings of this population-based cross-sectional study showed that of the 36% of MES respondents who reported some degree of problematic back pain during the first three months postpartum, almost half (46.3%) reported persistent BP when examined at 5 to 14 months after childbirth. Though this figure is somewhat lower than that reported in a previous Canadian study (period prevalence of 51% 3-6months postpartum)⁴², possibly due to the retrospective design, and the longer period postpartum (5-14 months) examined in the present study, however, our result falls within the range of 42%-80.6% reported in similar studies that examined women between 6 and 15 months after childbirth.^{22,24,26,57-59} Moreover, a reasonable body of literature ^{17,21-23,58,60} suggest that women whose back problem have not resolved by three months postpartum, were at higher risk of developing recurrent or persistent lumbopelvic pain. Since all the mothers included in the present study reported some degree ('somewhat' or 'a great deal') of back pain that persisted up to three months after the childbirth, it is therefore possible that the sample of mothers used in the present analysis may have an 'inherent' risk for pain persistence. These women may therefore represent a specific 'risk' group for early identification and targeted intervention. ^{23,58,60}

Chronic back pain is multifactorial health condition and the current evidence^{45,46,61-64} emphasizes the need to better understand this complex problem within a biopsychosocial framework which extends the purely biomedical model, to highlight individual psychological and social contexts as

pertinent determinants of chronic pain and disability. Applying a BPS lens to persistent BP postpartum can therefore promote public health interventions that are more holistic and better suited to women's unique situation.⁶¹ Based on the biopsychosocial BPS model, this study identified two biological/physical factors (back problem degree in early postpartum, and other pain persistent conditions), and four psychosocial factors (immigrant status, self-rated health, social support postpartum and history of violent abuse) that were associated with persistent BP after controlling for all other concomitant factors. In addition, this study found one two-way interaction between back problem degree in early postpartum and maternal age. However, no significant associations were found for maternal Aboriginal status, parity, mode of delivery, pre-existing depression, daily stress, marital status, work during pregnancy, current pregnancy status and postpartum period after childbirth in relation to pain persistence. The implications of these results are discussed in light of the existing literature.

4.6.1 Biological/physical factors

Having greater degree of problematic back pain during the first three months postpartum emerged as the factor most strongly associated with reporting persistent pain: ~65% in mothers who reported greatly problematic pain compared to 36.7% in mothers who only reported less problematic pain. This finding was expected since several studies have suggested that pain intensity or degree of bother during pregnancy and postpartum were strong predictors of longer-term BP.^{17,65,66} For example, in a study of 464 Swedish women, Mogren et al.,⁶⁵ found higher level of BP during and after pregnancy to be determinants of persistent lumbopelvic pain at 6 months after pregnancy, with the effect stronger for pain measured postpartum. Also, a 6-year prospective study by Ostgaard et al.¹⁷ showed that higher pain intensity during pregnancy and reporting much residual pain at 3 months postpartum were indicative of a negative prognosis postpartum. Moreover, women who have more bothersome pain tend to have higher disability, and report more sick leave which have been shown to predict more long term back problems later in life.^{24,30}

The new finding in the present study was that the relationship between degree of problematic back pain in early postpartum and persistent BP was modified by maternal age, in which older mothers (30+ years) who reported their symptoms as being “a great deal” problematic in early postpartum were more likely to have persistent problems than younger mothers. This finding aligns with

previous studies^{29,67,68} that suggest that older people tend to experience more severe BP and/or disability, which in turn has consequences in terms physical and social functioning thus exacerbating pain.^{23,57,69} Our findings are also somewhat consistent with another Taiwanese study⁷⁰ examining pain interference during pregnancy, which showed that higher pain intensity impaired functioning to a greater extent in older than younger pregnant women. These findings underscore a need to better understand the specific needs of different age groups regarding management and/or treatment of BP, particularly focusing on older women with more severe back problems.

Furthermore, mothers who reported other persistent pain conditions such as vagina or cesarean incision site pain, breasts pain or severe headaches showed a higher probability of persistent pain. This finding is consistent with studies^{29,31,71–73} that show that persistent BP is predicted by comorbid pain in other parts of the body, and thus underscores the need for health-care services and policies to consider the issue of multimorbidity, including multi-region pain, when designing targeted interventions.

Although maternal age did not reach statistical significance in the final main effects model, it comprised part of an interaction effect together with back pain degree in early postpartum. Conflicting results have been found with regards to the association of age and persistent BP,^{1,21,58,66,74,75} and as result age has been described as a bimodal factor in which both younger and older women may present with higher risk.⁴ In addition to this, age may not act alone in predicting persistent problems,⁵⁸ thus future studies should consider possible interactions between variables when predicting long-term problems.^{58,76}

4.6.2 Psychosocial factors

It is well established in published literature that psychosocial condition is related to low back pain,^{46,47,64,77} and that poor psychological health influence the onset, and maintenance of pain and predict the transition from acute to chronic illness.^{66,78–83} Indeed, a cyclic interplay between psychosocial factors and chronic pain have been suggested in extant studies,^{30,31,47,61,61,64,79,84–86} whereby psychosocial variables influence individual's perception and interpretation of pain, which in turn, modulate patient's pain experience, and can thus determine their prognostic outlook and

treatment outcomes. Chronic back pain in turn has been shown to have causal role in the development of psychological problems.^{29–31,80,83,85,87}

In studies examining BP postpartum, psychosocial factors including but not limited to self-rated health, work satisfaction, self-efficacy, pain catastrophizing, and emotional distress, including depression and anxiety, have been reported to influence pain persistence or non-recovery postpartum^{3,23,24,28,30,80,87} Our results support some of these findings. It is clear from the present analysis that mothers who have more psychological problems including poorer self-rated health, inadequate social support postpartum and a history of violent abuse were more likely to have persistent BP than those who did not have these problems. Similar findings were reported by Mogren et al.,²⁸ and Bergstrom et al.^{5,24,30} who found more favorable perceived health patterns among women who recovered compared to those who continued to have persistent symptoms. Furthermore, extant literature^{86,99–105} has reported the benefits of having ample social support on both physical and psychological wellbeing, including the ability to cope with pain and adhere to treatments for chronic back pain.^{36,88–94} Conversely, a lack of social support can contribute to non-recovery of chronic back pain^{88,95} and can influence non-optimal psychosocial adjustment postpartum,^{32,89,96,97} which may exacerbate individual pain experience and lead to persistent symptoms.

Furthermore, the result of this study corroborates previous research in pregnant^{98,99} and general populations^{47,100} that suggest a possible link between past or recent abuse and chronic back pain. It is possible that mothers with psychological challenges may be more likely conscious of their pain, and have increased anxiety, and worry about their non-recovery, which in turn may lead to more long-term problems, and vice-versa;^{31,61,101} This may be especially true since symptoms have persistent for longer than three months postpartum for these women.^{17,23,58} The findings of this study therefore raise a need for maternity care services to consider the emotional and psychological needs of women with persistent BP, and for back pain management strategies to incorporate early screening for psychosocial problems both during and after pregnancy in order to ensure early identification and appropriate referral and/or management of possible comorbid problems.

The higher persistent pain prevalence observed in immigrant mothers compared to Canadian-born women is consistent with the result of a systematic review¹ that showed race was predictive of persistent new-onset postpartum BP lasting up to 11 years postpartum but contradicts another review⁴ that showed no association of ethnicity with postpartum lumbopelvic pain beyond chance. However, the findings of this study are not surprising given the well-documented health disparities that exists in these populations as shown in studies conducted in both Canadian¹⁰²⁻¹⁰⁸ and international settings.^{102,109-115} Furthermore, Canadian studies suggest that immigrants and ethnic minority groups in Canada tend to report lower social support, poorer socio-economic conditions, higher psychological and physical health problems, and lower physical activity.^{102,104,108,111,116-118} Some of these factors that have been shown to correlate with an increased risk of chronic back pain^{77,88,112,115,119-123} and persistent BP after childbirth.^{14,23,24,28,30,80}

Lastly, mothers who reported not receiving information about back pain during pregnancy were more likely to report persistent BP postpartum (marginally significant). This finding aligns with past studies^{35,36,101,124} that raise the need for increased awareness about BP among healthcare providers and both pregnant and postnatal women themselves,^{35,36,101,124} which can help to improve clinician understanding and enhance timely and appropriate treatment. Women on the other hand may feel better supported and equipped to cope with their pain while anticipating eventual resolution of symptoms, and may be more likely to seek timely care, when furnished with relevant information.^{36,37,101,124} These can ultimately reduce the risk of long-term pain and disability.

4.6.3 Strength and limitations

Despite the strengths of this study, including use of a relatively large population-based data, evaluating a wide variety of predictors, and use of the robust BPS framework to investigate these factors' association with persistent back pain, a number of limitations still need to be considered when interpreting the results of this study. The cross-sectional nature precludes conclusions of causal effects. Back pain was self-reported, and the general term 'back pain' used precluded the possibility to differentiate between the types of back pain experienced by postpartum women; lumbar, pelvic girdle or combination/lumbopelvic pain.¹²⁵ This differentiation is important for appropriate management modalities specific for each subtype and to enhance uniformity and comparability across studies.^{4,126-127} Also, only one MES question was used to ascertain the

presence of back pain in the postnatal period which makes it challenging to tell if back pain started during pregnancy and persisted postpartum or was new-onset after childbirth, or a chronic condition that predated the index pregnancy. Since only mothers who had back pain in the first three months were asked about pain persistence in later postpartum, more than a third of the initial MES sample were excluded from the present analysis, thus we were unable to determine prevalence of back pain among mothers who were pain free in the early postpartum. This exclusion may limit our understanding of the full scale of the burden of back pain persistence in the general Canadian postnatal population. Finally, the data used in the present analysis is more than a decade old and may not reflect the current back pain landscape in the Canadian postnatal population. Notwithstanding, the prevalence reported in this study (46% at 5-14 months postpartum) somewhat agrees with a recent Canadian pilot study (51% between 3-6 months postpartum)⁵ that also showed back pain was highly prevalent beyond three months postpartum. Therefore, the gaps in the MES data highlights the need for more routinely collected nationally representative data on back pain and their subtypes both during and after pregnancy, given the high prevalence of these conditions, and the risk for chronicity postpartum when left untreated.

4.7 Conclusion

This population-based cross-sectional study found that almost half (46%) of the mothers who reported some degree of back pain during the first three months postpartum reported persistent symptoms at 5 to 14 months postpartum. A high degree of back problem in early postpartum and psychological factors were the main factors that influenced symptoms persistence. Furthermore, maternal age moderated the association between degree of problematic back pain experienced in early postpartum and persistent pain. These findings provide further evidence for the need to raise awareness about BP in health care settings as well as extend maternity care services and policies in Canada to include early screening of back problems both during pregnancy and postpartum and administer appropriate interventions. It is also crucial to pay special attention to biopsychosocial factors that may influence delayed recovery postpartum. Hence, maternity care services and policies should consider incorporating biopsychosocial perspectives when designing and implementing targeted interventions, which could aid in reducing the prevalence and persistence of BP in the immediate postpartum period and beyond.

4.8 References

1. Christopher S, McCullough J, Snodgrass SJ, Cook C. Predictive Risk Factors for First-Onset Lumbopelvic Pain in Postpartum Women: A Systematic Review. *J Women's Health Phys Ther.* 2019;43(3):127. doi:10.1097/JWH.000000000000133
2. Ostgaard H, Roos-Hansson E, Zetherstrom G. Regression of back and posterior pelvic pain after pregnancy. *Spine.* 1996;21 SRC-GoogleScholar:2777-2780.
3. Ostgaard HC, Andersson GBJ. Postpartum Low-Back Pain. *Spine.* 1992;17(1):53-55.
4. Wu WH, Meijer OG, Uegaki K, et al. Pregnancy-related pelvic girdle pain (PPP), I: Terminology, clinical presentation, and prevalence. *Eur Spine J.* 2004;13(7):575-589. doi:10.1007/s00586-003-0615-y
5. Bergström C, Persson M, Nergård KA, Mogren I. Prevalence and predictors of persistent pelvic girdle pain 12 years postpartum. *BMC Musculoskelet Disord.* 2017;18:399. doi:10.1186/s12891-017-1760-5
6. Björklund K, Bergström S. Is pelvic pain in pregnancy a welfare complaint? *Acta Obstet Gynecol Scand.* 2000;79(1):24-30. doi:10.1034/j.1600-0412.2000.079001024.x
7. Ostgaard HC, Andersson GBJ. Previous Back Pain and Risk of Developing Back Pain in a Future Pregnancy. *Spine.* 1991;16(4):432-436.
8. Russell R, Reynolds F. Back pain, pregnancy, and childbirth. *BMJ.* 1997;314(7087):1062-1062. doi:10.1136/bmj.314.7087.1062
9. Kanakaris NK, Roberts CS, Giannoudis PV. Pregnancy-related pelvic girdle pain: an update. *BMC Med.* 2011;9(1):15. doi:10.1186/1741-7015-9-15
10. Macarthur AJ, Macarthur C, Weeks SK. Is Epidural Anesthesia in Labor Associated with Chronic Low Back Pain? A Prospective Cohort Study. *Anesth Analg.* 1997;85(5):1066-1070.
11. Mens J, Vleeming A, Stoeckart R, Stam H, Snijders C. Understanding peripartum pelvic pain: Implications of a patient survey. *Spine Phila Pa Doi 101097000076320601000017 Discuss 13691370.* 1996;21(11 SRC-GoogleScholar):1363-1369.
12. Röst CCM, Jacqueline J, Kaiser A, Verhagen AP, Koes BW. Prognosis of women with pelvic pain during pregnancy: a long-term follow-up study. *Acta Obstet Gynecol Scand.* 2006;85(7):771-777. doi:10.1080/00016340600626982
13. Gutke A, Lundberg M, Östgaard HC, Öberg B. Impact of postpartum lumbopelvic pain on disability, pain intensity, health-related quality of life, activity level, kinesiophobia, and depressive symptoms. *Eur Spine J.* 2011;20(3):440-448. doi:10.1007/s00586-010-1487-6
14. Mogren IM. Physical activity and persistent low back pain and pelvic pain post partum. *BMC Public Health.* 2008;8(1):417. doi:10.1186/1471-2458-8-417
15. Simonds AH, Abraham K, Spitznagle T. Clinical Practice Guidelines for Pelvic Girdle Pain in the Postpartum Population. *J Womens Health Phys Ther.* 2022;46(1):E1-E38. doi:10.1097/JWH.0000000000000236
16. Norén L, Östgaard S, Johansson G, Östgaard HC. Lumbar back and posterior pelvic pain during pregnancy: a 3-year follow-up. *Eur Spine J.* 2002;11(3):267-271. doi:10.1007/s00586-001-0357-7
17. Östgaard HC, Zetherström G, Roos-Hansson E. Back Pain in Relation to Pregnancy: A 6-Year Follow-Up. *Spine.* 1997;22(24):2945-2950.
18. Stapleton DB, MacLennan AH, Kristiansson P. The prevalence of recalled low back pain during and after pregnancy: a South Australian population survey. *Aust N Z J Obstet Gynaecol.* 2002;42(5):482-485. doi:10.1111/j.0004-8666.2002.00482.x

19. Breen TW, Ransil BJ, Groves PA, Oriol NE. Factors Associated with Back Pain after Childbirth. *Anesthesiol J Am Soc Anesthesiol*. 1994;18(1):29-34.
20. van Beukering MDM. Work during pregnancy and postpartum period: research on sick leave (in Dutch;Werken tijdens zwangerschap en periode postpartum: onderzoek naar ziekteverzuim). *TBV – Tijdschr Voor Bedr- En Verzek*. 2002;10(1):2-8. doi:10.1007/BF03073675
21. Albert H, Godskesen M, Westergaard J. Prognosis in four syndromes of pregnancy-related pelvic pain. *Acta Obstet Gynecol Scand 101080j16000412080006505x*. 2001;80 SRC-GoogleScholar:505-510.
22. Robinson HS, Vøllestad NK, Veierød MB. Clinical course of pelvic girdle pain postpartum – Impact of clinical findings in late pregnancy. *Man Ther*. 2014;19(3):190-196. doi:10.1016/j.math.2014.01.004
23. Gutke A, Östgaard HC, Öberg B. Predicting Persistent Pregnancy-Related Low Back Pain: *Spine*. 2008;33(12):E386-E393. doi:10.1097/BRS.0b013e31817331a4
24. Bergström C, Persson M, Mogren I. Pregnancy-related low back pain and pelvic girdle pain approximately 14 months after pregnancy – pain status, self-rated health and family situation. *BMC Pregnancy Childbirth*. 2014;14(1):1-12. doi:10.1186/1471-2393-14-48
25. Brynhildsen J. Follow-Up of Patients With Low Back Pain During Pregnancy. *Obstet Gynecol*. 1998;91(2):182-186. doi:10.1016/S0029-7844(97)00630-3
26. Mogren I. Perceived health, sick leave, psychosocial situation, and sexual life in women with low-back pain and pelvic pain during pregnancy. *Acta Obstet Gynecol Scand J*. 2006;85(6 SRC-GoogleScholar):647-656.
27. Olsson C, Nilsson-Wikmar L. Health-related quality of life and physical ability among pregnant women with and without back pain in late pregnancy. *Acta Obstet Gynecol Scand J*. 2004;83(4 SRC-GoogleScholar):351-357.
28. Mogren I. Perceived health six months after delivery in women who have experienced low back pain and pelvic pain during pregnancy. *Scand J Caring Sci*. 2007;21(4):447-455. doi:10.1111/j.1471-6712.2006.00489.x
29. Gutke A, Josefsson A, Öberg B. Pelvic girdle pain and lumbar pain in relation to postpartum depressive symptoms. *Spine J*. 2007;32(13 SRC-GoogleScholar):1430-1436.
30. Bergström C, Persson M, Mogren I. Psychosocial and behavioural characteristics in women with pregnancy-related lumbopelvic pain 12 years postpartum. *Chiropr Man Ther*. 2019;27(1):1-12. doi:10.1186/s12998-019-0257-8
31. Bjelland EK, Stuge B, Engdahl B, Eberhard-Gran M. The effect of emotional distress on persistent pelvic girdle pain after delivery: a longitudinal population study. *BJOG Int J Obstet Gynaecol*. 2013;120(1):32-40. doi:10.1111/1471-0528.12029
32. Mackenzie J, Murray E, Lusher J. Women's experiences of pregnancy related pelvic girdle pain: A systematic review. *Midwifery*. 2018;56:102-111. doi:10.1016/j.midw.2017.10.011
33. Srisopa P, Lucas R. Women's Experience of Pelvic Girdle Pain After Childbirth: A Meta-Synthesis. *J Midwifery Womens Health*. 2021;66(2):240-248. doi:10.1111/jmwh.13167
34. Rexelius N, Lindgren A, Torstensson T, Kristiansson P, Turkmen S. Sexuality and mood changes in women with persistent pelvic girdle pain after childbirth: a case-control study. *BMC Womens Health*. 2020;20(1):201. doi:10.1186/s12905-020-01058-7

35. Elden H, Lundgren I, Robertson E. Life's pregnant pause of pain: pregnant women's experiences of pelvic girdle pain related to daily life: a Swedish interview study. *Sex Reprod Healthc Doi 101016jsrhc11003*. 2012;4(1 SRC-GoogleScholar):29-34.
36. Engeset J, Stuge B, Fegran L. Pelvic girdle pain affects the whole life—a qualitative interview study in Norway on women's experiences with pelvic girdle pain after delivery. *BMC Res Notes*. 2014;7(1):686. doi:10.1186/1756-0500-7-686
37. Wuytack F, Curtis E, Begley C. Experiences of First-Time Mothers With Persistent Pelvic Girdle Pain After Childbirth: Descriptive Qualitative Study. *Phys Ther*. 2015;95(10):1354-1364. doi:10.2522/ptj.20150088
38. Bergström C, Persson M, Mogren I. Sick leave and healthcare utilisation in women reporting pregnancy related low back pain and/or pelvic girdle pain at 14 months postpartum. *Chiropr Man Ther*. 2016;24(1):1-11. doi:10.1186/s12998-016-0088-9
39. Biering-Sørensen F. A prospective study of low back pain in a general population. I. Occurrence, recurrence and aetiology. *Scand J Rehabil Med*. 1983;15(2):71-79.
40. Svensson H, Andersson G, Hagstad A, Jansson P. The relationship of low-back pain to pregnancy and gynecologic factors. *Spine Phila Pa 101097000076320500000006*. 1990;15 SRC-GoogleScholar:371-375.
41. Roseen EJ, Rajendran I, Stein P, et al. Association of Back Pain with Mortality: a Systematic Review and Meta-analysis of Cohort Studies. *J Gen Intern Med*. Published online April 19, 2021. doi:10.1007/s11606-021-06732-6
42. Tavares P, Barrett J, Hogg-Johnson S, et al. Prevalence of Low Back Pain, Pelvic Girdle Pain, and Combination Pain in a Postpartum Ontario Population. *J Obstet Gynaecol Can*. 2020;42(4):473-480. doi:10.1016/j.jogc.2019.08.030
43. Mannion CA, Vinturache AE, McDonald SW, Tough SC. The Influence of Back Pain and Urinary Incontinence on Daily Tasks of Mothers at 12 Months Postpartum. *PLOS ONE*. 2015;10(6):e0129615. doi:10.1371/journal.pone.0129615
44. Gatchel RJ, Peng YB, Peters ML, Fuchs PN, Turk DC. The biopsychosocial approach to chronic pain: Scientific advances and future directions. *Psychol Bull*. 2007;133(4):581-624. doi:10.1037/0033-2909.133.4.581
45. O'Sullivan PB, Beales DJ. Diagnosis and classification of pelvic girdle pain disorders--Part 1: a mechanism based approach within a biopsychosocial framework. *Man Ther*. 2007;12(2):86-97. doi:10.1016/j.math.2007.02.001
46. Waddell G. Biopsychosocial analysis of low back pain. *Baillières Clin Rheumatol*. 1992;6(3):523-557. doi:10.1016/S0950-3579(05)80126-8
47. Linton SJ. A Review of Psychological Risk Factors in Back and Neck Pain. *Spine*. 2000;25(9):1148-1156.
48. World Health Organization, ed. *International Classification of Functioning, Disability and Health: ICF*. World Health Organization; 2001.
49. Dzakpasu S, Kaczorowski J, Chalmers B, Heaman M, Duggan J, Neusy E. The Canadian Maternity Experiences Survey: Design and Methods. *J Obstet Gynaecol Can*. 2008;30(3):207-216. doi:10.1016/S1701-2163(16)32757-8
50. Public Health Agency of Canada. *What Mothers Say: The Canadian Maternity Experiences Survey*. Public Health Agency of Canada; 2009.
51. Statistics Canada. *Maternity Experiences Survey, 2006 – User Guide*. Published online 2006:53.

52. Hosmer D, Lemeshow S, Sturdivant RX. *Applied Logistic Regression. 3rd Edition Ed.* New York: John Wiley & Sons; 2013.
53. Martinez BAF, Leotti VB, Silva G de S e, Nunes LN, Machado G, Corbellini LG. Odds Ratio or Prevalence Ratio? An Overview of Reported Statistical Methods and Appropriateness of Interpretations in Cross-sectional Studies with Dichotomous Outcomes in Veterinary Medicine. *Front Vet Sci.* 2017;4:193. doi:10.3389/fvets.2017.00193
54. Muller CJ, MacLehose RF. Estimating predicted probabilities from logistic regression: different methods correspond to different target populations. *Int J Epidemiol.* 2014;43(3):962-970. doi:10.1093/ije/dyu029
55. Akaike H. A New Look at the Statistical Model Identification. In: Parzen E, Tanabe K, Kitagawa G, eds. *Selected Papers of Hirotugu Akaike.* Springer Series in Statistics. Springer New York; 1974:215-222. doi:10.1007/978-1-4612-1694-0_16
56. Archer KJ, Lemeshow S. Goodness-of-fit Test for a Logistic Regression Model Fitted using Survey Sample Data. *Stata J.* 2006;6(1):97-105. doi:10.1177/1536867X0600600106
57. Olsson CB, Nilsson-Wikmar L, Grooten WJA. Determinants for lumbopelvic pain 6 months postpartum. *Disabil Rehabil.* 2012;34(5):416-422. doi:10.3109/09638288.2011.607212
58. Sjö Dahl J, Gutke A, Öberg B. Predictors for long-term disability in women with persistent postpartum pelvic girdle pain. *Eur Spine J.* 2013;22(7):1665-1673. doi:10.1007/s00586-013-2716-6
59. Woolhouse H, Perlen S, Gartland D, Brown SJ. Physical Health and Recovery in the First 18 Months Postpartum: Does Cesarean Section Reduce Long-Term Morbidity? *Birth.* 2012;39(3):221-229. doi:10.1111/j.1523-536X.2012.00551.x
60. Van De Pol G, Van Brummen HJ, Bruinse HW, Heintz APM, Van Der Vaart CH. Pregnancy-related pelvic girdle pain in the Netherlands. *Acta Obstet Gynecol Scand.* 2007;86(4):416-422. doi:10.1080/00016340601151683
61. Bastiaenen CH, Bie RA de, Wolters PM, et al. Effectiveness of a tailor-made intervention for pregnancy-related pelvic girdle and/or low back pain after delivery: Short-term results of a randomized clinical trial [ISRCTN08477490]. *BMC Musculoskelet Disord.* 2006;7(1):1-13. doi:10.1186/1471-2474-7-19
62. Engel G. The need for a new medical model: a challenge for biomedicine. *Science.* 1977;196(4286):129-136. doi:10.1126/science.847460
63. Kendall NAS. Psychosocial approaches to the prevention of chronic pain: the low back paradigm. *Best Pract Res Clin Rheumatol.* 1999;13(3):545-554. doi:10.1053/berh.1999.0044
64. Pincus T, Burton AK, Vogel S, Field AP. A Systematic Review of Psychological Factors as Predictors of Chronicity/Disability in Prospective Cohorts of Low Back Pain. *Spine.* 2002;27(5):E109.
65. Mogren IM. BMI, pain and hyper-mobility are determinants of long-term outcome for women with low back pain and pelvic pain during pregnancy. *Eur Spine J.* 2006;15(7):1093-1102. doi:10.1007/s00586-005-0004-9
66. To WWK, Wong MWN. Factors associated with back pain symptoms in pregnancy and the persistence of pain 2 years after pregnancy. *Acta Obstet Gynecol Scand.* 2003;82(12):1086-1091. doi:10.1046/j.1600-0412.2003.00235.x
67. Dionne CE, Dunn KM, Croft PR. Does back pain prevalence really decrease with increasing age? A systematic review. *Age Ageing.* 2006;35(3):229-234. doi:10.1093/ageing/afj055

68. Wu A, March L, Zheng X, et al. Global low back pain prevalence and years lived with disability from 1990 to 2017: estimates from the Global Burden of Disease Study 2017. *Ann Transl Med.* 2020;8(6). doi:10.21037/atm.2020.02.175
69. Oliveira V c., Ferreira M l., Morso L, Albert H b., Refshauge K m., Ferreira P h. Patients' perceived level of social isolation affects the prognosis of low back pain. *Eur J Pain.* 2015;19(4):538-545. doi:10.1002/ejp.578
70. Chang HY, Jensen MP, Yang YL, Lee CN, Lai YH. Risk factors of pregnancy-related lumbopelvic pain: a biopsychosocial approach. *J Clin Nurs.* 2012;21(9-10):1274-1283. doi:10.1111/j.1365-2702.2011.03895.x
71. Bath B, Trask C, McCrosky J, Lawson J. A Biopsychosocial Profile of Adult Canadians with and without Chronic Back Disorders: A Population-Based Analysis of the 2009-2010 Canadian Community Health Surveys. *BioMed Res Int.* 2014;2014. doi:10.1155/2014/919621
72. Øverås CK, Johansson MS, de Campos TF, et al. Distribution and prevalence of musculoskeletal pain co-occurring with persistent low back pain: a systematic review. *BMC Musculoskelet Disord.* 2021;22(1):91. doi:10.1186/s12891-020-03893-z
73. Wuytack F, Daly D, Curtis E, Begley C. Prognostic factors for pregnancy-related pelvic girdle pain, a systematic review. *Midwifery.* 2018;66:70-78. doi:10.1016/j.midw.2018.07.012
74. Gausel AM, Malmqvist S, Andersen K, et al. Subjective recovery from pregnancy-related pelvic girdle pain the first 6 weeks after delivery: a prospective longitudinal cohort study. *Eur Spine J.* 2020;29(3):556-563. doi:10.1007/s00586-020-06288-9
75. Kristiansson P, Svärdsudd K, von Schoultz B. Back Pain During Pregnancy: A Prospective Study. *Spine.* 1996;21(6):702-708.
76. Huang HC, Chang HJ, Lin KC, Chiu HY, Chung JH, Tsai HC. A Closer Examination of the Interaction among Risk Factors for Low Back Pain. *Am J Health Promot.* 2014;28(6):372-379. doi:10.4278/ajhp.120329-QUAN-171
77. Linton S, Boersma K, J. Early identification of patients at risk of developing a persistent back problem: the predictive validity of the Orebro Musculoskeletal Pain Questionnaire. *Clin Doi 101097000025080300000002.* 2003;19 SRC-GoogleScholar:80-86.
78. Bastiaanssen JM, de Bie RA, Bastiaenen CH, et al. Etiology and prognosis of pregnancy-related pelvic girdle pain; design of a longitudinal study. *BMC Public Health.* 2005;5(1). doi:10.1186/1471-2458-5-1
79. Cedraschi C, Allaz AF. How to identify patients with a poor prognosis in daily clinical practice. *Best Pract Res Clin Rheumatol.* 2005;19(4):577-591. doi:10.1016/j.berh.2005.03.002
80. Elden H, Gutke A, Kjellby-Wendt G, Fagevik-Olsen M, Ostgaard HC. Predictors and consequences of long-term pregnancy-related pelvic girdle pain: a longitudinal follow-up study. *BMC Musculoskelet Disord.* 2016;17(1):1-13. doi:10.1186/s12891-016-1154-0
81. Linton SJ. Do psychological factors increase the risk for back pain in the general population in both a cross-sectional and prospective analysis? *Eur J Pain.* 2005;9(4):355-355. doi:10.1016/j.ejpain.2004.08.002
82. Pincus T, Kent P, Bronfort G, Loisel P, Pransky G, Hartvigsen J. Twenty-Five Years With the Biopsychosocial Model of Low Back Pain—Is It Time to Celebrate? A Report From the Twelfth International Forum for Primary Care Research on Low Back Pain. *Spine.* 2013;38(24):2118-2123. doi:10.1097/BRS.0b013e3182a8c5d6

83. Weiser S, Cedraschi C. Psychosocial issues in the prevention of chronic low back pain—a literature review. *Baillieres Clin Rheumatol*. 1992;6(3):657-684. doi:10.1016/S0950-3579(05)80132-3
84. Linton SJ, Shaw WS. Impact of Psychological Factors in the Experience of Pain. *Phys Ther*. 2011;91(5):700-711. doi:10.2522/ptj.20100330
85. Alappattu MJ, Bishop MD. Psychological Factors in Chronic Pelvic Pain in Women: Relevance and Application of the Fear-Avoidance Model of Pain. *Phys Ther*. 2011;91(10):1542-1550. doi:10.2522/ptj.20100368
86. Grotle M, Brox JI, Veierød MB, Glomsrød B, Lønn JH, Vøllestad NK. Clinical Course and Prognostic Factors in Acute Low Back Pain: Patients Consulting Primary Care for the First Time. *Spine*. 2005;30(8):976. doi:10.1097/01.brs.0000158972.34102.6f
87. Vøllestad NK, Stuge B. Prognostic factors for recovery from postpartum pelvic girdle pain. *Eur Spine J*. 2009;18(5):718-726. doi:10.1007/s00586-009-0911-2
88. Oraison HM, Kennedy GA. The effect of social support in chronic back pain: number of treatment sessions and reported level of disability. *Disabil Rehabil*. 2019;0(0):1-6. doi:10.1080/09638288.2019.1668969
89. Surkan PJ, Peterson KE, Hughes MD, Gottlieb BR. The Role of Social Networks and Support in Postpartum Women's Depression: A Multiethnic Urban Sample. *Matern Child Health J*. 2006;10(4):375-383. doi:10.1007/s10995-005-0056-9
90. Tarkka MT, Paunonen M. Social support and its impact on mothers' experiences of childbirth. *J Adv Nurs*. 1996;23(1):70-75. doi:10.1111/j.1365-2648.1996.tb03137.x
91. Razurel C, Kaiser B, Antonietti JP, Epiney M, Sellenet C. Relationship between perceived perinatal stress and depressive symptoms, anxiety, and parental self-efficacy in primiparous mothers and the role of social support. *Women Health*. 2017;57(2):154-172. doi:10.1080/03630242.2016.1157125
92. Campbell P, Wynne-Jones G, Muller S, Dunn KM. The influence of employment social support for risk and prognosis in nonspecific back pain: a systematic review and critical synthesis. *Int Arch Occup Environ Health*. 2013;86(2):119-137. doi:10.1007/s00420-012-0804-2
93. Milgrom J, Hirshler Y, Reece J, Holt C, Gemmill AW. Social Support—A Protective Factor for Depressed Perinatal Women? *Int J Environ Res Public Health*. 2019;16(8):1426. doi:10.3390/ijerph16081426
94. Elsenbruch S, Benson S, Rütcke M, et al. Social support during pregnancy: effects on maternal depressive symptoms, smoking and pregnancy outcome. *Hum Reprod Oxf Engl*. 2007;22(3):869-877. doi:10.1093/humrep/del432
95. Gottlieb BH. Social Networks and Social Support: An Overview of Research, Practice, and Policy Implications. *Health Educ Q*. 1985;12(1):5-22. doi:10.1177/109019818501200102
96. Negron R, Martin A, Almog M, Balbierz A, Howell EA. Social Support During the Postpartum Period: Mothers' Views on Needs, Expectations, and Mobilization of Support. *Matern Child Health J*. 2013;17(4):616-623. doi:10.1007/s10995-012-1037-4
97. Cutrona CE. Social support and stress in the transition to parenthood. *J Abnorm Psychol*. 1984;93(4):378-390.
98. Drevin J, Stern J, Annerbäck EM, et al. Adverse childhood experiences influence development of pain during pregnancy. *Acta Obstet Gynecol Scand*. 2015;94(8):840-846. doi:10.1111/aogs.12674

99. Brown SJ, Conway LJ, FitzPatrick KM, et al. Physical and mental health of women exposed to intimate partner violence in the 10 years after having their first child: an Australian prospective cohort study of first-time mothers. *BMJ Open*. 2020;10(12):e040891. doi:10.1136/bmjopen-2020-040891
100. Linton SJ. A population-based study of the relationship between sexual abuse and back pain: establishing a link. *Pain*. 1997;73(1):47-53. doi:10.1016/S0304-3959(97)00071-7
101. Gutke A, Boissonnault J, Brook G, Stuge B. The Severity and Impact of Pelvic Girdle Pain and Low-Back Pain in Pregnancy: A Multinational Study. *J Womens Health*. 2018;27(4):510-517. doi:10.1089/jwh.2017.6342
102. Ng E, Zhang H. Access to mental health consultations by immigrants and refugees in Canada. *Health Rep*. 2021;32(82):13.
103. Mumtaz Z, O'Brien B, Higginbottom G. Navigating maternity health care: a survey of the Canadian prairie newcomer experience. *BMC Pregnancy Childbirth*. 2014;14(1):1-9. doi:10.1186/1471-2393-14-4
104. Sword W, Watt S, Krueger P. Postpartum Health, Service Needs, and Access to Care Experiences of Immigrant and Canadian-Born Women. *J Obstet Gynecol Neonatal Nurs*. 2006;35(6):717-727. doi:10.1111/j.1552-6909.2006.00092.x
105. Zerkowicz P, Saucier JF, Wang T, Katofsky L, Valenzuela M, Westreich R. Stability and change in depressive symptoms from pregnancy to two months postpartum in childbearing immigrant women. *Arch Womens Ment Health*. 2008;11(1):1-11. doi:10.1007/s00737-008-0219-y
106. Urquia ML, O'Campo PJ, Heaman MI. Revisiting the immigrant paradox in reproductive health: The roles of duration of residence and ethnicity. *Soc Sci Med*. 2012;74(10):1610-1621. doi:10.1016/j.socscimed.2012.02.013
107. Shah RR, Ray JG, Taback N, Meffe F, Glazier RH. Adverse Pregnancy Outcomes Among Foreign-Born Canadians. *J Obstet Gynaecol Can*. 2011;33(3):207-215. doi:10.1016/S1701-2163(16)34821-6
108. Ménard V, Sotunde OF, Weiler HA. Ethnicity and Immigration Status as Risk Factors for Gestational Diabetes Mellitus, Anemia and Pregnancy Outcomes Among Food Insecure Women Attending the Montreal Diet Dispensary Program. *Can J Diabetes*. 2020;44(2):139-145.e1. doi:10.1016/j.cjcd.2019.05.004
109. Lansakara N, Brown SJ, Gartland D. Birth Outcomes, Postpartum Health and Primary Care Contacts of Immigrant Mothers in an Australian Nulliparous Pregnancy Cohort Study. *Matern Child Health J*. 2010;14(5):807-816. doi:10.1007/s10995-009-0514-x
110. Lindström I, Areskoug B, Allebeck P. Do Immigrant Patients Differ From Native Swedish Patients With Back Pain When Entering Rehabilitation? *Adv Physiother*. 2002;4(2):74-84. doi:10.1080/140381902320141470
111. Robinson AM, Benzie KM, Cairns SL, Fung T, Tough SC. Who is distressed? A comparison of psychosocial stress in pregnancy across seven ethnicities. *BMC Pregnancy Childbirth*. 2016;16(1):1-11. doi:10.1186/s12884-016-1015-8
112. Bui Q, Doescher M, Takeuchi D, Taylor V. Immigration, Acculturation and Chronic Back and Neck Problems Among Latino-Americans. *J Immigr Minor Health*. 2011;13(2):194-201. doi:10.1007/s10903-010-9371-3
113. Lara-Cinisomo S, Girdler SS, Grewen K, Meltzer-Brody S. A Biopsychosocial Conceptual Framework of Postpartum Depression Risk in Immigrant and U.S.-born Latina Mothers in

- the United States. *Womens Health Issues*. 2016;26(3):336-343. doi:10.1016/j.whi.2016.02.006
114. Baron R, Manniën J, Velde SJ te, Klomp T, Hutton EK, Brug J. Socio-demographic inequalities across a range of health status indicators and health behaviours among pregnant women in prenatal primary care: a cross-sectional study. *BMC Pregnancy Childbirth*. 2015;15(1):1-11. doi:10.1186/s12884-015-0676-z
 115. Dragioti E, Tsamakidis K, Larsson B, Gerdle B. Predictive association between immigration status and chronic pain in the general population: results from the SwePain cohort. *BMC Public Health*. 2020;20(1):1462. doi:10.1186/s12889-020-09546-z
 116. Stewart DE, Gagnon A, Saucier JF, Wahoush O, Dougherty G. Postpartum Depression Symptoms in Newcomers. *Can J Psychiatry*. 2008;53(2):121-124. doi:10.1177/070674370805300208
 117. Government of Canada SC. Acute care hospitalization, by immigrant category: Linking hospital data and the Immigrant Landing File in Canada. Published August 17, 2016. Accessed September 14, 2021. <https://www150.statcan.gc.ca/n1/pub/82-003-x/2016008/article/14648-eng.htm>
 118. Pottie K, Greenaway C, Feightner J, et al. Evidence-based clinical guidelines for immigrants and refugees. *Can Med Assoc J CMAJ Ott*. 2011;183(12):E824-925.
 119. Picavet H, Schouten J, Smit H. Prevalence and consequences of low back problems in the Netherlands, working vs non-working population, the MORGEN-study. :5.
 120. Thomas E, Silman AJ, Croft PR, Papageorgiou AC, Jayson MIV, Macfarlane GJ. Predicting who develops chronic low back pain in primary care: a prospective study. *BMJ*. 1999;318(7199):1662-1667. doi:10.1136/bmj.318.7199.1662
 121. Mustafa N, Einstein G, MacNeill M, Watt-Watson J. The lived experiences of chronic pain among immigrant Indian-Canadian women: A phenomenological analysis. *Can J Pain*. 2020;4(3):40-50. doi:10.1080/24740527.2020.1768835
 122. Buscemi V, Chang WJ, Liston MB, McAuley JH, Schabrun SM. The Role of Perceived Stress and Life Stressors in the Development of Chronic Musculoskeletal Pain Disorders: A Systematic Review. *J Pain*. 2019;20(10):1127-1139. doi:10.1016/j.jpain.2019.02.008
 123. McKillop AB, Carroll LJ, Jones CA, Battié MC. The relation of social support and depression in patients with chronic low back pain. *Disabil Rehabil*. 2017;39(15):1482-1488. doi:10.1080/09638288.2016.1202335
 124. Wellock VK, Crichton MA. Understanding pregnant women's experiences of symphysis pubis dysfunction: the effect of pain. *Evid-Based Midwifery*. 2007;5(2):40-47.
 125. Nilsson-Wikmar L, Harms-Ringdahl K, Pilo C, Pahlbäck M. Back pain in women postpartum is not a unitary concept. *Physiother Res Int*. 1999;4(3):201-213. doi:10.1002/pri.166
 126. Vermani E, Mittal R, Weeks A. Pelvic girdle pain and low back pain in pregnancy: A review. *Pain Pract* Doi 101111j1533250000327x. 2009;10(1 SRC-GoogleScholar):60-71.
 127. Vleeming A, Albert H, Ostgaard H, Sturesson B, Stuge B. European guidelines for the diagnosis and treatment of pelvic girdle pain. *Eur Spine J* Doi 101007s0058600806024. 2008;17(6 SRC-GoogleScholar):794-819.

Transition to Chapter 5

The national cross-sectional studies from the third and fourth Chapters give us an insight into aspects of the burden of BP related to prevalence and potential risk factors among postpartum women in Canada. **Chapter 3** (Manuscript 1) determined the prevalence of BP to be about 36% during the first three months postpartum, with up to 11% of women reporting BP to be a great deal of a problem. While **Chapter 4** (Manuscript 2) determined the prevalence of persistent BP at 5-14 months postpartum to be 46% among those who had some degree of BP during the first months postpartum. Furthermore, a range of biopsychosocial factors, particularly degree of pain in early postpartum and psychosocial condition were identified as the main potential risk factors of symptoms persistence. In Chapter five (Manuscript 3) I will examine another aspect of disease burden; comorbidities – the association of BP, in terms of degree of problem and duration postpartum, with other indicators of postpartum health and wellbeing such as postpartum depression (PPD) and urinary incontinence (UI) at 5-14 months postpartum.

CHAPTER 5

5. MANUSCRIPT 3

5.1 General Information

5.1.1 Title

Association of back pain degree of problem and duration with postpartum depression and urinary incontinence at 5-14 months postpartum.

5.1.2 Citation

Awe O., Bath B., Farag M. Association of back pain, in terms of degree of problem and duration, with postpartum depression and urinary incontinence at 5-14 months postpartum. *Manuscript in preparation for submission.*

The PhD candidate, Awe O, contributed to conceiving and designing the study. She led and completed the RDC project approval submissions, conducted the data analysis and results interpretation, and prepared the manuscript.

5.2 Abstract

Background: Persistent back pain (BP) postpartum is an important public health concern, which can compromise both physical and mental health states in affected women. The aim of this study was to evaluate the association of BP postpartum with selected physical (urinary incontinence) and mental health (postpartum depression) conditions at 5-14 months postpartum among a national sample of Canadian mothers.

Methods: A secondary analysis of the Canadian Maternity Experiences Survey (MES) was conducted. BP, the exposure variable, was assessed in terms of degree of perceived problem at 3 months postpartum (not a problem; somewhat of a problem; a great deal of a problem) and duration of symptoms (no back pain; acute/ ≤ 3 months; persistent/5-14 months). Postpartum depression (PPD; yes/no) and urinary incontinence (UI; yes/no) at 5 to 14 months postpartum were the outcome variables. Multiple logistic regression models assessed the association of each BP

variable (i.e., degree and duration) with each of UI (weighted n=14,279) and PPD (weighted n=75,117), while controlling for select biopsychosocial variables.

Results: Overall, 7.8% and 30.3% of mothers self-reported having PPD and UI, respectively at 5-14 months postpartum. Among mothers with PPD, 57% also reported BP, whereas 43.7% of mothers reporting UI, also reported BP. In the adjusted logistic regression models, mothers who reported more problematic BP during the first three months postpartum (UI: OR_{greatly problematic} =1.85; 95% CI=1.21,2.82; PPD: OR_{somewhat problematic}=1.40, 95% CI=1.06,1.85; OR_{greatly problematic}=1.89, 95% CI=1.38,2.60) or had longer duration of symptoms (UI: OR_{persistent/5-14months}=1.63; 95% CI=1.11,2.39; PPD: OR_{persistent/5-14months} =1.90, 95% CI=1.43,2.54) were more likely to report UI and PPD, respectively.

Conclusion: Both BP degree of problem and duration postpartum were significantly associated with PPD and UI at 5-14 months postpartum. Given the personal, economic, and societal burden of BP, UI and PPD, it is imperative for healthcare providers to be aware of and screen for these possibly concomitant conditions early in the postpartum period and offer affected women timely and appropriate management options. Health care models and policies should incorporate biopsychosocial approaches for the concurrent management of these conditions both during and after pregnancy.

Keywords: back pain, postpartum depression, urinary incontinence, prevalence, postpartum, biopsychosocial

5.3 Introduction

Following childbirth, BP may persist for some women from residual antepartum back pain¹⁻³ or may develop de novo in relation childbirth and/or the physical demands (such as lifting, bending etc.) associated with caring for the newborn.⁴⁻⁹ As a result, between 2-75% of postnatal women have been documented to report BP for varying periods after childbirth.^{1-3,10,11} Also between 10-30% of women with persistent or chronic BP dated their first pain onset to a previous pregnancy or childbirth.^{12,13} Persistent BP therefore constitutes a significant public health burden. In addition to being associated with higher rates of sick leave and increased healthcare utilization,¹⁴⁻¹⁷

persistent BP postpartum also has physical and mental health ramifications, with varying short and long-term implications for both mother and child.^{4,8,18–23}

Urinary incontinence (UI) and postpartum depression (PPD) are also common and debilitating conditions experienced in the perinatal period. UI, broadly defined as the involuntary leakage of urine²⁴ has been estimated to affect about 41% of women during pregnancy,²⁵ while the figure in postpartum women was reported at 31% between 6 weeks and 1 year postpartum.²⁶ Importantly, more than 70% of women reporting UI complaints at three months postpartum still had persistent symptoms at 6 years²⁷ and 12 years postpartum.²⁸ UI is a debilitating condition and has been associated with social stigma, embarrassment, social isolation, impaired quality of life and psychological wellbeing as well as high economic costs.^{21,23,29–32} Similarly, PPD, which refers to the experience of any depressive episode occurring within the first year postpartum,³³ is considered one of the most common mental health disorders associated with childbirth, and can affect up to 13% of all postpartum women worldwide.³⁴ Global estimates measured using the Edinburgh Postpartum Depression Scale (EPDS) showed prevalence of 21% for possible PPD (EPDS ≥ 10) and 16.7% for probable PPD (EPDS ≥ 13).³⁵ Notably, when left untreated, PPD may persist in 25% of women up to 1 year postpartum³⁶ and recurrence rates can be as high as 50%.³⁷ According to the world health organization,³⁸ PPD is considered to be the highest contributor of disability among childbearing women, and has significant consequences for the health and wellbeing of both mother and child.^{38,39} It has been associated with negative maternal attitudes, parental negligence, impaired mother-child bonding, non-optimal breastfeeding practices and disruptions in familial relationships.^{34,38–41} Furthermore, infants of depressed mothers were reported to have delayed cognitive, behavioral, and emotional developmental trajectories.^{38–40}

The etiology of BP is complex, and several risk factors have been reported for its postpartum onset and persistence.^{42–45} Separate studies have also theorized and tested the association of BP with UI^{23,46,47} and BP with PPD following pregnancy and childbirth^{20,48–50} with high comorbidity rates reported during the first postnatal year.^{23,50–52} Proponents of the association between UI and BP in women have implicated injuries sustained during pregnancy and delivery on the pelvic floor muscles, which have a dual role of maintaining continence as well as lumbopelvic stability.^{53–55} This finding may be responsible for the increased risk of UI observed in women with low back

pain and vice versa.^{46,56} BP has also been consistently linked with depressive illness in the general population, through several neurophysiological, behavioral and cognitive processes, with the association depicted to be potentially causal in nature.⁵⁷⁻⁵⁹ Similar findings have been reported in relation to PPD, in which BP during pregnancy and/or postpartum is hypothesized to contribute to the risk of postpartum depressive symptoms.^{20,48-50}

In Canada, BP, UI and PPD are considered serious public health issues that carry significant personal and economic burden.^{40,60-64} Although the cost of pregnancy and postpartum-related BP in Canada are unknown, chronic BP-related expenditures in Canada were estimated to be between \$6 and \$12 billion annually. Similarly, the healthcare costs associated with depressive disorder in the general population in Canada was estimated to be \$12 billion annually.⁶⁵ Further, approximately 1 million women above 15 years of age were recorded to live with moderate to severe UI on a daily basis in 2011, accruing an estimated annual direct cost of about \$1.7 billion in related treatments.⁶⁶ However, studies examining both UI and PPD in association with BP in the same national population of postpartum women have not been previously reported, which raises concerns regarding the additional quality of life and physical functioning implications in comorbid women.^{21,23} Gaudet et al,⁶⁷ examined the relationship between chronic perinatal pain and PPD, and found a two-fold risk of depression in women who had chronic pain compared to those who did not. However, the study examined several perinatal pains together (i.e., vagina, caesarean incision site, breasts, back, and severe headaches) which may not give clear insight into specific pain-depression pathways that may be amenable for targeted interventions. Another study by Mannion et al,²³ examined 1,574 women between 4 and 12 months postpartum and found that 40% of the women reported both BP and UI; however, the study did not directly assess the magnitude or direction of the relationship, nor did it adjust for a wide range of potential confounders.

Furthermore, some studies have highlighted grading back pain in terms of perceived bothersomeness and/or duration of symptoms to be useful classifications for assessing overall disease severity and associated sequelae,^{68,68-71} which can inform targeting of health care resources and services to people who need them the most. Moreover, using these classifications (degree of problem and duration) and evaluating their associations with selected physical (UI) and mental health (PPD) outcomes can inform relevant modifications in BP management both during

pregnancy and in the postpartum. The aim of this study was therefore to explore the association between BP postpartum, in terms of degree of perceived problem and duration of symptoms postpartum, and the risk of UI and PPD in a national sample of Canadian mothers.

5.4 Methods

5.4.1 Data source

This study used data from the Maternity Health Survey (MES), a nationwide cross-sectional survey conducted by the Public Health Agency of Canada's Perinatal Surveillance System to gather information on women's pregnancy, birth, and postnatal experiences in Canada.⁷² The MES used a complex survey design with a random stratified sampling process to select a sample of 6,421 mothers (representing a total of 76,508 puerperal women) aged 15 years or older who had a singleton live birth between February 15, 2006, and May 15, 2006, in the Canadian provinces and November 1, 2005, and February 1, 2006, in the territories; and lived with their baby at the time of the data collection.⁷² Mothers living on First Nations reserves and in institutions at the time of the survey were excluded. Details of the survey methodology are available elsewhere.^{72,73}

5.4.2 Study variables

5.4.2.1 Outcome variables

The outcomes of interest in this study were postpartum depression (PPD) and urinary incontinence (UI) at 5-14 months postpartum.

Postpartum depression (PPD)

In the MES, PPD was measured using the Edinburgh Post-Partum Depression Scale (EPDS) at 5-14 months postpartum. The EPDS is a 10-item scale that is used to screen for symptoms of depression and anxiety during pregnancy, and up to one year after childbirth. The EPDS has been validated by Statistics Canada and in several epidemiological studies with good sensitivity and specificity.⁷⁴⁻⁷⁷ Using the EPDS, the MES respondents were asked about feelings of sadness, disinterest, or anxiety in the previous seven days before the interview. A total score of 13 or higher on the EPDS scale was indicative of probable clinical depression. PPD was measured as a binary outcome variable in this study; coded as 'yes' (EPDS score ≥ 13), and otherwise as 'no' (EPDS score < 13).

Urinary incontinence (UI)

UI at 5-14 months postpartum was measured through self-report in the MES. Respondents were initially asked to rate how much of a problem UI was during the first three months postpartum to which they could respond: a) not a problem, b) somewhat of a problem, and c) a great deal of a problem. Following this, respondents who reported somewhat or a great deal of problem were then asked “*Do you still have urinary incontinence.... yes, or no?*” For this study, mothers who responded affirmatively to having some degree of UI (somewhat or great deal) during the first 3 months postpartum and responded to having ongoing UI at 5-14 months postpartum were classified as having UI coded as “yes”; otherwise, women were classified as the reference category (no UI), coded as “no”

5.4.2.2 Independent variables

The main independent variable in this study was BP postpartum: degree of problem and duration.

BP degree of problem postpartum

The degree of back problem postpartum was assessed in the MES by asking respondents to rate how much of a problem they perceived their back pain to be during the first three months postpartum using the pre-set responses: a) ‘not a problem’, b) ‘somewhat of a problem’ and c) a great deal of a problem.

BP duration postpartum

The duration of back pain postpartum was assessed in this study as a three-level categorical variable (no back pain; acute/ ≤ 3 months; persistent/5-14 months) using two MES questions. Respondents who reported having some degree of back problem (‘somewhat’ or ‘great deal’) during the first three months postpartum were asked a follow-up question: “*Do you still have back pain (at 5 to 14 months postpartum)?*” which was recorded as ‘yes’ or ‘no’ responses. Mothers who reported no problematic back pain during the first 3 months postpartum were classified as having ‘no back pain’; mothers who reported some degree of problematic back pain during the first three months postpartum but responded ‘no’ to the follow-up question regarding persistent back pain at 5-14 months postpartum were grouped as having acute back pain only/ ≤ 3 months; while mothers who reported having back pain both during the first three months postpartum and

responded 'yes' to having persistent symptoms at the time of the interview were considered to have persistent pain at 5-14 months.

5.4.2.3 Covariates

A wide range of covariates were considered in this study to investigate the relationship between BP postpartum (degree and duration) and mothers' likelihood of reporting PPD and UI based on the biopsychosocial model.^{34,35,45,78-83} These variables include: i) biological/physical factors such as mother's age at time of interview, current BMI, parity, mode of birth, operative delivery, health problems during and after pregnancy, and persistent pain problems other than back pain (e.g. vaginal/ CS site, breast and severe headaches); ii) psychological factors such as self-rate health, daily stress, number of stressful life events, social support during and after pregnancy, first reaction to pregnancy, experience of labor and birth, history of violent abuse, and pre-pregnancy depression; iii) social factors such as marital status, immigrant status, Aboriginal status, province of residence, place of residence, level of education, annual household income, work during pregnancy, postpartum visit by public health nurse, perinatal information on back pain, prenatal class attendance, and substance (i.e. cigarette, alcohol or drug) use during pregnancy. Detailed description of the included variables can be found in Appendix C.

5.4.3 Statistical analysis

All analyses were performed using probability weights provided by Statistics Canada to account for the unequal probability of selection; while balanced repeated replication technique using 1000 bootstrap weights provided by Statistics Canada were used to account for complex survey design and estimate accurate 95% CIs.^{76,84} Prevalence of back pain postpartum, overall (at any point postpartum), and according to perceived degree of problem during the first three months postpartum and duration postpartum were assessed in mothers with and without UI and with and without PPD at 5 to 14 months postpartum.

Because BP degree and duration postpartum were highly correlated ($\rho=0.75$) the variables were assessed separately in relation to the outcomes (UI and PPD) using both univariable and multivariable logistic regression models. In all, four multivariable models were fitted to each of the outcome-exposure pairs, i.e., BP degree vs PPD and UI respectively, and BP duration vs PPD

and UI respectively. All models were adjusted for selected biological/physical, psychological, and social factors (the same combination of covariates was fitted to each of the exposure variables). Starting with all variables that were significant with each of the outcomes at $p < 0.20$ in the univariable analysis, manual backward model elimination strategy was used to identify the final parsimonious models based on alpha level = 0.05.^{85,86} Confounding was also assessed at each step. Furthermore, possible two-way interaction effects were explored between the main independent variables (BP degree and duration) and selected covariates that were significant (alpha = 0.05) in the main effects model. However, to improve the fit of the final models, it was necessary to explore additional two-way interaction terms among the covariates that maintained statistical significance at $p < 0.05$ in the main effects model. Strength of the associations was estimated using odds ratios (ORS) and corresponding 95% Confidence Intervals (CI). Missing values (including responses of 'don't know', 'not stated' or 'refusal') from the outcome and main independent variables were excluded from the analysis. Additional missing values from the covariates were dealt with using listwise deletions in STATA. All analyses were carried out using the STATA 15 software, and statistical significance was set at $p = 0.05$.

5.4.4 Ethics

Permission to use the MES for this study was obtained from Statistics Canada through the University of Saskatchewan Research Data Center, following rigorous screening and vetting procedures to ensure research quality and participant confidentiality.

5.5 Results

5.5.1 Descriptive results

MES respondents who responded to the PPD questions (weighted $n = 75,117$) and the UI questions (weighted $n = 14,279$) at 5 to 14 months postpartum (i.e., after excluding missing values from the variables of interest: BP, PPD and UI) were included in the present analysis. Using a cut-off score of ≥ 13 , 5,617 of the 75,117 mothers (7.5%; 95% CI = 7.3%, 7.7%) screened positive for PPD symptoms, while 4,330 of 14,279 women (30.3%; 95% CI = 29.6%, 31.1%) self-reported ongoing UI symptoms at 5-14 months postpartum ((Figure 5.1)).

Compared with mothers without PPD, those reporting PPD tended to be younger (below age 20 years), were non-immigrants, multiparous, without a partner, had less than or high school education, and earned less than \$40,000 in annual household income (all $p < 0.001$). Conversely, compared to mothers without UI, those with ongoing UI were more frequently older (aged above 30 years), Canadian-born, obese, earned \$80,000 or more in annual household income, and had greatly problematic UI during the first three months postpartum (all $p < 0.05$). Appendix E.1 shows the detailed characteristics of mothers with and without PPD. Appendix E.2 shows the detailed characteristics of mothers with and without UI.

According to Figure 5.1, the frequency of PPD was significantly higher in those with BP overall compared to those without BP (11.9% vs 5%; $p < 0.001$), with mothers reporting increasing degree of problematic back pain in the first three months postpartum and longer duration of pain showing higher rates of PPD than those with no BP ($p < 0.001$). On the other hand, the frequency UI was similar in those with or without BP overall (30.2% vs 30.5%; $p = 0.889$) (Figure 5.2), however, the proportion of mothers reporting greatly problematic BP at three months postpartum, and those who reported persistent back pain at 5-14 months postpartum were higher in the UI group than in those without UI ($p < 0.001$).

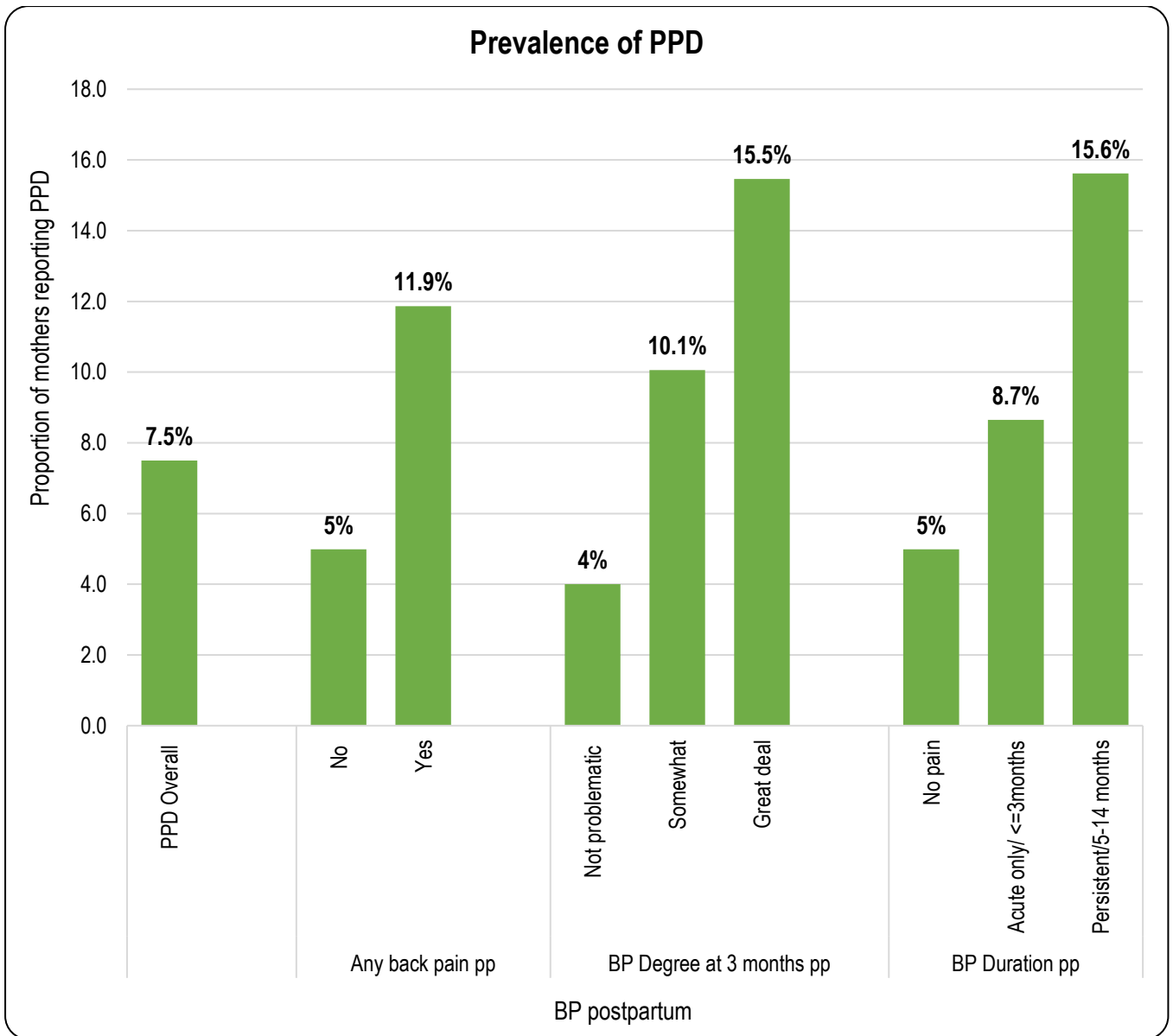


Figure 5.2: Proportion of mothers reporting PPD overall and by back pain status postpartum. pp: postpartum

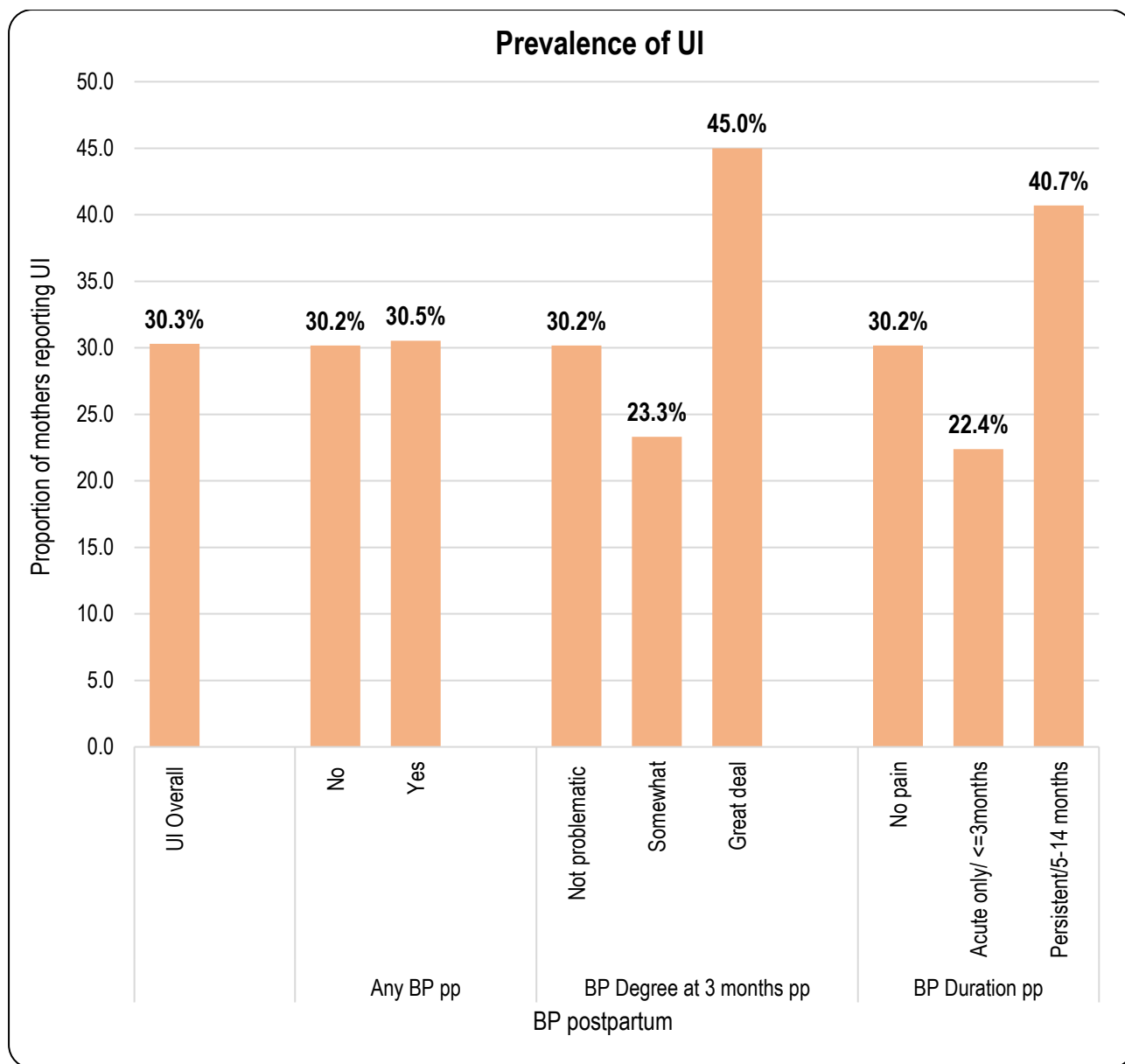


Figure 5.2: Proportion of mothers reporting UI overall and by back pain status postpartum. pp: postpartum

5.5.2 Association of BP (degree and duration) with PPD at 5-14 months postpartum

Table 5.1 displays the results of the univariable, and multivariable logistic regressions analysis for the odds of reporting PPD. Both BP degree and duration showed a gradient relationship with PPD in the unadjusted analysis. The likelihood of depressive symptoms increased as the degree to which the mothers considered their BP to be a problem during the first three months postpartum increased (OR somewhat problematic=2.13, 95% CI=1.69, 2.69; OR greatly problematic=3.48, 95% CI=2.67, 4.54).

Similarly, the odds of PPD increased with increasing duration postpartum ($OR_{\text{acute only}/<3\text{months}}=1.80$, 95% CI=1.38,2.35; $OR_{\text{persistent}/5-14\text{ months}}=3.52$, 95% CI=2.77,4.47). The observed trend persisted after adjusting for all selected covariates (the same set of covariates was assessed for each model) though significantly attenuated (mostly by psychosocial factors). Having BP for only a short duration postpartum (acute only/<3 months) was no longer statistically significant ($OR_{\text{acute only}/<=3\text{months}}=1.26$, 95% CI=0.92,1.72).

No interactions were found between BP degree or duration and any of the covariates. However, further exploration for interaction effects to improve the fit of the final models found 2 significant interactions terms: i) having other pain conditions + perceived availability of social support ($OR_{\text{yes}*inadequate\ support} = 0.36$; 95% CI=0.18, 0.72), and ii) immigrant status + number of stressful life events ($OR_{\text{immigrant}*one} = 0.38$; 95% CI= 0.18,0.79; $OR_{\text{immigrant}*three/more} = 0.36$; 95% CI= 0.17,0.76) (See Figure 5.4). Furthermore, psychosocial factors (e.g., immigrant status, self-rated health, inadequate social support, and having three or more stressful life events) emerged as the strongest predictors of PPD (all ORs > 3). Other factors that showed independent association with higher odds of reporting PPD were older maternal age, negative first reaction to the index pregnancy, having history of violent abuse, and pre-pregnancy depression. Current BMI and education level were retained in the final PPD models as confounders because they caused a change of >20% in the effect of BP degree and/or duration. The effects of all the covariates were similar in both models examining BP degree and duration, respectively. Appendix E.3 shows the result of the full multivariable PPD models (BP degree and duration) adjusted for selected biopsychosocial factors.

Table 5.1: Crude and adjusted odds ratios (OR) and the 95% Confidence Intervals for the associations between back pain postpartum (degree and duration) and postpartum depression.

Independent variables	n	PPD prevalence (%; 95% CI)	Crude OR (95% CI)	Adjusted OR: Final model (95% CI)
BP degree at 3 months postpartum*				
Not problematic	47,959	5 (4.3, 5.8)	1.00	1.00
Somewhat problematic	18,084	10.1 (8.6, 11.8)	2.13 (1.69, 2.69)	1.39 (1.06, 1.85)
Greatly problematic	9,074	15.5 (12.9, 18.5)	3.48 (2.67, 4.54)	1.89 (1.38, 2.60)
BP duration postpartum*				
No back problem	47,959	5 (4.3, 5.8)	1.00	1.00
Acute only/ <=3months	14,624	8.7 (7.1, 10.5)	1.80 (1.38, 2.35)	1.26 (0.91, 1.72)
Persistent/5-14 months	12,534	15.6 (13.4, 18.2)	3.52 (2.77, 4.47)	1.90 (1.43, 2.54)

BP: back pain; PPD: postpartum depression. *Each model was adjusted for selected biopsychosocial factors that were associated with PPD at $p < 0.05$: maternal age at time of interview, other persistent bodily pains, immigrant status, current BMI, self-rated health, perceived stress, number of stressful life events, social support, first reaction to index pregnancy, history of violent abuse, maternal education, other bodily pains*social support, and immigrant status* number of stressful life events.

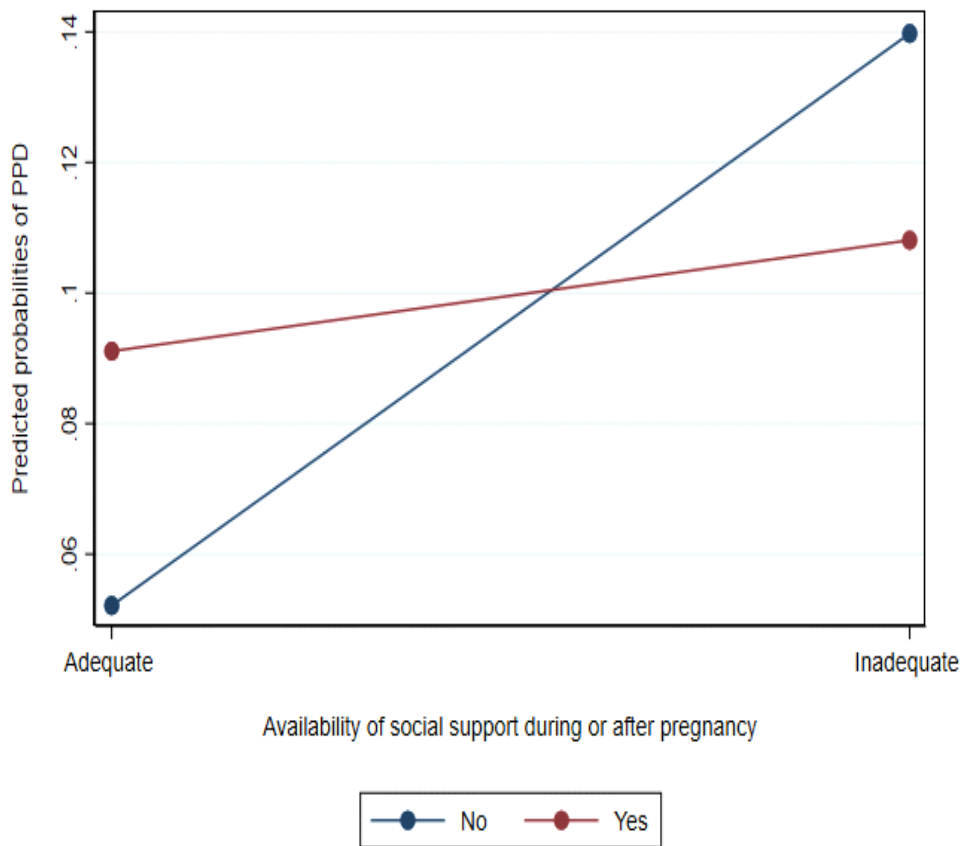


Figure 5.3: Multivariable PPD model: Interaction between other pain conditions and social support.

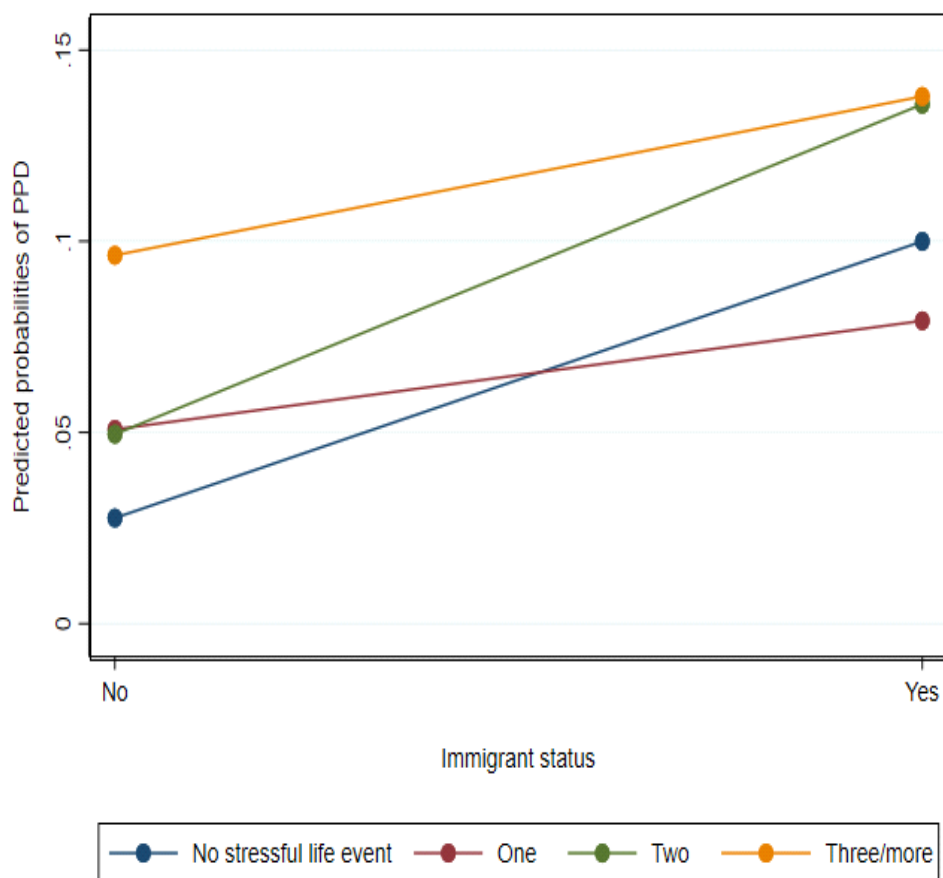


Figure 5.4: Multivariable PPD model: Interaction between immigrant status and number of stressful life events.

5.5.3 Association of BP (degree and duration) with UI at 5-14 months postpartum

As seen in Table 5.2, both BP degree and duration were associated with UI in the unadjusted analysis: mothers who had greatly problematic pain during the first three months postpartum (OR_{greatly problematic}=1.90; 95% CI=1.33, 2.69) or longer duration of back pain (OR_{persistent/5-14 months}=1.59; 95% CI=1.16, 2.18) were more likely to report UI than those without BP. On the other hand, having less problematic BP (OR_{somewhat problematic}=0.70; 95% CI=0.52, 0.96) or shorter BP duration postpartum (OR_{acute only/<=3months}=0.67; 95% CI=0.48, 0.93) was associated with lower odds of UI. After adjusting for all selected biopsychosocial factors (the same set of covariates was assessed for each model), only greatly problematic BP and persistent pain duration (5-14 months) remained significant (Table 5.2).

No interactions effects were found between the BP (degree and duration) variables and any of the covariates. Physical factors, particularly the degree of problematic UI during the first three months postpartum (OR=2.20; 95% CI= 1.43,3.38), and its interaction with pre-pregnancy depression (OR greatly problematic UI*depression=3.22; 95% CI= 1.30,7.98) emerged as the strongest predictors of UI. Figure 5.5 demonstrates the interactions in the model. All other variables including current BMI, immigrant status, maternal aboriginal status, operative delivery, and province of residence were retained in the final model as confounders because they caused a change of >20% in the effect of BP degree and/or duration. Appendix E.4 shows the result of the full multivariable UI models (BP degree and duration) adjusted for selected biopsychosocial factors.

Table 5.2: Crude and adjusted odds ratios (OR) and the 95% Confidence intervals for the associations between back pain postpartum (degree and duration) and persistent Urinary incontinence.

Independent variables	n	UI prevalence (% ; 95% CI)	Crude OR (95% CI)	Adjusted OR: (95% CI)
BP degree postpartum at 3 months postpartum*				
Not problematic	8,084	30.2 (26.9, 33.6)	1.00	1.00
Somewhat problematic	4,130	23.3 (19.0, 28.2)	0.70 (0.52, 0.96)	0.77 (0.54, 1.09)
Greatly problematic	2,065	45 (37.5, 52.8)	1.90 (1.33, 2.69)	1.85 (1.21, 2.82)
BP duration postpartum*				
No back problem	8,084	30.2 (26.9, 33.6)	1.00	1.00
Acute only/ <=3months	3,437	22.4 (17.9, 27.7)	0.67 (0.48, 0.93)	0.72 (0.50, 1.04)
Persistent/5-14 months	2,757	40.7 (34.4, 47.3)	1.59 (1.16, 2.18)	1.63 (1.11, 2.39)

BP: back pain; UI: postpartum depression*Each model was adjusted for selected biopsychosocial factors that were associated with UI at p<0.05: maternal age at time of interview, immigrant status, aboriginal status, current BMI, operative delivery, province of residence, annual household income, worked paid job during pregnancy, degree of UI at three months postpartum, pre-pregnancy depression, and degree of UI at three months postpartum*pre-pregnancy depression.

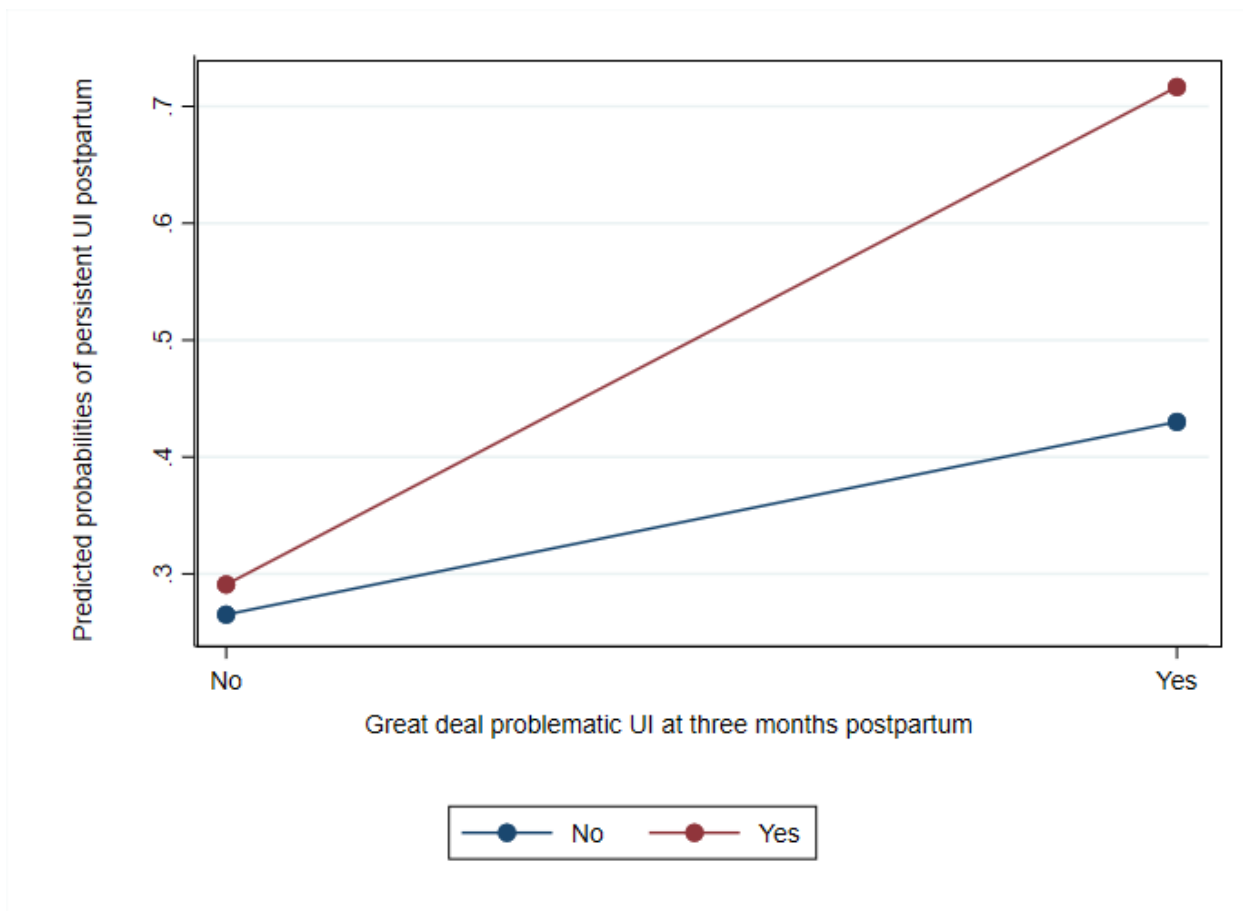


Figure 5.5: Multivariable UI model: Interaction between degree of problematic UI during the first three months postpartum and pre-pregnancy depression

5.6 Discussion

BP may be associated with urinary incontinence after childbirth which individually or additively may contribute to several psychological sequelae, including depressive symptoms.^{4,20,21,23,50,52,87}

This study aimed to evaluate the association between BP postpartum, in terms of the perceived degree of problem in early postpartum and duration postpartum, and both UI and PPD in the same national population of postpartum women in Canada. The main findings showed that BP was significantly more prevalent in mothers with UI and PPD up to 5-14 months postpartum, and that mothers who reported the greatest degree of problematic BP during the first three months postpartum and persistent duration of BP postpartum were the most likely to report both UI and PPD, respectively. Although these findings generally support other studies' findings that show comorbidity of BP with UI^{23,46,47} and BP with PPD childbirth^{20,48-50} in separate populations,

however, to the best of the authors' knowledge, this is the first study to investigate these relationships in the same nationally representative sample of postpartum mothers, while also taking into consideration perceived level of problem and the duration of back pain in the postpartum period.

5.6.1 BP degree and duration and PPD

In this study the prevalence of PPD was 7.5% and increased linearly with perceived degree of problematic BP reported during the first three months postpartum, as well as the postnatal duration of pain (i.e., acute/ ≤ 3 months or persistent/5-14 months). The prevalence of PPD reported in this study was markedly lower than that reported in a recent Canadian study (17.9%).⁶² This disparity may be explained by differences in the screening tools used to assess PPD (EPDS-5 versus the full EPDS used in our study) and the lower cut-off (≥ 7) used in the study⁶² which identified moderate depressive symptomatology, as opposed to probably major depression (cut-off ≥ 13) that we assessed in the present study. Data for our study were also collected over a decade ago in 2006, and may not have benefited from the improved mental health awareness and disclosure in Canada over the last decade.⁶²

Overall, the result of the present study agrees with earlier studies in various postnatal populations which showed an association between back pain and PPD,^{20,49,50,52,67} and thus confirms the comorbidity of these common problems in the first postpartum year and beyond. A few of these studies further reported varying prevalence of postnatal depression among women with different types of BP.^{20,49} However, no studies to our knowledge have investigated whether the prevalence of depressive symptoms varied with a graded assessments of BP severity, in terms of perceived bothersomeness or duration, which can give further insight than mere presence or absence of symptoms. Our findings showed that postnatal depression was 1.4 and 1.9 times, respectively, more prevalent in mothers who perceived their back pain to be “somewhat” or “great deal” problematic during the first three months postpartum compared to those without problematic BP. The present study further revealed that depressive symptoms were 1.9 times more prevalent in mothers who reported having BP for a persistent duration up to 5-14 months postpartum compared to those who had no pain. These findings somewhat agree with those reported by Gutke et al²⁰ and Woolhouse et al⁵⁰ who found that BP at three months postpartum predicted concurrent PPD at three months

postpartum^{4,50} and subsequent PPD between 6-12 months postpartum.⁵⁰ Our results are also consistent with the wider BP literature which show that level of pain severity/bothersomeness is a strong predictor for developing depressive symptoms.^{57,67,88-92} Additionally, people reporting severe acute pain are more likely to develop pain persistence, have higher sick leave, increased healthcare utilization and pain-related disability.^{10,14,23,68,69,88,89,93,94} These outcomes in turn have been shown to be highly correlate with depressive symptomatology.^{69,88,89,95,96}

In terms of duration of symptoms, previous studies have documented major depression to be more common in persons with chronic or persistent pain, and vice versa.^{10,57,67,69,80,97-99} In postpartum studies, Bergstrom et al¹⁰ found increased duration or persistence of pain to be a significant predictor of persistent BP 12 years after childbirth. In the wider BP literature, the chronic pain-depression relationship is suggested to be bidirectional in nature, in which both variables mutually influence each other.^{52,59,78,100} Several neurophysiological, behavioral and cognitive processes have been documented as pathways linking depression and persistent/chronic BP.^{58,59,98,101,102} Furthermore, studies show sleep disturbances and insomnia which tend to be common in the puerperium, may further exacerbate both back pain and depressive symptoms in persons with chronic pain.^{52,100,103,104}

Notwithstanding the effect of BP, psychosocial factors such as immigrant status, poorer self-rated health, higher number of stressful life events, and inadequate social support showed the strongest associations with PPD (all ORs > 3). These findings are consistent with current evidence indicating that PPD is a complex phenomenon in which psychological and psychosocial factors were the strongest predictors.^{22,34,81,105,106} In addition, this study found significant interaction effects between having other pain conditions+ social support and between immigrant status + number of stressful life events. The association between having other bodily pains and PPD appears to be stronger in mothers who report adequate social support during and/or after the pregnancy. The reason for this observation is unclear, however previous studies suggest that social support may not have a similar protective effect on PPD as it does on pain, but can instead re-enforce pain behaviors in pain patients.¹⁰⁷ Furthermore, the higher prevalence of PPD symptoms in immigrant mothers who reported higher number of stressful life events supports the findings of other studies that suggested that psychosocial life stressors, may contribute to a greater vulnerability of

experiencing depressive symptoms among immigrant mothers compared to non-immigrant ones.^{108,109}

5.6.2 BP degree and duration and UI

This study revealed a moderate prevalence of UI (30.3%) up to 5-14 months postpartum. This figure was lower than that reported in another Canadian study (49%)²³ but corresponds with that (31%) reported in a recent systematic review of 24 countries comprising of 35,064 women.²⁶ Moreover, our finding supports other studies that show UI to still be a common obstetric problem up to 1 year postpartum and beyond.^{23,26,32,87,110}

Only few studies have examined the link between BP and UI in postnatal women,^{23,51} although related studies in pregnant women¹¹¹ and in the general population^{46,56,112,113} are more common. In studies examining postpartum women, Chukwu et al⁵¹ showed low back pain to co-exist with UI in 42% of postpartum women, compared to 35.9% in pregnant women. Similarly, Mannion et al²³ found a co-existence of low back pain and UI in 40% of mothers at one year after childbirth. None of these studies examined the relationship between the two conditions using multivariate analysis. In a study of pregnant women, Smith et al¹¹¹ found the odds of having BP “often” and “rarely or sometimes” were 8.5 times and 3.8 times higher, respectively, in pregnant women who reported UI compared to no UI. In non-pregnant women, Bush et al.,¹¹² in a study of 2,341 women found 44% increased odds of UI in women with chronic back pain compared to those without chronic pain. Overall, our findings support these past studies. Although in this study, when back pain was assessed overall in the postpartum period, the prevalence of UI was not different in those with or without back pain; however, when we disaggregated BP based on the degree of problem experienced during the first three months postpartum and duration postpartum, an association of BP and UI was found in the most severe categories of BP (i.e. greatly problematic or persistent duration up to 5-14 months postpartum). The odds of UI were 1.85 times and 1.63 times, respectively, more elevated in mothers who experienced greatly problematic (but not at other problem levels) during the first three months postpartum or persistent (but not at shorter durations) BP lasting up to 5-14 months postpartum than those who reported no BP. On the other hand, having less problematic BP (OR=0.77) or shorter BP duration (acute only/<3 months) (OR=0.72) was associated with a lowered odds of UI compared to those with no BP. These findings therefore

provide further specific insight into the association of BP and UI than the general overall relationship presented in past studies.^{23,51}

One explanation for the observed relationship between BP and UI is a possible dysfunction to the control of the pelvic floor muscles (PFM), which has each been reported in persons with UI and LBP individually.^{46,114–117} Previous studies have documented that the PFM have a dual function of providing mechanical support to the lumbopelvic regions, as well as contribute to the maintenance of continence through co-activation of the pelvic floor and abdominal muscles.^{118–123} These claims are evidenced in studies that found that women with continence problems exhibited delayed or inadequate activation of the pelvic floor muscles when compared to continent women.^{46,116} It has also been demonstrated that women with low back pain showed significant differences in PFM muscle function compared to those without low back pain.^{114,115} Furthermore, Smith et al¹²⁴ reported impairment in truncal control (including respiratory, abdominal and pelvic floor muscles) to be related to development of lumbopelvic pain. Collectively, these studies suggest that dysfunction in the PMF leads to both UI and BP. Some other studies have also reported a link between UI and BP through joint risk factors such as obesity and physical activity.⁴⁶

In the context of this study, one may speculate that acute damage to the PFM sustained during pregnancy and the childbirth itself^{32,87,125,126} may be responsible for the higher prevalence of UI observed in mothers who experienced greatly problematic BP during the first three months postpartum. When these acute symptoms (i.e. BP and/or UI) in early postpartum are left unaddressed, symptoms may become persistent.^{4,127,128} It is not surprising then that this study found persistent back pain lasting up to 5-14 months postpartum, as well as having greatly problematic UI during the first three months postpartum were the main predictors of UI at 5-14 months postpartum. These finding are consistent with the literature showing that chronic BP was associated with UI,^{32,112} and that women who still had UI at 3 months postpartum were at greater risk of reporting longer term symptoms,^{110,128,129} even up to 12 years postpartum.²⁸

Furthermore, the present study revealed an interaction between greatly problematic UI during the first three months postpartum and pre-pregnancy depression, in which mothers who suffered from greatly problematic UI in early postpartum, together with pre-pregnancy depression had a

significantly higher probability of UI above and beyond that in those who suffered from only UI or only pre-pregnancy depression, respectively. These findings are somewhat consistent with studies that show that women who had UI complaints¹³⁰ or were impacted in their daily activities as a result of UI at 12 months postpartum^{23,87} were more likely to report impaired psychological wellbeing, including depressive symptoms. Other factors identified in this study to predict UI such as being Canadian-born and obese BMI have also been reported in past studies.^{23,87,131} However this study did not find an association of UI and mode of delivery (i.e. c-section or vaginal) or parity, which is also consistent with some studies.^{23,132}

5.6.3 Strengths and limitations

A limitation of this study is its cross-sectional nature, which prevent the ability to draw causal conclusions on the observed associations of interest. There is also the possibility of recall bias since study variables relied solely on self-reported accounts of women, which could lead to under or overestimation of symptoms of depression, UI, or BP. Moreover, mothers with ongoing UI or PPD at 5-14 months postpartum may recall pain differently compared to healthy women which may lead to a reverse causality bias and could give alternative interpretation to our study findings. Furthermore, there is possibility of misclassification bias since the EPDS used to identify women with PPD in this study is a screening tool and cannot confirm a medical diagnosis. Notwithstanding, the EPDS is the most frequently used screening instrument for measuring probable clinical depression in large scale population surveys and has been shown to correlate highly with clinical measures with high validity recorded in several populations.^{75,77} The MES did not collect information that make it possible to delineate women according to back pain subtypes, such as, low back, pelvic girdle, or combined pain. Furthermore, we were not able to differentiate among stress, urge or mixed urinary incontinence problems. Finally, although the literature suggests possible interrelationships among BP, PPD and UI,^{130,140} the present study only assessed BP within the PPD and UI categories; relationships between PPD and UI were not examined. Also, it would be interesting to assess if presence of joint PPD and UI symptoms had additive effects on mothers' reported pain status and other symptoms, which can give additional information on the extent and pattern of multimorbidity in the study population. Nonetheless, persistence of any one of these health problems is a concern for postpartum women, given their considerable health and quality of life implications. Despite these limitations several strengths of this study are apparent

including: use of a large national level population-based data; use of a robust biopsychosocial framework to investigate complex health problems such as BP, PPD and UI; and adjustment for a wide range of covariates. Moreover, the present study expands the current understanding on the inter-relations between these three common problems of pregnancy and the postpartum and raise the need for screening efforts to include not only depressive symptoms but also physical problems that can affect women's wellbeing long into the postpartum period and beyond. However, further research is needed to delineate the longitudinal associations between these variables and possible modifiable risk factors that can help to reduce the prevalence of these conditions and increase overall maternal wellbeing both during and after pregnancy.

5.7 Conclusion

In summary, the findings of this study expand current evidence by showing that both BP degree during the first three months postpartum and duration up to 5-14 months postpartum are associated with higher odds of reporting both UI and PPD, in which women reporting the worse categories of BP (greatly problematic, and persistent duration) showed the highest probability of these outcomes (PPD and UI). There is need for healthcare professionals to be aware of the importance of the severity of BP in postnatal women, especially in the first few months postpartum, and offer women appropriate pain management options in order to reduce personal suffering as well as mitigate subsequent health problems such as persistent BP, UI and depressive symptoms. The findings of this study also raise the need for BP management strategies that incorporate early screening for concomitant conditions, and adoption of a multidisciplinary approach that aims to improve pelvic floor function¹³³⁻¹³⁵ as well as provide psychosocial support^{136,137} to women both during and after pregnancy. Furthermore, there is need for public health policies and health promotional efforts that increase community awareness about BP, PPD and UI, and disabuse the notion that these problems are inevitable and acceptable consequences of pregnancy and childbirth.^{67,138,139} These interventions can help reduce possible stigma, and improve early help seeking for these conditions, which can ultimately lead to reduction in the prevalence of these disorders as well as improve women's overall wellbeing and quality of life both during and after pregnancy.

5.8 References

1. Björklund K, Bergström S. Is pelvic pain in pregnancy a welfare complaint? *Acta Obstet Gynecol Scand.* 2000;79(1):24-30. doi:10.1034/j.1600-0412.2000.079001024.x
2. Ostgaard H, Roos-Hansson E, Zetherstrom G. Regression of back and posterior pelvic pain after pregnancy. *Spine.* 1996;21 SRC-GoogleScholar:2777-2780.
3. Ostgaard HC, Andersson GBJ. Previous Back Pain and Risk of Developing Back Pain in a Future Pregnancy. *Spine.* 1991;16(4):432-436.
4. Gutke A, Lundberg M, Östgaard HC, Öberg B. Impact of postpartum lumbopelvic pain on disability, pain intensity, health-related quality of life, activity level, kinesiophobia, and depressive symptoms. *Eur Spine J.* 2011;20(3):440-448. doi:10.1007/s00586-010-1487-6
5. Kanakaris NK, Roberts CS, Giannoudis PV. Pregnancy-related pelvic girdle pain: an update. *BMC Med.* 2011;9(1):15. doi:10.1186/1741-7015-9-15
6. Macarthur AJ, Macarthur C, Weeks SK. Is Epidural Anesthesia in Labor Associated with Chronic Low Back Pain? A Prospective Cohort Study. *Anesth Analg.* 1997;85(5):1066-1070.
7. Mens J, Vleeming A, Stoeckart R, Stam H, Snijders C. Understanding peripartum pelvic pain: Implications of a patient survey. *Spine Phila Pa Doi 101097000076320601000017 Discuss 13691370.* 1996;21(11 SRC-GoogleScholar):1363-1369.
8. Mogren IM. Physical activity and persistent low back pain and pelvic pain post partum. *BMC Public Health.* 2008;8(1):417. doi:10.1186/1471-2458-8-417
9. Röst CCM, Jacqueline J, Kaiser A, Verhagen AP, Koes BW. Prognosis of women with pelvic pain during pregnancy: a long-term follow-up study. *Acta Obstet Gynecol Scand.* 2006;85(7):771-777. doi:10.1080/00016340600626982
10. Bergström C, Persson M, Nergård KA, Mogren I. Prevalence and predictors of persistent pelvic girdle pain 12 years postpartum. *BMC Musculoskelet Disord.* 2017;18:399. doi:10.1186/s12891-017-1760-5
11. Russell R, Reynolds F. Back pain, pregnancy, and childbirth. *BMJ.* 1997;314(7087):1062-1062. doi:10.1136/bmj.314.7087.1062
12. Biering-Sørensen F. A prospective study of low back pain in a general population. I. Occurrence, recurrence and aetiology. *Scand J Rehabil Med.* 1983;15(2):71-79.
13. Svensson H, Andersson G, Hagstad A, Jansson P. The relationship of low-back pain to pregnancy and gynecologic factors. *Spine Phila Pa 1010970000763205000000006.* 1990;15 SRC-GoogleScholar:371-375.
14. Bergström C, Persson M, Mogren I. Sick leave and healthcare utilisation in women reporting pregnancy related low back pain and/or pelvic girdle pain at 14 months postpartum. *Chiropr Man Ther.* 2016;24(1):1-11. doi:10.1186/s12998-016-0088-9
15. Bergström C, Persson M, Mogren I. Psychosocial and behavioural characteristics in women with pregnancy-related lumbopelvic pain 12 years postpartum. *Chiropr Man Ther.* 2019;27(1):1-12. doi:10.1186/s12998-019-0257-8
16. Mogren I. Perceived health, sick leave, psychosocial situation, and sexual life in women with low-back pain and pelvic pain during pregnancy. *Acta Obstet Gynecol Scand J.* 2006;85(6 SRC-GoogleScholar):647-656.
17. van Beukering MDM. Work during pregnancy and postpartum period: research on sick leave (in Dutch;Werken tijdens zwangerschap en periode postpartum: onderzoek naar ziekteverzuim). *TBV – Tijdschr Voor Bedr- En Verzek.* 2002;10(1):2-8. doi:10.1007/BF03073675

18. Bergstrom C, Persson M, Mogren I, BMC. Pregnancy-related low back pain and pelvic girdle pain approximately 14 months after pregnancy-pain status, self-rated health and family situation. *Childbirth* 48. 2014;14 SRC-GoogleScholar.
19. Engeset J, Stuge B, Fegran L. Pelvic girdle pain affects the whole life—a qualitative interview study in Norway on women’s experiences with pelvic girdle pain after delivery. *BMC Res Notes*. 2014;7(1):686. doi:10.1186/1756-0500-7-686
20. Gutke A, Josefsson A, Oberg B. Pelvic girdle pain and lumbar pain in relation to postpartum depressive symptoms. *Spine J*. 2007;32(13 SRC-GoogleScholar):1430-1436.
21. Handa VL, Zyczynski HM, Burgio KL, et al. The impact of fecal and urinary incontinence on quality of life 6 months after childbirth. *Am J Obstet Gynecol*. 2007;197(6):636.e1-636.e6. doi:10.1016/j.ajog.2007.08.020
22. Howard LM, Khalifeh H. Perinatal mental health: a review of progress and challenges. *World Psychiatry*. 2020;19(3):313-327. doi:10.1002/wps.20769
23. Mannion CA, Vinturache AE, McDonald SW, Tough SC. The Influence of Back Pain and Urinary Incontinence on Daily Tasks of Mothers at 12 Months Postpartum. *PLOS ONE*. 2015;10(6):e0129615. doi:10.1371/journal.pone.0129615
24. Abrams P, Cardozo L, Fall M, et al. The standardisation of terminology in lower urinary tract function: report from the standardisation sub-committee of the International Continence Society. *Urology*. 2003;61(1):37-49. doi:10.1016/S0090-4295(02)02243-4
25. Moosdorff-Steinhauser HFA, Berghmans BCM, Spaanderman MEA, Bols EMJ. Prevalence, incidence and bothersomeness of urinary incontinence in pregnancy: a systematic review and meta-analysis. *Int Urogynecology J*. 2021;32(7):1633-1652. doi:10.1007/s00192-020-04636-3
26. Moosdorff-Steinhauser HFA, Berghmans BCM, Spaanderman MEA, Bols EMJ. Prevalence, incidence and bothersomeness of urinary incontinence between 6 weeks and 1 year post-partum: a systematic review and meta-analysis. *Int Urogynecology J*. 2021;32(7):1675-1693. doi:10.1007/s00192-021-04877-w
27. Gartland D, Donath S, MacArthur C, Brown S. The onset, recurrence and associated obstetric risk factors for urinary incontinence in the first 18 months after a first birth: an Australian nulliparous cohort study: Urinary incontinence in the first 18 months after a first birth. *BJOG Int J Obstet Gynaecol*. 2012;119(11):1361-1369. doi:10.1111/j.1471-0528.2012.03437.x
28. MacArthur C, Wilson D, Herbison P, et al. Urinary incontinence persisting after childbirth: extent, delivery history, and effects in a 12–year longitudinal cohort study. *BJOG Int J Obstet Gynaecol*. 2016;123(6):1022-1029. doi:10.1111/1471-0528.13395
29. Coyne KS, Wein A, Nicholson S, Kvasz M, Chen CI, Milsom I. Comorbidities and personal burden of urgency urinary incontinence: a systematic review. *Int J Clin Pract*. 2013;67(10):1015-1033. doi:10.1111/ijcp.12164
30. Mendes A, Hoga L, Gonçalves B, Silva P, Pereira P. Adult women’s experiences of urinary incontinence: a systematic review of qualitative evidence. *JBI Database Syst Rev Implement Rep*. 2017;15(5):1350-1408. doi:10.11124/JBISRIR-2017-003389
31. Milsom I, Coyne KS, Nicholson S, Kvasz M, Chen CI, Wein AJ. Global Prevalence and Economic Burden of Urgency Urinary Incontinence: A Systematic Review. *Eur Urol*. 2014;65(1):79-95. doi:10.1016/j.eururo.2013.08.031

32. Sangsawang B, Sangsawang N. Stress urinary incontinence in pregnant women: a review of prevalence, pathophysiology, and treatment. *Int Urogynecology J*. 2013;24(6):901-912. doi:10.1007/s00192-013-2061-7
33. O'Hara MW. Postpartum depression: what we know. *J Clin Psychol*. 2009;65(12):1258-1269. doi:10.1002/jclp.20644
34. O'hara MW, Swain AM. Rates and risk of postpartum depression—a meta-analysis. *Int Rev Psychiatry*. 1996;8(1):37-54. doi:10.3109/09540269609037816
35. Hahn-Holbrook J, Cornwell-Hinrichs T, Anaya I. Economic and Health Predictors of National Postpartum Depression Prevalence: A Systematic Review, Meta-analysis, and Meta-Regression of 291 Studies from 56 Countries. *Front Psychiatry*. 2018;8:248. doi:10.3389/fpsy.2017.00248
36. Wylie L, Hollins Martin CJ, Marland G, Martin CR, Rankin J. The enigma of post-natal depression: an update. *J Psychiatr Ment Health Nurs*. 2011;18(1):48-58. doi:10.1111/j.1365-2850.2010.01626.x
37. Nonacs R, Cohen LS. Postpartum Mood Disorders: Diagnosis and Treatment Guidelines. *J Clin Psychiatry*. 1998;59(suppl 2):34-40.
38. World Health Organization. *The World Health Report. 2001: Mental Health: New Understanding, New Hope.*; 2001.
39. O'Hara MW, McCabe JE. Postpartum Depression: Current Status and Future Directions. *Annu Rev Clin Psychol*. 2013;9(1):379-407. doi:10.1146/annurev-clinpsy-050212-185612
40. Canadian Perinatal Mental Health Collaborative. *Time for Action: Why Canada Needs A National Perinatal Mental Health Strategy Now More Than Ever.*; 2021. Accessed November 1, 2021. <https://cpmhc.ca/report>.
41. McCoy BS. Postpartum Depression: An Essential Overview for the Practitioner: *South Med J*. 2011;104(2):128-132. doi:10.1097/SMJ.0b013e318200c221
42. Christopher S, McCullough J, Snodgrass SJ, Cook C. Predictive Risk Factors for First-Onset Lumbopelvic Pain in Postpartum Women: A Systematic Review. *J Women's Health Phys Ther*. 2019;43(3):127. doi:10.1097/JWH.000000000000133
43. Wu WH, Meijer OG, Uegaki K, et al. Pregnancy-related pelvic girdle pain (PPP), I: Terminology, clinical presentation, and prevalence. *Eur Spine J*. 2004;13(7):575-589. doi:10.1007/s00586-003-0615-y
44. Simonds AH, Abraham K, Spitznagle T. Clinical Practice Guidelines for Pelvic Girdle Pain in the Postpartum Population. *J Womens Health Phys Ther*. 2022;46(1):E1-E38. doi:10.1097/JWH.0000000000000236
45. Wiezer M, Hage-Fransen MAH, Otto A, et al. Risk factors for pelvic girdle pain postpartum and pregnancy related low back pain postpartum; a systematic review and meta-analysis. *Musculoskelet Sci Pract*. 2020;48:102154. doi:10.1016/j.msksp.2020.102154
46. Smith MD, Russell A, Hodges PW. Disorders of breathing and continence have a stronger association with back pain than obesity and physical activity. *Aust J Physiother*. 2006;52(1):11-16. doi:10.1016/S0004-9514(06)70057-5
47. Wijnhoven HAH, de Vet HCW, Smit HA, Picavet HSJ. Hormonal and reproductive factors are associated with chronic low back pain and chronic upper extremity pain in women--the MORGEN study. *Spine*. 2006;31(13):1496-1502. doi:10.1097/01.brs.0000220706.96724.76
48. Brown SJ, Conway LJ, FitzPatrick KM, et al. Physical and mental health of women exposed to intimate partner violence in the 10 years after having their first child: an Australian

- prospective cohort study of first-time mothers. *BMJ Open*. 2020;10(12):e040891. doi:10.1136/bmjopen-2020-040891
49. Long G, Yao ZY, Na Y, Ping Y, Wei S, Mingsheng T. Different types of low back pain in relation to pre- and post-natal maternal depressive symptoms. *BMC Pregnancy Childbirth*. 2020;20:551. doi:10.1186/s12884-020-03139-9
 50. Woolhouse H, Gartland D, Perlen S, Donath S, Brown SJ. Physical health after childbirth and maternal depression in the first 12 months post partum: Results of an Australian nulliparous pregnancy cohort study. *Midwifery*. 2014;30(3):378-384. doi:10.1016/j.midw.2013.03.006
 51. Chukwu C. Correlation Between the Intensities of Pregnancy - Related Low Back Pain and Urinary Incontinence in Pregnant and Postpartum Women in Enugu, Nigeria. *Online J Health Allied Sci*. 2019;18(1). Accessed November 6, 2021. <https://www.ojhas.org/issue69/2019-1-11.html>
 52. Brown S, Lumley J. Physical health problems after childbirth and maternal depression at six to seven months postpartum. *BJOG Int J Obstet Gynaecol*. 2000;107(10):1194-1201. doi:10.1111/j.1471-0528.2000.tb11607.x
 53. Connolly TJ, Litman HJ, Tennstedt SL, Link CL, McKinlay JB. The effect of mode of delivery, parity, and birth weight on risk of urinary incontinence. *Int Urogynecol J Pelvic Floor Dysfunct*. 2007;18(9):1033-1042. doi:10.1007/s00192-006-0286-4
 54. Dasikan Z, Ozturk R, Ozturk A. Pelvic floor dysfunction symptoms and risk factors at the first year of postpartum women: a cross-sectional study. *Contemp Nurse*. 2020;56(2):132-145. doi:10.1080/10376178.2020.1749099
 55. Davenport MH, Nagpal TS, Mottola MF, et al. Prenatal exercise (including but not limited to pelvic floor muscle training) and urinary incontinence during and following pregnancy: a systematic review and meta-analysis. *Br J Sports Med*. 2018;52(21):1397-1404. doi:10.1136/bjsports-2018-099780
 56. Kim JS, Kim SY, Oh DW, Choi JD. Correlation between the Severity of Female Urinary Incontinence and Concomitant Morbidities: A Multi-Center Cross-Sectional Clinical Study. *Int Neurourol J*. 2010;14(4):220-226. doi:10.5213/inj.2010.14.4.220
 57. Currie SR, Wang J. More data on major depression as an antecedent risk factor for first onset of chronic back pain. *Psychol Med*. 2005;35(9):1275-1282. doi:10.1017/S0033291705004952
 58. Fishbain DA, Cutler R, Rosomoff HL, Rosomoff RS. Chronic Pain-Associated Depression: Antecedent or Consequence of Chronic Pain? A Review. *Clin J Pain*. 1997;13(2):116-137.
 59. Linton SJ, Shaw WS. Impact of Psychological Factors in the Experience of Pain. *Phys Ther*. 2011;91(5):700-711. doi:10.2522/ptj.20100330
 60. Baydock SA, Flood C, Schulz JA, et al. Prevalence and Risk Factors for Urinary and Fecal Incontinence Four Months After Vaginal Delivery. *J Obstet Gynaecol Can*. 2009;31(1):36-41. doi:10.1016/S1701-2163(16)34051-8
 61. Dharma C, Lefebvre DL, Lu Z, et al. Risk for Maternal Depressive Symptoms and Perceived Stress by Ethnicities in Canada: From Pregnancy Through the Preschool Years. *Can J Psychiatry Rev Can Psychiatr*. 2019;64(3):190-198. doi:10.1177/0706743718792190
 62. Gheorghe M, Varin M, Wong SL, Baker M, Grywacheski V, Orpana H. Symptoms of postpartum anxiety and depression among women in Canada: findings from a national cross-

- sectional survey. *Can J Public Health*. 2021;112(2):244-252. doi:10.17269/s41997-020-00420-4
63. Millar W, JD. *Low Back Pain*, <Http://Www.Boneandjointcanada.Com/?SecId=485&msid=3>. *Canada BaPain*. Vol 7 SRC-GoogleScholar.; 1996:53.
 64. The Canadian, Continence Foundation; The Impact of Incontinence in Canada. A Briefing Document of Policy Makers. Published online December 2014.
 65. Tanner JA, Hensel J, Davies PE, Brown LC, Dechairo BM, Mulsant BH. Economic Burden of Depression and Associated Resource Use in Manitoba, Canada. *Can J Psychiatry*. 2020;65(5):338-346. doi:10.1177/0706743719895342
 66. Camaron Institute. *Impacts of Incontinence in Canada: A Briefing Document for Policy Makers*. The Canadian Continence Foundation; 2014. Accessed October 25, 2021. <https://www.canadiancontinence.ca/pdfs/en-impact-of-incontinence-in-canada-2014.pdf>
 67. Gaudet C, Wen SW, Walker MC. Chronic Perinatal Pain as a Risk Factor for Postpartum Depression Symptoms in Canadian Women. *Can J Public Health*. 2013;104(5):e375-e387. doi:10.17269/cjph.104.4029
 68. Dunn KM, Croft PR. Classification of Low Back Pain in Primary Care: Using “Bothersomeness” to Identify the Most Severe Cases: *Spine*. 2005;30(16):1887-1892. doi:10.1097/01.brs.0000173900.46863.02
 69. Dunn KM, Croft PR. The importance of symptom duration in determining prognosis. *Pain*. 2006;121(1):126-132. doi:10.1016/j.pain.2005.12.012
 70. Schmidt CO, Raspe H, Pflingsten M, et al. Back Pain in the German Adult Population: Prevalence, Severity, and Sociodemographic Correlates in a Multiregional Survey. *Spine*. 2007;32(18):2005-2011. doi:10.1097/BRS.0b013e318133fad8
 71. Von Korff M, Ormel J, Keefe FJ, Dworkin SF. Grading the severity of chronic pain. *Pain*. 1992;50(2):133-149. doi:10.1016/0304-3959(92)90154-4
 72. Public Health Agency of Canada. *What Mothers Say: The Canadian Maternity Experiences Survey*. Public Health Agency of Canada; 2009.
 73. Dzakpasu S, Kaczorowski J, Chalmers B, Heaman M, Duggan J, Neusy E. The Canadian Maternity Experiences Survey: Design and Methods. *J Obstet Gynaecol Can*. 2008;30(3):207-216. doi:10.1016/S1701-2163(16)32757-8
 74. Boyce P, Stubbs J, Todd A. The Edinburgh Postnatal Depression Scale: Validation for an Australian Sample. *Aust N Z J Psychiatry*. 1993;27(3):472-476. doi:10.3109/00048679309075805
 75. Cox JL, Holden JM, Sagovsky R. Detection of Postnatal Depression: Development of the 10-item Edinburgh Postnatal Depression Scale. *Br J Psychiatry*. 1987;150(6):782-786. doi:10.1192/bjp.150.6.782
 76. Government of Canada SC. Maternity Experiences Survey (MES). Published October 24, 2007. Accessed August 1, 2020. <http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5019#a4>
 77. Murray L, Carothers AD. The Validation of the Edinburgh Post-natal Depression Scale on a Community Sample. *Br J Psychiatry*. 1990;157(2):288-290. doi:10.1192/bjp.157.2.288
 78. Gatchel RJ, Peng YB, Peters ML, Fuchs PN, Turk DC. The biopsychosocial approach to chronic pain: Scientific advances and future directions. *Psychol Bull*. 2007;133(4):581-624. doi:10.1037/0033-2909.133.4.581

79. Martínez-Borba V, Suso-Ribera C, Osma J, Andreu-Pejó L. Predicting Postpartum Depressive Symptoms from Pregnancy Biopsychosocial Factors: A Longitudinal Investigation Using Structural Equation Modeling. *Int J Environ Res Public Health*. 2020;17(22):8445. doi:10.3390/ijerph17228445
80. Pincus T, Burton AK, Vogel S, Field AP. A Systematic Review of Psychological Factors as Predictors of Chronicity/Disability in Prospective Cohorts of Low Back Pain. *Spine*. 2002;27(5):E109.
81. Robertson E, Grace S, Wallington T, Stewart DE. Antenatal risk factors for postpartum depression: a synthesis of recent literature. *Gen Hosp Psychiatry*. 2004;26(4):289-295. doi:10.1016/j.genhosppsych.2004.02.006
82. Siahkhal SF, Irvani M, Mohaghegh Z, Sharifipour F, Zahedian M. Maternal, obstetrical and neonatal risk factors' impact on female urinary incontinence: a systematic review. *Int Urogynecology J*. 2020;31(11):2205-2224. doi:10.1007/s00192-020-04442-x
83. Waddell G. Biopsychosocial analysis of low back pain. *Baillières Clin Rheumatol*. 1992;6(3):523-557. doi:10.1016/S0950-3579(05)80126-8
84. Statistics Canada. Maternity Experiences Survey, 2006 – User Guide. Published online 2006:53.
85. Bursac Z, Gauss CH, Williams DK, Hosmer DW. Purposeful selection of variables in logistic regression. *Source Code Biol Med*. 2008;3(1):17. doi:10.1186/1751-0473-3-17
86. Hosmer D, Lemeshow S, Sturdivant RX. *Applied Logistic Regression. 3rd Edition Ed*. New York: John Wiley & Sons; 2013.
87. Åhlund S, Rothstein E, Rådestad I, Zwedberg S, Lindgren H. Urinary incontinence after uncomplicated spontaneous vaginal birth in primiparous women during the first year after birth. *Int Urogynecology J*. 2020;31(7):1409-1416. doi:10.1007/s00192-019-03975-0
88. Currie SR, Wang J. Chronic back pain and major depression in the general Canadian population. *Pain*. 2004;107(1):54-60. doi:10.1016/j.pain.2003.09.015
89. Eisenach JC, Pan PH, Smiley R, Lavand'homme P, Landau R, Houle TT. Severity of acute pain after childbirth, but not type of delivery, predicts persistent pain and postpartum depression. *Pain*. 2008;140(1):87-94. doi:10.1016/j.pain.2008.07.011
90. Kwok SC, Moo D, Sia ST, Razak AS, Sng BL. Childbirth pain and postpartum depression. *Trends Anaesth Crit Care*. 2015;5(4):95-100. doi:10.1016/j.tacc.2015.04.003
91. Lim G, LaSorda KR, Farrell LM, McCarthy AM, Facco F, Wasan AD. Obstetric pain correlates with postpartum depression symptoms: a pilot prospective observational study. *BMC Pregnancy Childbirth*. 2020;20(1):240. doi:10.1186/s12884-020-02943-7
92. Virgara R, Maher C, Kessel GV. The comorbidity of low back pelvic pain and risk of depression and anxiety in pregnancy in primiparous women. *BMC Pregnancy Childbirth*. 2018;18(1):1-7. doi:10.1186/s12884-018-1929-4
93. Östgaard HC, Zetherström G, Roos-Hansson E. Back Pain in Relation to Pregnancy: A 6-Year Follow-Up. *Spine*. 1997;22(24):2945-2950.
94. To WWK, Wong MWN. Factors associated with back pain symptoms in pregnancy and the persistence of pain 2 years after pregnancy. *Acta Obstet Gynecol Scand*. 2003;82(12):1086-1091. doi:10.1046/j.1600-0412.2003.00235.x
95. Dunn G, Egger MJ, Shaw JM, et al. Trajectories of lower back, upper back, and pelvic girdle pain during pregnancy and early postpartum in primiparous women. *Womens Health*. 2019;15:1745506519842757. doi:10.1177/1745506519842757

96. Dunn KM, Campbell P, Jordan KP. Long-term trajectories of back pain: cohort study with 7-year follow-up. *BMJ Open*. 2013;3(12):e003838. doi:10.1136/bmjopen-2013-003838
97. Gureje O, Von Korff M, Simon GE, Gater R. Persistent Pain and Well-being: A World Health Organization Study in Primary Care. *JAMA*. 1998;280(2):147. doi:10.1001/jama.280.2.147
98. Lintonl SJ, Nicholasl MK, MacDonaldl S, et al. The role of depression and catastrophizing in musculoskeletal pain. *Eur J Pain*. 2011;15(4):416-422. doi:10.1016/j.ejpain.2010.08.009
99. Mackenzie J, Murray E, Lusher J. Women's experiences of pregnancy related pelvic girdle pain: A systematic review. *Midwifery*. 2018;56:102-111. doi:10.1016/j.midw.2017.10.011
100. Ross LE, Murray BJ, Steiner M. Sleep and perinatal mood disorders: a critical review. *J Psychiatry Neurosci*. 2005;30(4):247-256.
101. Gatchel RJ. Comorbidity of Chronic Pain and Mental Health Disorders: The Biopsychosocial Perspective. *Am Psychol*. 2004;59(8):795-805. doi:10.1037/0003-066X.59.8.795
102. Blackburn-Munro G, Blackburn-Munro RE. Chronic Pain, Chronic Stress and Depression: Coincidence or Consequence? *J Neuroendocrinol*. 2001;13(12):1009-1023. doi:10.1046/j.0007-1331.2001.00727.x
103. Moldofsky H. Sleep and pain. *Sleep Med Rev*. 2001;5(5):385-396. doi:10.1053/smr.2001.0179
104. Talaei-Khoei M, Fischerauer SF, Jha R, Ring D, Chen N, Vranceanu AM. Bidirectional mediation of depression and pain intensity on their associations with upper extremity physical function. *J Behav Med*. 2018;41(3):309-317. doi:10.1007/s10865-017-9891-6
105. Davey HL, Tough SC, Adair CE, Benzies KM. Risk Factors for Sub-Clinical and Major Postpartum Depression Among a Community Cohort of Canadian Women. *Matern Child Health J*. 2011;15(7):866-875. doi:10.1007/s10995-008-0314-8
106. Lanes A, Kuk JL, Tamim H. Prevalence and characteristics of Postpartum Depression symptomatology among Canadian women: a cross-sectional study. *BMC Public Health*. 2011;11(1):302. doi:10.1186/1471-2458-11-302
107. Gil KM, Keefe FJ, Crisson JE, Van Daltsen PJ. Social support and pain behavior. *Pain*. 1987;29(2):209-217. doi:10.1016/0304-3959(87)91037-2
108. Saad M. Examining the Social Patterning of Postpartum Depression by Immigration Status in Canada: an Exploratory Review of the Literature. *J Racial Ethn Health Disparities*. 2019;6(2):312-318. doi:10.1007/s40615-018-0526-6
109. Zelkowitz P, Saucier JF, Wang T, Katofsky L, Valenzuela M, Westreich R. Stability and change in depressive symptoms from pregnancy to two months postpartum in childbearing immigrant women. *Arch Womens Ment Health*. 2008;11(1):1-11. doi:10.1007/s00737-008-0219-y
110. Woolhouse H, Perlen S, Gartland D, Brown SJ. Physical Health and Recovery in the First 18 Months Postpartum: Does Cesarean Section Reduce Long-Term Morbidity? *Birth*. 2012;39(3):221-229. doi:10.1111/j.1523-536X.2012.00551.x
111. Smith MD, Russell A, Hodges PW. Is there a relationship between parity, pregnancy, back pain and incontinence? *Int Urogynecology J*. 2008;19(2):205-211. doi:10.1007/s00192-007-0421-x
112. Bush HM, Pagorek S, Kuperstein J, Guo J, Ballert KN, Crofford LJ. The Association of Chronic Back Pain and Stress Urinary Incontinence: A Cross-Sectional Study. *J Womens Health Phys Ther*. 2013;37(1):11-18. doi:10.1097/JWH.0b013e31828c1ab3

113. Eliasson K, Elfving B, Nordgren B, Mattsson E. Urinary incontinence in women with low back pain. *Man Ther.* 2008;13(3):206-212. doi:10.1016/j.math.2006.12.006
114. Arab AM, Behbahani RB, Lorestani L, Azari A. Assessment of pelvic floor muscle function in women with and without low back pain using transabdominal ultrasound. *Man Ther.* 2010;15(3):235-239. doi:10.1016/j.math.2009.12.005
115. Radebold A, Cholewicki J, Panjabi MM, Patel TC. Muscle response pattern to sudden trunk loading in healthy individuals and in patients with chronic low back pain. *Spine.* 2000;25(8):947-954. doi:10.1097/00007632-200004150-00009
116. Smith MD, Coppieters MW, Hodges PW. Postural response of the pelvic floor and abdominal muscles in women with and without incontinence. *Neurol Urodyn.* 2007;26(3):377-385. doi:10.1002/nau.20336
117. Welk B, Baverstock R. Is there a link between back pain and urinary symptoms? *Neurol Urodyn.* 2020;39(2):523-532. doi:10.1002/nau.24269
118. Dumoulin C, Lemieux MC, Bourbonnais D, Gravel D, Bravo G, Morin M. Physiotherapy for Persistent Postnatal Stress Urinary Incontinence: A Randomized Controlled Trial. *Obstet Gynecol.* 2004;104(3):504-510. doi:10.1097/01.AOG.0000135274.92416.62
119. Hodges PW, Eriksson AEM, Shirley D, Gandevia SC. Intra-abdominal pressure increases stiffness of the lumbar spine. *J Biomech.* 2005;38(9):1873-1880. doi:10.1016/j.jbiomech.2004.08.016
120. Hodges PW, Sapsford R, Pengel LHM. Postural and respiratory functions of the pelvic floor muscles. *Neurol Urodyn.* 2007;26(3):362-371. doi:10.1002/nau.20232
121. Pool-Goudzwaard A, Hoek van Dijke G, van Gurp M, Mulder P, Snijders C, Stoeckart R. Contribution of pelvic floor muscles to stiffness of the pelvic ring. *Clin Biomech.* 2004;19(6):564-571. doi:10.1016/j.clinbiomech.2004.02.008
122. Sapsford R. Rehabilitation of pelvic floor muscles utilizing trunk stabilization. *Man Ther.* 2004;9(1):3-12. doi:10.1016/S1356-689X(03)00131-0
123. Sapsford RR, Hodges PW, Richardson CA, Cooper DH, Markwell SJ, Jull GA. Co-activation of the abdominal and pelvic floor muscles during voluntary exercises. *Neurol Urodyn.* 2001;20(1):31-42. doi:10.1002/1520-6777(2001)20:1<31::AID-NAU5>3.0.CO;2-P
124. Smith MD, Russell A, Hodges PW. Do Incontinence, Breathing Difficulties, and Gastrointestinal Symptoms Increase the Risk of Future Back Pain? *J Pain.* 2009;10(8):876-886. doi:10.1016/j.jpain.2009.03.003
125. Kelleher CJ, Cardozo LD, Khullar V, Salvatore S. A medium term analysis of the subjective efficacy of treatment for women with detrusor instability and low bladder compliance. *BJOG Int J Obstet Gynaecol.* 1997;104(9):988-993. doi:10.1111/j.1471-0528.1997.tb12054.x
126. Viktrup L. The risk of lower urinary tract symptoms five years after the first delivery*. *Neurol Urodyn.* 2002;21(1):2-29. doi:10.1002/nau.2198
127. Sjødahl J, Gutke A, Öberg B. Predictors for long-term disability in women with persistent postpartum pelvic girdle pain. *Eur Spine J.* 2013;22(7):1665-1673. doi:10.1007/s00586-013-2716-6
128. Viktrup L, Lose G. The risk of stress incontinence 5 years after first delivery. *Am J Obstet Gynecol.* 2001;185(1):82-87. doi:10.1067/mob.2001.114501
129. MacArthur C, Glazener CMA, Wilson PD, Lancashire RJ, Herbison GP, Grant AM. Persistent urinary incontinence and delivery mode history: a six-year longitudinal study. *BJOG Int J Obstet Gynaecol.* 2006;113(2):218-224. doi:10.1111/j.1471-0528.2005.00818.x

130. Fritel X, Tsegan YE, Pierre F, Saurel-Cubizolles MJ, “EDEN Mother-Child Cohort Study Group.” Association of postpartum depressive symptoms and urinary incontinence. A cohort study. *Eur J Obstet Gynecol Reprod Biol.* 2016;198:62-67. doi:10.1016/j.ejogrb.2015.12.028
131. Burgio K. Urinary incontinence in the 12-month postpartum period. *Obstet Gynecol.* 2003;102(6):1291-1298. doi:10.1016/j.obstetgynecol.2003.09.013
132. Press JZ, Klein MC, Kaczorowski J, Liston RM, von Dadelszen P. Does cesarean section reduce postpartum urinary incontinence? A systematic review. *Birth Berkeley Calif.* 2007;34(3):228-237. doi:10.1111/j.1523-536X.2007.00175.x
133. Ciaghi F, Bianco AD, Guarese O. Prevalence of pelvic floor disorders during the post-partum period. A prospective study and a proposal of a multidisciplinary prevention strategy/Prevalenza delle disfunzioni perineali nel post-partum. Studio prospettico di coorte e proposta di un percorso preventivo multiprofessionale. *Sci Riabil.* 2015;17(1):5-.
134. Ghaderi F, Mohammadi K, Amir Sasan R, Niko Kheslat S, Oskouei AE. Effects of Stabilization Exercises Focusing on Pelvic Floor Muscles on Low Back Pain and Urinary Incontinence in Women. *Urology.* 2016;93:50-54. doi:10.1016/j.urology.2016.03.034
135. Qi X, Shan J, Peng L, Zhang C, Xu F. The effect of a comprehensive care and rehabilitation program on enhancing pelvic floor muscle functions and preventing postpartum stress urinary incontinence. *Medicine (Baltimore).* 2019;98(35). doi:10.1097/MD.00000000000016907
136. Cooper PJ, Murray L. Postnatal depression. *BMJ.* 1998;316(7148):1884-1886. doi:10.1136/bmj.316.7148.1884
137. Stuge B, Lærum E, Kirkesola G, Vøllestad N. The Efficacy of a Treatment Program Focusing on Specific Stabilizing Exercises for Pelvic Girdle Pain After Pregnancy: A Randomized Controlled Trial. *Spine.* 2004;29(4):351-359. doi:10.1097/01.BRS.0000090827.16926.1D
138. Buurman MBR, Lagro-Janssen ALM. Women’s perception of postpartum pelvic floor dysfunction and their help-seeking behaviour: a qualitative interview study. *Scand J Caring Sci.* 2013;27(2):406-413. doi:10.1111/j.1471-6712.2012.01044.x
139. Wagg AR, Kendall S, Bunn F. Women’s experiences, beliefs and knowledge of urinary symptoms in the postpartum period and the perceptions of health professionals: a grounded theory study. *Prim Health Care Res Dev.* 2017;18(5):448-462. doi:10.1017/S1463423617000366
140. Swenson CW, DePorre JA, Haefner JK, Berger MB, Fenner DE. Postpartum depression screening and pelvic floor symptoms among women referred to a specialty postpartum perineal clinic. *Am J Obstet Gynecol.* 2018;218(3):335.e1-335.e6. doi:10.1016/j.ajog.2017.11.604

Transition to Chapter 6

Findings from Chapters **3, 4 and 5**, comprise Phase I of our study and represent the quantitative aspects of this thesis. In addition to findings in **Chapter 3 and 4** which showed that a considerable proportion of mothers (36%) report BP during the first three months postpartum, of which a high number continue to have persistent symptoms when examined at 5-14 months postpartum. Findings from **Chapter 5** indicate that mothers reporting BP postpartum were also more likely to have comorbid postpartum depression (PPD) and urinary incontinence (UI) up to 5-14 months after childbirth. Particularly, it was observed that PPD and UI symptoms were more common in those reporting the worse categories of BP i.e., mothers with greatly problematic BP during the first three months postpartum and those reporting persistent BP symptoms at 5-14 months postpartum. Based on these quantitative results, it can be summated that BP represents a considerable burden on a national population scale in Canada, and that mothers reporting persistent BP symptoms postpartum may not only be at higher risk of chronicity but may also be more likely to develop persistent multimorbidity lasting the first postpartum year and beyond. The next chapter, Chapter six, will delve deeper to understand the experiences of living with persistent BP up to 18 months after childbirth from the perspective of affected mothers themselves. Specifically, this chapter will build on the quantitative results by examining other aspects of disease burden that were not covered in the MES data, including the perceived impact of persistent BP on various aspects of women's lives, coping strategies adopted, and access to healthcare services to better manage persistent pain symptoms.

CHAPTER 6

6. MANUSCRIPT 4

6.1 General Information

6.1.1 Title

‘Not back to normal’: Experiences of Canadian mothers living with persistent back pain after childbirth—A qualitative study.

6.1.2 Citation

Awe O., Bath B., Trask C., Farag M. ‘Not back to normal’: Experiences of living with persistent back pain after childbirth in Canadian mothers –A qualitative study. *Manuscript in preparation for submission.*

The PhD candidate, Awe O, contributed to conceiving and designing the study. She led and completed the University of Saskatchewan Behavioural Ethics board approval submissions, conducted the data collection, transcriptions, analysis, results interpretation, and prepared the manuscript.

6.2 Abstract

Background: Back pain (BP) is considered a common and potentially disabling health problem among postpartum women. The experiences of mothers living with persistent BP have not been previously explored in Canada. This study aimed to explore Canadian mothers’ experiences of persistent BP after childbirth, with specific focus on the perceived impact on various aspects of life; coping strategies; and access to healthcare to better manage persistent symptoms.

Methods: This was a descriptive phenomenological study. Adult mothers within 18 months after childbirth living with persistent BP that started or was exacerbated by the pregnancy, birth or the postpartum period and has persisted for at least three months postpartum participated in individual video-recorded semi-structured interviews. Data were imported into NVivo 12 plus where they were transcribed verbatim and analyzed using inductive thematic analysis.

Results: In all, 11 mothers aged 25-40 years participated in the study. Three broad themes, each with sub-themes, were extracted from the semi-structured interviews: i) *'Everything can be difficult'* with subthemes *pain and physical limitations, altered life roles and psychological distress*; ii) *Pushing through; normalizing life* with subthemes *eliciting social support and self-management*; and iii) *Navigating healthcare* with subthemes *interacting with healthcare providers and overcoming access barriers; 'it really does take a village'*

Conclusion: This study showed that persistent BP affects various aspects of the mother's lives. Despite the mothers being able to initiate several coping strategies, they recommend improvements in health care provider knowledge and attitude about BP as well as early and effective referral to available treatments options and other support services for women dealing with BP both during pregnancy and postpartum. There is need for tailored healthcare services and policies that aim to address women's expectations and needs regarding persistent back pain, which in the long run, can mitigate barriers in seeking timely care, prevent deterioration of symptoms, and ensure overall wellbeing for the mothers.

6.3 Introduction

Globally, back pain (BP) is considered a serious health problem and is of particular concern in pregnant and postpartum populations. Existing evidence show that at least one in two women report some degree of BP during pregnancy¹⁻³ while about one in three women report residual complaints or develop new symptoms after childbirth⁴⁻¹¹—making it the most common musculoskeletal complaint reported in these populations. When left unmitigated, symptoms may become chronic or recurrent, and can have several short and long-term sequelae for both the mother and child. For example, 20-30% of women living with chronic pain dated their pain onset to a previous pregnancy or childbirth, that is compared to 6.3% in non-parous women,^{12,13} while a high relapse rate (85-95%) has been documented in subsequent pregnancies, in which symptoms appear earlier and are more severe.^{14,15} Furthermore, persistent BP interferes significantly with the postpartum life, limiting mothers' day-to-day activities, sleep, and sexual life.^{16,17} Consequent disability and fatigue can lead to maladaptation to motherhood and inadequate care for the newborn.¹⁶ Living with relentless pain has also been described by several postpartum women as precipitating psychological distress.^{16,18,19} Moreover, several quantitative studies demonstrate that

mothers who have persistent or chronic BP postpartum have a threefold higher risk of postpartum depression,²⁰ and were more likely to report anxiety, poorer health status, and poorer self-rated quality of life compared to those without persistent BP postpartum.^{21,22} The consequent disruptions to maternal role, mother-child bonding, important relationships and participation at work caused by relentless pain have also been described in many studies.^{16,18,19,23–27}

In Canada, few studies have examined BP that persists after childbirth.^{28,29} These studies show that a high proportion of mothers (up to 41-77%) may continue to have persistent BP complaints for varying periods in the first postpartum year.^{28,29} However, to the authors' knowledge no studies exist that have explored women's experiences of living with persistent BP lasting more than three months postpartum, using qualitative methods. Moreover, there is need to gain better understanding of how women cope with persistent BP, and their perceived access to healthcare and other resources that might help them better cope with their persistent symptoms, which have not been extensively explored among postpartum women.^{30–32} This information is crucial to shed light on women's needs and how to better support mothers living with persistent BP after childbirth, which can provide a basis for developing tailored healthcare services and policies that optimize maternity care relating to back pain, both during and after pregnancy. The aim of this study is therefore to explore the experiences of recent mothers in Canada living with persistent BP—specifically, the perceived impact of pain on various aspects of life, coping strategies, access to needed healthcare, including the additional support they feel they and future mothers need to help them better cope with persistent back pain. Ultimately, the overarching goal is to better understand the burden of BP in postpartum women and specific ways to better help them cope with this condition.

6.4 Methods

6.4.1 Study design and sample

A qualitative research approach, situated within a descriptive phenomenological framework, was chosen for this study since little knowledge exist on the lived experience of persistent BP among postpartum mothers in Canada³³ and in line with the study's aim to provide a detailed description of women's experiences of living with persistent BP, and therefore staying as close as possible to women's first-hand narratives with minimal interpretation.^{34,35}

Participants living in Saskatoon, Saskatchewan Canada and surrounding regions were recruited through poster ads on online platforms such as: University of Saskatchewan web network, the School of Rehabilitation Science's Facebook page, Twitter, Facebook, and mothers' community groups (see Appendix F.1 for the recruitment posters). Eligible participants were adult mothers who had given birth within the last 18 months, who were fluent in the English language, and currently have or had a history of persistent BP that started or was exacerbated by the pregnancy, birth, or the postpartum period. BP was considered persistent in this study if it was present for a minimum of 3 months duration and had limited usual activities to some extent.^{36,37} Prospective participants were excluded if they reported any history of back and/or pelvic pain problems that pre-dated the present or previous pregnancy and/or childbirth, multiple births or other pregnancy-related complications that may interfere with the perinatal period (e.g., pre-eclampsia, eclampsia, recent trauma or surgery involving the spine, intellectual or psychiatric impairment, malignancy, or infection) or BP symptoms lasting for less than 3 months postpartum or that had resolved at the time of the interview.

6.4.2 Study procedure and Data collection

Potential participants who indicated interest in the study (via email or text message), were contacted by the first author (OA) within a week of indicating interest to offer them information about the study, their participation rights and screen them for eligibility to participate. Following this a one-on-one (remote video conferencing) interview was scheduled for a day and time that was most convenient for participants. The use of video web conferencing was informed by the COVID 19 pandemic, since for safety reasons, face-to-face interviews with participants were not feasible. Prospective participants were sent all relevant information about the study, including the consent form (Appendix F.2), pre-interview questionnaire (Appendix F.3) and interview guide (Appendix F.4), electronically (via individual email) to enable them better to prepare for scheduled data collection and for their information and records.

Shortly before or at the time of the interview, participants completed the pre-interview questionnaire, which included a pain diagram to indicate the location of pain, a series of demographic and general health questions, and standardized questionnaire on BP interference with

daily activities using the modified Oswestry Disability Index (ODI).³⁸ The qualitative data were then obtained through recorded interviews with consenting participants. The semi-structured interviews were guided by an interview guide (Appendix F.4), developed by the first author (OA) after modifications were made based on a series of reviews by the authorship team and pilot testing with two postpartum women. The guide consisted of core open-ended questions and optional prompts pertaining to the women's experiences of BP; the perceived impact of persistent BP on various aspects of the mothers' lives, coping strategies, and access to needed healthcare, including mothers' recommendations on care/ resources that would help them better cope with their back pain. The women were free to direct the conversation. OA conducted all interviews and maintained a field note to capture observations and thoughts about the participants responses during and after each interview. All interviews lasted between 45-60 minutes and were conducted between April to and August 2020. Participating mothers received a coffee shop gift card of \$10 value in gratitude for their time.

6.4.3 Ethics

Ethical approval was for this study granted by the University of Saskatchewan's Research Ethics Board (Project ID: 1126). All participants provided oral informed consent to take part in the study.

6.4.4 Data analysis

The interview data (videos) were imported into NVivo, version 12 Plus (QSR International, Burlington, MA), where they were transcribed verbatim (manually) by the first author (OA), managed, and analyzed. Thematic analysis followed a continuous and iterative process in which each transcript was read multiple times to aid familiarization with the data, after which all transcripts were inductively coded. First, open codes were generated by assigning a label (name or short phrase) to relevant excerpts of data in line with the research objective.^{35,39} These initial codes, were then grouped together into meaningful categories, following which broader themes were created (axial coding). The emergent themes were further refined through a recursive process involving series of reviews by the authors (OA, BB, CT and MF) and referencing emergent categories and themes against the transcripts and original data (videos), to enhance trustworthiness and credibility of the analysis. During this process, some of the initial broad themes were combined, while others were further disaggregated, until a consensus was reached on the final

framework of broad themes and sub-themes and that these represented the content of the interviews.^{35,40} The research team brought a variety of perspectives to the research work. The first author, OA, is a mother with personal experience of perinatal BP. Co-authors, BB is a mother and a licensed physical therapist and health services researcher; MF is a mother and with professional experience in health economics and public policy; and CT is a trained Occupational Hygienist with professional experience in ergonomics and working in healthcare injury prevention projects. OA coded and analyzed all 11 transcripts, while BB and MF supervised the whole analysis process and interpretation of findings relative to the study objectives. CT also contributed to results interpretation.

Several strategies were used to ensure trustworthiness and credibility. First, using member checking procedure, participants were offered an opportunity to have their interview transcript returned to them to review their responses and add and/or revise their narrative as appropriate, thus contributing credibility.³⁴ Furthermore, the emergent themes and categories were scrutinized and reviewed during debriefing meetings with the co-authors to ensure the findings were clearly derived from the data.⁴¹ A reflexive journal was maintained (by OA) to catalogue all important observations, personal assumptions and reflections, and decisions made during the research process.^{35,39,40} Furthermore, the interview guide included cues and probes that allowed us gain greater depth and richness about women's lived experiences, while direct quotations from participants were used to support the study findings.³⁵

6.5 Results

6.5.1 Participant characteristics

Sociodemographic and general health characteristics of participants can be found in Table 6.1. In all 11 postpartum mothers living with persistent BP were included in the study. The mothers were aged 25-40 years and were on average 9.5 (range= 4.5-18) months postpartum at the time of the interviews. Most mothers (6/11) were first time mothers, while the remaining mothers had 2-5 children. The majority (10/11) of the mothers were born in Canada or had been living in Canada for at least 5 years. All mothers had at least a university education. For most mothers (8/11) BP symptoms started during the index pregnancy, while many mothers reported concomitant

depression (7/11) and anxiety (7/11). Notwithstanding, the majority of mothers perceived disability due to persistent BP to be only minimal (6/11) or moderate (5/11).

Table 6.1: Sociodemographic, Health and Pain Characteristics of recent Mothers with persistent BP after childbirth	
Characteristic	Number (%) of participants (n=11)
Age, y	
25-29	5 (45.5)
30-34	5 (45.5)
>35	1 (9.1)
Country of birth (years in Canada)	
Canada	7 (63.6)
Indonesia (17 years)	1 (9.1)
Scotland (5.5 years)	1 (9.1)
Nigeria (8 years)	1 (9.1)
Cameroon (2 years)	1 (9.1)
Number of children	
One	6 (54.5)
Two	3 (27.3)
Three or more	2 (18.2)
Number of months postpartum at time of interview	
3-6	3 (27.3)
6-9	3 (27.3)
9-12	2 (18.2)
12-18	3 (27.3)
Highest level of education	
University	6 (54.5)
Graduate	5 (45.5)
Presence of comorbidities*	
Depression/low mood	7 (63.6)
Anxiety	7 (63.6)
Urinary incontinence	2 (18.2)
Painful sex	4 (36.4)
Access to additional health insurance (that covers physiotherapy, massage etc.)	
No	2 (18.2)
Yes	9 (81.8)
Pain onset	
Previous pregnancy	2 (18.2)
During index pregnancy	8 (72.7)
After childbirth	1 (9.1)
BP interference based on ODI scores	
Minimal perceived disability (0-20%)	6 (54.5)
Moderate perceived disability (21-40%)	5 (45.5)

*Total more than 100% because some mothers reported multiple comorbidities.

6.5.2 Thematic analysis findings

Three broad inter-related themes, each with sub-themes (Figure 6.1), emerged from the present study: i) “Everything can be difficult” ii) Pushing through; normalizing life and iii) Navigating health care. These categories, capture the complexity of recent mothers’ experiences of living with BP that has persisted for at least 3 months postpartum, and reflect the perspective that the BP and its impact on women’s lives, including the negotiations for coping strategies and seeking/ not seeking professional solutions for the condition, is an experiential journey that could start at any point during the perinatal period, (i.e., pregnancy, childbirth or postpartum). Moreover, symptoms could also start pre-pregnancy and worsen during any of these time periods. In addition, the study was carried out during the Covid 19 pandemic and the effect of this was all encompassing in interacting with both the negative impacts of BP itself as well as exacerbating existing barriers in seeking/receiving needed care. Figure 6.1. depicts these concepts figuratively.

Overall, the mothers describe difficulty of living with back pain both during pregnancy, and especially postpartum, in which bodily pain, functional limitations, psychological distress and social limitations were common features of the mothers’ experiences as they engaged in their daily lives. Despite this, many mothers adopted a positive attitude to their pain and strived to persevere in their daily routine by adopting several coping strategies, though they questioned when the pain would go away and wished to no longer be in pain. The mothers also sought help from a variety of healthcare providers including those they saw as part of their regular peri and post partum care (e.g., family physicians, obstetricians, public health nurses) and others (physiotherapists, chiropractors, or massage therapists) with variable positive and negative experiences described. However, several barriers were encountered in seeking timely care for their BP, most common of which were lack of time and perceived lack of awareness about available services both by healthcare providers and the mothers themselves.

In reflecting on their experiences and how they and future mothers can be better supported to manage BP, the mothers highlighted the need for timely information on BP, and more holistic maternity care that includes better follow-up care postpartum, early screening for back problems and referral to individualized physiotherapy and other relevant services both during pregnancy and after childbirth. They also expressed a need for available services to be made affordable for

women. The importance of improving societal attitudes around women’s health during pregnancy and beyond were also highlighted. The details of each theme are illustrated below and supported with direct quotes from the mothers (represented by assigned pseudonyms and parity).

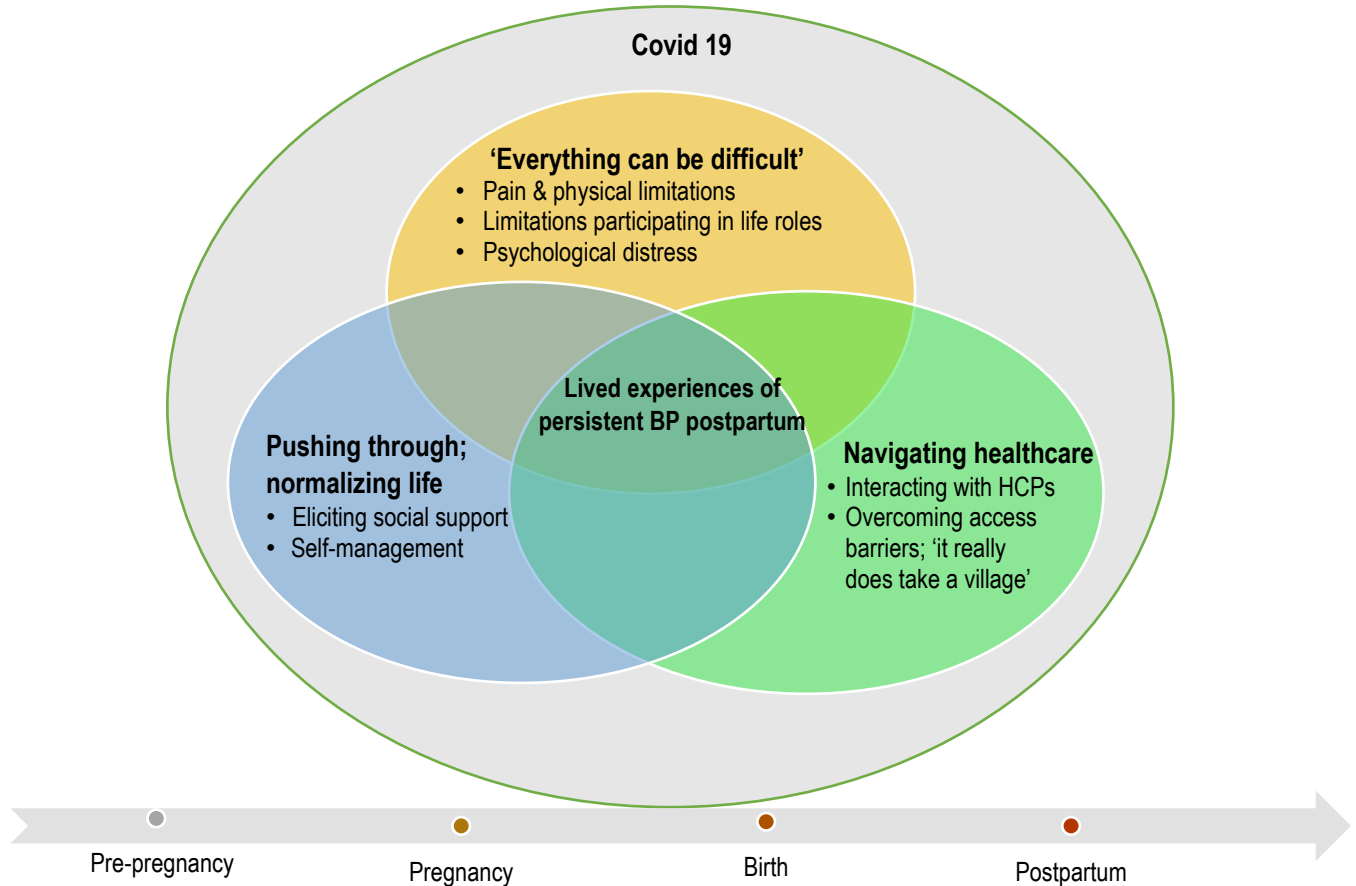


Figure 6.1: Overview of themes and sub-themes identified from qualitative interviews with recent mothers living with persistent BP after childbirth. HCPs: healthcare providers.

6.5.2.1 Theme 1: ‘Everything can be difficult’

Pain and Physical Limitations

Bodily pain was a central feature of the mothers’ experience with BP. Pain symptoms were described using various descriptors that reflected the nature, pattern, location, and interference of pain with usual activities. For most mothers the onset of BP became noticeable at around 20 weeks of pregnancy or earlier in parous mothers who had a previous experience of BP and had persisted up to at least 7-8 months postpartum. For one mother, BP started after childbirth. Pain locations

that were marked on the pain diagram and/or described during the interviews indicated a variety of locations that involved predominantly a combination of the lumbar region of the back and pelvic regions and could sometimes radiate to other body parts such as the upper back, abdomen, thighs and legs. Pain symptoms could be mild, severe, intense, shooting, sharp, electrical, or burning, and could also vary between being intermittent and constant depending on the type of activities the mothers engaged in.

For many mothers, BP made completing simple everyday activities more difficult. Persistent pain resulted in a general 'slowing down' and 'doing less' and some mothers described feeling weaker and being more physically restricted. For example, daily routine, completing household chores and practical day-to-day caring for the baby became harder work and sometimes aggravated pain. As a result, some mothers felt BP made their postpartum recovery slower.

“The back pain really affected my daily activities - pretty much anything like walking, sitting and sleeping. I can't really do much...like I can't stand up for a long time, I can't walk for a long time; it's just really hard” (P003, 3)

” But the back pain has been notable with this pregnancy, and it definitely has persisted...yeah, like I guess relative to my previous experience with pregnancy, c-section, birth, recovery, it all felt pretty far from the course.” (P001, 2)

Compromised sleep quality both during pregnancy and postpartum, as well as limitations in physical activity were also paramount concerns. Postnatally, sleeplessness contributed to exhaustion and fatigue, and was related to worsening BP symptoms. Furthermore, mothers who had been very active pre-pregnancy, found it difficult and even painful to regain or maintain their exercise levels due to the pain and body weakness:

“I'm a very physically active individual, like I used to do something [physical activity] every day, [but] the back pain stopped me - it stopped me going to the gym, it stopped me walking (the dog); it's so exhausting” (P004, 1)

Limitations participating in life roles

Almost all mothers said that their back pain affected their pregnancy experience, especially towards the end, making an already uncomfortable pregnancy more challenging and ‘unbearable’ for some. Furthermore, the mothers expressed that the transition to motherhood was hard, and that their back pain made caring for the newborn in general less pleasurable. Other mothers said the pain limited the things they could do with and for their baby and older children, with activities such as playing, carrying, bathing, and soothing the baby being harder work than they would have liked it to be. Though, the mothers strived to not allow the pain affect love for their baby, some expressed difficulties coping with motherhood.

“...I hated having a newborn, like I loved my baby but (laughs) waking up every three hours, dealing with the pain, like it was just...it was terrible. I hated that phase of uhm (.) having my baby... I couldn't cope with having a newborn and like the demands of the baby because, you know, I'm just in so much pain” (P006,1)

Persistent BP also impacted mothers’ ability to socialize with others, engage in leisure activities and pursue hobbies they previously enjoyed doing, while some mothers spoke to limiting social interactions to people who have children and can understand the pain. However, some mothers spoke to limiting their social interactions because of the Covid-19 pandemic and them wanting to be safe (i.e., prior to the mandatory Covid-19-related lockdown), rather than the BP itself. Furthermore, participating at work and school was difficult, with some mothers finding themselves more distracted and less able to function optimally due to pain. As a result, one mom felt she would not be able fit back into her career, while another mother said BP has limited her job choices.

“The jobs that I look for now are different because I associate around not wanting to stand—because I know what kind of pain I’m gonna have to be dealing with in the long run.” (P010, 5)

Psychological Distress

For all mothers, accepting their persistent BP was difficult, and not being able to do return to their pre-pregnancy life as they knew it and to do the things they previously used to do effortlessly precipitated several negative emotions. For some mothers, not being able to care for the baby or older siblings the way they hoped produced feelings of frustration, disappointment, guilt and

sadness, and sometimes affected their sense of ‘self’. Alterations to self-esteem and self-image were also described when BP interfered with participants’ work and career.

“Yeah, so it’s a feeling of guilt—so you feel like oh I’m not doing what I should do as a mum, I’m not being there for my child. I’m feeling bad that I can’t provide comfort for this child...sometimes he’s fussy, he’s cranky, you feel maybe giving him a bath would make him feel better and make him feel calm, but I couldn’t because my back was on fire. So, I was always having that guilt...I felt like I wasn’t putting the child’s needs above mine— I felt like I was being selfish—I felt like I should have pushed more, you know. I felt like I wasn’t doing enough” (P008, 1)

Feelings of sadness and frustration were also expressed as pain was ‘invisible’ and hence difficult to explain to other people, while some mothers said BP made them more irritable and impatient with their family, and even the baby.

“I’d say my family-wise, they don’t really know what I’m feeling [chuckles]. It really kind of frustrates me and makes me feel sad they don’t... ‘cos I sometimes I take it out on them and its not even their fault and then that makes ME feel sad’ (P010, 5)

Finally, the mothers expressed fear and worry in relation to the prognosis of BP, saying they don’t feel back to normal and questioned when the pain would go away. As a result, some mothers said they would be reluctant to consider having future pregnancies, however others said they would not let BP deter them from having more kids, though they hoped to not experience BP in future pregnancies. Given their experiences, some mothers went further to say BP caused or worsened their postpartum anxiety and depression.

6.5.2.2 Theme 2. Pushing through; Normalizing Life

Eliciting social support

The mothers experienced social support to be crucial in their ability to cope with the pain and physical disability. Partners were the main source of support for most mothers, helping with household chores, running errands, childcare, personal grooming and providing moral support. Other family members, such as mothers, parents-in-law, were also a good source of support with provision of meals or minding the baby. Although, the mothers were less likely to discuss their

back pain with non-family members, they valued support offered by friends who dropped off meals, offered useful information on available BP care, or showed understanding for their physical disability without being judgmental. Some mothers also experienced support from their employers in terms of flexibility to leave work early or work from home. Other mothers recounted being given a special chair or back support equipment to help alleviate their discomfort.

However, some mothers felt limited in their avenues for social support with having partners that worked long shifts and needing to be gone most of the time, having ageing parents who have health concerns of their own or families that lived far way. One mother mentioned not being able to receive support from her family that was specifically needed to alleviate her back pain.

“My mum would rather not...she would do everything for you except bathe the baby...so I still had to figure that out even though I was in pain” (P008, 1)

Self-management

Many mothers learned to cope with persistent BP over time, though coping was especially difficult in the initial postpartum months. Most mothers generally strived to push through their pain to complete daily tasks or tried to not allow it to affect their daily lives despite being present. For some mothers, putting up with the pain was the only option they had, especially when no one else was available to help, or where the baby’s needs were perceived as higher priority than theirs or when maintaining their jobs was concerned.

“Like I just pushed through the pain, I did everything...I mean I was alone, so I had to do everything you know...even practical things like laundry or whatever, but it was just super painful and there was just nothing I could do about it” (P006, 1)

“I just push through it a lot. I always put his (baby’s) needs first before mine...so, I would kinda just push my pain to the side to just make sure he is ok, and I really had no problem doing that” (P011, 2)

Some mothers learned to be proactive in identifying provocative activities and tried to mitigate them early to prevent flareups or aggravation of symptoms by planning ahead,

modifying/eliminating aggravating activities, pacing out household tasks that were not considered urgent or making practical changes around the house (e.g. use of bassinet rather than a playpen). Other mothers spoke to being intentional about initiating or increasing their physical activity levels, however doing this without causing more pain was difficult to balance.

“I know that getting stronger would help it but at the same time, that process of getting stronger brings its own pain” (P005, 2)

Other coping strategies that the mothers found to be helpful were doing sports (e.g., swimming), correcting posture, taking breaks between activities, doing stretches, laying down to rest, using pillow support, using ice or heat packs, and having a hot bath. Most of the mothers did not take any medications for their back pain, though some used Tylenol or Advil occasionally when pain was severe, however they did not find these to be helpful. In contrast, some mothers found it difficult to cope with the pain and engaged in avoidance behaviour or relied on prescribed medications like antidepressants to manage their pain. However, for some mothers, having a prior knowledge of BP, seeing improvements in their symptoms, or being told that BP would resolve after childbirth, helped them to maintain a hopeful mindset while they endured the present pain.

6.5.2.3 Theme 3: Navigating healthcare

Interacting with Health Care Providers (HCPs)

All the mothers received maternity care, including postpartum care, jointly from a general practitioner (GP) and an obstetrician/gynaecologist (OB/GYN), while a public health nurse (PHN) conducted home visits within the first few days postpartum. The mothers expressed that the topic of back pain was often not ‘brought up’ by their care providers during antenatal or postnatal appointments or home visits by PHNs, with the focus being mainly on the baby. However, mothers who approached their HCPs about their BP reported mixed responses. Whereas some mothers felt supported by their HCP, most experienced that their care providers had limited knowledge of BP and often explained it away as a ‘normal’ part of pregnancy, with the usual advice being ‘to wait it out’. Other mothers felt that their complaints were not acknowledged, or ignored, while others perceived their provider to be empathic of their pain, though minimal options were offered for pain

relief (e.g., pregnancy pillows, heat pads), and referrals to other services were usually not made. One mother lamented:

“She [OB/GYN] just said, it's really normal—it's just part of pregnancy, which looking back I don't think that's true; I was in way more pain than anybody else I knew. So, I think that she could have probably done more, or at least try to give more options instead of she just saying it was normal” (P006, 1)

Another mother said:

“I said, well, my back is sore [chuckles]... every time I would see him, I'd say, oh, my back is pretty sore—it's getting pretty sore. He'd be like, oh well, yup, you're pregnant, you'll have a sore back; that'll go away once the baby comes...that was the extent of it. So, there was never any, even the suggestion that there might be something that I could do about it” (P005,2)

Furthermore, the mothers expressed dissatisfactions with the duration and simplicity of the postpartum follow-up care received, stating that it was too short and ‘narrow minded’ in not assessing for other health problems such as BP. This lack of assessment for persistent BP can result in a disconnect between healthcare providers’ assessment of ‘postnatal recovery’ (from a medical point of view) as opposed to the mother’s reality of being ‘recovered’, as one mother remarked:

“I think having just this one 6-week follow-up with just a GP or just an obstetrician... I feel like it's so limiting... it's just simply checking from a medical standpoint: has there been healing? Is there any infection? But from an orthopedic or musculoskeletal standpoint, there isn't any assessment for that. And so, women may or may not speak up about that pain but if a practitioner is telling them, oh you're good to go, you've recovered; you can return to your normal activities, and they haven't had any true assessment for these things or true understanding of how their pain fits into returning to those activities, I think there's a really big gap there that's missing.”(P001, 1)

Furthermore, postpartum consultations tended to be short or rushed, which was perceived to be a deterrent to reporting of persistent BP due to the mothers being preoccupied with the baby’s welfare and other concerns of having recently given birth. Moreover, when care providers do not

proactively inquire about BP, the mothers felt it was not an important topic to bring up and so they too did not feel comfortable talking about it.

“The fact that we really usually have like one 6-week postpartum checkup, you know, it's just maybe some women will mention their back pain then but maybe they won't because they've got a lot going on or they're very tired, and if those visits don't happen again or the visits after that are only with baby, women I think don't feel like they can speak up or obviously it's not a big deal because they're not asking how I'm doing— they're just asking about baby or whatever it may be” (P001,1)

Some mothers also sought care from other HCPs such as physiotherapists, chiropractors and/or massage therapists, with variable experiences with these services. However, most mothers spoke favourably of the support received from physiotherapists, which included varying combinations of BP education, pelvic support belt, manual therapy and prescribed exercises and stretches. They particularly appreciated the BP education and prescribed exercise and stretches which helped them to manage their BP symptoms at home, especially during the Covid-19 lockdown when receiving in-person care was no longer feasible. However, a few mothers found the prescribed exercises too cumbersome to maintain in their already busy lives as new moms or wished treatments would include more manual therapy, while others felt the BP information could be provided in written form as pamphlets which mothers can read at their own time and thus saving the cost of booking an extra appointment just for that. Notwithstanding most mothers commented that physiotherapy helped to significantly relieve their BP symptoms, and that they experienced symptomatic relief for longer periods, compared to when they received care from a chiropractor and massage therapists, and such that some mothers became hopeful about the prognosis of their BP.

“So, it got to the point um where most days I was feeling almost pain-free which was crazy...it had been about five years that I had been [pain-free] ... So, I have faith that it can be better, but it's not gone away” (P005,2)

Overcoming access barriers; ‘it really does take a village’

The mothers described several practical barriers to seeking and/or receiving professional help, including having no time or motivation to seek care, cost of or having no health insurance coverage

for physiotherapy and chiropractic services, long wait time, lack of awareness of services, negative past experiences with the healthcare system, difficulty booking appointments, considerations for childcare and because pain was still somewhat manageable.

“I am a student, I do have children, and I'm living off of student loan. So, every visit is 40 dollars...and 40 dollars can sometimes go quite a while for us. So, it's like uhm (.) I need to be able to know that I have extra spending money, which I usually don't.” (P011, 2)

Preconceptions about BP and available services also presented obstacles to seeking needed care. Some mothers believed BP to be a normal discomfort to be expected from having given birth. One mother feared not being believed by her doctor, while another mother believed that BP would not be considered a treatment priority in chiropractic and physiotherapy settings, since it may be perceived by these providers as less disabling than occupational BP. In addition, the mothers spoke of barriers relating to the Covid-19 pandemic and related lockdown, which impacted their ability to initiate care or continue to receive care from their physiotherapist or a chiropractor. For other mothers, the lockdown made them more sedentary and not engaging in physical activities as much they used to before the lockdown, which aggravated their symptoms.

In reflecting on how they and future mothers can be better supported to cope with persistent BP, the mothers summed that *“it really does take a village”* and that concerted efforts are needed both at the healthcare system and societal levels. At the healthcare system level, the mothers unanimously stressed the need for better acknowledgement of BP and for increased awareness among healthcare providers about these issues, including what options and services are available for effective pain management and treatment. The mothers also suggested that women should be ‘empowered’ with more consistent, timely and personalized information that meet their healthcare needs. They further described various ways to do this including, offering early prenatal classes that educate women on back pain, direct back pain education from their physician and obstetricians or written pamphlets or via signposts to relevant services. One mother said:

Maybe better understanding and education for women beyond six weeks postpartum or at that six-week OB appointment, signposting to postpartum women: these are other options you have available to you... don't just stop at 6 weeks' (P004,1).

The mothers further highlight the need for better support and follow-up of mothers postpartum beyond the 6–8 weeks mark, with the provision of more holistic care that includes timely referral to musculoskeletal health care providers such as physiotherapists or chiropractor for mothers who develop persistent symptoms. The mothers further voiced a need for available services to be made affordable for the mothers, either subsidized or publicly funded, which they feel would greatly increase access to these services.

“I think that one of the things the healthcare system should do is: they should make these services readily available; they should make it part of any pregnant woman's plan ... They should put much effort into it just in same way they would look into okay, how is the baby doing –just assuming and making people believe or under the impression that back pain comes with pregnancy, there's really no services out there for you until when you give birth, I don't think it's good... because all those things affect their ability to take care of their kids.” (P008,1)

“I think that pre and post partum physical therapy should absolutely be funded publicly” (P002,1)

At the societal level, many mothers expressed a desire for more robust and proactive support for women both during pregnancy and postpartum. Many mothers thought that pregnancy-related complaints such as BP are ‘normalized’ in the society at large as the ‘price’ for pregnancy. They also highlight that the societal expectations of the role of ‘mother’ were unrealistic and does not recognize mothers as multidimensional beings. One mother commented:

“We still have to recognize that women are people and have interests and activities and things they need to do, in addition to caring for a small infant...being a mother is just a part of who you are and not all of who you are; I don't think that's recognized as much and really takes a toll on women as well too from a mental perspective” (P002,1)

6.6 Discussion

The findings of this study revealed that persistent BP after childbirth has a significant and multidimensional impact on the mothers’ lives, making the pregnancy and postpartum periods more challenging from physical, psychological, and social perspectives. Various strategies were adopted to cope with the pain and disability, including seeking support, using self-management

strategies, and exploring professional solutions from within or outside the standard maternity healthcare settings. The mothers expressed unmet expectations and needs regarding their BP and experienced several barriers in accessing needed care. As a result, the mothers expressed the need for improved maternity care approaches and attitudes among healthcare providers and the community at large, and sought timely education, assessment, and referral to relevant services, such as physiotherapy to better manage their BP. Although the findings of this study are consistent with past studies,^{18,19,31,32} to the authors knowledge, the study is the first to explore the lived experienced of persistent PP among recent mothers in Canada.

Theme 1: 'Everything can be difficult'

In this study as well as other international studies in both pregnant^{25,42-44} and postpartum populations,^{18,19,45,46} a biopsychosocial picture is revealed that reflects the complexities of living with BP and the significant impact it has on various aspects of women's lives both during pregnancy and in the postpartum. Our findings also confirm existing knowledge that BP is not always self-limiting upon childbirth but can constitute a continuing challenge for some women, several months and even years after childbirth.^{18,19,47,48} Overall, then, the findings from this and other studies support the need for greater attention on this common health problem in order to reduce associated morbidity.

The mothers in this study reported functional limitations in engaging in daily life of caring for the baby, family, and home, as well as disruptions to sleep, physical activity, social and work life; all of which have considerable implications for their psychological wellbeing. These findings are consistent with extant literature.^{16,23} Studies also show that the postpartum period is inherently characterized by sleep disruptions and psychosocial adjustments,⁴⁹ in which persistent pain can cause additional strain for women and impede their mothering role.^{19,25,43} Among Irish first time mothers, sleep disruptions due to BP was perceived to cause additional layer of exhaustion beyond that inherent to the postpartum period,¹⁹ a finding that was also reflected in the narratives of both first-time and previous mothers in the present study. This negative impact of BP on sleep has also reported in several quantitative studies,⁵⁰⁻⁵² and sleep disturbance has in turn been associated with poorer quality of life, higher depressed affect and can be a perpetrating factor for pain persistence

in women.^{53–55} Some of these findings are reflected in the present study, as the mothers related their sleep deprivation and exhaustion to worsening BP symptoms.

Furthermore, the significant emotional and psychological impacts of BP are apparent; all mothers expressed some level of frustration, disappointment, sadness, irritation, worry or fear regarding their persistent BP as they mourned the losses experienced in their mobility and ability to carry out their usual life roles. Although, all mothers said their BP did not impact love for the baby and many pushed through their pain to care for their baby to the maximum ability possible; however, all mothers said BP made caring for baby less pleasurable, while few mothers experienced childcare struggles and feelings of guilt that they were not being a proper mother. Some participants also described difficulties in caring their other children. These feelings of guilt and inadequacy in performing the mothering role were emergent themes in past studies,^{16,23} and the reported feelings of fear and worry when BP does not resolve itself after the birth, contrary to what women have been told, described by mothers in this study have also been previously documented.^{16,23} Some mothers went further to say persistent BP was the cause or a contributory factor in their development of postpartum depression and anxiety. These findings are not surprising given the abundant evidence associating BP with negative emotional and psychological effects such as low mood and feelings of despair and helplessness.^{16,19,23,44,56,57} Several studies have also reported greater risk of postpartum depression (PPD) among women with BP and confirmed the comorbidity of BP and PPD in the first postpartum year^{20,58,59}—findings which are similar with the present study since almost all the mothers reported having depressed mood and together with their BP. Moreover, sleep problems can further exacerbate both BP and depressive symptoms in persons with chronic pain^{60–63} which can further explain the experiences described in the present study. These findings therefore underscore the need to incorporate early screening for concomitant BP and PPD and develop effective interventions to address these common problems of pregnancy and the postpartum. However, in Canada, even though routine screening is carried out for PPD,⁶⁴ no national guidelines exist for screening, diagnosis, and management of BP.⁶⁵

Theme 2: Pushing through; normalizing life

Coping with persistent BP can be exhausting and psychologically stressful, especially in the early postnatal months, which is in line with prior studies.^{18,19} According to the social support theory,

the supporting actions of others or a perceived availability of support can enhance coping and ameliorate the effect of life stressors on health.⁶⁸ Furthermore, receiving the right type for support, from the right person and at the right time have been shown to be important to people living with BP.^{67,69} All mothers in the present study appreciated the practical and psychological support received mainly from their partners and sometimes from close family members when dealing with BP. However, some described frustrations when perceived needed support was not received at the time needed. These findings concur with existing literature^{31,42,44,70} that discuss the importance of support and understanding from women's social environment, particularly the essential role of the partner to women being able to cope with pain. These findings create the need to educate partners and close people in the family, such as mothers, about back pain and involve them in its management.

In contrast to what has been described in past studies,¹⁶ mothers in this study did not actively seek support from non-family members, however they appreciated when support and understanding were offered by their friends and employers. Cernja et al⁴² described a similar theme, in which Australian pregnant women were wary of talking to others about BP due to fear of being a burden and being judged by others. Although mothers in this study did not explicitly mention these fears, they can be inferred since some of the mothers limited their social interactions to only families with children who perhaps can better understand the pain, while others spoke to a lack of community support and unrealistic societal expectations of women during pregnancy and the postpartum. Moreover, Irish mothers in the study by Wuytak et al³¹ perceived that women without a previous experience of BP struggled to understand their experiences of persistent BP, which further highlights the lack of awareness that BP may persist after childbirth for some women. The findings of this and other studies therefore underscore the need for better community educational campaigns on BP which can improve societal awareness, attitudes, understanding and support for women living with BP during pregnancy and beyond.

Further to social support, mothers in this study relied on self-management strategies to cope with BP. They prioritized having a positive attitude, pushing through activities and being proactive in dealing with provocative activities early. Self-care as a coping strategy has been documented to curtail the impact of illness and improve health.⁷¹ In our study sample, this coping approach may

be warranted given the varied roles of the women as mothers, students, and professionals, in which pushing through the pain was not only perceived as necessary to meet up with their maternal, school or work demands but may be the only option available where external help was perceived as limited. The need for self-management may also be exacerbated by the barriers in accessing professional help identified by the mothers and may thus reflect the mother's resilience in the face of adversity. This can-do attitude and use of self-care strategies to mitigate the negative impacts of BP have also been described to varying degrees among Norwegian,¹⁸ Australian⁴² and Irish³¹ women. Moreover, use of active coping strategies has been shown to improve health and aligns with current management guidelines for back pain.⁷² However, some mothers felt resigned about their BP and described using passive coping strategies, such as avoidance behaviour to mitigate their pain.

Cognitive appraisal of etiology and prognosis back pain can also influence affective response, coping methods and recovery potential.⁷³ The quality of information and support from healthcare providers can affect these dynamics and increasing studies among women with BP show that they place a high value on receiving credible information and effective interventions from their healthcare providers to enable them cope with the pain.^{16,42,44} Moreover, having relevant knowledge about BP can contribute to a hopeful outlook and realistic expectations about recovery, as well as can increase perceived self-efficacy in managing pain.⁷⁴ Mothers in this study who had prior knowledge of BP described fewer negative experiences with persistent BP, expressed less worry about prognosis and had greater confidence in their ability to manage the pain in the meantime as they awaited recovery.

Theme 3: Navigating healthcare

In expanding on information and support from health professionals, it is clear from this study that the mothers experienced unmet expectations and needs from their maternity providers (GP, OB/GYN, PHN) for their BP complaints, stating that providers do not proactively ask about BP, and when mothers complained about their BP, they felt ignored and their complaints minimized as a normal part of pregnancy. This lack of acknowledgement, knowledge and understanding of BP among care providers have been reported in qualitative studies of care experience for BP in other countries,^{18,32,42,45,56,75} despite the varying maternity care models in these countries and may

thus speak to an ongoing lack of awareness of BP and the significant negative impact on women among healthcare providers.^{16,23,70} In Canada, family physicians, are typically the first point of contact for many health problems, including back pain,⁷⁶ A lack of awareness or acknowledgement of BP may impede early diagnosis, which in turn can delay timely identification and management and may increase morbidity. Even though maternity care providers may not be specifically trained to manage BP, they have a responsibility to provide support, offer referrals when appropriate, and ensure the overall wellbeing of women throughout course of pregnancy, birth and postpartum.^{65,77,78}

Furthermore, the mothers raised concerns regarding the duration and the simplicity of their postpartum follow-up care, stating that care was stopped too soon (only one consultation at 6 -8 weeks) and was 'narrowly' focused on absence of complications, not assessing for other postpartum health problem women may have, such as persistent BP. Moreover, short or rushed postnatal consultations as well as women's own preconceptions were found to limit reporting of persistent BP and early care-seeking. These issues concur with international reporting,³¹ and time constraints of postpartum visits was acknowledged by Swedish midwives to be a limiting factor to what issues can be addressed with regards to women's persistent BP.⁷⁰ Furthermore, when care providers do not actively ask about BP, the mothers perceived their BP to not be important enough to discuss. Current best practices for managing BP suggest for maternity care providers to routinely ask and assesses for persistent BP after childbirth,^{65,79} which can enhance early symptom recognition and prompt management. Fahey et al⁴⁹ also recognized the need for a new model of maternity care that enhance support for women beyond the current practice of 6-8 weeks since many biopsychosocial disruptions inherent in the postpartum period take a much longer time to resolve. Accordingly, mothers in this study expressed the desire for postpartum follow-up care to extend beyond the current 6-8 weeks mark and for a more holistic maternity care that is proactive in evaluating BP and other postpartum health concerns women may still struggle with beyond the duration of standard maternity care.

In contrast, many mothers appreciated care received from physiotherapists, finding the treatments and exercises effective in reducing their pain levels for longer periods, especially during the Covid pandemic-related lockdown. The positive effect of physiotherapy on BP has been reported in past

studies.^{56,79–82} However, mothers in this study were less likely to be referred to a physiotherapist by their maternity care providers; specifically, only two of the mothers were referred to a physiotherapist, while some took the initiative themselves to seek direct access. This is consistent with an Australian study, that showed that only 35% of women who reported BP to their healthcare provider received any treatment.⁸⁰ In a Chinese study, only 9% of women reporting BP received physiotherapy.⁸¹ One reason for this trend may be that maternity care providers do not have knowledge about the efficacy of physiotherapy treatments and their safety.^{56,81,82} Women themselves also tend to not know about available services and physiotherapy in particular.⁵⁶ This lack of awareness of services of healthcare providers and women themselves were also highlighted by mothers in the present study. For instance, one mother reported suffering with back pain for 5 years yet none of her healthcare providers that she complained to suggested physiotherapy to her. Another mother held the belief physiotherapist and chiropractic treatments were suitable for more disabling back pain from occupational hazards, rather than BP which is considered common and by extension ‘normal’ in pregnancy. The finding of this study further emphasizes the need for improved BP education, and information on available services among healthcare providers and BP sufferers themselves, which would ensure effective interventions and referral to relevant services in order to prevent missed opportunities for intervention and treatment, prolonged suffering, delayed care seeking and the potential for chronicity to develop.

In addition to a lack of awareness, mothers in this study also highlighted other barriers to health care access, including lack of time and financial constraints in accessing additional professional help, among others. In Canada, most of the community-based care provided by physiotherapists and chiropractors does not fall within the publicly funded medical care system,^{83,84} hence people who cannot pay out of pocket or have additional health coverage for these services may experience accessibility problems,⁸³ which were also expressed by some mothers in the present study. This potential inequity in accessing to non-physician care providers, such as physiotherapy and chiropractor care has been highlighted as an ongoing public health challenge for people living with chronic back pain in Canada.⁷⁶ Although, this was not confirmed in the present study, a lack available community-based publicly funded physiotherapy services in the study setting (Saskatoon, Canada), may be one of the barriers for physicians in offering referral to these services to women with BP complaints. Exploring the barriers physicians face in caring for women with

BP during and after pregnancy would be interesting to explore in subsequent studies. Notwithstanding, past studies^{85,86} have emphasized the need as well as explored the feasibility of including physiotherapists or chiropractors within primary care settings, and evidence exist that show considerable clinical and economic benefits of primary care models that include physiotherapists in the primary care team as a way of improving back pain management.^{85,87} Such interventions were highlighted by mothers in the present study as having the potential to help they and other mothers better cope with back pain. Specifically, the mothers voiced the need for the integration of publicly funded physiotherapy or chiropractor services in routine maternity care practice in order to ensure improved access to these services for their BP.

6.6.1 Strengths, Limitations & Further Studies

This study had several limitations. First, was the inclusion of only highly educated mothers (all had at least a university education). Although, having a high education did not seem to coincide with an increased knowledge about BP or available treatment options among the participants, lower educational attainment (especially the lowest levels) has been associated with onset and severity of BP,^{52,88,89} as well as poorer occupational and lifestyle conditions that in turn may influence individual BP experience.⁸⁸⁻⁹⁰ Furthermore, most of the mothers were married or had a co-habiting partner. Given the central role of partners as a valuable resource for social support and coping, our findings may not reflect the experiences of single mothers since they may have different or possible lack of social support structure. Nonetheless, our sample was varied on other characteristics such as parity, country of birth lending a rich discourse to the topic under consideration.

Another limitation was that all the mothers were recruited from Saskatoon and surrounding communities, and thus the finding of the study may not reflect experiences of mothers in other Canadian provinces or elsewhere internationally. Finally, although the social distancing restrictions during the COVID-19 global pandemic prevented having face-to face interviews with the mothers, however, the use of video conferencing helped to ameliorate this challenge and enhanced rapport with the mothers. Moreover, the remote format of the study and ability of mothers to choose the day and time of the interview, afforded mothers the convenience of having the interview in the familiar environment of their homes (most were sitting in their special chair

to minimize pain), and at a time when they had minimal distractions, which enabled them to comfortably tell their story of living with back pain. As was experienced in previous qualitative studies exploring perinatal back pain,^{32,42,44,75} the mothers in this study expressed gratitude to have the opportunity to share their experiences, opinions, concerns as well as ask further questions about their back pain, which they found to be empowering and validating of their pain. Nonetheless, this study may have benefitted from follow-up interviews and more robust member checking process to follow up on responses of interest and confirm the emergent themes truly reflect participants' lived experiences, which could provide further credibility to the work.⁹¹

6.7 Conclusion

The findings of this study shows that BP has a considerable, and multidimensional impact on women's lives, in which bodily pain, physical limitations in completing tasks, psychological distress and diminished social interactions are common features of women's daily life, both during pregnancy, and even several months after childbirth. The mothers mainly relied on social support and self-management strategies to cope with the pain, while others struggled to cope on their own. Many mothers experienced limited support from their healthcare providers regarding their BP though physiotherapist services were described more favourably in terms providing education, support, and symptomatic relief. However, there are many potential barriers to accessing needed care. The mothers therefore seek greater support from healthcare providers in providing timely and appropriate education, assessments, and referral to available services for BP. They unanimously called for a more holistic maternity care that involves better follow up care postpartum, integration of individualized physiotherapy both during and after childbirth, and for these services to be made affordable (publicly funded or subsidized) for mothers.

The findings of this study have important healthcare and policy implications and provides the groundwork for developing effective prevention and management strategies in addressing the needs and expectations of women living with BP. There is also a clear need for better community-based educational campaigns to improve community attitudes and expectations of women during pregnancy and beyond. Future research exploring the experiences of women in other Canadian provinces would be beneficial to uncover any parallels and/or differences in how women

experience persistent BP after childbirth and what potential strategies are used to enhance access to health care services.

6.8 References

1. Vleeming A, Albert H, Ostgaard H, Stureson B, Stuge B. European guidelines for the diagnosis and treatment of pelvic girdle pain. *Eur Spine J Doi 101007s0058600806024*. 2008;17(6 SRC-GoogleScholar):794-819.
2. Wu WH, Meijer OG, Uegaki K, et al. Pregnancy-related pelvic girdle pain (PPP), I: Terminology, clinical presentation, and prevalence. *Eur Spine J*. 2004;13(7):575-589. doi:10.1007/s00586-003-0615-y
3. Robinson HS, Eskild A, Heiberg E, Eberhard-Gran M. Pelvic girdle pain in pregnancy: The impact on function. *Acta Obstet Gynecol Scand*. 2006;85(2):160-164. doi:10.1080/00016340500410024
4. Ostgaard H, Roos-Hansson E, Zetherstrom G. Regression of back and posterior pelvic pain after pregnancy. *Spine*. 1996;21 SRC-GoogleScholar:2777-2780.
5. Ostgaard HC, Andersson GBJ. Postpartum Low-Back Pain. *Spine*. 1992;17(1):53-55.
6. Gutke A, Lundberg M, Östgaard HC, Öberg B. Impact of postpartum lumbopelvic pain on disability, pain intensity, health-related quality of life, activity level, kinesiophobia, and depressive symptoms. *Eur Spine J*. 2011;20(3):440-448. doi:10.1007/s00586-010-1487-6
7. Macarthur AJ, Macarthur C, Weeks SK. Is Epidural Anesthesia in Labor Associated with Chronic Low Back Pain? A Prospective Cohort Study. *Anesth Analg*. 1997;85(5):1066-1070.
8. Mens J, Vleeming A, Stoeckart R, Stam H, Snijders C. Understanding peripartum pelvic pain: Implications of a patient survey. *Spine Phila Pa Doi 101097000076320601000017 Discuss 13691370*. 1996;21(11 SRC-GoogleScholar):1363-1369.
9. Röst CCM, Jacqueline J, Kaiser A, Verhagen AP, Koes BW. Prognosis of women with pelvic pain during pregnancy: a long-term follow-up study. *Acta Obstet Gynecol Scand*. 2006;85(7):771-777. doi:10.1080/00016340600626982
10. Mogren IM. Physical activity and persistent low back pain and pelvic pain post partum. *BMC Public Health*. 2008;8(1):417. doi:10.1186/1471-2458-8-417
11. Kanakaris NK, Roberts CS, Giannoudis PV. Pregnancy-related pelvic girdle pain: an update. *BMC Med*. 2011;9(1):15. doi:10.1186/1741-7015-9-15
12. Svensson H, Andersson G, Hagstad A, Jansson P. The relationship of low-back pain to pregnancy and gynecologic factors. *Spine Phila Pa 101097000076320500000006*. 1990;15 SRC-GoogleScholar:371-375.
13. Biering-Sorensen F. Low back trouble in a general population of 30-, 40-, 50-, and 60-year-old men and women. *Study Des Represent Basic Results Dan Med Bull Bibliogr Links*. 1982;29 SRC-GoogleScholar:289-299.
14. Mogren IM, Pohjanen AI. Low Back Pain and Pelvic Pain During Pregnancy: Prevalence and Risk Factors. *Spine*. 2005;30(8):983-991. doi:10.1097/01.brs.0000158957.42198.8e
15. Skaggs CD, Prather H, Gross G, George JW, Thompson PA, Nelson DM. Back and Pelvic Pain in an Underserved United States Pregnant Population: A Preliminary Descriptive Survey. *J Manipulative Physiol Ther*. 2007;30(2):130-134. doi:10.1016/j.jmpt.2006.12.008
16. Mackenzie J, Murray E, Lusher J. Women's experiences of pregnancy related pelvic girdle pain: A systematic review. *Midwifery*. 2018;56:102-111. doi:10.1016/j.midw.2017.10.011

17. Sabino J, Grauer JN. Pregnancy and low back pain. *Curr Rev Musculoskelet Med*. 2008;1(2):137-141. doi:10.1007/s12178-008-9021-8
18. Engeset J, Stuge B, Fegran L. Pelvic girdle pain affects the whole life—a qualitative interview study in Norway on women’s experiences with pelvic girdle pain after delivery. *BMC Res Notes*. 2014;7(1):686. doi:10.1186/1756-0500-7-686
19. Wuytack F, Curtis E, Begley C. Experiences of First-Time Mothers With Persistent Pelvic Girdle Pain After Childbirth: Descriptive Qualitative Study. *Phys Ther*. 2015;95(10):1354-1364. doi:10.2522/ptj.20150088
20. Gutke A, Josefsson A, Oberg B. Pelvic girdle pain and lumbar pain in relation to postpartum depressive symptoms. *Spine J*. 2007;32(13 SRC-GoogleScholar):1430-1436.
21. Bergstrom C, Persson M, Mogren I, BMC. Pregnancy-related low back pain and pelvic girdle pain approximately 14 months after pregnancy-pain status, self-rated health and family situation. *Childbirth* 48. 2014;14 SRC-GoogleScholar.
22. Olsson C, Nilsson-Wikmar L. Health-related quality of life and physical ability among pregnant women with and without back pain in late pregnancy. *Acta Obstet Gynecol Scand J*. 2004;83(4 SRC-GoogleScholar):351-357.
23. Srisopa P, Lucas R. Women’s Experience of Pelvic Girdle Pain After Childbirth: A Meta-Synthesis. *J Midwifery Womens Health*. 2021;66(2):240-248. doi:10.1111/jmwh.13167
24. Mogren I. Perceived health, sick leave, psychosocial situation, and sexual life in women with low-back pain and pelvic pain during pregnancy. *Acta Obstet Gynecol Scand J*. 2006;85(6 SRC-GoogleScholar):647-656.
25. Elden H, Lundgren I, Robertson E. Life’s pregnant pause of pain: Pregnant women’s experiences of pelvic girdle pain related to daily life: A Swedish interview study. *Sex Reprod Healthc*. 2013;4(1):29-34. doi:10.1016/j.srhc.2012.11.003
26. van Beukering MDM. Work during pregnancy and postpartum period: research on sick leave (in Dutch;Werken tijdens zwangerschap en periode postpartum: onderzoek naar ziekteverzuim). *TBV – Tijdschr Voor Bedr- En Verzek*. 2002;10(1):2-8. doi:10.1007/BF03073675
27. Bergström C, Persson M, Mogren I. Sick leave and healthcare utilisation in women reporting pregnancy related low back pain and/or pelvic girdle pain at 14 months postpartum. *Chiropr Man Ther*. 2016;24(1):1-11. doi:10.1186/s12998-016-0088-9
28. Tavares P, Barrett J, Hogg-Johnson S, et al. Prevalence of Low Back Pain, Pelvic Girdle Pain, and Combination Pain in a Postpartum Ontario Population. *J Obstet Gynaecol Can*. 2020;42(4):473-480. doi:10.1016/j.jogc.2019.08.030
29. Mannion CA, Vinturache AE, McDonald SW, Tough SC. The Influence of Back Pain and Urinary Incontinence on Daily Tasks of Mothers at 12 Months Postpartum. *PLOS ONE*. 2015;10(6):e0129615. doi:10.1371/journal.pone.0129615
30. Cernja D, Chipchase L, Liamputtong P, Gupta A. How do Australian women cope with pelvic girdle pain during pregnancy? A qualitative study protocol. *BMJ Open*. 2018;8(7):e022332. doi:10.1136/bmjopen-2018-022332
31. Wuytack F, Curtis E, Begley C. The health-seeking behaviours of first-time mothers with persistent pelvic girdle pain after childbirth in Ireland: A descriptive qualitative study. *Midwifery*. 2015;31(11):1104-1109. doi:10.1016/j.midw.2015.07.009
32. Wellock VK, Crichton MA. Symphysis pubis dysfunction: women’s experiences of care. *Br J Midwifery*. 2007;15(8):494-499. doi:10.12968/bjom.2007.15.8.24390

33. Neergaard MA, Olesen F, Andersen RS, Sondergaard J. Qualitative description – the poor cousin of health research? *BMC Med Res Methodol.* 2009;9(1):52. doi:10.1186/1471-2288-9-52
34. Liamputtong P. *Qualitative Research Methods.* Fourth edition. Oxford University Press; 2013.
35. Sundler AJ, Lindberg E, Nilsson C, Palmér L. Qualitative thematic analysis based on descriptive phenomenology. *Nurs Open.* 2019;6(3):733-739. doi:10.1002/nop2.275
36. Dionne CE, Dunn KM, Croft PR, et al. A Consensus Approach Toward the Standardization of Back Pain Definitions for Use in Prevalence Studies: *Spine.* 2008;33(1):95-103. doi:10.1097/BRS.0b013e31815e7f94
37. Airaksinen O, Brox J, Cedraschi C, et al. European Guidelines for the Management of Chronic Non-Specific Low back Pain Cost B13 working group Eur Spine J200615S192S30010.1007/s00586-006-1072-116550448. *Eur Spine J Off Publ Eur Spine Soc Eur Spinal Deform Soc Eur Sect Cerv Spine Res Soc.* 2006;15 Suppl 2:S192-300. doi:10.1007/s00586-006-1072-1
38. Williams L. The Oswestry Disability Index. :14.
39. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol.* 2006;3(2):77-101. doi:10.1191/1478088706qp063oa
40. Richards L. *Handling Qualitative Data: A Practical Guide.* SAGE Publications; 2005.
41. Lincoln YS, Guba EG. *Naturalistic Inquiry.* Sage Publications; 1985.
42. Cęprnja D, Chipchase L, Liamputtong P, Gupta A. “This is hard to cope with”: the lived experience and coping strategies adopted amongst Australian women with pelvic girdle pain in pregnancy. *BMC Pregnancy Childbirth.* 2022;22(1):96. doi:10.1186/s12884-022-04426-3
43. Persson M, Winkvist A, Dahlgren L, Mogren I. “Struggling with daily life and enduring pain”: a qualitative study of the experiences of pregnant women living with pelvic girdle pain. *BMC Pregnancy Childbirth.* 2013;13(1):111. doi:10.1186/1471-2393-13-111
44. Clarkson CE, Adams N. A qualitative exploration of the views and experiences of women with Pregnancy related Pelvic Girdle Pain. *Physiotherapy.* 2018;104(3):338-346. doi:10.1016/j.physio.2018.05.001
45. Shepherd J. Symphysis pubis dysfunction: a hidden cause of morbidity. *Br J Midwifery.* 2005;13(5):301-307. doi:10.12968/bjom.2005.13.5.18092
46. Crichton MA, Wellock VK. Pain, disability and symphysis pubis dysfunction: women talking. *Evid-Based Midwifery.* 2008;6(1):9-18.
47. Gutke A, Bullington J, Lund M, Lundberg M. Adaptation to a changed body. Experiences of living with long-term pelvic girdle pain after childbirth. *Disabil Rehabil.* 2018;40(25):3054-3060. doi:10.1080/09638288.2017.1368724
48. Valinger Aggeryd K, Bergström C, Mogren I, Persson M. A limited life – a mixed methods study on living with persistent pregnancy-related lumbopelvic pain more than 12 years postpartum in Sweden. *Disabil Rehabil.* Published online January 29, 2021:1-9. doi:10.1080/09638288.2020.1852447
49. Fahey JO, Shenassa E. Understanding and Meeting the Needs of Women in the Postpartum Period: The Perinatal Maternal Health Promotion Model. *J Midwifery Womens Health.* 2013;58(6):613-621. doi:10.1111/jmwh.12139

50. Wang S, Dezinno P, Maranets I, Berman M, Caldwell-Andrews A, Kain Z. Low back pain during pregnancy: prevalence, risk factors, and outcomes. *Obstet Gynaecol.* 2004;104 SRC-GoogleScholar:65-70.
51. To WWK, Wong MWN. Factors associated with back pain symptoms in pregnancy and the persistence of pain 2 years after pregnancy. *Acta Obstet Gynecol Scand.* 2003;82(12):1086-1091. doi:10.1046/j.1600-0412.2003.00235.x
52. Chang HY, Yang YL, Jensen MP, Lee CN, Lai YH. The Experience of and Coping with Lumbopelvic Pain among Pregnant Women in Taiwan. *Pain Med.* 2011;12(6):846-853. doi:10.1111/j.1526-4637.2011.01151.x
53. Finan PH, Smith MT. The comorbidity of insomnia, chronic pain, and depression: Dopamine as a putative mechanism. *Sleep Med Rev.* 2013;17(3):173-183. doi:10.1016/j.smrv.2012.03.003
54. Wolfson AR, Crowley SJ, Anwer U, Bassett JL. Changes in Sleep Patterns and Depressive Symptoms in First-Time Mothers: Last Trimester to 1-Year Postpartum. *Behav Sleep Med.* 2003;1(1):54-67. doi:10.1207/S15402010BSM0101_6
55. Skouteris H, Germano C, Wertheim EH, Paxton SJ, Milgrom J. Sleep quality and depression during pregnancy: a prospective study. *J Sleep Res.* 2008;17(2):217-220. doi:10.1111/j.1365-2869.2008.00655.x
56. Cernja D, Chipchase L, Gupta A. The role of physiotherapy in managing pregnancy related pelvic girdle pain. *N Z J Physiother.* 2017;45(2):57-58. doi:http://dx.doi.org/10.15619/NZJP/45.2.01
57. Lintonl SJ, Nicholasl MK, MacDonalld S, et al. The role of depression and catastrophizing in musculoskeletal pain. *Eur J Pain.* 2011;15(4):416-422. doi:10.1016/j.ejpain.2010.08.009
58. Woolhouse H, Gartland D, Perlen S, Donath S, Brown SJ. Physical health after childbirth and maternal depression in the first 12 months post partum: Results of an Australian nulliparous pregnancy cohort study. *Midwifery.* 2014;30(3):378-384. doi:10.1016/j.midw.2013.03.006
59. Long G, Yao ZY, Na Y, Ping Y, Wei S, Mingsheng T. Different types of low back pain in relation to pre- and post-natal maternal depressive symptoms. *BMC Pregnancy Childbirth.* 2020;20:551. doi:10.1186/s12884-020-03139-9
60. Brown S, Lumley J. Physical health problems after childbirth and maternal depression at six to seven months postpartum. *BJOG Int J Obstet Gynaecol.* 2000;107(10):1194-1201. doi:10.1111/j.1471-0528.2000.tb11607.x
61. Moldofsky H. Sleep and pain. *Sleep Med Rev.* 2001;5(5):385-396. doi:10.1053/smrv.2001.0179
62. Ross LE, Murray BJ, Steiner M. Sleep and perinatal mood disorders: a critical review. *J Psychiatry Neurosci.* 2005;30(4):247-256.
63. Talaei-Khoei M, Fischerauer SF, Jha R, Ring D, Chen N, Vranceanu AM. Bidirectional mediation of depression and pain intensity on their associations with upper extremity physical function. *J Behav Med.* 2018;41(3):309-317. doi:10.1007/s10865-017-9891-6
64. Joffres M, Jaramillo A, Dickinson J, et al. Recommendations on screening for depression in adults. *CMAJ Can Med Assoc J.* 2013;185(9):775-782. doi:10.1503/cmaj.130403
65. PHAC. Chapter 5: Postpartum Care. In: *Public Health Agency of Canada. Family-Centred Maternity and Newborn Care: National Guidelines.*; 2020.

- <https://www.canada.ca/content/dam/hc-sc/documents/services/publications/healthy-living/maternity-newborn-care-guidelines-chapter-5/maternity-guidelines-chapter-5-en.pdf>
66. Cutrona CE. Social support and stress in the transition to parenthood. *J Abnorm Psychol.* 1984;93(4):378-390.
 67. Negron R, Martin A, Almog M, Balbierz A, Howell EA. Social Support During the Postpartum Period: Mothers' Views on Needs, Expectations, and Mobilization of Support. *Matern Child Health J.* 2013;17(4):616-623. doi:10.1007/s10995-012-1037-4
 68. GRUEN R. Social Support Measurement and Intervention. Eds. S. Cohen, L. G. Underwood and B. H. Gottlieb. Oxford University Press, 2000. Pp. 345. £32.50. *Epidemiol Infect.* 2001;126(3):461-463.
 69. Masters KS, Stillman AM, Spielmans GI. Specificity of Social Support for Back Pain Patients: Do Patients Care Who Provides What? *J Behav Med.* 2007;30(1):11-20. doi:10.1007/s10865-006-9078-z
 70. Mogren I, Winkvist A, Dahlgren L. Trust and ambivalence in midwives' views towards women developing pelvic pain during pregnancy: a qualitative study. *BMC Public Health.* 2010;10(1):600. doi:10.1186/1471-2458-10-600
 71. Riegel B, Dunbar SB, Fitzsimons D, et al. Self-care research: Where are we now? Where are we going? *Int J Nurs Stud.* 2021;116:103402. doi:10.1016/j.ijnurstu.2019.103402
 72. Bernstein IA, Malik Q, Carville S, Ward S. Low back pain and sciatica: summary of NICE guidance. *BMJ.* 2017;356:i6748. doi:10.1136/bmj.i6748
 73. Williams DA, Keefe FJ. Pain beliefs and the use of cognitive-behavioral coping strategies. *Pain.* 1991;46(2):185-190. doi:10.1016/0304-3959(91)90074-8
 74. Mantle MJ, Holmes J, Currey HLF. BACKACHE IN PREGNANCY II: PROPHYLACTIC INFLUENCE OF BACK CARE CLASSES. *Rheumatology.* 1981;20(4):227-232. doi:10.1093/rheumatology/20.4.227
 75. Elden H, Lundgren I, Robertson E. The pelvic ring of pain: Pregnant women's experiences of severe pelvic girdle pain: An interview study. *Clin Nurs Stud.* 2014;2(2):p30. doi:10.5430/cns.v2n2p30
 76. Bath B, Lawson J, Ma D, Trask C. Self-reported use of family physician, chiropractor and physiotherapy services among adult Canadians with chronic back disorders: an observational study. *BMC Health Serv Res.* 2018;18:970. doi:10.1186/s12913-018-3790-6
 77. Jenkins MG, Ford JB, Todd AL, Forsyth R, Morris JM, Roberts CL. Women's views about maternity care: How do women conceptualise the process of continuity? *Midwifery.* 2015;31(1):25-30. doi:10.1016/j.midw.2014.05.007
 78. Zelmer J, Leeb K. CIHI Survey: Challenges for Providing Maternity Services: The Impact of Changing Birthing Practices. *Healthc Q.* 2004;7(3):21-23. doi:10.12927/hcq.2004.16459
 79. Pelvic Obstetric and Gynaecological Physiotherapy. Pregnancy-related Pelvic Girdle Pain-guidance for Health Professionals. Published online 2015. Accessed March 22, 2022. <http://pogp.csp.org.uk/publications/pregnancy-related-pelvic-girdle-pain-pgp-health-professionals>
 80. Pierce H, Homer C, Dahlen H, King J. Pregnancy-related lumbopelvic pain: Listening to Australian women. *Nurs Res Pract J* 387428. 2012;2012 SRC-GoogleScholar.
 81. Chang HY, Jensen MP, Lai YH. How do pregnant women manage lumbopelvic pain? Pain management and their perceived effectiveness. *J Clin Nurs.* 2015;24(9-10):1338-1346. doi:10.1111/jocn.12742

82. Gutke A, Betten C, Degerskär K, Pousette S, Olsén MF. Treatments for pregnancy-related lumbopelvic pain: a systematic review of physiotherapy modalities. *Acta Obstet Gynecol Scand.* 2015;94(11):1156-1167. doi:10.1111/aogs.12681
83. Paul J, Park L, Ryter E, et al. Delisting publicly funded community-based physical therapy services in Ontario, Canada: a 12-month follow-up study of the perceptions of clients and providers. *Physiother Theory Pract.* 2008;24(5):329-343. doi:10.1080/09593980802278397
84. Deslauriers S, Raymond MH, Laliberté M, et al. Variations in demand and provision for publicly funded outpatient musculoskeletal physiotherapy services across Quebec, Canada. *J Eval Clin Pract.* 2017;23(6):1489-1497. doi:10.1111/jep.12838
85. Hill JC, Whitehurst DG, Lewis M, et al. Comparison of stratified primary care management for low back pain with current best practice (STarT Back): a randomised controlled trial. *The Lancet.* 2011;378(9802):1560-1571. doi:10.1016/S0140-6736(11)60937-9
86. Miller J, Barber D, Donnelly C, et al. Determining the impact of a new physiotherapist-led primary care model for back pain: protocol for a pilot cluster randomized controlled trial. *Trials.* 2017;18(1):526. doi:10.1186/s13063-017-2279-7
87. Maeng DD, Graboski A, Allison PL, Fisher DY, Bulger JB. Impact of a value-based insurance design for physical therapy to treat back pain on care utilization and cost. *J Pain Res.* 2017;10:1337-1346. doi:10.2147/JPR.S135813
88. Baron R, Manniën J, Velde SJ te, Klomp T, Hutton EK, Brug J. Socio-demographic inequalities across a range of health status indicators and health behaviours among pregnant women in prenatal primary care: a cross-sectional study. *BMC Pregnancy Childbirth.* 2015;15(1):1-11. doi:10.1186/s12884-015-0676-z
89. Huang HC, Chang HJ, Lin KC, Chiu HY, Chung JH, Tsai HC. A Closer Examination of the Interaction among Risk Factors for Low Back Pain. *Am J Health Promot.* 2014;28(6):372-379. doi:10.4278/ajhp.120329-QUAN-171
90. Leclerc A, Gourmelen J, Chastang JF, Plouvier S, Niedhammer I, Lanoë JL. Level of education and back pain in France: the role of demographic, lifestyle and physical work factors. *Int Arch Occup Environ Health.* 2009;82(5):643-652. doi:10.1007/s00420-008-0375-4
91. Carpenter C, Suto M. *Qualitative Research for Occupational and Physical Therapists: A Practical Guide.* Blackwell Pub; 2008.

CHAPTER 7

7. CONCLUSIONS AND IMPLICATIONS OF STUDY

7.1 Overview

Despite current evidence on the high prevalence and far-reaching impacts of persistent back pain (BP) on women's lives postpartum, national level-studies on the condition are lacking in Canada. Unravelling the burden of persistent BP in the postpartum population in Canada is critical in identifying opportunities for prevention and early management of BP and forming maternity care practices and relevant policies that are more sensitive and targeted towards women's musculoskeletal needs both during and after pregnancy. This information can also offer valuable knowledge to healthcare providers that can improve understanding and empathy towards affected women, and hopefully encourage the provision of better support and improved care to women during pregnancy and beyond. The overarching aim of this dissertation was to explore the burden of persistent BP among postpartum women in Canada. To address this aim, I set out to answer the following research questions related to disease burden: (1) What is the prevalence of BP, based on degree of perceived bother, during the early postnatal months (first three months) and what risk factors, based on the biopsychosocial (BPS) model, contribute to increased prevalence within the Canadian postnatal population? (addressed in **Chapter 3**); (2) What is the prevalence of persistent BP among mothers who reported BP during the first three months postpartum, and what biological, psychological and social factors predict prevalence in the study population?(addressed in **Chapter 4**); (3) Is BP severity (based on perceived degree of bother and duration) associated with other postnatal indicators of health and wellbeing such as urinary incontinence (UI) and postpartum depression (PPD) in the study population? (Addressed in **Chapter 5**); and (4) How do recent adult mothers experience living with persistent BP, in terms of the perceived impact on various aspects of their lives, coping strategies, and access to healthcare for their BP complaints? (Addressed in **Chapter 6**).

The posed research questions were addressed using a convergent parallel mixed-methods research (MMR) design, which combined quantitative data from existing nationally representative Canadian survey, with primary qualitative data from semi-structured interviews with affected women. The study was conducted in two phases: Phase I involved a quantitative exploration of

aspects of disease burden related to the prevalence, risk factors, and comorbidity of BP with postpartum depression (PPD) and urinary incontinence (UI) among a national sample of postpartum mothers in Canada, through secondary analyses of existing national level population-based maternity data (i.e., research questions 1,2 and 3); while Phase II, involved a qualitative exploration of women's lived experiences of persistent BP after childbirth (i.e., research question 4). The study Phases (i.e., quantitative, and qualitative investigations) were carried out independently in parallel, and analysed separately, following which the findings were integrated in a final interpretative stage to obtain a detailed picture of the burden of BP in the postpartum population in Canada.

When properly designed, the MMR approach is considered to be more advantageous over separate quantitative and qualitative studies predominantly because it allows synergistic use of data to provide a more holistic and contextualized insight into a research problem. Within the context of this study, employing MMR enabled us to gain insight into the breadth of the burden of BP by obtaining representative data on persistent BP postpartum (prevalence, risk factors and comorbidities) at a national population level in Canada, and at the same time, gain in-depth understanding into what living with persistent BP means for Canadian mothers who continue to have unresolved BP after childbirth. In this way, the qualitative study complements and expands upon the quantitative results, by exploring other areas of disease burden (i.e., perceived impact of daily life, coping strategies, and challenges in accessing healthcare) that were not covered in the MES questionnaire and could not be explored using quantitative approaches alone. This research approach (i.e., MMR) therefore allowed us gain insight and knowledge that cannot be gained with one data source and methodological approach alone, while also ensuring that the study findings are grounded in participants' experiences.

This chapter summarizes the results of the studies contained in this dissertation, synthesizing the qualitative and quantitative findings for a more holistic and meaningful interpretation of study results. A discussion of the practical implications of the study will follow, limitations of the thesis, and finally recommendations for future research are outlined. This thesis represents the first study to examine back pain during the first postnatal year and beyond at a national population level in Canada. Specifically, it is the first nationally representative study to comprehensively evaluate the

prevalence, risk factors, and comorbidities of persistent postpartum back pain, based on severity and duration of BP symptoms, and using a biopsychosocial framework. It is also the first study to provide contextual understanding about the lived experience of BP among postpartum women in Canada, by reflecting participants' voices.

7.2 Summary of findings

7.2.1 Phase I: Quantitative results

Maternity Experiences Survey (MES) was used to answer the research questions addressed in Phase I (i.e., research questions 1,2 and 3), representing the quantitative aspects of this dissertation. The MES is the first and only nationally representative survey to gather information on the pregnancy, birth, and postpartum experiences of mothers in Canada. The survey was designed by the Public Health Agency of Canada in partnership with Statistics Canada, as part of the Canadian Perinatal Surveillance System. The target population consisted of mothers 15 years of age or older who had a singleton live birth between February 15, 2006, and May 15, 2006, in the Canadian provinces and November 1, 2005, and February 1, 2006, in the territories, and lived with their baby at the time of the data collection. A simple random stratified sampling process was used to select mothers based on province and territory, maternal age (<20 years and > 20 years) and place of dwelling (rural/urban). The findings from the quantitative study are presented in three manuscripts that represent **Chapters 3,4 and 5** of this dissertation.

Chapter 3 (Manuscript 1) investigated the prevalence of BP, based on degree of perceived problem, during the first three months postpartum and the associated biopsychosocial factors contributing to problem status at the national level in Canada. The study findings indicated that at least one in every three mothers experienced BP that was deemed problematic to some degree (24.3% rated BP as being “somewhat of a problem”; 11.7% as “a great deal of a problem”) up to three months postpartum. In addition, a range of biopsychosocial factors were found to be associated with an increased likelihood of reporting some degree of problematic BP, including: younger maternal age; immigrant status; higher pre-pregnancy BMI; pre-pregnancy depression; vaginal birth; lower self-rated health; higher perceived stress, higher number of stressful life events; inadequate social support after childbirth; province of residence; lower educational attainment; lower household income; and perceived inadequate information on topics such as back

pain. Notably, for mothers with poorer perceived self-rated health and a history of violent abuse, the magnitude of the association was stronger for reporting the extreme category of problem (i.e., “a great deal” problem) than other problem categories (“somewhat or not a problem”).

These findings suggest the need for improved identification and management of back problems early during pregnancy and in the immediate postpartum period, as this could reduce individual suffering and decrease the risk of transition into chronicity. Furthermore, our findings confirm the multidimensional nature of pregnancy/postpartum-related back pain and provides empirical support for the use of the biopsychosocial model to better understand the condition and to design appropriate management options.

Building on chapter 3, the study in **Chapter 4** (Manuscript 2) evaluated the occurrence of persistent BP at 5-14 months postpartum and the associated biological, psychological, and social factors, among mothers who reported some degree of problematic back pain during the first three months postpartum. This study revealed that 54% of mothers with BP at 1-3 months postpartum no longer had complaints at 5-14 months postpartum, whereas 46% continued to report unresolved pain (i.e., persistent BP). Having a higher degree of problematic BP in early postpartum and psychosocial factors (including, being an immigrant, having other pain conditions, poorer self-rated health, inadequate social support postpartum, and history of violent abuse) were the main factors influencing the increased likelihood of symptoms persistence. Although past studies have suggested that pain severity was an important prognostic factor for BP recovery, in which reporting higher pain intensity or bothersomeness during pregnancy and postpartum was linked with a higher risk of persistent and longer-term BP,¹⁻³ an additional finding of the study was that the relationship between degree of problematic back pain in early postpartum and persistent BP was modified by maternal age. It was observed that older mothers (30+ years) who had greatly problematic BP in early postpartum had a significantly higher probability of reporting persistent BP when compared to mothers aged 20-29 years and those who had milder early postpartum pain, but they did not differ significantly from similar mothers aged below 20 years. This finding indicated that mothers in the youngest (<20 years) and oldest (>30 years) age groups may be at higher risk of persistent BP.

These findings are very important considering that BP typically levels off during the first few months after childbirth and women still having complaints after this may have a poorer prognosis and are at a higher risk of developing longer term problems. In this context, our findings reiterate the need to extend maternity care services and policies in Canada to include early screening of back problems both during pregnancy and postpartum and refer to and/or administer appropriate interventions. It is crucial to pay special attention to biopsychosocial factors that may influence delayed recovery postpartum. Hence, maternity care services and policies should consider incorporating biopsychosocial perspectives when designing and implementing targeted interventions, which could aid in reducing the prevalence and persistence of BP in the postpartum period and beyond.

In **Chapter 5** (Manuscript 3), the comorbidity of BP postpartum (based on perceived degree of problem and duration) with other postnatal indicators of health and wellbeing such as urinary incontinence (UI) and postpartum depression (PPD) was assessed. This is the first study that used logistic regression models to investigate the association of BP with both PPD and UI in the same national population of postpartum mothers, adjusting for a wide array of potential confounders. PPD and UI are common disorders of the pregnancy and postpartum, that have significant short- and long-term health and financial implications for affected women, their families, and the society. Emergent evidence suggests that both PPD and UI may be more common among women living with persistent BP postpartum, thus contributing to added disease burden in multimorbid women. Examining the risk of comorbidity of PPD and UI in postpartum women with back pain is therefore beneficial to raise awareness about the co-existence and persistence of these health problems after childbirth, which could heighten the need for early screening and management, not only for mental health issues, but also physical health problems that may impair women's pregnancy and postpartum and possibly long-term health. The results of this chapter demonstrated that BP was significantly more prevalent in mothers with UI and PPD up to 5-14 months postpartum, in which mothers reporting the worse categories of BP, i.e., greatly problematic BP during the first three months postpartum or persistent duration up to 5-14 months postpartum, were the most likely to report both UI and PPD, respectively. It however should be noted that beyond the effect of BP, it was observed that psychosocial factors such as immigrant status, poorer self-rated health, higher number of stressful life events, and inadequate social support showed the strongest associations

with PPD (all ORs > 3), whereas physical factors of degree of problematic UI during the first three months postpartum and its interaction with pre-pregnancy depression were the strongest predictors of UI at 5-14 months postpartum.

These findings confirm past studies suggesting the comorbidity of BP with UI and PPD in the first postnatal year and beyond,⁴⁻⁸ and highlights the need for maternity carers to be aware of and screen for possible multimorbidity in persons with greater BP severity (based on perceived problem with BP and duration of symptoms) postpartum. This is crucial since early and appropriate management of BP could go a long way in preventing subsequent development of comorbidities, such as PPD. Moreover, it is imperative for intervention models and policies to incorporate biopsychosocial and multidisciplinary approaches for the concurrent management of persistent BP and associated comorbidities (such as PPD and UI) early during pregnancy and postpartum in order to prevent chronicity and more generally to improve the long-term health and wellbeing of mothers.

7.2.2 Phase II: Qualitative results

Qualitative data obtained from in-depth semi-structured interviews conducted with recent adult mothers living in Saskatoon, and its environs were used to answer the research question addressed in Phase II (i.e., research question 4), representing the qualitative aspect of this dissertation. The findings from the qualitative study are presented in the final manuscript that represents **Chapter 6** of this dissertation.

In **Chapter 6** (Manuscript 4) the burden of BP was explored further through concepts that were not covered in the MES questionnaire. Specifically, we sought to understand the lived experience of persistent BP after childbirth, in terms of the impact of BP on various aspects of women's lives, coping strategies the mothers adopted to manage persistent pain and challenges they experience in seeking and receiving healthcare for their BP complaints postpartum.

This study was carried out within a descriptive phenomenological framework, using inductive thematic analysis to uncover themes relating to the mothers' experiences of persistent BP postpartum. In all 11 mothers, aged 25-40 years, that were on average 9.5 (range= 4.5-18) months postpartum were interviewed. There was an equal distribution of first-time (54.5%) and previous mothers (45.5%), and for most (72.7%) BP symptoms were experienced for the first time during

the index pregnancy. For these women BP onset was reported to be at about 20 weeks of pregnancy, and some mothers still had symptoms at an average of 7-8 months postpartum. Also of note was that most mothers (63.6%) reported concomitant depression and anxiety, while some also reported having urinary incontinence (18.2%). Notwithstanding, the majority of mothers perceived their overall disability due to persistent BP as measured using the Oswestry Disability Index to be only minimal (i.e., 0-20%; 54.5%) or moderate (21-40%; 45.5%).

Overall, three broad themes, each with sub-themes, were extracted from the qualitative data and data analysis, which overlap and collectively capture the complexity of recent mothers' experiences of living with persistent BP after childbirth. The mothers also expressed what they feel are the ways future mothers can be best supported to better manage BP during pregnancy and postpartum. Each theme and sub-themes are described below:

Theme 1, '*Everything can be difficult*' describes the difficulties the mothers experienced in their everyday life both during pregnancy and postpartum as pertaining to their persistent BP. The theme covers the following subthemes: *pain and physical limitations* which describes experiences of pain, weakness, exhaustion, and physical restrictions in engaging in daily life of caring for the baby, family, and home and as well as in initiating and/or maintaining their exercise levels; *limitations participating in life roles* in which the mothers revealed difficulties in carrying out their maternal role as best as they wished too, and limitations in participating optimally in social and work/school contexts; and *psychological distress* in which the mothers discuss the resultant impact of pain and disability due to persistent BP on their psychological health, expressed in feelings of frustration, disappointment, sadness, irritation, worry and fear, as they mourned the losses experienced in their mobility and ability to carry out their usual life roles. Some mothers went further to say their persistent BP caused or worsened their postpartum anxiety and depression, whereas others experienced alterations to their self-esteem and self-image when pain interfered with their ability to care for their baby or attend to their work/career.

Theme 2, '*Pushing through; normalizing life*' describes how the mothers generally strived to push through their pain to achieve normalcy in their daily lives and caring for the newborn, despite their situation. The subthemes, '*eliciting social support*' revealed that receiving needed support and at

the time needed, especially from their spouse and close family members, was central to the mother's ability to cope effectively with the pain; while *'self-management'* captures the strategies such as modifying/eliminating provocative activities, pacing out tasks, planning ahead, resting and taking breaks between activities, that the mothers deployed to cope with their persistent pain. Furthermore, for some mothers, pushing through/putting up with pain was not perceived to be choice, especially where external help was perceived as limited, or in order to meet their maternal, school or work demands; whereas others found it difficult to cope with the pain and used avoidance behaviours or prescription meds (antidepressants), to mitigate their pain.

In Theme 3, *'Navigating healthcare'* it emerged that many mothers experienced unmet expectations and needs from their maternity carers with regards to their BP complaints. The subtheme *'interacting with health care providers'* revealed that the mothers perceived that their healthcare providers (GP, Obstetrician/gynaecologist and/or public health nurse) appeared to have limited knowledge of BP and often explained it away as a 'normal' part of pregnancy, with little to no treatment/ referral offered for management. Dissatisfactions were also expressed in terms of the duration and simplicity of the postpartum follow-up care received, which did not cater to other health care needs women may have beyond theirs' and the baby's survival. In contrast, few mothers sought care from physiotherapist and chiropractors, and felt better understood and supported with their back pain. Most mothers particularly spoke favourably of the care received from physiotherapists, finding the treatments and take-home exercises effective in reducing their pain levels for longer periods, especially during the Covid pandemic-related lockdown. Furthermore, the mothers discussed, in the subtheme *'overcoming access barriers; it really does take a village'* the barriers they experienced in accessing needed care, among which were lack of awareness about available services, no time/too busy to seek care, need for childcare, financial constraints, the belief that BP was a normal consequence of pregnancy and childbirth for which care was not needed, or fear that their complaints would be dismissed, they would appear weak or may be tagged as exaggerating. Some ways the mothers proposed to combat identified barriers/problems are summarized in Table 7.1.

Table 7.1: <i>'Overcoming access barriers; it really does take a village':</i> Participants' reflections on how they and future mothers can be better supported to cope with persistent BP
Addressing barriers at the level of the Healthcare system
De-normalization of BP by HCPs: <i>'I do think that it's [BP] quite common but it doesn't mean that it has to be put under the list of things that everyone deals with in pregnancy'</i>
Educate HCPs about BP and potential for persistence postpartum
Better acknowledgement of BP and improved empathy from HCPs
HCPs should proactively and routinely ask about BP during pregnancy and postpartum
Education of HCPs about management options for BP and available treatment services
HCPs should offer early pain management options
Proper referral framework to available treatment services, such as physiotherapy
Women should be encouraged to talk/seek help about BP: <i>'don't suffer [laughs] for five years [like me] before you decide to find something that helps...it doesn't have to turn into a chronic condition'</i>
Offer potential mothers timely/ consistent education about BP
Potential mothers should be offered early prenatal classes that include BP education
Potential mothers should be offered routine back pain screening during pregnancy and postpartum
Offer pamphlets on BP to potential mothers
Provide signpost to follow-up services at HCP offices: <i>'if I knew more about different resources and things you could do for pain management for my back, then I think I would like to explore that option; also, fairly more like cost-friendly'</i>
Need for more comprehensive and longer postpartum care and support
Provision of holistic/multidisciplinary perinatal care that caters to the physical, psychological as well as musculoskeletal health needs of mothers: <i>'it's so much more complex than just giving birth, and then getting a quick check, and then moving forward from that'</i>
Affordable (subsidized/publicly funded) physiotherapy/exercise programs: <i>'I think that pre and postpartum physical therapy should absolutely be funded publicly'</i>
Addressing barriers at the level of the society
Improved societal recognition and attitudes towards mothers with pregnancy/postpartum-related complaints such as BP: <i>'oh well you're pregnant, of course, you have pain [BP]... just suck it up! That's what people are told, sometimes, and it's not right'</i>
Recognition of mothers as multidimensional beings: <i>'being a mother is just a part of who you are and not all of who you are; I don't think that's recognized as much'</i>
Realistic expectations of the role of 'mother'

7.3 Contributions to the knowledge base and Policy implications

Collectively, the results presented in this dissertation (Manuscripts 1,2,3&4) represent novel contributions to BP research in the postpartum population in Canada and contributes new evidence to the wider international literature on BP in postpartum populations. Within the Canadian context, findings presented in **Chapters 3 & 4** were the first to provide empirical data on the prevalence of persistent BP after childbirth (up to 14 months postpartum) in a nationally representative sample of postpartum mothers, as well as a wide array of factors associated with prevalence, using the BPS model. Although it is challenging to compare prevalence studies due to varying methodologies employed in different studies, the overall prevalence figures presented in our studies were somewhat consistent with those reported in other Canadian⁹ as well as international studies^{3,10-14} both during the early postpartum months (up to 3 months) and later in the postpartum year and beyond (up to 5-14 months postpartum). Furthermore, the results of the studies provide evidence that the potential risk factors for persistent BP postpartum cover all aspects of the biopsychosocial framework, and involve interrelationships among biological, psychological, and social factors. The findings therefore confirm the use of the biopsychosocial model as an important framework to better understand and manage BP in postpartum populations.

The findings presented in **Chapter 5**, showing the comorbidity of BP, based on degree of bother and duration postpartum, with PPD and persistent UI, has not been previously reported in the same national sample of postpartum mothers both in Canada and internationally. However, our study findings support several separate studies showing relationships between BP and PPD^{6,7,21,22} and between BP and UI^{4,5,23-25} both during pregnancy and postpartum, with a further finding that these associations were particularly more pronounced in mothers reporting the worse categories of BP (greatly problematic BP in early postpartum, and persistent duration up to 5-14 months postpartum). In addition to BP, a range of psychosocial factors were also associated with reporting these outcomes (i.e., PPD and UI). These findings demonstrate the need for healthcare professionals and relevant policies to be aware of possible multimorbidity in persons with persistent BP and the need for a multidimensional approach for the identification and management of BP and its associated comorbidities in postpartum populations, in order to mitigate the consequent personal and societal burdens associated these potentially debilitating health conditions.

Finally, there are no studies to our knowledge, that have explored the lived experiences (in terms of perceived impact, coping, and access to healthcare) of recent mothers with persistent BP up to 18 months postpartum, using qualitative methods, in a Canadian context (presented in **Chapter 6**). Only one international study was found to have examined similar constructs among postpartum Irish mothers, which revealed largely similar experiences despite the somewhat different organization of the healthcare systems,^{26,27} indicating the need for better recognition of BP as a significant maternal and women's health issue both among clinicians and in the society as a whole.

Taken together, the evidence presented in the four studies contained in this dissertation indicate that persistent BP after childbirth, represents a significant burden among postpartum mothers in Canada, which is reflected in the high prevalence of problematic BP in the early postpartum months; the considerable proportion of mothers still reporting symptom persistence up to 5-14 months postpartum, and comorbidity of BP with other debilitating health conditions (i.e. PPD and UI) which have significant functional impairment and life alterations implications for affected women. This burden was further elucidated as affected mothers themselves described the negative impact of persistent BP on their physical, psychological, and social lives, including perceived unmet healthcare needs and barriers regarding receiving appropriate management for BP during pregnancy and postpartum.

Several implications of the results presented in this thesis are apparent, which may guide prevention and management strategies for BP during pregnancy, postpartum and beyond. Firstly, findings from **Chapters 3, 4,5** and **6** indicate that there is need for greater efforts from clinical and policy perspectives to prioritize screening and identifying women at risk of persistent BP. This should preferably be initiated early in pregnancy since women typically have frequent contact with the health care system during this period, thus presenting a window of opportunity for early diagnosis and referral to relevant treatment services. Furthermore, these overall findings confirm the multidimensional nature of persistent BP postpartum as a condition with biopsychosocial influences and consequences and provides empirical support for the use of the biopsychosocial model to better understand the condition and to design appropriate management options.

Secondly, specific findings from **Chapters 3 and 4** indicate there is need to take into consideration women's biopsychosocial characteristics in order to identify those that may be at higher risk for persistent BP and to offer relevant advice/interventions for their condition. For example, the increased likelihood of BP postpartum among teenage mothers (<20 years) as well as immigrant and aboriginal mothers (revealed in by univariate analysis), underscore the need to better understand the specific BP needs of these vulnerable populations, given their probability to be challenged by greater stress, worse economic circumstances, lower social support, difficulties maneuvering the healthcare system, and more generally may experience greater unmet healthcare needs, including for BP. Further to this, our qualitative study, **Chapter 6**, revealed that immigrant mothers appeared to be less likely to seek care for their persistent BP, partly due to not knowing how and where to seek care. Hence, targeting of BP information, reassurance and treatment to these mothers may be explored as ways to enhance access to needed care and diminish unmet needs.

Furthermore, the association of higher BMI with persistent BP found in this study raises the need to encourage engagement in regular physical activity (PA) and consumption of proper diet both during and after pregnancy, as this may help reduce excessive weight gain during pregnancy and maintenance of normal BMI throughout the perinatal period,^{28,29} which in turn can reduce the BP persistence after childbirth. Although not directly assessed in this study (due to lack of information on PA in the MES), engaging in regular PA has been shown to have a host of maternal and newborn benefits, including decreased total gestational weight gain as well as and decreased severity of lumbopelvic pain.²⁹ It can also reduce the risk of developing BP in subsequent pregnancies.^{30,31} A pan-Canadian guidelines for PA during pregnancy has been published,²⁹ which should be implemented into routine maternity care practice to improve both musculoskeletal health and general health outcomes of women during pregnancy and long after childbirth.

Thirdly, our study findings (from both the quantitative and qualitative studies) highlight the importance of receiving adequate social support and relevant information about BP among postpartum mothers. In the quantitative studies, **Chapters 3 and 4**, having inadequate social support and not receiving information on BP during pregnancy were associated with persistent BP both in the early postpartum period and at 5-14 months after childbirth; whereas being able to

access the relevant support when needed, from loved ones, and having prior knowledge of BP were found to enable coping among mothers in the qualitative study (**Chapter 6**). These findings underscore the need to target BP educational programs to women's immediate family members, particularly partners, and involve them in the management for the condition. Moreover, equipping mothers and their social circle with consistent and adequate knowledge about BP can mitigate pain-related worry, enhance social support, promote reasonable expectations about postnatal recovery, enhance self-efficacy in coping with symptoms, and contribute to early care seeking—all of which were observable among participants in the qualitative study who had prior knowledge of BP, or had a partner or a close relative who did. Consequently, there is need for more health promotional efforts to increase awareness about BP occurrence during pregnancy, childbirth and/or the postpartum and the potential for its persistent long after childbirth targeted towards healthcare providers, the public, and potential mothers themselves. Some ways to do this maybe to organize regular trainings or workshops on BP for HCPs providing maternity care, as well as include advertisements about BP, its effects on affected women and avenues for treatment and management in doctor's offices, on the television or on public transportation services in order to increase awareness in the general public. Furthermore, information on BP and available management services, including advice to mitigate symptoms and relevant support groups can be included in prenatal classes or in the form of pamphlets and offered to potential mothers upon discharge from the maternity ward.

Fourth, the findings from **Chapter 5**, which showed the possible comorbidity of BP with PPD and UI and the persistence of these health issues during the first postnatal year and beyond, especially among mothers with greater BP severity in early postpartum, offers a potential means of identifying women that may be at-risk of these health problems early. Similar findings were observed in the qualitative study, Chapter 6, in which about 64% of the mothers reported concomitant BP with depressive and anxiety symptoms, and about 18% of mothers with persistent BP also reported UI. Mothers suffering these health issues (BP, PPD and/or UI) after childbirth may not discuss them with their HCPs during perinatal visits due to beliefs that they are normal consequence of pregnancy and the childbirth, or prioritization of the baby's welfare.³²⁻³⁶ It is therefore imperative for HCPs to be proactive in initiating these discussions with prospective mothers as well as encouraging women to report these problems early if they do occur, and provide

timely referrals to appropriate services for their management and treatment. Furthermore, health promotional efforts that increase community awareness about BP, PPD and UI, can help to disabuse the notion that these problems are inevitable and acceptable consequences of pregnancies, reduce possible stigma, and improve early help seeking for these conditions, which can ultimately improve women's overall wellbeing and quality of life both during and after pregnancy. Moreover, in addition to BP, a range of psychosocial factors were also associated with reporting PPD and UI, which further highlights the need for a multidisciplinary approach³⁷⁻⁴¹ for the joint identification and management of BP and these associated comorbidities in postpartum populations in order to mitigate the consequent personal and societal burdens associated these potentially debilitating health conditions.

Finally, from the findings of the qualitative study, Chapter 6, the role of maternity care providers in providing education, reassurance, support, and timely referral to relevant services cannot be over stressed. This starts with better acknowledgement of BP by HCPs as a potentially serious health problem in pregnant and postpartum populations and improved empathy towards affected mothers. To do this, HCPs need to be better educated that BP in these populations is not always a self-limiting condition which would resolve spontaneously after the birth and they should therefore endeavour to listen to women and acknowledge their subjective experience of pain and disability, while being quick to offer effective pain management options and referral to treatment services, such as physiotherapy. Furthermore, even though significant health gains were described by mothers in our study who sought physiotherapy care, however referral to and uptake of these services were low. There is therefore need for improved awareness about the efficacy of physiotherapy treatments and their safety in pregnant and postnatal populations both among HCPs and affected women themselves. Furthermore, these services need to be made available to mothers for easier access and uptake. One way to do this is for the government to increase funds for the provision of publicly funded physiotherapy services, which is yet lacking in the study setting (Saskatoon, Canada), or offer subsidized payments for private physiotherapy. Specifically, the mothers in this study unanimously expressed the need for the for the integration of publicly funded physiotherapy or chiropractor services in routine maternity care practice to ensure improved access to these services for their BP. Other specific desires of the mothers in Canada regarding how they

and other potential mothers can be better supported to better cope with persistent BP, from the mother's own point of view are summarized in Figure 7.1.

Best practice guidelines for BP management in postpartum populations recommends physical therapist intervention, incorporating biopsychosocial perspectives and deployed within a multidisciplinary care model.³⁸ Such policies can be incorporated into routine obstetric care practices in Canada.

7.4 Thesis limitations

Although the findings presented in this thesis work have important healthcare and policy implications and provides the groundwork for developing effective prevention and management strategies in addressing the needs and expectations of women living with persistent BP postpartum, several limitations of the thesis are discussed under various chapters in this thesis. In brief, the main limitation of this thesis work was the lack of longitudinal data on back pain related to pregnancy and postpartum, thus the quantitative aspects of this study, presented in Chapters 3,4 and 5 relied on a single secondary analysis of cross-sectional survey. The drawbacks of using the MES for this study included: first, the cross-sectional nature of the MES precludes drawing conclusions regarding cause and effect, only potential associations can be inferred. Furthermore, since the study did not have a temporal component, and given the often recurring nature of BP, it is possible that reverse causality bias was introduced into the study. Reverse causality could also result from differential recall of pain status and other covariates yielding alternate interpretations for the direction of associations observed in this study. Second, assessments of BP (both in the early postpartum months and at 5-14 months postpartum) and selected biopsychosocial factors in this thesis were based on self-reported accounts and thus may be subject to information and recall bias as well as variable interpretations by respondents. However, given the subjective nature of pain, it has been argued that history/self-report is the most appropriate method for assessing the construct.⁴²

Third, the survey only captured presence of back pain during the postpartum period, as such it was not possible to provide a complete picture of the clinical course of back pain from pregnancy to the postpartum period, which is important to adequately understand the prognostic factors that are involved in the transition from acute to chronic back pain. It was also difficult to tell if the back

pain measured was directly linked to pregnancy and/or postpartum, since the actual onset of pain was difficult to determine. Fourth, the broad language of “back pain” used in the survey did not allow for discrimination among the types of back pain experienced by postpartum women (i.e. lumbar, pelvic girdle or combination/lumbopelvic pain),⁴³ in line with current literature suggesting that pregnancy and postpartum-related BP do not represent a singular entity.^{44,45} Fifth, even though this study examined a wide range of independent variables, certain relevant factors such as history of back and/or pelvic pain, and back and/or pelvic pain during pregnancy (which have been shown to be strong predictors of persistent back and pelvic pain postpartum^{44,46,47}) were not included. Excluding such potentially relevant risk factors may overestimate the importance of certain variables in our multivariate analysis. Sixth, in our analysis of maternal age, we recognize that the age group ‘30+’ may not represent a homogenous group of older mothers, since advance maternal age is historically considered from age >35 or >40 in many research and clinical settings. However, our sensitivity analysis examining different age cut points did not yield significantly different results (see example in appendix C.2). Moreover, recent Canadian research shows that the risk of severe maternal morbidity begins to rise between ages 28-30 years.⁶⁰⁻⁶¹ Finally, the data contained in MES was more than a decade old and may not reflect the current back pain landscape in the Canadian postnatal population. Taken together, these limitations necessitate caution to be taken when interpreting the study results, noting that the observed associations are only exploratory rather than confirmatory.

Notwithstanding the limitations, the MES remains the only available national level data source on back pain in the puerperal population in Canada and the data is of high quality and can thus provide relevant information on prevalence rates and associated biopsychosocial risk factors in the postpartum period. These limitations also highlight the need for more routinely collected population-based surveys addressing pregnancy and postpartum-related musculoskeletal problems given their high prevalence both during and after pregnancy. Further, there is need for well-designed prospective studies that control for the effects of time to better elucidate the relationship between persistent BP and individual biopsychosocial factors in the postpartum population.

There were also limitations in the qualitative study, since data collection was limited to recent mothers residing in Saskatoon and surrounding area, which may limit transferability to other provinces due to varying health care practices, services, and policies. Nonetheless, similar experiences with BP^{26,48-50} and perceived barriers to accessing BP-related health care^{48,49,51-54} have been reported in international studies^{26,48-50} despite the varying maternity care models and policies in these countries. Moreover, the purpose of qualitative study is not to be representative but rather to provide awareness and new knowledge about BP occurring postpartum within the Canadian context.

Another potential limitation was the inclusion of only highly educated mothers (all had at least a university education); however, this (i.e., having a high education) did not seem to correspond to an increased knowledge about BP and available treatment options among the participants. Nevertheless, lower educational attainment (especially the lowest levels) has been shown to correlate directly⁵⁵⁻⁵⁷ and indirectly,^{55,57,58} through occupational and lifestyle factors, with the recurrence and severity of LBP, which ultimately can influence an individual's overall BP experience. Furthermore, our qualitative study mostly included mothers who were married or had a co-habiting partner, and thus may not reflect the perspectives of single mothers who may have different or limited social support networks. Moreover, it would have been good to explore the experience of teenage mothers with persistent BP, which was not feasible due to the sensitivity of getting institutional ethical approval when including such "vulnerable subgroup" and the time and resource constraints in completing this research work. The unique biological and psychosocial circumstances surrounding teenage birth, may have contributed to a richer discussion around the burden of BP in this population of mothers. Additionally, it may have been beneficial to include a few more participants who were not Canadian citizens (i.e., immigrants to Canada in the last 5 years) in order to compare the perspectives of those who were and those who were not Canadian citizens regarding their experiences of BP and access to relevant care and support.

Notwithstanding, the sample was diverse in terms of other factors like parity and place of birth, fostering a rich discussion of the subject at hand. Moreover, the information emerging from this small-scale study may be further explored in larger samples to provide more in-depth understanding of persistent BP among postpartum populations in Canada. Our rationale is to

provide a platform to enable future research in this field and potentially start a discourse on these pregnancy and postpartum-related complications within the Canadian context.

7.5 Recommendations for Future work research

Considering the limitations described in this thesis work, future studies that employ longitudinal study designs are needed to further elucidate the associations of biopsychosocial factors as well as UI and PPD with persistent BP postpartum in order to strengthen the findings from this thesis and limit the potential for recall and misclassification biases from self-reporting. Such studies can also help confirm possible modifiable risk factors that can help to reduce the prevalence of BP and increase overall maternal wellbeing both during and after pregnancy. Future studies examining the experiences of BP among postpartum women in other Canadian provinces would be interesting to compare with the results of the current study in order to spot any potential parallels and/or differences in the ways in which women experience persistent BP after giving birth and what potential strategies are used to enhance access to health care services.

Finally, given the crucial role of family physicians in the maternity care model in Canada, future studies exploring the barriers physicians face in caring for women with BP during and after pregnancy can help provide a fuller picture of BP experience within the Canadian context and the barriers that mitigate early management and treatment, and thus enhance more holistic intervention strategies to be created.

7.6 Conclusion

The main aim of this thesis was to investigate the burden of BP in the postpartum population of Canada by exploring aspects of disease burden related to prevalence, risk factors, comorbidity and lived experiences of persistent BP up to 18 months after childbirth. This is the first known Canadian study to investigate BP persistence up to 14 months after childbirth in a nationally representative sample of postpartum mothers, as well as explore in-depth the lived experiences of recent mothers living with unresolved symptoms lasting up to the first postnatal year and beyond.

Taken together, the overarching message of this research work is that persistent BP after childbirth, represents a significant burden among postpartum mothers in Canada, which highlight the need for early identification and management of women at risk of persistent symptoms and potential

development of comorbidities; the importance of a biopsychosocial approach to facilitate identification of at-risk mothers and development of more holistic prevention and management measures for persistent BP postpartum; and the necessity of improving clinical and societal support for mothers still having ongoing BP symptoms after childbirth to enable them better access needed care and support to manage their condition. To do these, efforts must first be made to improve awareness and acknowledgement of BP among HCPs in order to facilitate early diagnosis and effective referral to relevant services, as well as prevent delayed care seeking and prolonged suffering for affected mothers. Furthermore, it is imperative to make relevant services readily available and affordable for affected mothers in order to mitigate accessibility barriers and improve uptake of needed services. According to the WHO “health is a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity”⁵⁹ When considering the results of this dissertation, it becomes apparent that musculoskeletal care during pregnancy and postpartum is as crucial to maternity care provision in ensuring a healthy mother and child. This is also evidenced in the unanimous call for a more holistic maternity care that involves better follow-up postpartum care, integrates individualized physiotherapy, and ensures affordability of these services (publicly funded or subsidized) both during and after childbirth by postpartum mothers in this study.

7.7 References

1. Östgaard HC, Zetherström G, Roos-Hansson E. Back Pain in Relation to Pregnancy: A 6-Year Follow-Up. *Spine*. 1997;22(24):2945-2950.
2. Mogren IM. BMI, pain and hyper-mobility are determinants of long-term outcome for women with low back pain and pelvic pain during pregnancy. *Eur Spine J*. 2006;15(7):1093-1102. doi:10.1007/s00586-005-0004-9
3. Bergström C, Persson M, Mogren I. Pregnancy-related low back pain and pelvic girdle pain approximately 14 months after pregnancy – pain status, self-rated health and family situation. *BMC Pregnancy Childbirth*. 2014;14(1):1-12. doi:10.1186/1471-2393-14-48
4. Mannion CA, Vinturache AE, McDonald SW, Tough SC. The Influence of Back Pain and Urinary Incontinence on Daily Tasks of Mothers at 12 Months Postpartum. *PLOS ONE*. 2015;10(6):e0129615. doi:10.1371/journal.pone.0129615
5. Smith MD, Russell A, Hodges PW. Disorders of breathing and continence have a stronger association with back pain than obesity and physical activity. *Aust J Physiother*. 2006;52(1):11-16. doi:10.1016/S0004-9514(06)70057-5
6. Gutke A, Josefsson A, Oberg B. Pelvic girdle pain and lumbar pain in relation to postpartum depressive symptoms. *Spine J*. 2007;32(13 SRC-GoogleScholar):1430-1436.

7. Long G, Yao ZY, Na Y, Ping Y, Wei S, Mingsheng T. Different types of low back pain in relation to pre- and post-natal maternal depressive symptoms. *BMC Pregnancy Childbirth*. 2020;20:551. doi:10.1186/s12884-020-03139-9
8. Woolhouse H, Gartland D, Perlen S, Donath S, Brown SJ. Physical health after childbirth and maternal depression in the first 12 months post partum: Results of an Australian nulliparous pregnancy cohort study. *Midwifery*. 2014;30(3):378-384. doi:10.1016/j.midw.2013.03.006
9. Tavares P, Barrett J, Hogg-Johnson S, et al. Prevalence of Low Back Pain, Pelvic Girdle Pain, and Combination Pain in a Postpartum Ontario Population. *J Obstet Gynaecol Can*. 2020;42(4):473-480. doi:10.1016/j.jogc.2019.08.030
10. Mogren I. Perceived health, sick leave, psychosocial situation, and sexual life in women with low-back pain and pelvic pain during pregnancy. *Acta Obstet Gynecol Scand J*. 2006;85(6 SRC-GoogleScholar):647-656.
11. Olsson CB, Nilsson-Wikmar L, Grooten WJA. Determinants for lumbopelvic pain 6 months postpartum. *Disabil Rehabil*. 2012;34(5):416-422. doi:10.3109/09638288.2011.607212
12. Robinson HS, Vøllestad NK, Veierød MB. Clinical course of pelvic girdle pain postpartum – Impact of clinical findings in late pregnancy. *Man Ther*. 2014;19(3):190-196. doi:10.1016/j.math.2014.01.004
13. Sjødahl J, Gutke A, Öberg B. Predictors for long-term disability in women with persistent postpartum pelvic girdle pain. *Eur Spine J*. 2013;22(7):1665-1673. doi:10.1007/s00586-013-2716-6
14. Woolhouse H, Perlen S, Gartland D, Brown SJ. Physical Health and Recovery in the First 18 Months Postpartum: Does Cesarean Section Reduce Long-Term Morbidity? *Birth*. 2012;39(3):221-229. doi:10.1111/j.1523-536X.2012.00551.x
15. Albert H, Godsken M, Westergaard J. Prognosis in four syndromes of pregnancy-related pelvic pain. *Acta Obstet Gynecol Scand 101080j16000412080006505x*. 2001;80 SRC-GoogleScholar:505-510.
16. Cooklin AR, Amir LH, Jarman J, Cullinane M, Donath SM. Maternal Physical Health Symptoms in the First 8 Weeks Postpartum Among Primiparous Australian Women. *Birth*. 2015;42(3):254-260. doi:10.1111/birt.12168
17. Gausel AM, Malmqvist S, Andersen K, et al. Subjective recovery from pregnancy-related pelvic girdle pain the first 6 weeks after delivery: a prospective longitudinal cohort study. *Eur Spine J*. 2020;29(3):556-563. doi:10.1007/s00586-020-06288-9
18. Gutke A, Östgaard HC, Öberg B. Predicting Persistent Pregnancy-Related Low Back Pain: *Spine*. 2008;33(12):E386-E393. doi:10.1097/BRS.0b013e31817331a4
19. Robinson HS, Mengshoel AM, Veierød MB, Vøllestad N. Pelvic girdle pain: Potential risk factors in pregnancy in relation to disability and pain intensity three months postpartum. *Man Ther*. 2010;15(6):522-528. doi:10.1016/j.math.2010.05.007
20. Terzi H, Terzi R, Altinbilek T. Pregnancy-related lumbopelvic pain in early postpartum period and risk factors. *Int J Res Med Sci*. Published online 2015:1617-1621. doi:10.18203/2320-6012.ijrms20150239
21. Brown SJ, Conway LJ, FitzPatrick KM, et al. Physical and mental health of women exposed to intimate partner violence in the 10 years after having their first child: an Australian prospective cohort study of first-time mothers. *BMJ Open*. 2020;10(12):e040891. doi:10.1136/bmjopen-2020-040891

22. Lim G, LaSorda KR, Farrell LM, McCarthy AM, Facco F, Wasan AD. Obstetric pain correlates with postpartum depression symptoms: a pilot prospective observational study. *BMC Pregnancy Childbirth*. 2020;20(1):240. doi:10.1186/s12884-020-02943-7
23. Smith MD, Russell A, Hodges PW. Do Incontinence, Breathing Difficulties, and Gastrointestinal Symptoms Increase the Risk of Future Back Pain? *J Pain*. 2009;10(8):876-886. doi:10.1016/j.jpain.2009.03.003
24. Kim JS, Kim SY, Oh DW, Choi JD. Correlation between the Severity of Female Urinary Incontinence and Concomitant Morbidities: A Multi-Center Cross-Sectional Clinical Study. *Int Neurourol J*. 2010;14(4):220-226. doi:10.5213/inj.2010.14.4.220
25. Chukwu C. Correlation Between the Intensities of Pregnancy - Related Low Back Pain and Urinary Incontinence in Pregnant and Postpartum Women in Enugu, Nigeria. *Online J Health Allied Sci*. 2019;18(1). Accessed November 6, 2021. <https://www.ojhas.org/issue69/2019-1-11.html>
26. Wuytack F, Curtis E, Begley C. Experiences of First-Time Mothers With Persistent Pelvic Girdle Pain After Childbirth: Descriptive Qualitative Study. *Phys Ther*. 2015;95(10):1354-1364. doi:10.2522/ptj.20150088wu
27. Wuytack F, Curtis E, Begley C. The health-seeking behaviours of first-time mothers with persistent pelvic girdle pain after childbirth in Ireland: A descriptive qualitative study. *Midwifery*. 2015;31(11):1104-1109. doi:10.1016/j.midw.2015.07.009
28. O'Brien EC, Segurado R, Geraghty AA, et al. Impact of maternal education on response to lifestyle interventions to reduce gestational weight gain: individual participant data meta-analysis. *BMJ Open*. 2019;9(8):e025620. doi:10.1136/bmjopen-2018-025620
29. Mottola MF, Davenport MH, Ruchat SM, et al. 2019 Canadian guideline for physical activity throughout pregnancy. *Br J Sports Med*. 2018;52(21):1339-1346. doi:10.1136/bjsports-2018-100056
30. Mogren IM, Pohjanen AI. Low Back Pain and Pelvic Pain During Pregnancy: Prevalence and Risk Factors. *Spine*. 2005;30(8):983. doi:10.1097/01.brs.0000158957.42198.8e
31. Ostgaard H, Zetherstrom G, Roos-Hansson E, Svanberg B. Reduction of back and posterior pelvic pain in pregnancy. *Spine*. 1994;19 SRC-GoogleScholar:894-900.
32. Wagg AR, Kendall S, Bunn F. Women's experiences, beliefs and knowledge of urinary symptoms in the postpartum period and the perceptions of health professionals: a grounded theory study. *Prim Health Care Res Dev*. 2017;18(5):448-462. doi:10.1017/S1463423617000366
33. Buurman MBR, Lagro-Janssen ALM. Women's perception of postpartum pelvic floor dysfunction and their help-seeking behaviour: a qualitative interview study. *Scand J Caring Sci*. 2013;27(2):406-413. doi:10.1111/j.1471-6712.2012.01044.x
34. Elden H, Lundgren I, Robertson E. Life's pregnant pause of pain: Pregnant women's experiences of pelvic girdle pain related to daily life: A Swedish interview study. *Sex Reprod Healthc*. 2013;4(1):29-34. doi:10.1016/j.srhc.2012.11.003
35. Pierce H, Homer C, Dahlen H, King J. Pregnancy-related lumbopelvic pain: Listening to Australian women. *Nurs Res Pract J* 387428. 2012;2012 SRC-GoogleScholar.
36. Canadian Perinatal Mental Health Collaborative. *Time for Action: Why Canada Needs A National Perinatal Mental Health Strategy Now More Than Ever.*; 2021. Accessed November 1, 2021. <https://cpmhc.ca/report>.

37. Cooper PJ, Murray L. Postnatal depression. *BMJ*. 1998;316(7148):1884-1886. doi:10.1136/bmj.316.7148.1884
38. Simonds AH, Abraham K, Spitznagle T. Clinical Practice Guidelines for Pelvic Girdle Pain in the Postpartum Population. *J Womens Health Phys Ther*. 2022;46(1):E1-E38. doi:10.1097/JWH.000000000000236
39. Ciaghi F, Bianco AD, Guarese O. Prevalence of pelvic floor disorders during the post-partum period. A prospective study and a proposal of a multidisciplinary prevention strategy/Prevalenza delle disfunzioni perineali nel post-partum. Studio prospettico di coorte e proposta di un percorso preventivo multiprofessionale. *Sci Riabil*. 2015;17(1):5-.
40. Qi X, Shan J, Peng L, Zhang C, Xu F. The effect of a comprehensive care and rehabilitation program on enhancing pelvic floor muscle functions and preventing postpartum stress urinary incontinence. *Medicine (Baltimore)*. 2019;98(35). doi:10.1097/MD.0000000000016907
41. Ghaderi F, Mohammadi K, Amir Sasan R, Niko Kheslat S, Oskouei AE. Effects of Stabilization Exercises Focusing on Pelvic Floor Muscles on Low Back Pain and Urinary Incontinence in Women. *Urology*. 2016;93:50-54. doi:10.1016/j.urology.2016.03.034
42. Breivik H, Borchgrevink PC, Allen SM, et al. Assessment of pain. *Br J Anaesth*. 2008;101(1):17-24. doi:10.1093/bja/aen103
43. Nilsson-Wikmar L, Harms-Ringdahl K, Pilo C, Pahlbäck M. Back pain in women postpartum is not a unitary concept. *Physiother Res Int*. 1999;4(3):201-213. doi:10.1002/pri.166
44. Wu WH, Meijer OG, Uegaki K, et al. Pregnancy-related pelvic girdle pain (PPP), I: Terminology, clinical presentation, and prevalence. *Eur Spine J*. 2004;13(7):575-589. doi:10.1007/s00586-003-0615-y
45. Ostgaard H, Zetherstrom G, Roos-Hansson E, Svanberg B. Reduction of back and posterior pelvic pain in pregnancy. *Spine*. 1994;19 SRC-GoogleScholar:894-900.
46. Vermani E, Mittal R, Weeks A. Pelvic girdle pain and low back pain in pregnancy: A review. *Pain Pract Doi 101111j1533250000327x*. 2009;10(1 SRC-GoogleScholar):60-71.
47. Vleeming A, Albert H, Ostgaard H, Sturesson B, Stuge B. European guidelines for the diagnosis and treatment of pelvic girdle pain. *Eur Spine J Doi 101007s0058600806024*. 2008;17(6 SRC-GoogleScholar):794-819.
48. Engeset J, Stuge B, Fegran L. Pelvic girdle pain affects the whole life—a qualitative interview study in Norway on women’s experiences with pelvic girdle pain after delivery. *BMC Res Notes*. 2014;7(1):686. doi:10.1186/1756-0500-7-686
49. Shepherd J. Symphysis pubis dysfunction: a hidden cause of morbidity. *Br J Midwifery*. 2005;13(5):301-307. doi:10.12968/bjom.2005.13.5.18092
50. Crichton MA, Wellock VK. Pain, disability and symphysis pubis dysfunction: women talking. *Evid-Based Midwifery*. 2008;6(1):9-18.
51. Wellock VK, Crichton MA. Symphysis pubis dysfunction: women’s experiences of care. *Br J Midwifery*. 2007;15(8):494-499. doi:10.12968/bjom.2007.15.8.24390
52. Cernja D, Chipchase L, Gupta A. The role of physiotherapy in managing pregnancy related pelvic girdle pain. *N Z J Physiother*. 2017;45(2):57-58. doi:http://dx.doi.org/10.15619/NZJP/45.2.01
53. Cernja D, Chipchase L, Liamputtong P, Gupta A. “This is hard to cope with”: the lived experience and coping strategies adopted amongst Australian women with pelvic girdle pain in pregnancy. *BMC Pregnancy Childbirth*. 2022;22(1):96. doi:10.1186/s12884-022-04426-3

54. Elden H, Lundgren I, Robertson E. The pelvic ring of pain: Pregnant women's experiences of severe pelvic girdle pain: An interview study. *Clin Nurs Stud.* 2014;2(2):p30. doi:10.5430/cns.v2n2p30
55. Baron R, Manniën J, Velde SJ te, Klomp T, Hutton EK, Brug J. Socio-demographic inequalities across a range of health status indicators and health behaviours among pregnant women in prenatal primary care: a cross-sectional study. *BMC Pregnancy Childbirth.* 2015;15(1):1-11. doi:10.1186/s12884-015-0676-z
56. Chang HY, Yang YL, Jensen MP, Lee CN, Lai YH. The Experience of and Coping with Lumbopelvic Pain among Pregnant Women in Taiwan. *Pain Med.* 2011;12(6):846-853. doi:10.1111/j.1526-4637.2011.01151.x
57. Huang HC, Chang HJ, Lin KC, Chiu HY, Chung JH, Tsai HC. A Closer Examination of the Interaction among Risk Factors for Low Back Pain. *Am J Health Promot.* 2014;28(6):372-379. doi:10.4278/ajhp.120329-QUAN-171
58. Leclerc A, Gourmelen J, Chastang JF, Plouvier S, Niedhammer I, Lanoë JL. Level of education and back pain in France: the role of demographic, lifestyle and physical work factors. *Int Arch Occup Environ Health.* 2009;82(5):643-652. doi:10.1007/s00420-008-0375-4
59. World health organization. *The first ten years of the world health organization.* 1958.
60. Kadour-Peero E, Sagi S, Awad J, Vitner D. What is the maternal age cut-off showing an increase in adverse outcomes? *J Obstet Gynaecol Can.* Published online November 2021:S1701216321008082. doi:10.1016/j.jogc.2021.09.026
61. Aoyama K, Pinto R, Ray JG, et al. Association of Maternal Age With Severe Maternal Morbidity and Mortality in Canada. *JAMA Netw Open.* 2019;2(8):e199875. doi:10.1001/jamanetworkopen.2019.9875

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Appendix A: Research Data Centre Microdata Research Contract

Contract number: 18-SSH-SKY-5419
MICRODATA RESEARCH CONTRACT ✓ APR 06 2018

(Hereinafter referred to as the "Contract")

BETWEEN:

HER MAJESTY THE QUEEN IN RIGHT OF CANADA, as represented by the Minister responsible for Statistics Canada,
 (Hereinafter referred to as "Statistics Canada"),

AND:

✓ Oluwakemi Awe ; University of Saskatchewan
 ✓ Marwa Farag ; University of Saskatchewan

(Hereinafter referred to as Researcher(s))

Each a "Party" and collectively referred to as "Parties".

IN WITNESS WHEREOF, this Contract has been executed on behalf of:

FOR STATISTICS CANADA:

[Signature] **G. Jourdain**
 Director, Microdata Access Division Print Name

[Signature] Marta Peio-Fiallo
 Witness Print Name

DATED at Ottawa, Province of Ontario, this 21 day of June (month) 2018 (year).

FOR THE PRINCIPAL RESEARCHER AND CO-RESEARCHER(S):

[Signature] MARWA FARAG
 Principal Researcher (sign here) Print Name

[Signature] RUBEN MERCADO
 Witness (sign here) Print Name

DATED at Saskatoon (location), this 4th day of April (month) 2018 (year).

[Signature] Awe Oluwakemi
 Co- Researcher (sign here) Print Name

[Signature] RUBEN MERCADO
 Witness (sign here) Print Name

DATED at Saskatoon SK (location), this 18th day of Jan (month) 2018 (year).

(Complete for all deemed employees signing contract)

Appendix B: Letters of Ethics Approval



Behavioural Research Ethics Board (Beh-REB) 03-Aug-2022

Certificate of Re-Approval

Application ID: 1126

Principal Investigator: Marwa Farag

Department: School of Public Health

Locations Where Research

Activities are Conducted: School of Public Health, University of Saskatchewan, Canada

Student(s): Kemi Awe

Funder(s):

Sponsor:

Title: Pregnancy-Related Chronic Back Pain: Analysis of the Prevalence, Risk Factors and Burden Among Postpartum Women in Canada.

Approval Effective Date: 02-Aug-2022

Expiry Date: 02-Aug-2023

Acknowledgment Of: N/A

Review Type: Delegated Review

* This study, inclusive of all previously approved documents, has been re-approved until the expiry date noted above

CERTIFICATION

The University of Saskatchewan Behavioural Research Ethics Board (Beh-REB) is constituted and operates in accordance with the current version of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans - TCPS 2 (2018). The University of Saskatchewan Beh-REB has reviewed the above-named project. The proposal was found to be acceptable on ethical grounds. The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to this project, and for ensuring that the authorized project is carried out according to the conditions outlined in the current approved protocol. This Certificate of Approval is valid for the above time period provided there is no change in experimental protocol or consent process or documents.

ONGOING REVIEW REQUIREMENTS

Any significant changes to the proposed method, or consent and recruitment procedures must be reported to the Chair through submission of an amendment for Beh-REB consideration in advance of implementation.

To remain in compliance, a status report (renewal or closure form) must be submitted to the Beh-REB Chair for consideration within one month prior to the current expiry date each year the project remains open, and upon project completion. Please refer to the Research Ethics Office website for further instructions and current forms.

*Digitally Approved by Pammla Petrucka
Chair, Behavioural Research Ethics Board
University of Saskatchewan*

Appendix C. Additional Files from Chapter 3

Appendix C.1. Description and Categories of study variables

Type of Variable	Variable name	Description	Categories
Biological/ physical	Maternal age (years)	Age of mother at birth of selected baby Age of mother at time of interview (5-14 months postpartum) ¹	<20 20 to 29 ≥ 30 (ref)
	Maternal BMI	Pre-pregnancy BMI Current BMI ²	Underweight Normal weight (ref) Overweight Obese
	Maternal parity	Whether mother has one or multiple past pregnancies	primipara (ref) Multipara
	Maternal pre-pregnancy health problems	Health problems before pregnancy	No (ref) Yes
	Maternal new health problems	New health problem during pregnancy	No (ref) Yes
	Type of birth	Final mode of delivery	Vaginal (ref) Cesarean
Psychological	Maternal self-rated health	Mother's overall self-rated health	Good to excellent (ref) Fair to poor
	Maternal perceived stress	Self-perceived stress during pregnancy	Not stressed (ref) Somewhat/very stressed
	Stressful events	Number of stressful events in the 12 months before birth of baby	None (ref) One Two Three or more
	Support during pregnancy	Self-perceived social support during pregnancy	Adequate (ref) Inadequate
	Support after birth	Self-perceived social support after birth of baby	Adequate (ref) Inadequate
	History of abuse	Experience of any type of violent abuse in the past 2 years	No (ref) Yes

	History of depression	Previous diagnosis of depression or having been prescribed antidepressants	No (ref) Yes
	Maternal smoking	Smoking during pregnancy	No (ref) Yes
	Maternal alcohol use	Use of alcohol during pregnancy	No (ref) Yes
	Maternal drug use	Drug use during pregnancy	No (ref) Yes
	Maternal education	Mother's education level	Less than high school High school graduate Some post-secondary Bachelor's and higher (ref)
Social	Maternal marital status	Mother's marital status	Has a partner (ref) No partner
	Maternal immigrant status	Whether mother is an immigrant or not	No (ref) Yes
	Maternal aboriginal status	Whether mother is a First Nations, Métis or Inuit	No (ref) Yes
	Maternal region of residence	Mother's region of residence based on the 2006 census	Atlantic (ref) Quebec Ontario Prairies British Columbia Territories
	Dwelling area	Size of area of residence based on the 2006 census	Rural area Urban population $\leq 499,999$ Urban population $\geq 500,000$ (ref)
	Household annual income	Household income for the past 12 months	Less than \$20,000 \$20,000 to \$39,999 \$40,000 to \$59,999 \$60,000 to \$79,999 \$80,000 to \$99,999 \$100,000 or more (ref) Missing
	Worked during pregnancy	Had a paid job during pregnancy	No Yes (ref)
	Maternal prenatal education	Attended prenatal classes/ education	No

			Yes (ref)
	Received prenatal information on back pain	Informed about physical changes to the body during pregnancy, e.g. back backache	No Yes (ref)

Appendix C.2. Distribution of back problem status with maternal age (expanded age groups).

	Respondents	Degree of problem with back pain in the first 3 months postpartum				
	N (%) *	None (%) *	Somewhat (%)*	Great deal (%)*	Univariable results	Multivariable results*
Overall	n= 70,320 (100)	n= 44,999 (64)	n= 17,103 (24.3)	n= 8,218 (11.7)	“Great deal” ^{ab} AOR (95% CI) †	“Great deal” ^{ab} AOR (95% CI) †
Maternal age (years)						
<20	1,957 (2.8)	1,025 (52.4)	516 (26.4)	416 (21.2)	1.77 (1.17 - 2.67)	1.46 (0.94 - 2.28)
20 - 24	8,982 (12.8)	5,448 (60.7)	2,198 (24.5)	1,337 (14.9)	1.21 (0.85 – 1.73)	1.09 (0.75 - 1.59)
25 - 29	23,529 (33.5)	15,197 (64.6)	5,724 (24.3)	2,608 (11.1)	0.99 (0.71 – 1.38)	1.05 (0.75 - 1.48)
30 - 34	23,543 (33.5)	15,514 (65.9)	5,464 (23.2)	2,566 (10.9)	0.94 (0.68 – 1.31)	1.04 (0.74 - 1.45)
35 - 39	10,259 (14.6)	6,517 (63.5)	2,623 (25.6)	1,119 (10.9)	1.03 (0.72 – 1.47)	1.09 (0.76 - 1.55)
≥ 40 (ref)	2,050 (2.9)	1,298 (63.3)	579 (28.2)	173 (8.4)	ref	ref

* Sample size is estimated using population weights. ^a Reference category are “Not a problem + Somewhat of a problem” ^b No violation of the proportional odds assumption, indicating similar effects across all problem levels of BP; hence only one OR are produced (irrespective of the outcome category chosen as the reference). † 95% CI was estimated using bootstrapping technique

*Note: There was no statistically significant difference (LR test p-value= 0.1087; AIC= AIC=9896.784 vs 9897.215) between the model with expanded age groups (<20, 20-24, 24-29, 30-34, 34-39, ≥ 40) and that with the re-categorized age groups (<20, 20-29, ≥ 30) used this study.

Appendix D. Multivariable logistic regression model estimating adjusted odds ratios (OR) and corresponding 95% CIs of having persistent back pain at 5-14 months postpartum according to selected biopsychosocial factors.

Variable	Final Multivariable model (Weighted n=24,713)	
	OR (95% CI)	p-value
Biological factors		
Maternal age at time of interview (years)		
30+	ref	
Below 20	4.23 (3.14, 5.69)	0.272
20 to 29	1.04 (0.93, 1.15)	0.432
Current BMI (kg/m ²)		
Under/Normal weight	ref	
Overweight	1.07 (0.95, 1.19)	0.267
Obese	1.09 (0.95, 1.22)	0.199
Degree of back pain during the first 3 months postpartum		
Mildly problematic	ref	
Greatly problematic	1.69 (1.54, 1.85)	<0.0001
Other pain conditions in the postpartum period		
No	ref	
Yes	1.34 (1.21, 1.47)	<0.0001
Interaction: Degree of back pain during the first 3 months postpartum* maternal age		
Greatly problematic*30+	ref	
Greatly problematic*below 20	1.00 (0.72, 1.28)	0.999
Greatly problematic*20-29	0.87 (0.76, 0.98)	0.025
Psychological factors		
Self-rated health		
Good-to-excellent	ref	
Fair-to-poor	1.26 (1.05, 1.47)	0.013
Perceived social support postpartum		
Adequate	ref	
Inadequate	1.30 (1.08, 1.51)	0.007
History of violent abuse		
No	ref	
Yes	1.17 (1.02, 1.33)	0.029
Social factors		
Immigrant status		
Canadian-born	ref	
Immigrant	1.20 (1.06, 1.33)	0.004
Province of residence		
Eastern Atlantic	ref	
Eastern Central	1.12 (0.97, 1.27)	0.115
Western Prairies	0.99 (0.83, 1.14)	0.875
Western BC	0.91 (0.71, 1.11)	0.365
Northern Territories	0.85 (0.65, 1.05)	0.152
Place of residence		
Urban<=499,999	ref	

Rural	1.13 (0.99, 1.27)	0.066
Urban>=500,000	1.02 (0.90, 1.13)	0.755
Level of education		
Bachelor's/Higher	ref	
Below HS/HS	0.96 (0.82, 1.10)	0.544
Some Postsecondary	0.98 (0.87, 1.09)	0.716
Annual household income		
\$80,000 or more	ref	
Below\$40,000	1.05 (0.91, 1.20)	0.475
\$40,000 – below \$80,000	1.08 (0.94, 1.22)	0.283
Unknown	1.03 (0.79, 1.27)	0.806
Substance (cigarette, alcohol, drug) use during pregnancy		
No	ref	
Yes	1.13 (0.99, 1.26)	0.064
Perceived inadequate information about BP during pregnancy		
Yes	ref	
No	1.19 (1.00, 1.38)	0.05
<p>CI: confidence interval; BMI: body mass index; HS: high school; ref: reference category. Eastern Atlantic: Newfoundland and Labrador, Prince Edward Island, Nova scotia, and New Brunswick; Eastern central: Quebec and Ontario; Western Prairies: Manitoba, Saskatchewan, and Alberta; Western BC: British Columbia; Northern Territories: Yukon, Northwest territories, and Nunavut.</p>		

Appendix E. Additional Files from Chapter 5

Appendix E.1. Characteristics of mothers with and without PPD at 5-14 months postpartum and univariable results.

Proportion of mothers with and without PPD according to back pain status and selected biopsychosocial characteristics. Maternity Experiences Survey (MES/ 2006/2007).											
		Total Population (n=75 117)	No PPD (n=69500; 92.5%)			Yes PPD (5617; 7.5%)			PPD Crude OR		
<i>Independent variables</i>	Category	n	%	95% CI		%	95% CI		OR	95% CI	
Degree of BP at three months postpartum	0.Notproblematic	47959	65.6	64.29	66.80	42.6	37.90	47.52	1.00		
	1.Somewhat	18084	23.4	22.25	24.59	32.4	28.22	36.85	2.13	1.69	2.69
	2.Greatdeal	9074	11	10.23	11.90	25	21.13	29.27	3.48	2.67	4.54
Duration of BP postpartum	0.Nopain (ref)	47959	65.6	64.29	66.80	42.6	37.90	47.52	1.00		
	1.Acuteonly<=3months	14624	19.2	18.20	20.29	22.5	18.69	26.87	1.80	1.38	2.35
	2.chronic>3months	12534	15.2	14.26	16.23	34.8	30.34	39.63	3.52	2.77	4.47
Covariates											
Other pain conditions postpartum	0.No (ref)	62902	84.9	84.32	86.24	69.6	65.87	74.53	1.00		
	1.Yes	11806	14.6	13.76	15.68	29.3	25.47	34.13	2.44	1.95	3.06
	Missing	409	0.5			1.1					
Maternal age at time of interview (years)	0.below20y	1460	1.8	1.58	2.01	@	-	-	2.14	1.38	3.30
	1.20to29y	31883	42.7	41.98	43.51	38.7	34.51	43.15	0.88	0.72	1.07
	2.30+y (ref)	41774	55.5	54.71	56.24	57.3	52.90	61.63	1.00		
Current BMI (kg/m2)	0.Under/Normal weight	40986	54.9	55.21	58.03	50.9	50.83	60.34	1.00		
	1.Overweight	18576	24.9	24.54	26.97	22.2	20.51	28.61	1.22	0.95	1.57
	2.Obese	12904	17.1	16.62	18.71	18.3	16.37	24.27	1.46	1.14	1.86
	Missing	2651	3.1			8.6					

Parity (number of previous pregnancies)	0.primiparous (ref)	25291	34.1	33.19	35.20	27.9	23.93	32.27	1.00	1.08	1.67
	1.Multiparous	49714	65.7	64.80	66.81	72.1	67.73	76.07	1.34		
	Missing	113	0.2			0					
Current pregnancy	0.No (ref)	73375	97.7	97.87	98.57	97.2	96.07	98.94	1.00	0.53	2.60
	1.Yes	1323	1.7	1.43	2.13	@	-	-	1.18		
	Missing	420	0.5			0.7					
Postpartum period from birth of baby	0.EarlyPostpartum (ref)	21119	28.3	27.15	29.56	26.1	22.20	30.49	1.00	0.88	1.40
	1.LatePostpartum	37984	50.5	49.22	51.96	51.8	47.06	56.49	1.11		
	1.MidPostpartum	15852	21	20.02	22.17	22.1	18.43	26.21	1.14		
	Missing	163	0.2			0					
Mode of birth	0.Vaginal (ref)	55428	73.7	72.49	74.85	75.1	70.75	78.98	1.00	0.74	1.17
	1.Caesarean	19689	26.3	25.15	27.51	24.9	21.02	29.25	0.93		
Operative delivery (forceps, vacuum, episiotomy)	0.No (ref)	56193	75	74.84	77.15	72.6	69.71	78.44	1.00	0.86	1.39
	1.Yes	17852	23.7	22.85	25.16	25.1	21.56	30.29	1.10		
	Missing	1072	1.4			2.3					
Health problems before pregnancy	0.No (ref)	63606	85.2	84.33	86.21	77.6	73.28	81.48	1.00	1.30	2.15
	1.Yes	11471	14.7	13.79	15.67	22.4	18.52	26.72	1.67		
	Missing	41	0.1			0					
New health problems during pregnancy	0.No (ref)	56681	76.1	75.02	77.28	67.2	62.77	71.77	1.00	1.24	1.92
	1.Yes	18375	23.8	22.72	24.98	32.4	28.23	37.23	1.54		
	Missing	61	0.1			0.4					
Self-rated health	0.Goodtoexcellent (ref)	71131	96	95.46	96.54	78.4	74.27	82.37	1.00	4.95	8.76
	1.Fairtopoor	3956	4	3.46	4.54	21.3	17.63	25.73	6.59		
	Missing	30	0.02			0.3					
Stress on most days	0.No (ref)	32280	44.8	43.63	46.26	20.3	16.78	24.57	1.00	2.49	4.08
	1.Yes	42596	54.9	53.74	56.37	79.1	75.43	83.22	3.19		
	Missing	241	0.29			0.6					

Number of stressful life events	0.None (ref)	29094	40.3	39.27	41.87	19.3	15.80	23.84	1.00		
	1.One	20918	28.3	27.27	29.69	22.5	18.84	27.22	1.66	1.19	2.32
	2.Two	11890	15.7	14.83	16.77	17.7	14.33	22.17	2.36	1.66	3.36
	3.Three/more	12703	15.1	14.29	16.15	39.3	35.26	44.56	5.45	4.08	7.28
	Missing	512	0.6			1.2					
Social support during/after pregnancy	0.Some/all (ref)	68563	92.6	92.30	93.69	74.5	70.25	78.76	1.00		
	1.Little/none	6240	6.9	6.31	7.70	25.2	21.24	29.75	4.51	3.51	5.79
	Missing	314	0.4			0.3					
First reaction to the index pregnancy	0.Very/somewhat Happy (ref)	69760	93.5	93.07	94.30	85.2	82.53	88.91	1.00		
	1.Indifferent	3027	4	3.51	4.51	@	-	-	1.30	0.83	2.05
	2.Somewhat/very Unhappy	2112	2.3	1.95	2.73	9.1	6.81	12.36	4.35	3.01	6.30
	Missing	218	0.2			1					
Experience of the labour/childbirth	0.Positive (ref)	59950	80.1	79.37	81.49	76.1	72.04	80.50	1.00		
	1.Negative	6861	8.8	8.12	9.60	13.4	10.46	17.09	1.60	1.18	2.17
	2.Neither	7981	10.7	9.91	11.59	10	7.40	13.47	0.98	0.69	1.40
	Missing	326	0.4			0.5					
History of violent abuse	0.No (ref)	66698	89.8	84.72	86.59	76.5	66.18	74.92	1.00		
	1.Yes	8173	9.9	13.41	15.28	22.8	25.08	33.82	2.71	2.15	3.40
	Missing	247	0.3			0.7					
Pre-existing depression	0.No (ref)	63437	85.6	84.72	86.59	70.1	66.18	74.92	1.00		
	1.Yes	11577	14.3	13.41	15.28	29	25.08	33.82	2.47	1.97	3.10
	Missing	104	0.1			0.9					
Marital status	0.Nopartner	6237	7.9	7.25	8.58	13.7	10.85	17.05	1.85	1.40	2.44
	1.Partner (ref)	68713	91.9	91.42	92.75	86.3	82.95	89.15	1.00		
	Missing	167	0.2			0.04					
Immigrant status	0.No (ref)	57262	79.3	78.48	80.72	64.0	59.28	68.97	1.00		
	1.Yes	17578	20.3	19.28	21.52	35.6	31.03	40.72	2.17	1.73	2.72
	Missing	277	0.4			0.4					

Aboriginal status	0.No (ref)	71704	95.6	95.44	96.40	93.5	91.11	95.27	1.00	1.14	2.37
	1.Yes	3174	4	3.60	4.56	@	-	-	1.65		
	Missing	240	0.3			0.04					
Province of residence	0.EasternAtlantic (ref)	4503	6.1	5.95	6.22	5.1	4.07	6.37	1.00	0.97	1.64
	1.EasternCentral	47042	62.4	62.08	62.91	66	61.69	70.02	1.26		
	2.WesternPrairies	14329	19.2	18.87	19.53	18.1	15.02	21.65	1.12		
	3.WesternBC	8729	11.7	11.48	12.06	10.2	7.61	13.43	1.03		
	4.NorthernTerritories	357	0.5	0.44	0.49	0.7	0.51	0.87	1.73		
	Missing	157	0.2			0.04					
Place of residence	0.Rural	12982	17.5	17.23	19.21	14.1	11.61	18.19	1.00	0.73	1.36
	1.Urban<=499,999 (ref)	26837	36.3	36.42	38.82	29.2	26.09	34.85	1.00		
	2.Urban>=500,000	32587	42.6	43.07	45.31	53.1	50.35	59.78	1.55		
	Missing	2711	3.6			3.7					
Level of education	0.belowHS/HS	15528	19.9	19.07	21.06	30.4	26.53	35.44	1.92	1.47	2.51
	1.SomePostSec	32487	43.5	42.56	45.22	39.8	35.83	44.94	1.15		
	3.Bachelor's/Higher	26463	35.8	34.80	37.35	28.5	24.65	33.53	1.00		
	Missing	639	0.8	42.56	45.22	1.2	35.83	44.94			
Annual household income	0.below\$40,000	19314	24.4	23.26	25.58	41.9	37.34	46.62	2.61	2.00	3.41
	1.\$40,000tobelow\$80,000	27811	37.7	36.39	39.00	28.8	24.56	33.44	1.16		
	2.\$80,000orMore (ref)	23812	32.5	31.34	33.75	21.4	17.61	25.73	1.00		
	3.Unknown	4181	5.4	4.80	6.02	@	-	-	2.24		
Work during pregnancy	0.No	22787	29.2	28.17	30.60	44.2	39.83	50.13	1.96	1.58	2.44
	1.Yes (ref)	51875	70.3	69.40	71.83	54.2	49.87	60.17	1.00		
	Missing	455	0.5			1.5					
Postpartum visit by a PH nurse	0.Yes (ref)	69907	93.3	92.77	94.10	90.4	87.05	93.09	1.00	1.04	2.18
	1.No	5065	6.5	5.90	7.23	@	-	-	1.50		
	Missing	145	0.2			0.1					
Perceived inadequate information about BP during pregnancy	0.Yes (ref)	69794	93.4	92.67	94.06	87.0	83.30	89.92	1.00		

	1.No	5319	6.6	5.94	7.33	13.0	10.08	16.70	2.12	1.54	2.92
	Missing	4	0.01			0					
Prenatal class attendance	0.Yes (ref)	24653	33.3	32.26	34.36	26.9	23.17	31.04	1.00		
	1.No	50450	66.7	65.64	67.74	73.1	68.96	76.83	1.36	1.10	1.67
	Missing	14	0.02			0					
Substance use during pregnancy	0.No (ref)	59957	80.3	79.64	81.62	74.1	69.89	78.26	1.00		
	1.Yes	14826	19.3	18.38	20.36	25.6	21.74	30.11	1.44	1.15	1.81
	Missing	334	0.5			0.2					

BP: back pain; PPD: postpartum depression, BMI: body mass index; HS: high school; OR: odds ratio; ref: reference category; Eastern Atlantic: Newfoundland and Labrador, Prince Edward Island, Nova scotia, and New Brunswick; Eastern central: Quebec and Ontario; Western Prairies: Manitoba, Saskatchewan, and Alberta; Western BC: British Columbia; Northern Territories: Yukon, Northwest territories, and Nunavut. **Bold**: statistically significant at alpha level =0.05

@ High variability (CV >16): interpret with caution. * Weighted estimates, n and %, were computed using population weights; BRR 95% CI were computed using bootstrap weights (n=1000).

Appendix E.2 Characteristics of mothers with and without UI at 5-14 months postpartum and univariable results.

Proportion of mothers with and without UI according to back pain status and selected biopsychosocial characteristics. Maternity Experiences Survey (MES/ 2006/2007).											
		Total Population (n=75 117)	No UI (n=9949; 69.67 %)			Yes UI (n= 4330; 30.33%)			UI Crude OR		
<i>Independent variables</i>	<i>Category</i>	n	%	95% CI		%	95% CI		OR	95% CI	
Degree of BP at three months postpartum	0.Not problematic	8084	56.7	53.1	60.3	56.3	51.2	61.3	1.00		
	1.Somewhat	4130	31.8	28.5	35.4	22.2	18.3	26.8	0.70	0.52	0.96
	2.Greatdeal	2065	11.4	9.3	13.9	21.5	17.4	26.2	1.89	1.33	2.69
Duration of BP postpartum	0.Nopain (ref)	8084	56.7	53.1	60.3	56.3	51.2	61.3	1.00		
	1.Acuteonly<=3months	3437	26.8	23.8	30.1	17.8	14.2	22.0	0.67	0.48	0.92
	2.chronic>3months	2757	16.4	14.0	19.2	25.9	21.6	30.8	1.59	1.16	2.18
Covariates											
Greatly problematic UI at three months postpartum	0.No	11717	87.3	84.7	89.5	70.1	65.1	74.7	1.00		
	1.Yes (ref)	2562	12.7	10.5	15.3	29.9	25.3	34.9	2.92	2.12	4.02
Other pain conditions postpartum	0.No (ref)	11196	79.6	77.3	82.9	75.7	71.6	80.8	1.00		
	1.Yes	2956	19.6	17.1	22.7	23.2	19.2	28.4	1.25	0.91	1.71
	Missing	127	0.8			1.0					
Maternal age at time of interview (years)	0.below20y	267	@	-	-	@	-	-	0.57	0.23	1.40
	1.20to29y	5099	38	34.8	41.4	30.4	25.9	35.4	0.70	0.53	0.92
	2.30+y (ref)	8914	59.9	56.5	63.2	68.2	63.3	72.8	1.00		
Current BMI (kg/m2)	0.Under/Normal weight	8057	58.3	56.5	63.8	52.2	48.6	59.3	1.00		
	1.Overweight	3280	23.3	21.2	27.2	22.3	18.9	27.8	1.07	0.78	1.47
	2.Obese	2475	15.2	13.2	18.6	22.2	18.9	27.5	1.62	1.16	2.27

	Missing	467	3.2			3.3						
Parity (number of previous pregnancies)	0.primiparous (ref)	4737	34.8	31.9	38.3	29.4	24.9	34.4	1.00			
	1.Multiparous	9490	64.7	61.7	68.1	28.3	65.6	75.1	1.29	0.98	1.70	
	Missing	52	0.5			42.2						
Current pregnancy	0.No (ref)	13845	97.2	96.9	98.8	96.5	94.9	98.6	1.00			
	1.Yes	301	@	-	-	@	-	-	1.44	0.58	3.58	
	Missing	132	1.0			0.8						
Postpartum period from birth of baby	0.EarlyPostpartum (ref)	3735	26.3	23.4	29.5	25.8	21.6	30.9	1.00			
	1.LatePostpartum	7454	51.4	48.0	55.0	54.0	49.1	59.1	1.07	0.80	1.43	
	1.MidPostpartum	3058	22.1	19.3	25.3	19.8	16.1	24.3	0.91	0.63	1.32	
	Missing	32	0.2			0.4						
Mode of birth	0.Vaginal (ref)	12415	86.5	84.0	88.7	87.9	84.0	90.9	1.00			
	1.Caesarean	1864	13.5	11.3	16.0	12.1	9.1	16.0	0.88	0.60	1.31	
Operative delivery (forceps, vacuum, episiotomy)	0.No (ref)	9792	66.2	64.5	71.3	74.1	70.0	79.4	1.00			
	1.Yes	4167	31.1	28.7	35.5	24.7	20.6	30.0	0.71	0.53	0.95	
	Missing	320	2.7			1.2						
Health problems before pregnancy	0.No (ref)	11767	83.7	81.3	86.3	79.4	74.8	83.4	1.00			
	1.Yes	2483	16	13.7	18.7	20.6	16.6	25.2	1.35	0.97	1.88	
	Missing	29	0.3									
New health problems during pregnancy	0.No (ref)	10452	76.1	72.9	79.0	66.6	61.3	71.5	1.00			
	1.Yes	3827	23.9	21.0	27.1	33.4	28.5	38.7	1.60	1.20	2.12	
Self-rated health	0.Goodtoexcellent (ref)	13509	95.5	93.9	96.7	92.5	89.3	94.8	1.00			
	1.Fairtopoor	769	4.5	3.3	6.1	@	-	-	1.73	1.03	2.91	
Stress on most days	0.No (ref)	5178	36.9	33.7	40.5	34.9	30.1	40.3	1.00			
	1.Yes	9051	62.8	59.5	66.3	64.8	59.7	69.9	1.09	0.83	1.44	
	Missing	50	0.4			0.3						

Number of stressful life events	0.None (ref)	5157	36.9	33.7	40.7	34.3	29.6	39.9	1.00		
	1.One	3872	27.7	24.7	31.2	25.9	21.6	31.0	1.00	0.72	1.41
	2.Two	2356	15.1	12.9	17.9	19.7	15.9	24.3	1.40	0.97	2.02
	3.Three/more	2802	19.7	17.1	22.9	19.5	15.9	24.0	1.07	0.74	1.53
	Missing	93	0.6			0.7					
Social support during/after pregnancy	0.Some/all (ref)	12741	89.8	88.1	92.5	87.8	83.9	90.9	1.00		
	1.Little/none	1464	9.4	7.5	11.9	12.2	9.1	16.1	1.32	0.87	2.01
	Missing	74	0.7								
First reaction to the index pregnancy	0.Very/somewhatHappy (ref)	13147	92.3	90.5	94.2	91.6	88.2	94.1	1.00		
	1.Indifferent	677	4.9	3.6	6.6	@	-	-	0.91	0.47	1.76
	2.Somewhat/veryUnhappy	425	@	-	-	@	-	-	1.57	0.74	3.30
	Missing	31	0.3								
Experience of the labour/childbirth	0.Positive (ref)	10831	76.5	73.6	79.8	74.5	69.7	79.3	1.00		
	1.Negative	1508	10.7	8.7	13.2	10.3	7.5	14.1	0.99	0.64	1.54
	2.Neither	1875	12.4	10.3	15.1	14.8	11.3	19.2	1.22	0.83	1.79
	Missing	65	0.5			0.5					
History of violent abuse	0.No	12306	86.6	84.9	89.5	85.3	81.7	88.8	1.00		
	1.Yes	1869	12.5	10.5	15.1	14.3	11.2	18.3	1.16	0.81	1.66
	Missing	104	0.9			0.3					
Pre-existing depression	0.No (ref)	11487	82.6	80.3	85.6	75.5	70.5	79.8	1.00		
	1.Yes	2727	16.7	14.4	19.7	24.5	20.2	29.5	1.61	1.18	2.19
	Missing	65	0.7								
Marital status	0.Nopartner	1213	9.2	7.4	11.4	@	-	-	0.73	0.45	1.18
	1.Partner (ref)	13031	90.5	88.6	92.6	93.1	90.1	95.2	1.00		
	Missing	35	0.4								
Immigrant status	0.No (ref)	10815	72.9	69.7	76.5	82.3	77.7	86.1	1.00		
	1.Yes	3414	26.6	23.5	30.3	17.7	13.9	22.3	0.56	0.39	0.80
	Missing	50	0.5								

Aboriginal status	0.No (ref)	13694	96	95.1	97.5	95.6	93.2	97.2	1.00		
	1.Yes	534	3.5	2.5	@	@	-	-	1.28	0.70	2.33
	Missing	50	0.5			0.5					
Province of residence	0.EasternAtlantic (ref)	746	4.7	4.1	5.6	6.3	5.1	7.8	1.00		
	1.EasternCentral	9119	65.4	62.6	68.6	60.3	55.3	65.2	0.69	0.51	0.94
	2.WesternPrairies	2608	17.8	15.6	20.4	19.3	15.5	23.6	0.81	0.54	1.21
	3.WesternBC	1707	11.2	9.3	13.5	13.7	10.5	17.6	0.91	0.59	1.41
	4.NorthernTerritories	64	0.5	0.4	0.6	0.4	0.3	0.5	0.58	0.34	0.99
	Missing	35	0.4								
Place of residence	0.Rural	2427	16.2	14.4	19.3	18.8	15.4	23.8	1.02	0.71	1.47
	1.Urban<=499,999 (ref)	4604	31	28.8	35.2	35.1	31.2	41.1	1.00		
	2.Urban>=500,000	6841	49.8	47.8	54.8	43.5	39.5	50.0	0.77	0.58	1.03
	Missing	406	2.9			2.7					
Level of education	0.belowHS/HS	2288	17	14.5	19.8	14.4	11.1	18.7	0.77	0.53	1.12
	1.SomePostSec	5828	41	38.4	45.6	39.5	34.9	45.2	0.86	0.65	1.13
	3.Bachelor's/Higher	5984	40	37.6	44.6	45.1	40.5	50.8	1.00		
	Missing	179	1			0.9					
Annual household income	0.below\$40,000	3299	24	21.2	27.2	21.0	17.1	25.5	0.74	0.53	1.04
	1.\$40,000tobelow\$80,000	5222	36	32.7	39.4	37.9	32.9	43.3	0.90	0.67	1.21
	2.\$80,000orMore (ref)	5057	33.6	30.3	37.1	39.5	34.4	44.8	1.00		
	3.Unknown	701	6.4	4.8	8.4	@	-	-	0.21	0.07	0.59
Work during pregnancy	0.No	4183	28.8	26.0	32.4	30.5	26.1	35.4	1.07	0.82	1.41
	1.Yes (ref)	9979	70.2	67.6	74.0	69.2	64.6	73.9	1.00		
	Missing	116	1			0.3					
Postpartum visit by a PH nurse	0.Yes (ref)	13413	93.5	91.4	95.0	95.0	91.9	97.0	1.00		
	1.No	866	6.5	5.0	8.6	@	-	-	0.75	0.40	1.41
Perceived inadequate information about BP during pregnancy	0.Yes (ref)	13278	92.4	90.5	94.2	94.3	91.5	96.3	1.00		
	1.No	986	7.4	5.8	9.5	@	-	-	0.75	0.44	1.25

	Missing	15	0.2								
Prenatal class attendance	0.Yes (ref)	5161	36	32.8	39.5	36.4	31.7	41.4	1.00		
	1.No	9104	63.8	60.5	67.2	63.6	58.6	68.3	0.99	0.76	1.28
	Missing	14	0.1								
Substance use during pregnancy	0.No (ref)	11214	80.3	77.7	83.5	74.4	69.7	78.6	1.00		
	1.Yes	3013	19.2	16.5	22.3	25.6	21.4	30.3	1.44	1.08	1.93
	Missing	52	0.5								

BP: back pain; UI: urinary incontinence, BMI: body mass index; HS: high school; OR: odds ratio; ref: reference category; Eastern Atlantic: Newfoundland and Labrador, Prince Edward Island, Nova scotia, and New Brunswick; Eastern central: Quebec and Ontario; Western Prairies: Manitoba, Saskatchewan, and Alberta; Western BC: British Columbia; Northern Territories: Yukon, Northwest territories, and Nunavut. **Bold**: statistically significant at alpha level =0.05

@ High variability (CV >16): interpret with caution. * Weighted estimates, n and %, were computed using population weights; BRR 95% CI were computed using bootstrap weights (n=1000).

Appendix E.3. Full multivariable PPD models (BP degree and duration) adjusted for selected biopsychosocial factors.

Associations of back pain postpartum (degree and duration) and PPD, and the sensitivity analysis using logistic regression modelling: Multivariable analyses.		
	Multivariable PPD models	
	Model 1: BP degree at 3 months postpartum [†]	Model 2: BP duration postpartum [§]
<i>Independent variables</i>	Adjusted OR (95% CI)	Adjusted OR (95% CI)
Degree of back problem at three months postpartum		
Not problematic	1	-
Somewhat problematic	1.39 (1.06, 1.85)	
Greatly problematic	1.89 (1.38, 2.60)	
Duration of back pain postpartum		
No back pain	-	1
Acute only/ <=3months		1.26 (0.92, 1.72)
Persistent/ > 3 months		1.90 (1.43, 2.54)
Covariates		
Other problematic bodily pains		
No	1	1
Yes	2.03 (1.52, 2.73)	1.95 (1.45, 2.63)
Maternal age at time of interview (years)		
30+	1	1
Below 20	0.90 (0.51, 1.59)	0.89 (0.50, 1.57)
20-29	0.75 (0.58, 0.96)	0.75 (0.58, 0.97)
Immigrant status		
Canadian-born	1	1
Immigrant	4.44 (2.42, 7.47)	4.42 (2.63, 7.43)
Current BMI (kg/m ²)		
Under/Normal weight	1	1
Overweight	0.88 (0.67, 1.16)	0.87 (0.67, 1.16)
Obese	0.83 (0.60, 1.15)	0.83 (0.60, 1.14)
Self-rated health		
Good-to-excellent	1	1
Fair-to-poor	3.44 (2.63, 4.90)	3.42 (2.40, 4.85)
Stress on most days		
No stress	1	1
Somewhat/very stressful	2.27 (1.70, 3.02)	2.27 (1.70, 3.02)
Number of stressful life events		
None	1	1
One	2.01 (1.25, 3.23)	1.97 (1.23, 3.17)
Two	1.93 (1.19, 3.13)	1.92 (1.19, 3.11)
Three or more	4.29 (2.74, 6.73)	4.22 (2.70, 6.62)
Social support during and/or after pregnancy		
Adequate	1	1

Inadequate	3.45 (2.49, 4.84)	3.41 (2.45, 4.75)
Pre-existing depression		
No	1	1
Yes	1.85 (1.38, 2.47)	1.88 (1.41, 2.51)
History of violent abuse		
No	1	1
Yes	1.57 (1.15, 2.12)	1.58 (1.17, 2.14)
Reaction to pregnancy		
Very/somewhat happy	1	1
Indifferent	0.62 (0.36, 1.07)	0.63 (0.37, 1.08)
Very/somewhat unhappy	2.01 (1.24, 3.28)	1.97 (1.20, 3.24)
Level of education		
Bachelor's/Higher	1	1
Below HS/HS	1.24 (0.87, 1.78)	1.25 (0.87, 1.78)
Some Postsecondary	0.99 (0.74, 1.32)	0.99 (0.74, 1.32)
Interactions		
Ref (Problematic pain other than back pain=no & social support=adequate)		
Yes*Inadequate	0.36 (0.18, 0.70)	0.37 (0.19, 0.78)
Ref (Immigrant status=Canada-born & stressful life event=none)		
Immigrant *One stressful event	0.38 (0.19, 0.80)	0.37 (0.18, 0.79)
Immigrant *Two stressful events	0.80 (0.37, 1.73)	0.77 (0.36, 1.68)
Immigrant *Three/more stressful events	0.35 (0.16, 0.75)	0.36 (0.17, 0.76)
BP: back pain; PPD: postpartum depression, BMI: body mass index; HS: high school; OR: odds ratio. Bold: statistically significant at alpha level =0.05. † Model 1: Multivariable logistic regression predicting PPD with degree of BP during the first three months postpartum as main exposure. § Model 2: Multivariate logistic regression predicting PPD with BP duration in the postnatal period as main exposure		

Appendix E.4. Full multivariable UI models (BP degree and duration) adjusted for selected biopsychosocial factors.

Associations of back pain postpartum (degree and duration) and persistent UI using logistic regression modelling: Multivariable analyses.		
	Multivariable UI models	
<i>Independent variables</i>	Model 1: BP degree at 3 months postpartum [†]	Model 2: BP duration postpartum [§]
	Adjusted OR (95% CI)	Adjusted OR (95% CI)
Degree of back problem at three months postpartum		
Not problematic	1	-
Somewhat problematic	0.77 (0.54, 1.09)	
Greatly problematic	1.85 (1.21, 2.82)	
Duration of back pain postpartum		
No back pain	-	1
Acute only/ <=3months		0.71 (0.50, 1.04)
Persistent/ > 3 months		1.63 (1.11, 2.39)
Covariates		
Greatly problematic UI at three months postpartum		
No	1	1
Yes	2.26 (1.48, 3.45)	2.27 (1.48, 3.49)
Maternal age at time of interview (years)		
30+	1	1
Below 20	0.56 (0.18, 1.73)	0.59 (0.19, 1.80)
20-29	0.76 (0.55, 1.05)	0.77 (0.56, 1.06)
Immigrant status		
Canadian-born	1	1
Immigrant	0.64 (0.43, 0.96)	0.64 (0.43, 0.96)
Aboriginal status		
No	1	1
Yes	0.70 (0.32, 1.57)	0.66 (0.30, 1.46)
Current BMI (kg/m ²)		
Under/Normal weight	1	1
Overweight	1.02 (0.72, 1.46)	1.03 (0.72, 1.47)
Obese	1.53 (1.05, 2.24)	1.52 (1.04, 2.23)
Operative delivery (forceps, vacuum, episiotomy)		
No	1	1
Yes	0.70 (0.51, 0.98)	0.71 (0.51, 0.99)
Pre-existing depression		
No	1	1
Yes	1.16 (0.78, 1.74)	1.14 (0.76, 1.72)
Province of residence *		
Eastern Atlantic	1	1

Eastern Central	0.79 (0.54, 1.14)	0.76 (0.52, 1.10)
Western Prairies	0.93 (0.59, 1.46)	0.90 (0.57, 1.42)
Western BC	0.94 (0.55, 1.62)	0.96 (0.56, 1.65)
Northern Territories	0.90 (0.47, 1.73)	0.89 (0.46, 1.72)
Annual household income		
\$80,000 or more	1	1
Below \$40,000	0.66 (0.43, 1.02)	0.63 (0.40, 0.98)
\$40,000-below \$80,000	0.80 (0.57, 1.12)	0.79 (0.57, 1.11)
Unknown	0.20 (0.06, 0.67)	0.19 (0.06, 0.64)
Work during pregnancy		
Yes	1	1
No	1.37 (0.98, 1.92)	1.42 (1.02, 1.99)
Interactions		
Ref (UI at three months postpartum=none/mildly problematic & pre-pregnancy depression=no)		
Greatly problematic UI*depressed	3.07 (1.26, 7.50)	3.23 (1.31, 7.94)

BP: back pain; UI: urinary incontinence, BMI: body mass index; OR: odds ratio. *Eastern Atlantic: Newfoundland and Labrador, Prince Edward Island, Nova scotia, and New Brunswick; Eastern central: Quebec and Ontario; Western Prairies: Manitoba, Saskatchewan, and Alberta; Western BC: British Columbia; Northern Territories: Yukon, Northwest territories, and Nunavut. Bold: statistically significant at alpha level =0.05. † Model 1: Multivariable logistic regression predicting PPD with degree of BP during the first three months postpartum as main exposure. § Model 2: Multivariate logistic regression predicting PPD with BP duration in the postnatal period as main exposure

Appendix F. Additional Files from Chapter 6

Appendix F.1. Participant recruitment posters

APPENDIX A: Recruitment Poster



PARTICIPANTS NEEDED FOR PREGNANCY-RELATED CHRONIC BACK PAIN (CBP) STUDY

We are looking for women who have had a baby in the last 12 months to volunteer to take part in a study aiming to describe the lived experiences of mothers with pregnancy-related chronic back pain in Canada. As a participant in this study, you would be asked to take part in a telephone or face-to-face conversation/interview to describe your experiences with living with persistent PLBPP after child birth and also and complete a brief questionnaire

Your participation would involve one interview session, which will take approximately 45-60 minutes.

In appreciation for your time, you will receive a Tim Horton's gift card for your contribution.

To be eligible to participate you need to be 18 years old or older, have given birth within the last 12 months, have back pain or related symptoms that has lasted more than 3 months postpartum and has affected your usual activities.

Interested? For more information about this study, or to volunteer for this study, please contact: Awe Oluwakemi, oluwakemi.awe@usask.ca; (306) 951 0248



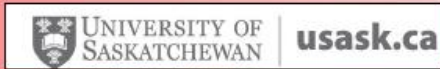
Project ID: 1126: Version 3

This study has been reviewed by, and received approval through, the Research Ethics Office, University of Saskatchewan

- ✓ Have you had a baby in the last 12 months?
- ✓ Do you have back or pelvic pain?

We are doing a research study to learn about your experiences.

Contact us at <http://usask.ca>



This study has been reviewed by, and received approval through the Research Ethics Office University of Saskatchewan

- ✓ Have you had a baby in the last 12 months?
- ✓ Do you have back or pelvic pain?

We are doing a research study to learn about your experiences.

Contact us at <https://research-groups.usask.ca/ergolab/our-research/post-partum-back-and-pelvic-pain.php>



This study has been reviewed by, and received approval through the Research Ethics Office University of Saskatchewan

Appendix F.2. Participant Information and Consent form

PROJECT TITLE

Pregnancy-related low back and/or pelvic girdle pain (PLBPP): Analysis of the prevalence, risk factors and burden among postpartum women in Canada.

RESEARCHERS

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INTRODUCTION

You are invited to participate in this research study aimed at evaluating the prevalence, risk factors and burden of pregnancy-related low back and/or pelvic girdle pain (PLBPP) in Canada. The study is being conducted by a graduate student (PhD) with the School of Public Health, University of Saskatchewan, under the supervision of Dr. Farag (School of Public Health) and Dr. Bath (School of Physical Therapy). I am going to give you information and invite you to be part of this research.

Your participation is entirely voluntary. It is your choice whether or not you wish to take part in this study. If you accept our invitation to participate, you will be asked to sign this form. You are free to change your mind at any time and without giving any reasons for withdrawing, even if you agreed earlier to participate.

You do not have to decide today whether or not you wish to participate. Before you decide, you can talk to anyone you feel comfortable with about the research, e.g., your family, friends, or health care provider.

Please take time to read the following information carefully. This consent form may contain words or information that you do not clearly understand. You may ask me as many questions as you need, at any time during the study, using the contact information provided above and I will provide the needed explanation.

PURPOSE OF THE STUDY

Pregnancy-related back and pelvic problems are common musculoskeletal complications in pregnancy, with up to 80% of women experiencing some degree of back pain during pregnancy or shortly after childbirth. While symptoms typically resolve within the first 3 months after the birth, a proportion of women go on to develop chronic symptoms. Chronic back pain or problems have major economic and personal burden, and there is a need to focus more specifically on chronic back pain among pregnant women as they may be particularly vulnerable to experiencing these symptoms.

Currently, little is known about chronic back problems (i.e., low back and/or pelvic pain) occurring to pregnant women in Canada. The purpose of this two-phased study is to: 1) evaluate the occurrence and contributing factors to experiencing short-lasting and persistent PLBPP after childbirth; 2) explore how women experience chronic back and/or pelvic pain during pregnancy and after childbirth, particularly the perceived impact of the condition on their maternity experience and postpartum health and wellbeing, and how they have coped with and managed their chronic pain symptoms.

You are being invited to take part in this research because we feel that sharing your experience with pregnancy-related chronic back pain (low back and/or pelvic girdle pain) can contribute to our understanding of the burden of chronic back problems in the Canadian pregnant population. We hope that this information will be used to develop more responsive healthcare services and

enable provision of enhanced support to new mothers with persistent back pain or problems postnatally and beyond.

PROCEDURES

- In this study, you will be asked to share with the researcher(s), in an individual conversation (interview), your personal experiences of living with chronic back pain or problems during pregnancy and after childbirth, including how you coped with your symptoms and the challenges you encountered in seeking and receiving needed healthcare for your pain.
- During the interview you will be asked to complete a short questionnaire (lasting approximately 5 minutes) that includes a pain diagram to confirm the location of your pain, and also to collect a few sociodemographic information, including age, highest qualification, ethnicity, number of days postpartum and specific information about your back pain.
- The interviews will be scheduled to be conducted via individual telephone/ video conferencing interview, depending on which you are more comfortable with, at a time and/or location most convenient for you (preferably in a private room with minimal distraction). Interviews (1 session/participant) will take approximately 45-60 minutes of your time.
- Interviews will be audio-recorded, with your permission; the interviewer may also take notes during the interview. Note that you may request that the audio-recorder be turned off at any time during the interview. Both audiotape and notes will be accessible only to the research team and will not be used for any other purpose.
- Please feel free to ask any questions regarding the procedures and goals of the study or your role.

ELIGIBILITY TO PARTICIPATE

Did you have a baby in the last one year?

Do you have low back or pelvic pain (includes pain, discomfort, stiffness etc. located in the lower back, buttocks, groin area or leg areas) that started or worsened due to pregnancy or childbirth?

Has your back pain lasted more than 3 months after the birth of your baby and has affected usual activities?

Are you 18 years of age or older?

FUNDING

This study has not been funded by any grants. The researchers will not receive any direct financial benefit from conducting this study.

POTENTIAL RISKS

There are no known or anticipated risks to you by participating in this research. You do not need to share information you are not comfortable to share.

POTENTIAL BENEFITS

Your participation in this study may or may not be of any direct benefit to you. However, the study provides an opportunity for you to relate your experiences of low back and/or pelvic pain during your pregnancy and after the birth of your baby. We hope that the information gained from this study can be used in the future to benefit other women with a similar condition.

COMPENSATION

New mothers with pregnancy-related low back and/or pelvic girdle pain participating in this study will receive a \$10 Tim Horton's gift card for their contribution.

CONFIDENTIALITY AND RIGHT TO WITHDRAW

- Your participation is entirely voluntary. You may decline to answer any question and you have the right to withdraw from participation at any time.
- If you choose to withdraw, you can do this before data analysis has been completed (2-3 months after data collection). In this instance, you may request for all data collected prior to your withdrawal to be deleted and removed from the analysis; any paper materials pertaining to your contributions will also be destroyed.
- Note that the data from this research project will be used for peer-reviewed journal articles and presented at conferences; a unique code or pseudonym will be used to protect your real identity when direct quotations from the interview are used.
- All associated materials and results from this research project will be safeguarded and securely stored on password protected computers. Paper files will be stored in a locked cabinet within the School of Public Health. Consent forms will be stored separate from the

data. According to the University of Saskatchewan's guidelines, all research records from this project must be stored for five years after the completion of the study.

- Your participation or non-participation in this project will not affect your relationship with your current healthcare provider or members of the research team.
- You will have the opportunity to choose whether you would like to review the full transcription of your interview in order to be able to add or change information from the transcript as appropriate.
- Finally, in order to be able to receive the honoraria (Tim Horton's gift card) for participating in this study, we would require a mailing address to which this could be sent to you.

QUESTIONS OR CONCERNS

- Contact the researcher(s) using the information at the top of page 1.
- This research project has been approved on ethical grounds by the University of Saskatchewan Research Ethics Board. Any questions regarding your rights as a participant may be addressed to that committee through the Research Ethics Office ethics.office@usask.ca (306) 966-2975. Out of town participants may call toll free (888) 966-2975.

CONSENT

Check only those that apply:

- I had an opportunity to ask any questions I had about my participation and they were answered to my satisfaction
- I hereby agree to participate in the conversation/interview
- I grant the researcher permission to make an audio recording of my conversation/interview
- I would like a chance to review the full transcription of my personal interview in this study with the opportunity to add, alter, and delete information from the transcript as appropriate.
- A copy of this Consent Form has been given to me for my records

ORAL CONSENT

“I read and explained this Consent Form to the participant before receiving the participant’s consent, and the participant had knowledge of its contents and appeared to understand it.” In addition, consent may be audio or videotaped.

Name of Participant *Researcher’s Signature* *Date*

Participant Contact Information (for transcript review, and to receive honoraria):

Name_____

Street Address_____

Postal Code_____

E-Mail Address_____

A copy of this consent will be left with you, and a copy will be taken by the researcher.

Appendix F.3: Participant Demographic and Health Questionnaire

Thank you for agreeing to participate in this study. Please answer the following questions to the best of your knowledge. If you have questions about the questionnaires, please contact the researchers. (306-951-0248; oluwakemi.awe@usask.ca).

ABOUT YOU:

1. Age (years)

2. Country of birth

Canada

Other _____

o How long have you been in Canada? _____

3. Education- Highest qualification

Less than high school

High school

University/ College

Graduate school

4. How many children have you had? _____

5. Time postpartum at the time of interview (number of months since the birth of your child)

6. Do you have access to additional health insurance that covers physio, massage etc.?

No

Yes

7. Please indicate whether you suffer from or experienced any of the following:

Depression

Low mood

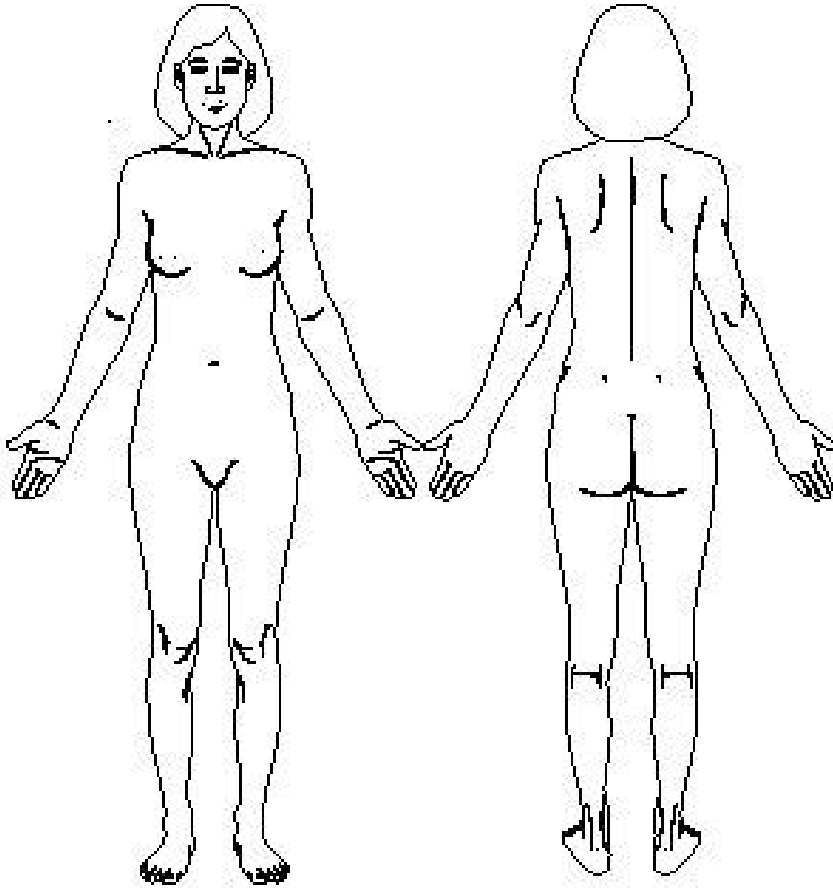
Anxiety

Urinary incontinence

Painful sex

ABOUT YOUR BACK PAIN:

8. On the diagram below, mark an 'X' on the area(s) where you feel pain or other symptoms



9. How long have you had problems with your low back or pelvic girdle (please indicate in days, weeks, months, or years)?

- Days _____
- Weeks _____
- Months _____
- Years _____

10. When did your pain first start? During pregnancy After childbirth.

11. Did you take time off from work because of your back and/or pelvic girdle? Yes No. If so, how long?

_____ days
_____ weeks

MODIFIED OSWESTRY DISABILITY QUESTIONNAIRE

For the following questions, please answer by checking **one box** in each section that indicates the statement **which most clearly describes** how your back pain and other symptoms is affecting your ability to manage in everyday life.

12. Pain Intensity

- I have no pain at the moment
- The pain is very mild at the moment
- The pain is moderate at the moment
- The pain is fairly severe at the moment
- The pain is very severe at the moment
- The pain is the worst imaginable at the moment

13. Personal Care (e.g., washing, dressing)

- I can look after myself normally without causing extra pain
- I can look after myself normally but it causes extra pain
- It is painful to look after myself and I am slow and careful
- I need some help but can manage most of my personal care
- I need help every day in most aspects of self-care
- I do not get dressed, wash with difficulty and stay in bed

14. Lifting

- I can lift heavy weights without extra pain
- I can lift heavy weights but it gives me extra pain
- Pain prevents me lifting heavy weights off the floor but I can manage if they are conveniently placed eg. on a table
- Pain prevents me lifting heavy weights but I can manage light to medium weights if they are conveniently positioned
- I can only lift very light weights
- I cannot lift or carry anything

15. Walking

- Pain does not prevent me walking any distance
- Pain prevents me from walking more than 2 kilometres
- Pain prevents me from walking more than 1 kilometre
- Pain prevents me from walking more than 500 metres
- I can only walk using a stick or crutches
- I am in bed most of the time

16. Sitting

- I can sit in any chair as long as I like
- I can only sit in my favourite chair as long as I like
- Pain prevents me sitting more than one hour
- Pain prevents me from sitting more than 30 minutes

- Pain prevents me from sitting more than 10 minutes
- Pain prevents me from sitting at all

17. Standing

- I can stand as long as I want without extra pain
- I can stand as long as I want but it gives me extra pain
- Pain prevents me from standing for more than 1 hour
- Pain prevents me from standing for more than 30 minutes
- Pain prevents me from standing for more than 10 minutes
- Pain prevents me from standing at all

18. Sleeping

- My sleep is never disturbed by pain
- My sleep is occasionally disturbed by pain
- Because of pain I have less than 6 hours sleep
- Because of pain I have less than 4 hours sleep
- Because of pain I have less than 2 hours sleep
- Pain prevents me from sleeping at all

19. Social Life

- My social life is normal and gives me no extra pain
- My social life is normal but increases the degree of pain
- Pain has no significant effect on my social life apart from limiting my more energetic interests (e.g., sport)
- Pain has restricted my social life and I do not go out as often
- Pain has restricted my social life to my home
- I have no social life because of pain

20. Traveling

- I can travel anywhere without pain
- I can travel anywhere but it gives me extra pain
- Pain is bad but I manage journeys over two hours
- Pain restricts me to journeys of less than one hour
- Pain restricts me to short necessary journeys under 30 minutes
- Pain prevents me from traveling except to receive treatment

21. Employment/ Homemaking

- My normal homemaking/job activities do not cause pain

- My normal homemaking/job activities increase my pain, but I can still perform all that is required of me
- I can perform most of my homemaking/job duties, but pain prevents me from performing more physically stressful activities (e.g., lifting, vacuuming).
- Pain prevents me from doing anything but light duties
- Pain prevents me from doing even light duties.
- Pain prevents me from performing any job or homemaking chores

Appendix F.4: Participant Interview Guide

Grand tour questions

With as much detail as you can, tell me about your back pain?

Possible prompt questions

Thinking back on your most recent pregnancy, through childbirth to the present day...

1. How do you feel your back pain has affected your life in general?
 - a. How do you feel your back pain has affected your life as a new mother?
 - b. How do you feel your back pain has affected your experience of pregnancy and the birth?
 - c. What, if any, were the impacts of back pain on your ability to care for your baby?
 - d. What, if any, were the impacts of back pain on your mental state (i.e., your mood, self-esteem, self-image, attitude. etc.)?
 - e. What, if any, were the impacts of back pain on your social and leisure activities (e.g., visiting with family and friends, attending social events, etc.)?
 - f. What, if any, were the impacts of back pain on your work life?
2. How do you manage your back pain and other symptoms (e.g., self-medication, changes to usual routine, seek support from family, friends, work colleagues, healthcare, etc.)? What do/ did you find most helpful and why?
3. What kinds of health care services, if any, did you receive for pain during your pregnancy and since the birth?
 - a. Can you tell me about your interaction with any healthcare provider(s) you sought care from concerning your back pain during your pregnancy and/or after the birth of your baby? Did you find they were supporting and helpful? Why or why not?
 - b. Tell me which service, if any, met your needs? Which did not? What type of care or support do you think was missing?

c. Did you encounter any challenges accessing healthcare you felt would be helpful? (at this point let them talk) _

i. (IF they don't say what type of care, use this prompt) which type of care was it?

ii. What was challenging about it?

1. Did you encounter any specific barriers or challenges accessing it (for example, time, cost, location, wait time, cultural barriers, others)?

d. In your opinion, what care/support do you think will best help you or other new mothers cope with back pain?

Ending question

Anything else you feel we should know about your experience as a new mother about your back pain?

Thank you so much for participating in the interview, I have learned a lot and I appreciate you taking the time to speak with me.

1) May we contact you in the future if we wish to clarify any answers you gave in this interview?

You always have the option to decline at that time.

a) IF YES, how should we get in touch with you? _____

b) IF NO: no problem, thanks so much for all the information you shared with me today.

2) If you have questions about the interview or the study in the future, please feel free to contact me. The names and phone numbers of the investigators, including me, are included in the consent form I gave you.