Screening for Intimate Partner Violence in the Early Postpartum Period: Pregnancy, Maternal, and Child Outcomes from the Prenatal Period to Five Years Post-Delivery

by

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ABSTRACT

In Manitoba, government policy is for public health nurses to screen families with newborns within one week post-discharge for a number of risk factors associated with poor child developmental health, including a question on a past or current history of intimate partner violence (IPV) between parenting partners. The purpose of this study was to examine differences in the developmental trajectories of mothers and their children from the prenatal period to 5-years post-delivery based on the IPV screen response.

Administrative databases housed at the Manitoba Centre for Health Policy provided data for this study. Manitoban women giving birth to a live singleton infant from January 1, 2003 to December 31, 2006 were included in analyses. Outcomes assessed included sociodemographic covariates, maternal prenatal morbidities and complications, birth outcomes, maternal postpartum health, child postpartum health, postpartum child welfare organization involvement, and children's readiness for school at kindergarten entry. Descriptive statistics and logistic regression were used to examine differences in outcomes of interest based on IPV screen response (i.e., negative IPV screen, positive IPV screen, not screened for IPV).

In the study population, 66.7% of the sample was screened for a history (past or current) of IPV between parenting partners. Among women who were screened, 2.1% screened positive for IPV. Findings indicated that a positive IPV screen was associated with increased maternal prenatal morbidities (e.g., mental health problems, hospitalizations), as well as more adverse birth outcomes (e.g., low birthweight, preterm birth). In the 5 years post-delivery, a positive screen for IPV at birth was associated with poorer maternal and child health, increased child and families services contact, and children being less ready for school at kindergarten entry relative to those with a negative IPV screen. Similar patterns of adverse outcomes were noted among

women (and their children) who were not screened for IPV (vs. women screening negative for IPV) in the early postpartum period.

Incorporating IPV screening into routine prenatal care, rather than only assessing IPV experiences after birth, may help to better identify families in need of support and, ultimately, improve pregnancy outcomes and the longer-term trajectory of women and their children.

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DEDICATION

This dissertation is dedication to my mother – Lynda Taillieu (May 18, 1953 – December 2, 2008). Although you didn't get to see me embark on this journey, you were with me every step of the way.

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STRUCTURE AND ORGANIZATION OF THESIS

This thesis is organized according to the manuscript style, with three distinct, but interrelated, manuscripts compromising the main body of the document. Chapter 1 provides an overall introduction to the topic, and reviews relevant literature related to the thesis topic in order to provide a rationale for the three main studies. Chapter 2 provides an overview of the data sources, methods, measures, and statistical techniques to be used throughout the series of studies. The findings from the thesis are then presented in three separate manuscripts (Chapters 3 to 5). Chapter 3 examines the characteristics of families who are screened versus not screened for intimate partner violence (IPV) around the time of delivery in Manitoba. Chapter 4 examines the differences in prenatal morbidities and complications and birth outcomes based on the IPV screen response (i.e., negative IPV screen, positive IPV screen, not screened for IPV). Chapter 5 examines longer-term maternal and child outcomes (i.e., from birth to 5-years post-delivery) associated with the IPV screen response (i.e., negative IPV screen, positive IPV screen, not screened for IPV) around the time of delivery. All of the manuscripts were developed as independent research studies that have been, or will be, submitted for publication as per manuscript style thesis requirements. Selected journals include the *Canadian Journal of Public Health* (Chapter 3), *the Journal of Obstetrics and Gynaecology Canada* (Chapter 4), and *Child Abuse & Neglect* (Chapter 5). Finally, Chapter 6 provides an overall summary of the findings as well as a discussion of the implications of the findings, future research directions, the strengths and limitations of study, and an overall conclusion.

CHAPTER 1: GENERAL INTRODUCTION

Violence against women is a global public health concern that not only has devastating consequences for individual victims,[1-3] but to a society as a whole.[4-8] The World Health Organization estimates that 1 in 5 women will experience some form of physical and/or sexual violence in their lifetime.[9] Violence during pregnancy is a substantial public health issue as it not only has a negative impact on the physical and mental health of the mother,[1,10-12] but can also have devastating consequences for the developing child. Violence during pregnancy has been linked to a number of adverse pregnancy outcomes,[10,13-23] which, in turn, have developmental consequences for the child after birth.[24] Identification of, and intervention targeting, women at risk of experiencing violence during pregnancy may help to reduce its occurrence and ameliorate the negative consequences associated with pregnancy violence.

A recent review of the literature estimated that between 3 and 11% of pregnant women will experience physical violence during pregnancy.[25] Research has also indicated that violence during pregnancy may be more frequent and severe than violence experienced exclusively outside the pregnancy period.[25-34] The pregnancy period offers a unique opportunity to intervene in the lives of women experiencing violence because prenatal care encompasses multiple visits, reaches almost all pregnant women, and targets the age group most at risk for violence.[35] However, despite recommendations from several key health organizations,[36-41] most health care providers do not routinely screen for violence during pregnancy.[35,42-46]

In order to improve the health and well-being of pregnant women and their children, it is important that research investigates the risk factors for violence during pregnancy, the short- and long-term consequences of such violence, and the mechanisms through which pregnancy violence leads to adverse maternal and child outcomes. Therefore, the overall objective of this

thesis was to compare pregnancy, maternal, and child outcomes from the prenatal period to 5 years post-delivery for women screening positive for a current/past history of violence between parenting partners relative to women screening negative for violence. An important secondary objective of this thesis was to inform the debate over the utility of universal screening for violence among pregnant women by examining the extent to which developmental differences in pregnancy, maternal, and child outcomes are detectable by a women's violence status around the time of delivery. To accomplish these overall objectives, a series of studies was undertaken in order to better understand the association between pregnancy violence and adverse pregnancy, maternal, and child outcomes.

This introductory chapter briefly reviews the relevant literature on violence during pregnancy in order to establish a strong rationale for the proposed series of studies. More specifically, this introduction reviews: (1) risk factors for pregnancy violence, (2) adverse pregnancy outcomes associated with the experience of violence during pregnancy, (3) maternal health outcomes associated with violence during pregnancy, (4) links between prenatal violence and child developmental health, (5) current policy and practice recommendations regarding screening for violence during pregnancy, and (6) the specific rationales, objectives, and hypotheses for each of the individual thesis projects. To assist the reader, a glossary of terms is provided in Appendix A.

Risk Factors for Pregnancy Violence

A wide range of prevalence estimates for pregnancy violence have been reported in the literature. Differences in estimates vary according to sample characteristics, the mode of inquiry, the timing of the inquiry, and both the definition and measurement of violence used in a particular study[1,25,47,48]; however, most studies find that between 3 and 11% of women will

experience physical violence during pregnancy.[25] Approximately 450,000 Canadian women become pregnant annually,[49] which translates into anywhere from 13,500 to 49,500 women being at risk for experiencing physical violence during their pregnancies each year. Given the magnitude of the problem, identification of factors associated with violence during pregnancy is necessary to reduce its occurrence and to promote better outcomes. Risk factors for violence during pregnancy can be broadly categorized as: (1) sociodemographic risk factors, (2) behavioural risk factors, and (3) pregnancy-related factors.

Sociodemographic Risk Factors

A number of sociodemographic risk factors have been associated with an increased risk of violence during pregnancy. Similar to research on violence experiences of non-pregnant women, young age,[14,15,19,21,33,50-59] single/unmarried marital status,[15,21,33,50,54,58-69] separation or divorce during pregnancy,[30,53,58,70] low education,[14,19,33,51,52,54,55,58,59,69,71,72] low income,[17,30,50,56,60,62,63,68,69,73] or proxy indicators of socioeconomic disadvantage such as Medicaid receipt or use of a public prenatal provider,[50,54,58,60] accessing public health care benefits,[65] or having difficulty accessing basic foods[74] have been associated with an increased risk of experiencing violence during pregnancy. Other challenging circumstances such as frequent moves,[63] crowded living conditions,[54] lack of permanent living arrangements,[52] and homelessness[53,58] have also been associated with an increased risk of violence during pregnancy.

There is also some indication that racialized women may be at an increased risk for violence during pregnancy.[14,15,19,21,51,54,58,61,63,65,73] In the Canadian context, Indigenous women have been found to be at greater risk for violence both in the general population[75,76] and during pregnancy.[21,56,62,63] Both in Canada, and elsewhere, the elevated risk for pregnancy violence among racialized and Indigenous women could be due to socioeconomic disadvantage rather

than race or ethnicity per se.[65] Many other factors likely contribute to the elevated risk for partner violence among these women, such as the intersection of multiple oppressions,[77] and other historical events (e.g., the history of slavery and racial discrimination in the United States[77,78] or the colonization of Indigenous peoples and the legacy of the residential school system in Canada[75,76]) that continue to disadvantage racialized women in contemporary society.

These sociodemograhic indicators associated with violence risk during pregnancy are largely not unique to the pregnancy period, but instead may be important risk factors to focus on when dealing with violence risk over the entire lifespan of women.[58] For example, these same factors (e.g., young age, single marital status, low education, poverty, and unemployment) have also been shown to increase the risk of violence in the year after childbirth.[79,80] From a *social determinants of health perspective*, socioeconomic disadvantage is known to have a negative impact on health status overall[81,82] and has also been linked more specifically to adverse pregnancy outcomes.[83-86] The interrelationships between socioeconomic disadvantage, poor health status, and violence risk are important to consider when examining both the short-term and long-term impact of violence during pregnancy on maternal and child health.

Behavioural Risk Factors

Women experiencing violence during pregnancy are also more likely to use tobacco,[15,19,21,33,42,50,53,54,57,65,67,87-90] alcohol,[13,17,21,33,42,50,52,53,65,67,88-94] and/or drugs[21,26,33,42,52,63,67,88,89,91-94] during pregnancy compared to women who do not experience violence during pregnancy. Whether the elevated rates of substance use among pregnant women experiencing violence is a cause or consequence of the violence experienced remains unknown.[87,88,95,96] The stress associated with experiencing violence may cause women to initiate or sustain substance use as a coping mechanism or as a means to self-medicate.[87,88,95]

Alternatively, the use of substances may position women in circumstances that increase their risk of victimization.[96] Nonetheless, these behavioural risks not only jeopardize the pregnant woman's health status, but are known risk factors for poor pregnancy outcomes,[68,86,88,97] and need to be considered potential mediating variables in the association between pregnancy violence and adverse pregnancy outcomes.

Pregnancy-Related Factors

Pregnancy-related factors such as prenatal care access,[10] mulitiparity,[14,15,50,59,74,98] lack of contraceptive use,[1,11,30,99-101] unintended or unwanted pregnancy,[20,33,50,51,54,59-61,64,69,73,74,100-104] and pregnancy termination/abortion history [21,65,105-107] have all been shown to increase the risk of violence during pregnancy. Researchers have speculated that women experiencing violence may have difficulty negotiating contraceptive use in violent relationships[1,100,101,104,108,109] and requests for contraceptive use may lead to accusations of infidelity[1,110] and the potential for further violence.[111]

Researchers have also speculated that abusive partners may interfere with a pregnant woman's access to prenatal care.[63] For example, late entry into prenatal care[14,32,42,54,57,59,74,88,100,112] and inadequate prenatal care[17,60,63,65,94] have both been associated with an increased risk of violence during pregnancy. Inadequate or late entry into prenatal care can increase the risk of poor pregnancy outcomes; therefore, the extent to which prenatal care is compromised among women experiencing violence during pregnancy needs to be considered as a potential mediating or moderating variable in the relationship between pregnancy violence and pregnancy outcome.

In the Canadian context, Heaman[63] found no difference between pregnant women experiencing violence compared to pregnant women not experiencing violence in terms of the

initiation of prenatal care. However, the adequacy of prenatal care (i.e., missed number of visits, timing of first visit, and an index of three levels of adequacy) did significantly differ between pregnant women experiencing violence and pregnant women who did not experience violence in Manitoba. In Saskatoon, pregnant women who experienced violence compared to pregnant women who did not experience violence did not differ with regard to adequacy of prenatal care in fully adjusted models.[56] Similarly, in a nationally representative sample of recently postpartum Canadian women, no difference was reported between women experiencing violence and women who did not experience violence in the two years preceding the survey in terms of the number of prenatal visits during pregnancy.[113] However, among a sample of recent migrants to Canada, women who experienced violence during pregnancy and/or in the early postpartum period were more likely to start prenatal care after the first trimester and to report a lack of contraceptive use than women with no violence experienced.[114] This seems to suggest that research specific to the Canadian context is warranted as most of the research evidence supporting an association between pregnancy violence and inadequate prenatal care is from the United States[14,32,42,54,57,60,65,88,112] or the developing world.[17,59,74,94] These findings may not be generalizable to the Canadian context due to differences in national health care systems as it seems likely that access to prenatal care is at least partially dependent on the extent to which health care is provided on a universal basis,[63] as well as the extent to which socioeconomic disadvantage within this universal system compromises access to prenatal care.[86,115]

Maternal Morbidities, Pregnancy Complications, and Pregnancy Outcomes Associated with Violence During Pregnancy

Violence during pregnancy has been associated with a number of maternal morbidities and complications during pregnancy including gestational diabetes,[19] gestational hypertension,[19]

preeclampsia and sepsis,[116] low maternal weight gain,[17,57,117] kidney and/or urinary tract infection,[19,51,118] preterm labour,[13,14,19,51,89,118,119] vaginal bleeding/placenta problems,[19,92] abruption placenta,[14,118,120] antepartum[14,21] and postpartum[15] hemorrhage, premature rupture of membranes,[14,15,19] caesarean delivery,[14,51,118] and stillbirth/miscarriage.[121,122] As well, violence during pregnancy has also been linked to a number of adverse birth outcomes such as low birth weight,[13-20,22,23,57,123,124] premature delivery,[13,14,18,124,125] intrauterine growth restriction[21] and small-for-gestational age infants,[22,23,68] low 5 minute Apgar scores (i.e., < 7),[13] fetal distress,[14,53,118] neonatal intensive care unit admissions,[13,19] and fetal/neonatal death.[13,14,21,53,94,126] Early identification and appropriate referral of pregnant women experiencing violence may help to reduce these negative sequelae.

On the other hand, a number of studies have reported no significant relationship between violence during pregnancy and maternal morbidities such as preeclampsia, diabetes, and hypertension[59,68] or adverse pregnancy outcomes such as premature rupture of the membranes,[13,51,53,59,118,119,127] low birth weight,[51,53,67,68,118,119,128-130] or premature labour and/or delivery.[51,53,59,67,68,89,107,118,127-131] Further, some studies find that violence during pregnancy independently predicts adverse pregnancy outcomes,[13,20,22,123] whereas other studies find that the association is substantially mediated by other abuse-related factors such as tobacco,[88,91,132] substance use,[21,88,91] or poor nutrition and low weight gain during pregnancy.[90,132,133]

The mechanism linking intimate partner violence (IPV) to adverse pregnancy outcomes is not well understood. Violence can be targeted at the pregnant women's abdomen,[23,33,73,134,135] which may represent a direct causal pathway linking violence to adverse fetal outcomes. Abdominal trauma may cause placental damage or premature rupture of membranes, which could then lead to miscarriage, antepartum hemorrhage, or preterm delivery and low birth

weight.[1,20,136] The mechanism could also be indirect through a psychological stress response.[10,20,23,100,137] IPV during pregnancy is associated with stress,[20,23,72,99,100,138-140] and it seems likely that stress acts as the mediator between violence, physiological consequences, and poor pregnancy outcomes.[23,63,97,100,141,142] For example, stress affects the neuroendocrine system and hypothalamic-pituitary-adrenal production, which can restrict fetal growth and contribute to preterm labour.[10,20,97,100,141] In a study examining the neuroendocrine response to violence during pregnancy and pregnancy outcome, evidence was found for both a direct (via abdominal trauma) and an indirect (via stress as assessed by maternal salivary cortisol levels) pathway linking violence during pregnancy to decreased gestational age at delivery and low birth weight.[23] Also, stress is associated with engagement in risky health behaviours such as smoking during pregnancy which, in turn, is associated with low birth weight and/or preterm birth.[1,63,100] The fact that experiencing verbal and/or psychological violence in the absence of physical violence has been associated with poor outcomes[126] lends support to the existence of an indirect pathway.

The relationship between pregnancy violence and pregnancy outcomes remains relatively unexplored as it pertains to the Canadian context; only two Canadian studies were found that directly examined this relationship.[21,143] Janssen et al.[21] found a significant relationship between physical violence during pregnancy and antepartum hemorrhage, intrauterine growth restriction, and perinatal death. The relationship between violence and intrauterine growth restriction was largely mediated through the use of substances; however, physical violence during pregnancy independently predicted antepartum hemorrhage (Adjusted odds ratio [AOR] = 3.51) and perinatal death (AOR=7.28). Physical violence during pregnancy did not significantly increase the risk of preterm labour or delivery in this study. The markedly lower reported rate of physical

violence during pregnancy (1.2%) in this study compared to rates reported elsewhere in Canada,[33,56,62,63] and the fact that only 48.5% of the population-based study was screened for violence (and included in analyses), makes the ability to generalize from these findings limited. Using data from the recent nationally representative Maternal Experiences Survey, Urquia et al.[143] reported no significant association for violence during pregnancy and preterm birth or small-for-gestational age infants after adjustment for confounding variables. The higher response rate (78%) and nationally representative nature of this survey makes generalizations to the population of Canadian pregnant women more valid; however, it is also limited in that only two potential adverse outcomes were assessed. Neither study examined maternal or child outcomes beyond delivery nor did they assess the adequacy of prenatal care as a potential confounding variable.

The inconsistencies reported in the literature are likely due to the extent to which confounders and potential mediators are incorporated into the study design as well as the extent to which the particular sample engages in compromising health behaviours. The overreliance on non-representative, low income, high risk samples[13,17,53,57,59,67,68,91,92,119-122,124,126,128,129,131] in this area needs to be viewed as a significant limitation of extant research. As well, sample size restrictions often preclude the examination of low base rate events and many studies may lack sufficient power to detect differences between women experiencing pregnancy violence compared to women not experiencing pregnancy violence. Further, the examination of multiple outcomes including pre-existing maternal morbidities, pregnancy and labour and delivery complications, and birth outcomes in single study is rare. Finally, the association of prenatal experiences to longer-term maternal and child health has also not been adequately examined in

research to date. The proposed research was designed to overcome these limitations of extant research.

Maternal Health Outcomes Associated with IPV During Pregnancy

IPV remains one of the leading causes of injury among women.[1,11,14,144,145] As a matter of fact, 10% of all hospitalizations during pregnancy are a direct result of injuries sustained from IPV.[11] As well, IPV during pregnancy is one of the leading causes of maternal death,[31,34,136,146-148] and women experiencing violence during pregnancy are two to three times more likely to become a victim of femicide than women who experience violence outside the pregnancy period only.[34,147] In a review of pregnancy associated violent deaths in Virginia, it was determined 65% of the deaths attributable to IPV were preventable.[149] It is worth noting that even though a substantial proportion of femicide victims saw their health care provider in the year prior to their death,[31,146] most service providers were unaware of the violence these victims experienced in their lives.[31,34,150] The fact that many pregnancy associated violent deaths are deemed to be preventable,[149] as well as research indicating that nearly all pregnant women come into contact with the health care providers at some point during their pregnancies,[112,151] suggests that the health care system may have an integral role to play in efforts to address violence against pregnant women.

Similar to non-pregnant women experiencing IPV, pregnant women report a number of physical injuries as a result of the violence.[11,26,33,134,152] IPV during pregnancy has also been shown to have a negative impact on physical health. Women experiencing violence during pregnancy report poorer general health status[1,53,107,153]; decreased positive health behaviours[59]; higher somatization scores[154]; more gynecological problems,[11,92] sexually transmitted diseases,[1,52,91] and high risk sexual behaviours (i.e., no condoms and/or multiple partners)[92];

increased use of health care services,[1,11] more antenatal hospitalizations,[19,120] longer maternal hospital stay after birth[89]; and reduced quality of life[1,130] compared to women who do not experience violence during pregnancy. Women experiencing violence during pregnancy have been found to report increased physical health problems related to stress compared to women who do not experience pregnancy violence.[53] Thus, it seems likely that in addition to the physical injuries sustained, the stress associated with experiencing IPV also has a negative impact on physical health through its contribution to chronic health problems, recurring central nervous system symptoms, and compromised immune system functioning.[1]

In addition to a deleterious effect on physical health, the experience of violence during pregnancy can have a profound negative impact on the pregnant woman's mental health. Violence during pregnancy has been linked to depression,[11,12,30,59,72,91,99,100,138,154-159] anxiety,[154,158,160] post-traumatic stress disorder,[12,22,155,158] obsessive-compulsive symptoms,[155] stress[20,72,99,138,139,155] and stressful life events,[50,53,58,60] suicidal and self-harming thoughts and behaviour,[91,145,148,161,162] as well as a number of other psychological, emotional, and mental health problems.[26,138,154,163] Therefore, pregnancy violence not only has a direct, negative impact on the physical and mental health of the pregnant women, but likely compromises a new mother's ability to parent effectively in the postpartum period,[80,160,164-168] which can have profound developmental consequences for the child.

Finally, one of strongest predictors of pregnancy violence is a history of pre-pregnancy violence[30,33,58,69,71,79,88,99,169-172]; between 60 and 96% of women experiencing violence during pregnancy also report violence in the pre-pregnancy period.[25] Violence during pregnancy is also a strong predictor of postpartum violence.[61,79,80,156,164,171-174] In a study examining the patterns of physical violence before (past year), during, and after pregnancy, Martin et al.[79] reported that less

than 1% of the women reporting a history of violence reported experiencing physical violence for the first time in the postpartum period.

The strong association between pregnancy violence and postpartum violence suggests that the impact of postpartum violence on maternal mental health is also important to consider when examining the long-term impact of pregnancy violence on maternal and child outcomes. In a follow-up study of women experiencing violence during pregnancy, Stewart[174] found that 90% of the sample (27/30) also experienced physical violence in the first 3 months postpartum, and more than 80% (25/30) met diagnostic criteria for a current psychiatric disorder. As well, the effects of both early (6 weeks) and/or concurrent (24 months) postpartum violence have been shown to significantly increase maternal psychological distress scores two years post-delivery relative to women not reporting postpartum violence.[175] Postpartum depression is one of the most common mental disorders associated with childbirth and is a significant health concern.[176] A large body of research exists linking violence experiences before or during pregnancy to an increased risk of depression in the postpartum period.[12,113,153,155,156,159,165,176-180] As a matter of fact, population attributable fractions calculated from various studies suggest that the incidence of postpartum depression might decrease by 10.6% to 23.6% if IPV against pregnant women was eliminated.[12,176,179]

Taken together, the interrelationships between sociodemographic and behavioural risks, poor pregnancy outcomes, postpartum violence risk, and compromised maternal functioning associated with violence during pregnancy likely have a substantial impact on the developmental trajectory of the newborn child.

Linking Child Developmental Outcomes to the Prenatal Period

Health inequities start early in life, and can even be traced to events that happen in the

prenatal period.[181] However, little is known about the specific impact of prenatal violence on child developmental health after birth as the longer-term effects of pregnancy violence have not been adequately addressed in research to date. Also, more generally, there remains a scarcity of research on the impact of violence against women on children's physical health.[182] Therefore, this study extends the current body of research by examining the association of a history of violence (past or current) between parenting partners (assessed around the time of delivery) on infant and child developmental health beyond the immediate postpartum period.

In the limited research explicitly examining this relationship, IPV during pregnancy has been associated with increased infant outpatient physician visits and emergency department visits at 2 months of age,[89] any IPV at baseline (past month/assessed shortly after birth) or follow-up (at 1 year postpartum) has been associated with poorer infant health and a more difficult infant temperament at age 1,[153,183] chronic IPV (during both pregnancy and/or infancy and early childhood) has been associated with child obesity at age 5,[184] early postnatal violence has been associated with infant respiratory infections and diarrhea over the first 5 months of life,[185] and lifetime exposure to any form of family violence has been associated with fetal and early childhood growth impairment.[182] However, other studies report no significant difference in infant health status based on violence during pregnancy and/or in the early postpartum period.[89,114] In a large cohort study examining the impact of pregnancy violence on maternal mental health and child behaviour problems in the United Kingdom, pregnancy violence predicted child behaviour problems (hyperactivity, conduct, emotion, and pro-social domains) at 42 months of age in bivariate models, but this relationship was mediated by maternal depression and postnatal violence exposure.[156] In this study, child behaviour problems were also associated with a number of other factors (e.g., low maternal age at birth, lower education, lower income,

non-homeowner, smoking and alcohol use, small-for-gestational age infants, and paternal depression) in bivariate analyses. This highlights the importance of disentangling the effects of violence exposure, parental mental health problems, indicators of socioeconomic disadvantage, and pregnancy outcome on later child behaviour problems as each factor exerts a profound influence on child developmental health.[156]

The fact that violence during pregnancy has been associated with adverse pregnancy outcomes may also contribute to developmental problems in children who are exposed to violence prenatally. Many of the adverse pregnancy outcomes associated with violence during pregnancy (e.g., low birth weight and preterm birth) have been associated with developmental problems in children. For example, preterm and low birth weight infants are at risk for a number of problems including mortality, growth impairment, frequent and chronic illness, inattention, hyperactivity, language delays, cognitive impairments and academic difficulties, as well as emotional and behavioural problems that persist throughout childhood and adolescence into adulthood.[24,86,137,141,186-188] Therefore, the mechanism linking prenatal violence exposure to suboptimal child development could be through its impact on pregnancy outcome. As a matter of fact, there are a number of other biological and psychological reasons for hypothesizing that violence during pregnancy could be associated with long-term developmental consequences for the child.[156]

First, the effects of maternal prenatal stress may alter developing fetus and, therefore, have an influence on children's subsequent functioning.[156] Approximately 40 to 50% of preterm births are idiopathic,[97,141] and it has been hypothesized that these unknown mechanisms may be related to the effects of prenatal stress on the developing fetus.[97,141] Substantial preclinical (rodent and primate) evidence exists supporting a link between prenatal stress exposure and

impaired offspring development,[97,141,189-191] and there is reason to believe that these findings are relevant to human development as well. Maternal stress hormones (i.e., cortisol) may cross the placental barrier and affect amniotic cortisol levels which, in turn, affect fetal development and pregnancy outcome.[191-194] It is believed that prenatal exposure to maternal stress hormones can result in early programming of brain functions with permanent change in neuroendocrine regulation and behaviour in offspring.[97,137,193,194] As well, disruption or chronic activation of the neuroendocrine system early in development (even prenatally) can alter the functional status of the developing immune system, which may have long-term physical health consequences for the developing fetus.[195,196]

In human studies, amniotic cortisol levels have been found to be associated with low birth weight which, in turn, predicted infant fear and distress at 3 months of age.[192] Amniotic cortisol has also been found to be negatively associated with cognitive ability at 17 months of age, but only among insecurely (vs. securely) attached infants.[197] In studies using self-reported measures of maternal prenatal stress and/or anxiety, prenatal stress exposure has been linked to poorer motor skills, physical development, and cognitive development at 8 months of age[198]; poorer mental development and observed fearfulness in infants aged 14 to 19 months[199]; poorer verbal cognitive function at 18 months, non-verbal cognitive development at 24 months, and decreased self-regulation at 37 months[200]; antisocial child behaviour in early childhood[142]; attention-deficit/ hyperactivity disorder at age 7[201]; and child internalizing and externalizing behaviour problems at 4 years of age[202,203] that persist throughout childhood to adolescence.[204] Reviews on the effects of prenatal exposures on child neurodevelopment estimate that between 15 to 22% of the variance in several child behavioural outcomes can be linked to fetal exposure to maternal stress, anxiety, and/or depression.[193,194]

The relationship between prenatal stress exposure and poor developmental outcomes has been found to persist in both genetically related and unrelated mother-child dyads,[142] and independent from post-natal stress exposure.[193,199,202,204] These studies lend support to the assertion that prenatal stress exposure has effects beyond genetic influences among human offspring. It is also important to note that stress is an inherently subjective experience, and there is wide variability in what individuals perceive as stressful and how they respond to stress.[86,189,205] Prenatal stress is usually assessed with a life event or anxiety measure, but because stress response varies greatly by individual, subjective stress may be greater determinant of outcome than more objective measures.[86,189] Interestingly, in studies disentangling the types of stressors experienced, partner and/or relationship problems[193,199,203] have been reported as the main stressor associated with negative outcomes. Altarac and Strobino[206] found that self-reported stress because of violence (emotional, physical, or sexual) during pregnancy, rather than actual experiences of physical violence during pregnancy, was significantly associated with low birth weight in a sample of high-risk pregnant women. The strong association of violence during pregnancy with stress,[20,72,99,138,139,155] and the likelihood that this specific type of violence is perceived and experienced as stressful for many pregnant women, suggests a potential pathway by which violence during pregnancy impairs fetal and child development.

Second, the experience of violence during pregnancy may cause the mother to develop more negative representations of self and child and, hence, lead to disruptions in attachment and weaker mother-infant bonds.[156] Evidence suggests that violence during pregnancy is associated with more negative representations of the unborn child,[207-209] insecure mother-infant attachment/bonding both prenatally[208-210] and postnatally,[127,207,210,211] low parenting morale in the early postpartum period,[168] and problematic co-parenting at 1 year postpartum.[167] Low maternal-

fetal attachment during pregnancy places the child at risk for developmental delays across multiple domains of functioning (i.e., communication, gross motor skills, fine motor skills, problem solving, and personal-social) at 14 to 26 months of age.[209] As well, negative representations of the unborn child have also been shown to predict hostile and controlling parenting behaviours[212] and insecure mother-infant attachment at 1 year postpartum.[207] Both hostile/controlling parenting[213-215] and insecure attachment[216-221] are known risk factors for negative outcomes across the lifespan. However, there is also evidence suggesting that positive early caregiving experiences can reverse the effects of prenatal biological risk.[137,189,191,193,199] This points to the importance of the early caregiver relationship as a potential moderator in the relationship between adverse prenatal exposures and developmental outcomes.[191,197]

Third, violence during the prenatal period has been shown to be associated with maternal mental health problems both during pregnancy[11,12,22,30,72,91,99,138,154,156,158] and postpartum.[12,113,138,153,155,156,159,165,176-180] Maternal prenatal stress, anxiety, and depression have been associated with child development problems across multiple domains of functioning.[222,223] Maternal mood and/or anxiety disorders during pregnancy have been found to predict parenting stress at 3 and 6 months postpartum,[224] observed child aggressiveness at 12 months of age,[225] and child psychiatric disorders at age 6.[226] Inconsistent findings are reported in the literature regarding the extent to which the association between pregnancy violence and negative child outcomes is mediated by maternal mental health problems, with some studies find no mediating effect[89,202] and others reporting independent mediating effects for both maternal mental health problems and pregnancy[22] or postpartum[156] partner violence exposure. Thus, the relationship between prenatal violence and child developmental problems might be mediated by maternal

mental health problems,[156] although it seems likely that postpartum violence risk also plays a role in the relationship between prenatal violence exposure and child developmental health.

Thus, a final potential mechanism through which prenatal violence may have an impact on children after birth is through the increased risk that violence between parenting partners will continue in the postpartum period. As a matter of fact, the American Academy of Pediatrics[227] has urged pediatricians to routinely screen all women for IPV as an important component in the primary prevention of child abuse. As previously stated, violence during pregnancy is a strong predictor of postpartum violence[61,79,80,156,172,174] and IPV and child maltreatment tend to co-occur,[1,11,27,160,228] placing the child at risk for experiencing violence themselves.[11,160,164,166,229] For example, maternal prenatal depression has also been found to predict offspring psychopathy in adolescence, but only through its impact on the increased risk for child maltreatment in the postpartum period.[230] In a prospective study, violence during pregnancy has also been shown to predict both lifetime and past-year physical child abuse, although this relationship was mediated by recent (past-year) IPV.[164] Even in the absence of direct victimization, exposure to violence between parents has been shown to increase the risk of child developmental problems across multiple domains of functioning.[11,166,229,231-236] The proposed study extends the existing body of literature on child exposure to IPV by examining the extent to which differences in developmental outcomes can be traced to violence that occurs prior to a child's birth.

Current Practice Recommendations

Research has shown that early identification and appropriate counselling can reduce behavioural risk factors among pregnant women,[237] and that repeated screening throughout pregnancy facilitates identification and disclosure among women experiencing violence during pregnancy.[25,47,237-239] Screening may also help to promote better pregnancy outcomes. For

example, Coker et al.[240] examined rates of adverse pregnancy outcomes pre- and post-implementation of a universal screening policy based on the American College of Obstetricians and Gynecologists' guidelines,[37,241] and found that screened women were significantly less likely to have low birth weight infants, preterm births, any maternal complication, and higher newborn Apgar scores than non-screened women.[240] Despite the fact that violence during pregnancy is much more common than many other conditions that women are routinely screened for during pregnancy,[11,47] routine screening for violence during pregnancy has not been widely implemented in practice.[35,43-46,242]

Several key health organizations in the United States[36,37,227,241,243,244] and the United Kingdom[39-41] have recommended that health care providers routinely screen all women for violence during pregnancy. To date, similar recommendations for universal screening have not been endorsed by Canadian professional health care organizations.[245-250]

In Manitoba, government policy, as part of its Families First program, is for public health nurses to screen families with newborns within one week post-discharge for biological, demographic, and psychosocial risk factors associated with poor child developmental health.[251] The screening form consists of 38 dichotomous items (risk is present or not present), that are summed in order to create a total risk score. Total scores of 3 or more are considered a positive screen, and families with a positive screen may require additional services (e.g., home visitation, parenting programs, child care, financial services, mental health services).[251] Information on most of the biological risks (e.g., low birth weight) is obtained from the hospital record, and nurses are trained to inquire about the remaining risk factors (including a question pertaining to a past or current history of violence between parenting partners) in a sensitive and non-judgemental manner.[252] Due to jurisdictional issues related to health care delivery in Manitoba,

women living in First Nations (i.e., reserve) communities (under federal vs. provincial jurisdiction) are not screened as part of the provincial Families First program.[252,253] All other births occurring to Manitoban families are eligible for screening by provincial public health nurses. It is estimated that approximately 81.4% to 83% of eligible (i.e., families living off reserve) Manitoban families are screened as part of the Families First program.[252,253] Therefore, although the intention is to screen all eligible families with newborns (i.e., families living off reserve), a substantial proportion of eligible families (i.e., approximately 17% to 18.4%) are not being screened.[252],[253] Importantly, the non-screened group of new mothers appear to represent a particularly high risk subset of families in Manitoba as children from these families are twice as likely to enter child protective care than children from screened families.[252] Therefore, generating information on the characteristics and outcomes of these families and their children may help to identify and intervene with non-screened, high risk families in need of support whose needs are not being met within the current system.

Study Rationale and Purpose

There are a number of limitations in the extant research on violence during pregnancy. First, much of the research is from the United States.[1,63] Only a limited number of studies have examined this phenomena in the Canadian context,[21,26,33,56,62,63,143] and much of this research has focused on the prevalence, risk factors, and correlates of violence during pregnancy rather than pregnancy or developmental outcomes per se. Differences in the ethnic composition of the American and Canadian populations and differences in national health care systems suggest that more research in the Canadian context is warranted.[63] Second, research examining the experience of violence during pregnancy rarely follows the same sample of women and children into the postpartum period[25]; thus, limiting our knowledge of the long-term consequences of

pregnancy violence on maternal and child health. As well, the overreliance on low income, high-risk, and non-representative samples of pregnant women limit the generalizability of findings.[104] Most studies are limited to women seeking medical care who are willing to disclose IPV.[65] This only captures a subset of exposed women, particularly since pregnant women experiencing violence may be less likely to access prenatal care.[65] The use of a population-wide sample of women increases generalizability of the findings, facilitates the examination of low base-rate events, and allows for the use of more complex models to be tested in order to better understand the pathways through which pregnancy violence leads to poor developmental outcomes. Finally, the reluctance of Canadian health care organizations to endorse universal screening for IPV among pregnant women[245-250] suggests that evidence specific to the Canadian context is required to inform this debate.

Therefore, the overall objective of this series of studies was to compare pregnancy, maternal, and child outcomes from the prenatal period to 5 years post-delivery for women screening positive for a current or history of violence between parenting partners around the time of delivery relative to women screening negative for violence. This series of studies also examined outcomes among the population of woman who were not screened for a current or history of violence between parenting partners around the time of delivery. The extent to which differences in outcomes were detectable from the violence screen response (i.e., negative IPV screen, positive IPV screen, not screened for IPV) was an important secondary objective that was considered throughout the series of studies. The overall hypothesis was that women screening positive for IPV (and non-screened women) around the time of delivery (vs. women screening negative for IPV) would have more adverse pregnancy outcomes, poorer physical and mental

health (both prenatally and in the postpartum period), and that their children would evidence less favourable health and social outcomes starting at birth and persisting 5 years post-delivery.

Study 1: Who Gets Screened for Prenatal Violence in Manitoba?

Rationale. As stated, government policy in Manitoba is for public health nurses to screen eligible families with newborns (i.e., families living off reserve) within one week post-discharge for biological, demographic, and psychosocial risk factors associated with poor child developmental health as part of its Families First program.[252] Although the intention is to screen all eligible families with newborns, in practice, a substantial minority of eligible families are not being screened.[252,253] This is concerning given evidence that non-screened families may represent a particularly high risk subset of the Manitoba population.[252] Research has suggested that partner interference with health care is a significant problem for women living in abusive relationships (e.g., preventing the female partner from attending appointments, interfering with the provision of health care, not allowing the female partner to meet privately with health care providers).[254] Safety concerns are paramount in any IPV intervention, and health care providers should be trained to only ask about IPV experiences in a safe, private, and confidential environment.[255] Thus, in families experiencing IPV, it may be difficult for public health nurses to screen for violence without compromising a woman's safety. Even among screened families, it seems likely that public health nurses may be reluctant to enquire about, and new mothers may be reluctant to disclose, experiences of IPV during the prenatal period.

Objectives. To compare the characteristics of families who are screened for a history of violence (past or current) between parenting partners relative to families who are not screened for a history of violence (including differences in those families not screened at all relative to

those who were screened, but missing a response to the violence screening question) using a population-wide sample of Manitoba women.

Hypotheses. Hypothesis 1A: The pattern of missing data with regard to overall screening practices, and the violence screening question specifically, will be non-random. Hypothesis 1B: Compared to families who are screened for violence, families who are not screened at all will represent a high risk subset of Manitoba families (e.g., young maternal age, low income, unmarried, poor pregnancy outcomes). Hypothesis 1C: Compared to families who are screened for prenatal violence, families who are screened, but are missing a response to the violence screen question, will represent both high risk and low risk subsets of Manitoba families.

Study 2: Violence During Pregnancy: Risk Factors and Pregnancy Outcomes

Rationale. Most of the research examining the relationship between violence during pregnancy and pregnancy outcomes has been conducted in the United States, and differences in national health care systems suggest that these findings may not generalize to the Canadian context. As well, the overreliance on small, non-representative, and high risk samples in this area further limits the generalizability of extant findings. Finally, the relationship between violence during pregnancy and pregnancy outcomes had not been adequately addressed in Canadian research to date.

Objectives. To examine the relationship between a history of violence (past or current) between parenting partners (assessed around the time of delivery) and sociodemographic risk, maternal morbidities, pregnancy complications, and adverse pregnancy outcomes using a population-wide sample of Manitoba women. An important secondary objective was to examine these same characteristics in the subset of women who are not screened for violence around the time of delivery relative to the subset of women screening negative for violence.

Hypotheses. Hypothesis 2A: Women screening positive for IPV around the time of delivery will evidence greater sociodemographic risk, maternal morbidities, pregnancy complications, and adverse birth outcomes than women screening negative for IPV around the time of delivery. Hypothesis 2B: Women who were not screened for IPV around the time of delivery or will evidence greater sociodemographic risk, maternal morbidities, pregnancy complications, and adverse birth outcomes than women screening negative for IPV around the time of delivery. Hypothesis 2C: The relationship between a positive IPV screen response (vs. negative IPV screen) and adverse birth outcome will persist after controlling for sociodemographic covariates, pregnancy complications, and maternal prenatal morbidities.

Study 3: Maternal and Child Health Associated with Maternal Prenatal Violence: Birth to 5 years Post-Delivery

Rationale. A major limitation of extant research is that relatively little is known about the longer-term impact of violence during pregnancy on maternal and child health and social outcomes. A growing body of research has shown associations between prenatal stress exposure and long-term developmental consequences, and it seems likely that violence experienced during pregnancy is, in fact, perceived and experienced as stressful by pregnant women. Violence during pregnancy also has been shown to have a negative impact on the physical and mental health of the mother both during pregnancy and in the early postpartum period. However, because most research in the area focuses on more immediate outcomes (e.g., birth outcomes), and the same sample of women and children is rarely followed into the postpartum period, relatively little is known on the long-term impact of pregnancy violence on maternal and child developmental outcomes.

Objectives. To examine the relationship between a history of violence (past or current) between parenting partners and maternal and child health (e.g., mental health, physical health, injury hospitalizations) and social outcomes (e.g., child welfare organization contact, child apprehensions, child readiness for school) from birth to 5 years post-delivery. An important secondary objective was to examine these same characteristics in the subset of women who were not screened for IPV around the time of delivery relative to the subset of women screening negative for IPV. Finally, in the event that a direct relationship between a history of violence (past or current) between parenting partners and child readiness for school exists at the bivariate level, to examine the pathways through which maternal partner IPV experienced prior to delivery influences child functioning across multiple domains at kindergarten entry.

Hypotheses. Hypothesis 3A: Women screening positive for IPV around the time of delivery will have more adverse mental and physical health outcomes than women screening negative for IPV from birth to 5 years post-delivery. Hypothesis 3B: Women who were not screened for IPV around the time of delivery will have more adverse mental and physical health outcomes than women screening negative for IPV from birth to 5 years post-delivery. Hypothesis 3C: Children born to women screening positive for IPV around the time of delivery will have more adverse mental and physical health outcomes than children born to women screening negative for IPV from birth to 5 years post-delivery. Hypothesis 3D: Children born to women who were not screened for IPV around the time of delivery will have more adverse mental and physical health outcomes than children born to women screening negative for IPV from birth to 5 years post-delivery. Hypothesis 3E: Children born to women screening positive for IPV around the time of delivery will evidence greater child welfare organization contact, will be more likely to enter child protective care, and be less ready for school at kindergarten entry

than children born to women screening negative for IPV. Hypothesis 3F: Children born to women who were not screened for IPV around the time of delivery will evidence greater child welfare organization contact, will be more likely to enter child protective care, and be less ready for school at kindergarten entry than children born to women screening negative for IPV. Hypothesis 3G: Among children born to women who were screened for IPV, a positive screen for IPV (vs. negative screen) around the time of delivery will remain independently associated with children's readiness for school assessment at kindergarten entry after controlling for sociodemographic disadvantage, adverse pregnancy outcome, maternal postpartum health problems, child health problems, and postpartum violence risk. It is also hypothesized that these covariates will substantially attenuate the relationship between a positive IPV screen (vs. negative screen) around the time of delivery and children's readiness for school at kindergarten.

Significance

Ensuring optimal maternal and child health should be an integral goal of any population health strategy.[181] This research advances our understanding of what places a woman at risk for experiencing IPV in the prenatal period, and the mechanisms through which this type of violence leads to adverse short- and long-term pregnancy, maternal, and child health outcomes. Overall, this research also addresses a number of limitations of extant research specific to the Canadian context, and will help to inform the debate regarding the utility of universal screening for IPV during pregnancy. Findings not only have a number of policy and practice implications, but can also be used to better inform prevention and intervention strategies targeted at preventing and/or reducing IPV against pregnant women and associated adverse maternal and child outcomes. Ultimately, the primary goal of this research is to improve the health and well-being of both Canadian women and their children.

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CHAPTER 2: MATERIAL AND METHODS

Data Sources

Several administrative databases housed at the Manitoba Centre for Health Policy (MCHP) in the Manitoba Population Health Research Repository ("the Repository") provided data for this series of studies. Specifically, information from Manitoba Health, Seniors and Active Living (i.e., Health Insurance Registry, Hospital Discharge Abstracts, Medical Services, Drug Program Information Network databases), Healthy Child Manitoba (i.e., Families First and Early Development Instrument databases), Family Services (i.e., Child and Family Services Information System database), and the Canadian Census public access files were used in this thesis. Virtually all contacts by Manitoba residents in these systems are captured in the health and social databases in the Respository.[1] Prior to being deposited in the Repository, all individual level identifiers are removed (e.g., name, address) and replaced with an encrypted, numeric personal identifier.[1] Because the personal identifier is encrypted in the same way for each file, data sets are linkable across files and over time. The linkage capabilities for data housed in the Repository are a powerful and valuable tool for studying important health and social issues for an entire population.[2]

The Health Insurance Registry contains information on an individual's status as a Manitoba resident, as well as their age, sex, and area of residence and provided the basic information required (e.g., status as Manitoba resident, coverage period start and end dates, demographics) to determine the study population. Public use Census files can be used to generate area-level income estimates for Manitoba residents. Population-wide individual-level income measures are not available in the administrative datasets housed at the MCHP; therefore, a neighbourhood-level (i.e., area-level) income measure based on the average household income

for each Census dissemination area (i.e., approximately 400 to 700 persons living in a small geographic area of one or more neighbouring blocks)[3] was used as a proxy indicator of individual-level household socioeconomic status in this study. In short, each individual is assigned the average household income of the neighbourhood income where they reside.[4,5] Evidence exists supporting the validity of ecological measures of income to represent individual-level income in health research.[6,7]

The Hospital Discharge Abstracts database contains clinical and demographic information (e.g., gender, postal code, diagnoses and procedure codes) on all hospital separations (inpatient stays and day surgery services) and were used to determine birth, maternal, and child health outcomes across the series of studies. The Medical Services database contains clinical and demographic information on all patient physician visits and was also used to determine health outcomes across the series of studies. The Drug Program Information Network database contains transaction-based information for all prescriptions filled by Manitoba residents and was used to validate the presence of specific health conditions.

Families First (FF) is a brief screen completed by a public health nurse during the course of a postnatal visit to assess a number of biological, social (including a current or past history of violence between parenting partners), and demographic risk factors in families with newborns.[1] The complete FF screen is available at: https://www.gov.mb.ca/healthychild/edi/pancan/pres_ffs.pdf. Responses to the intimate partner violence (IPV) screen question were used to determine the comparison groups used throughout this series of studies (i.e., negative IPV screen, positive IPV screen, not screened for IPV) required for analyses. These comparison groups are described in more detail in the next section of this thesis.

The Early Development Instrument (EDI) is a validated tool to assess child school readiness at kindergarten entry across five specific domains (i.e., physical health and well-being, social competence, emotional maturity, language and cognitive development, communication skills and general knowledge) of functioning.[8] In Manitoba, the EDI is implemented at the population-level every second year.

The Child and Family Services Information System database contains information on families receiving services from Child and Family Services as well as information regarding children taken into child protective care.

Study Population

Manitoban women giving birth to a live singleton infant (weighing at least 400 grams and born at a minimum of 18 weeks gestation) in the province from January 1, 2003 to December 31, 2006 were included in analyses (*N*=52,710). Multiple births were excluded due to higher incidence of adverse birth outcomes;[9,10] hence, cofounding relationships between IPV screen response and birth outcomes. Because this study was focused on singleton births, multiple births were not included in the data provided by the MCHP. In Manitoba, multiple births represent approximately 2.5% to 3.0% of all births in the province.[9] Infants born extremely premature (i.e., less than 18 weeks gestation) or at extremely low birth weights (i.e., less than 400 grams) were excluded due to the low probability of survival (so it was unlikely these families would have a completed FF screen).[11,12] More conservative gestational age (i.e., less than 18 weeks gestation) and birthweight (i.e., less than 400 grams) exclusion criteria were chosen (compared to more traditional standards such as 20 weeks gestation and 500 grams) in order to ensure that as many live births as possible were captured in the study. Similar exclusion criteria has been used elsewhere.[13,14] Births to women living in First Nations (i.e., reserve) communities were also

excluded (i.e., an area-level exclusion based on postal code at time of birth) due to jurisdictional issues related to health care delivery in Manitoba. First Nations (i.e., reserve) communities fall under federal (vs. provincial) jurisdiction and, as such, families living on reserve are not screened as part of the provincial Families First program in Manitoba.[1,15] This resulted in a final sample of *N*=45,896 births used in baseline analyses contained in Chapter 3 (i.e., comparisons of screened vs. not screened families) and Chapter 4 (i.e., comparisons of maternal prenatal morbidities, pregnancy complications, and birth outcomes) of this thesis For Chapter 3 analyses, the population was divided into three groups based on whether the woman was screened for IPV on the FF screen form: (1) screened for IPV, (2) not screened at all/no FF screen form, and (3) screened [i.e., FF screen form filled out], but missing a response to the IPV screen item. For Chapter 4 analyses, the population was divided into three groups based on the documented response to the IPV screen item: (1) negative IPV screen, (2) positive IPV screen, and (3) not screened for IPV [either due to missing IPV item or missing FF form].

A flow chart detailing exclusions from the study population at various stages of the project is provided in Figure 1. Differences in the sociodemographic characteristics between those who were excluded from the baseline sample (i.e., infants born at less than 18 weeks gestation or at less than 400 grams and women living on reserve) compared to those who were retained in the baseline sample are provided in Table 2.1. As shown in Table 2.1, significant differences were noted in the sociodemographic characteristics of those who were excluded from the baseline sample compared to those who were retained in the final sample (details regarding the measurement of sociodemographic covariates are provided in the next section of this thesis). Women who were excluded from the baseline sample were younger, less likely to be in a registered marital or common-law union, more likely to be living in a lower area-level income

quintile, to be multiparous, and to have 3 or more children living in the home at the time of birth than women who were included in the baseline sample. Women who were excluded from the baseline sample were also more likely to be living in the northern region of the province than women who were retained in the final sample. In Manitoba, many First Nations communities (relative to non-First Nations communities) are located in the northern areas of the province (see https://www.aadnc-aandc.gc.ca/eng/1100100020558/1100100020563 for a map of reserve communities in Manitoba). Thus, the exclusion of First Nations (i.e., reserve) communities from the baseline sample (as women living on reserve are not screened as part of the provincial FF program) likely explains the high percentage of exclusions from the northern region of the province. The final baseline sample (*N*=45,896) was used for analyses contained in Chapter 3 (i.e., comparisons of screened vs. not screened families) and Chapter 4 (i.e., comparisons of maternal prenatal morbidities, pregnancy complications, and birth outcomes) of this thesis.

For Chapter 5 analyses (i.e., maternal and child postpartum outcomes), we further excluded children who were not living in the home of the registered family head at the time of birth (*n*=234) as well as mothers and/or children without continuous Manitoba Health insurance coverage (e.g., moved out of province, deaths) over the study period (*n*=5,611). This resulted in a final sample of *N*=40,051 families included in the postpartum follow-up study discussed in Chapter 5. For these analyses, the population was divided into three groups based on the documented response to the IPV screen item: (1) negative IPV screen, (2) positive IPV screen, and (3) not screened for IPV [either due to missing IPV item or missing FF form].

Differences in the violence screen response, sociodemographic characteristics, and pregnancy outcomes between those who were excluded from the follow-up sample (i.e., children not living in the home of the registered family head at the time of birth and mothers and/or

children without continuous Manitoba Health insurance coverage over the study period) compared to those who were retained in the follow-up sample are provided in the Supplementary Table S2 that has been incorporated into the manuscript contained in Chapter 5 (see page 154 of this thesis). No significant differences were noted between the baseline and follow-up samples with regard to violence screen response, sociodemographic covariates (i.e., maternal age at birth, marital status, area-level income quintile, total number of children living in home at time of birth, provincial region of residence, or child sex), or birth outcomes (i.e., preterm birth, low birthweight, small-for-gestational age, neonatal intensive care unit admissions, or newborn length of stay greater than 3 days).

Study Variables

This section briefly reviews the variables used across the series of studies. More specific details regarding all study variables (i.e., measurement, coding, and data sources) are included in Appendix B. Study variables were chosen based on their association with an increased risk of violence during pregnancy and/or adverse outcomes, the availability of validated MCHP concepts (to facilitate comparisons) to compute variables, and adherence to strict MCHP data release guidelines designed to protect privacy and confidentiality. It is important to note that some important outcomes could not be assessed in this study as they did not meet minimum cell count size requirements for data release when stratified by violence screen response (e.g., post-term births, child and maternal mortality, child intentional injury hospitalizations). In addition, variable selection was limited to variables available in the administrative data used for this study. For example, race/ethnicity,[16-21] household income,[16,18,19,21,22] maternal weight gain,[23] pregnancy intention,[21,24-27] stress,[28-34] attachment patterns,[35-40] and postpartum parenting behaviours[41,42] have all been associated with violence during pregnancy and/or adverse outcomes, but were not

available in the data. Finally, other outcomes that have been associated with violence during pregnancy, such as fetal/neonatal deaths,[43-47] stillbirths/miscarriage,[20,48,49] and pregnancy termination/abortion,[20,45,50,51] could not be assessed due to the nature of the FF screening policy in Manitoba. That is, woman are generally not screened until after the birth of a live infant and screens are not done among women whose pregnancy does not result in a live birth, thus precluding the examination of these outcomes in this study.

Sociodemographic Covariates

Sociodemographic covariates assessed at the time of birth (and that were also available for the missing FF screen group) included: maternal age (ordinal), marital status (i.e., registered legal marriage or common-law union in health insurance registry vs. no registered union in health insurance registry), area-level income quintile (based on postal code at the time of birth),[3-5] total number of children in home (including the newborn), parity (primaparous vs. multiparous), and provincial region of residence (i.e., Winnipeg, Southern, Interlake-Eastern, Prairie Mountain-Western, and Northern). A map of provincial regions is available at https://www.gov.mb.ca/health/rha/map.html.

Prenatal Care Visits

In this study, a low number of prenatal care visits (yes or no) was defined as having less than five prenatal care visits prior to delivery,[9] and was used as an indicator of the adequacy of prenatal care.

Maternal Prenatal Morbidities and Complications

Maternal prenatal morbidities included diagnosed: maternal prenatal mood and/or anxiety disorder (yes or no),[9] maternal prenatal hypertension (yes or no),[9] and maternal prenatal diabetes (yes or no)[9] in the year prior to delivery. Pregnancy and delivery complications included: any

antenatal pregnancy-related hospitalization (yes or no), placenta previa/abruptio placenta (yes or no), breech birth/other fetal malpresentation (yes or no), induction of labour (yes or no), assisted delivery using forceps or vacuum extraction (yes or no), caesarean delivery (yes or no), fetal distress (yes or no), and maternal length of stay post-delivery (less than 3 days or 3 days or more).[9] Pregnancy-related hospitalizations included any hospitalizations for: threatened preterm labour, antepartum hemorrhage, diabetes, hypertension, genitourinary complications, vomiting, premature rupture of membranes, known or suspected fetal problems, cervical incompetence, or abdominal pain in the gestation period.[9] These conditions have been identified as the most common reasons for hospitalization during pregnancy in Manitoba.[9] Dichotomous assessments (yes or no) of maternal smoking, alcohol use, and drug use during pregnancy were also documented by public health nurses on the FF screen form; however, these variables could not be assessed in comparisons involving mothers who were missing the FF screen form (i.e., not screened at all group).

Birth Outcomes

Birth outcomes included: child sex (male or female), preterm birth (i.e., less than 37 weeks gestation),[9] low birth weight (i.e., less than 2500 grams),[8,13] high birth weight (i.e., more than 4500 grams),[9,13] small-for-gestational age (i.e., birthweight at or below the 10th percentile based on Canadian standards for sex and gestational age),[52] large-for-gestational age (i.e., birthweight at or above the 90th percentile based on Canadian standards for sex and gestational age),[52] low 5 minute Apgar score (i.e., Apgar score of less than 7),[9,44,53] admission to a neonatal intensive or special care unit (yes or no),[9] and newborn length of stay (less than 3 days or 3 days or more).

Maternal Postpartum Health Outcomes

Maternal mental health outcomes assessed included diagnosed: mood and/or anxiety disorder (yes/no),[54-58] personality disorder (yes/no),[59] and substance use disorder (yes/no).[59] Maternal physical health conditions included diagnosed: diabetes (yes/no);[54,60-65] hypertension (yes/no);[60-62,64,66] respiratory morbidity (i.e., asthma, bronchitis, bronchiolitis, emphysema, and/or chronic airway obstruction) (yes/no);[59-61,64,66] intentional (self-inflicted and violence by others) injury hospitalization (yes/no); and non-intentional injury hospitalization (yes/no). All maternal postpartum health outcomes were assessed from birth to 5-years post-delivery.

Child Postpartum Health Outcomes

Child mental or behavioural outcomes included diagnosed: mood and/or anxiety disorder (yes/no),[54,55,58] autism spectrum disorder (yes/no),[12] and attention deficit-hyperactivity disorder (yes/no).[54,55,58,62] Child physical health outcomes included diagnosed: congenital anomalies (yes/no);[12] lower respiratory tract infection (yes/no);[12,67] and injury hospitalization (yes/no). All child postpartum health outcomes were assessed from birth to 5-years post-delivery.

Child Welfare Organization Involvement

Two measures of child welfare organization involvement were assessed: (1) child's family is/was receiving services from Child and Family Services (yes/no), and (2) the child is/was taken into care by Child and Family Services (yes/no).[52,53] Child welfare organization involvement included any contacts with Child and Family Services that occurred from birth to 5-years post-delivery.

Child School Readiness at Kindergarten Entry

Child's school readiness was based on the child's EDI assessment at kindergarten entry. The EDI is a population-based measure of school readiness filled out by kindergarten teachers

when the child is approximately 5 years old. The EDI assesses a child's readiness across five domains (physical health and well-being, social competence, emotional maturity, language and cognitive development, and communication skills and general knowledge).[8,70] Consistent with scoring guidelines, dichotomous assessments (ready vs. not ready) were determined for each separate domain (children scoring in the 10th percentile or lower are deemed to be 'not ready') as well as for an overall assessment of school readiness (ready vs. not ready) that is based on whether the child scores in the 10th percentile or lower in at least one domain (i.e., not ready).[8,70] Finally, a multiple challenge index (the child scores at the 10th percentile or below in at least three different domains) can be used to indicate children who are particularly vulnerable for poor outcomes.[8] The lowest 10th percentile is used as a cut-off point because it is broad enough to capture children who may be at risk for later problems in childhood, rather than using a more conservative cut-off point (e.g., the lowest 5th percentile) that likely only captures children who have been identified as visibly struggling.[70] This study assessed school readiness across the five domains individually, the overall assessment of school readiness, and the multiple challenge index as indicators of school readiness at kindergarten entry. In Manitoba, population wide assessments are only conducted every second year, therefore only children entering kindergarten in 2009, 2011, and 2013 (N=16,767) were included in child school readiness analyses. All children with an EDI assessment were included in analyses examining the relationship between IPV screen status around the time of delivery and school readiness during their kindergarten year, regardless of child age at the time of the EDI assessment. Thus, analyses examining school readiness extended beyond 5 years after birth for some children and included children up to 7 years of age.

Statistical Analyses

Descriptive statistics (frequencies, cross tabulations) and logistic regression (unadjusted, multivariate, and sequential models) were used to examine relationships between variables of interest and IPV screen response throughout the series of studies. Logistic regression modelling used Fisher's scoring as the optimization technique to obtain maximum likelihood estimates for parameter estimates. The statistical significance of parameter estimates from logistic regression models was based on Wald Chi-square tests. Further details on the specific techniques used for each study are provided in Chapters 3, 4, and 5. To account for the increased risk of error associated with multiple comparisons (and the large sample size),[71] results at a *p*-value of 0.01 (and corresponding 99% confidence intervals)[72] were considered statistically significant across the series of studies. All data management, programming, and analyses were performed using SAS® version 9.4.

Data Access and Ethics Approvals

To access the data, proposal and feasibility forms were first submitted to the MCHP. Data access also required completing annual accreditation sessions at the MCHP and a completed University of Manitoba-Manitoba Centre for Health Policy researcher agreement. All analyses were completed at secure MCHP facilities. To protect confidentiality and anonymity, strict MCHP vetting procedures were adhered to prior to the release of all analyses.

Ethical approval for this study was obtained from the University of Manitoba Health Research Ethics Board (Ethics file No. H2015:355[HS18922]). A copy of the ethics approval certificate is provided in Appendix C. Approval for this study was also obtained from the Manitoba Health Information Privacy Committee (HIPC No. 2015/206-31). The Health Information Privacy Committee reviews studies for concerns regarding privacy and

confidentiality. Additional approvals were also obtained from all the data providers including Healthy Child Manitoba, Families Services, and Vital Statistics.

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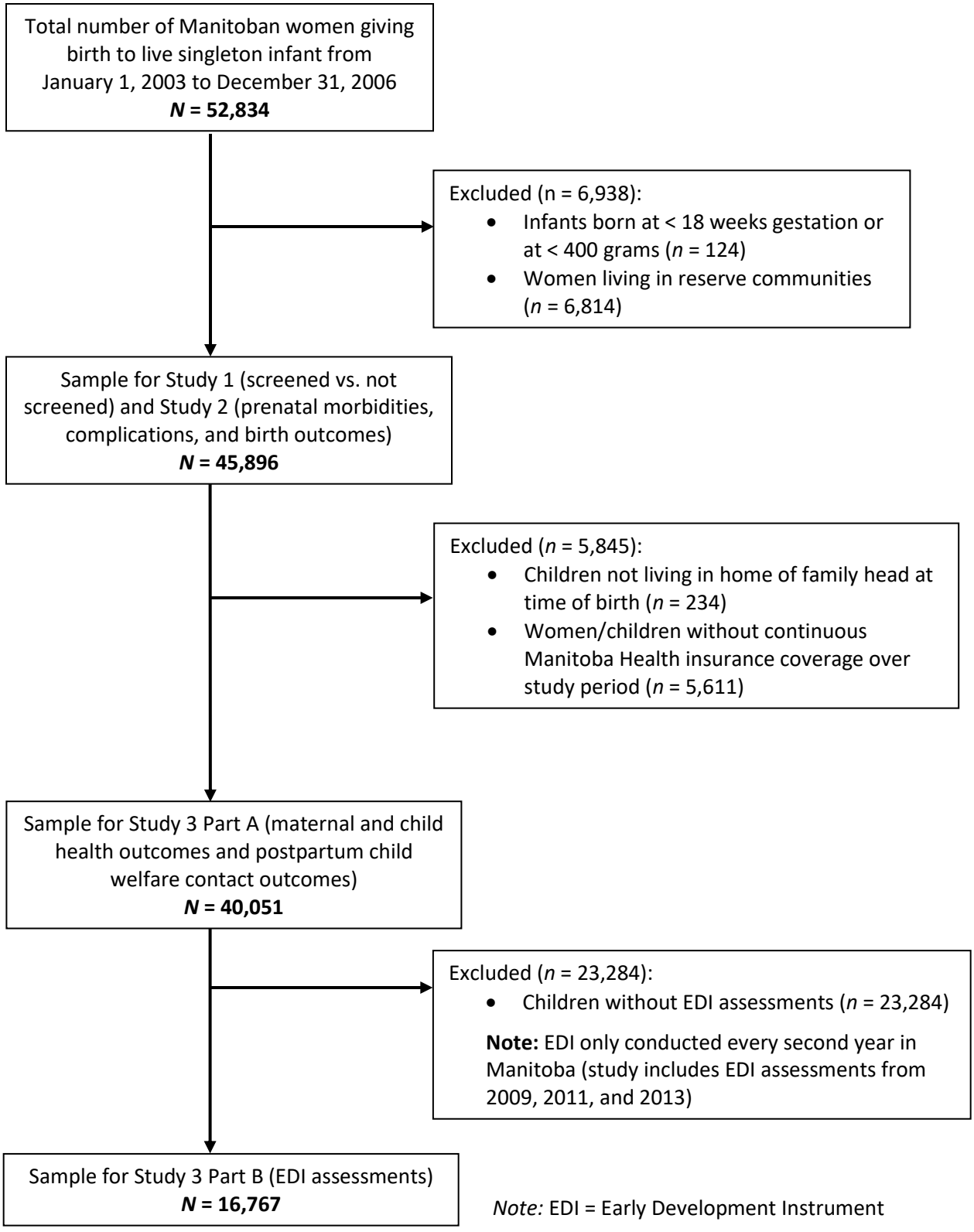
Figure 1.1. Flow Chart of the Study Population



Note: EDI = Early Development Instrument

Table 2.1. Sociodemographic Covariates based on Baseline Sample Exclusion Criteria			
Covariate	Excluded from Sample N = 6,938	Included in Sample N = 45,896	Chi-Square (df) p-value
	% (n)	% (n)	
Maternal age at birth			
Less than 20 years	22.21 (1541)	7.02 (3223)	
20 to 24 years	31.87 (2211)	20.61 (9460)	
25 to 29 tears	23.53 (1632)	30.95 (14207)	
30 to 34 years	14.69 (1019)	27.79 (12754)	
35 to 39 years	6.49 (450)	11.41 (5236)	
40 years and older	1.21 (84)	2.21 (1016)	2560.64 (5) $p < .0001$
Marital status			
Married/common-law	19.73 (1366)	45.11 (20638)	
No registered union	80.27 (5557)	54.89 (25110)	1592.51 (1) $p < .0001$
Area-level income quintile			
1 (lowest)	66.46 (4601)	21.23 (9719)	
2	24.27 (1680)	20.14 (9218)	
3	5.68 (393)	20.23 (9260)	
4	3.38 (234)	19.78 (9055)	
5 (highest)	0.22 (15)	18.62 (8525)	7446.84 (4) $p < .0001$
Total children in home			
0	1.07 (74)	0.51 (234)	
1	27.10 (1876)	42.18 (19298)	
2	23.62 (1635)	33.79 (15458)	
3 or more	48.22 (3338)	23.52 (10758)	1934.87 (3) $p < .0001$
Parity			
Primaparous	27.97 (1940)	40.64 (18652)	
Multiparous	72.03 (4997)	59.36 (27242)	407.07 (1) $p < .0001$
Provincial region of residence			
Winnipeg	0.72 (50)	59.15 (27147)	
Southern	8.62 (598)	17.03 (7816)	
Interlake-Eastern	20.92 (1451)	7.12 (3267)	
Prairie Mountain	13.20 (916)	12.51 (5742)	
Northern	56.54 (3922)	4.19 (1924)	20473.73 (4) $p < .0001$
Child sex			
Male	50.74 (3520)	51.21 (23505)	
Female	49.26 (3417)	48.79 (22391)	0.54 (1) $p = .4643$

CHAPTER 3: CHARACTERISTICS OF SCREENED AND NON-SCREENED FAMILIES IN MANITOBA

Chapter Overview

Manuscript Title: Screening for Partner Violence in the Early Postpartum Period: Characteristics of Screened Families and Non-Screened Families in Manitoba, Canada

Authors: Tamara L. Taillieu, Douglas A. Brownridge, Michelle M. Porter, & Marni Brownell

Author Contributions: Tamara Taillieu developed the research questions and design of the study, coded all study variables, conducted the data analysis, interpreted the data, and wrote and revised the manuscript. Douglas Brownridge, Michelle Porter, and Marni Brownell contributed to the conception and design of the study, supervised data analysis, interpreted the data, and edited and revised the manuscript.

Overview: The purpose of this study was to compare characteristics of families who are screened for a history of violence (past or current) between parenting partners relative to families who are not screened for a history of violence (including differences in those families not screened at all relative to those who were screened, but missing a response to the violence screening question) using a population-wide sample of Manitoba women.

Abstract

Objectives: In Manitoba, government policy is for public health nurses to screen families with newborns within one week post-discharge for risk factors associated with poor child developmental health. The purpose of this study was to compare the characteristics of families who are screened for intimate partner violence (IPV) to families who are not screened for IPV using a population-wide sample of Manitoban women.

Methods: Manitoban women giving birth to a live singleton infant in the province from January 1, 2003 to December 31, 2006 were included in the analyses (*N*=52,710). Data were part of a larger research study following these families for several years to examine longer-term developmental outcomes. Administrative databases from the Manitoba Centre for Health Policy provided data for the study. Descriptive statistics and logistic regression were used to examine relationships between IPV screen status and sociodemographic covariates and birth outcomes.

Results: In the study population, 66.7% of the sample was screened for IPV. Women less than 20 years of age, not in married or common-law unions, and living in lower income areas were less likely to be screened for IPV. Fewer prenatal care visits, diagnosed prenatal mental health problems, and prenatal substance use were also associated with a decreased likelihood of being screened for IPV. Finally, women with premature and low birthweight deliveries were also less likely to be screened for IPV

Conclusion: Incorporating violence screening into routine prenatal care, rather than only visiting women after birth, may help to better identify families in need of support.

Introduction

Violence against women is a global public health concern that not only has devastating consequences for individual victims,[1] but for society as a whole.[2] The World Health Organization estimates that 1 in 5 women will experience some form of physical and/or sexual violence in their lifetime.[1] Violence during pregnancy is a substantial public health issue. It can have a negative impact on the physical and mental health of the mother,[3-6] a number of adverse pregnancy outcomes,[3,5,6,7-9] and devastating consequences for the developing child.[6]

It is estimated that between 3 and 11% of pregnant women will experience physical violence during pregnancy.[10] The pregnancy period offers a unique opportunity to intervene in the lives of women experiencing violence because prenatal care encompasses multiple visits, reaches almost all pregnant women, and targets the age group most at risk for violence.[11] However, most health care providers do not routinely screen for violence during pregnancy.[5,11-14]

Several key health organizations in the United States[15-18] and the United Kingdom[19,20] have recommended that health care providers routinely screen all women for intimate partner violence (IPV) during pregnancy. To date, similar recommendations for universal screening have not been endorsed by Canadian professional health care organizations.[21,22] In Manitoba, government policy, as part of its Families First (FF) program, is for public health nurses to screen families with newborns within one week post-discharge for risk factors associated with poor child developmental health.[23] Information on most of the biological risks (e.g., low birth weight) is obtained from the hospital record, and nurses are trained to inquire about the remaining risk factors (including a question pertaining to a past or current history of violence between parenting partners) in a sensitive and non-judgemental manner.[23] Due to jurisdictional issues related to health care delivery in Manitoba, women living in First Nations (i.e., reserve)

communities are under federal (vs. provincial) jurisdiction and, therefore, are not screened as part of the provincial FF program.[23,24] All other Manitoban families with newborns are eligible for the FF screen. It is estimated that approximately 83% of all eligible Manitoba births are screened.[24] Therefore, although the intention is to screen all eligible families with newborns, a substantial proportion of eligible families are not being screened at all.[23] Importantly, the non-screened group of new mothers appears to represent a particularly high risk subset of families in Manitoba as children from these families are twice as likely to enter child protective care than children from screened families.[23] Consequently, generating information on the characteristics of these families and their children may help to identify and intervene with non-screened, high risk families in need of support whose needs are not being met within the existing system.

The primary objective of this study was to compare the characteristics of families who were screened for a history of IPV (past or current) between parenting partners relative to families who were not screened for a history of IPV (including differences in those families not screened at all relative to those who were screened, but missing a response to the violence screen question) using a population-wide sample of Manitoba women. It was hypothesized that missing data on the FF screen would be non-random for both not screened at all families (i.e., missing FF form) and families missing a response to the IPV screen question (i.e., missing IPV item on FF form). Further, compared to families who were screened for IPV, families who were not screened for IPV would represent a high-risk subset of Manitoba families (e.g., young maternal age, low income, low education, poor pregnancy outcomes).

Method

Population and Data Source

Administrative databases housed at the Manitoba Centre for Health Policy in the Manitoba Population Research Data Repository ("the Repository") provided the data for this study. The health and social databases housed in the Repository capture virtually all contacts by Manitoba residents in these systems.[23] Individual-level identifiers (e.g., name, address) are removed, and replaced with an encrypted, numeric personal identifier prior to being deposited in the Repository. Because the personal identifier is encrypted in the same way for each file, data sets are linkable across files and over time.[23] Information from the provincial department of health (Hospital Discharge Abstracts, Medical Services, Health Insurance Registry) and Healthy Child Manitoba (FF Screen) were linked to provide data for the current study. All Manitoba women giving birth to a live singleton infant (weighing at least 400 grams and born at a minimum of 18 weeks gestation) in the province from January 1, 2003 to December 31, 2006 were included in analyses (N=52,710). Data were part of a larger research study that is following the same cohort of women and children for several years to examine longer-term developmental differences based on IPV screen response around the time of delivery. Women living in First Nations (i.e., reserve) communities were excluded (based on postal code at time of birth) from analyses due to differences in screening practices in First Nations, reserve communities in Manitoba.[23,24] This resulted in a final sample of N=45,896 births. This study was approved by Manitoba Health Information Privacy Committee (HIPC No. 2015/2016-31) and the University of Manitoba Human Research Ethics Board (Ethics File No. H2015:355 [HS18922]).

Measures

Violence screen. An item from the FF screen form was used to assess IPV screen status. Specifically, public health nurses document whether or not there was a "current or history of violence between parenting partners" (yes or no). Mothers and their children were divided into three groups based on whether the mother was screened for a history of IPV on the FF screen form: (1) screened for IPV; (2) screened [i.e., FF screen form filled out], but missing a response to the IPV screen question; and (3) not screened at all/no FF screen form.

Sociodemographic characteristics. Sociodemographic covariates included: maternal age at birth (ordinal), marital status (i.e., registered legal marriage or common-law union in health insurance registry vs. no registered union in health insurance registry), area-level income quintile (based on postal code at the time of birth), total number of children in home (including the newborn), and provincial region of residence (i.e., Winnipeg, Southern, Interlake-Eastern, Prairie Mountain-Western, and Northern). A map of provincial regions is available at https://www.gov.mb.ca/health/rha/map.html. Low maternal education (i.e., mother's highest level of education completed is less than a grade 12) and social assistance receipt/financial difficulties (yes or no) were only assessed on the FF screen form; therefore, these variables could not be assessed in comparisons involving mothers who were missing the FF screen form (i.e., the not screened at all group).

Pregnancy-related characteristics. Pregnancy-related covariates included: low number of prenatal care visits (i.e., less than 5 visits prior to delivery), parity (primaparous or multiparous), and maternal prenatal mood or anxiety disorder (yes or no). Maternal prenatal mood or anxiety disorder was based on whether the mother had a diagnosed mood and/or anxiety disorder (as indicated in hospital discharge abstracts, medical claims records, and/or prescription

drug information) in the year prior to delivery.[25] Dichotomous assessments (yes or no) of maternal smoking, alcohol use, and drug use during pregnancy were also documented by public health nurses on the FF screen form; therefore, these variables could not be assessed in comparisons involving mothers who were missing the FF screen form (i.e., not screened at all group).

Birth outcomes. Birth outcomes included: child sex (male or female), preterm birth (i.e., less than 37 weeks gestation), low birth weight (i.e., less than 2500 grams), high birth weight (i.e., more than 4500 grams), small-for-gestational age (i.e., birthweight at or below the 10th percentile based on Canadian standards for sex and gestational age),[26] and large-for-gestational age (i.e., birthweight at or above the 90th percentile based on Canadian standards for sex and gestational age).[26]

Statistical Analyses

Descriptive analyses involved computing the prevalence of screening for a history of violence (past or current) between parenting partners in the study population. Second, group differences (i.e., screened; screened, but missing response to IPV item; not screened at all/missing FF screen form) on sociodemographic covariates, pregnancy-related variables, and birth outcomes were examined using crosstabulations with Chi-square tests of association. Significant differences between groups indicated that missing values were likely non-random. Third, three series of multivariable logistic regression models were computed to examine the extent to which each covariate was associated with each category of missingness: (1) screened, but missing response to IPV screen question vs. screened for IPV; (2) not screened at all/missing FF form vs. screened for IPV; and (3) screened, but missing response to IPV screen question vs. not screened at all/missing FF form. Multivariable logistic regression models adjusted for

sociodemographic covariates available for all three groups (i.e., maternal age, marital status, total number of children in home, area-level income quintile, and provincial region of residence). All of these covariates were significantly associated with IPV screen status at the bivariate level based on results from Chi-square tests of association from cross-tabulations. Sociodemographic covariates were entered into the logistic regression models simultaneously. To account for the increased risk of error associated with multiple comparisons, results at a *p*-value of 0.01 (and corresponding 99% confidence intervals) were considered statistically significant. All data management, programming, and analyses were performed using SAS® version 9.4.

Results

In the study population, 66.7% of the sample was screened for a history (past or current) of violence between parenting partners (among screened women, 2.1% screened positive for a history of past or current IPV); 22.7% were missing a response to the violence screen question on the FF form, and 10.7% were not screened at all as part of the FF screening program.

Crosstabulation analyses indicated a number of significant differences between screen response groups (see Table 3.1), suggesting that missingness on the IPV screen question was likely non-random. Women less than 20 years of age, not in a registered marital or common-law union, living in a lower income area, or living in Winnipeg or the Northern provincial region were less likely to be screened for IPV. Women whose FF forms indicated that they were receiving social assistance and/or having financial difficulties were also less likely to have been screened for IPV on the FF form relative to women not experiencing these difficulties. Pregnancy-related factors also appeared to be related to whether or not a history of IPV was documented on the FF form. Multiparous women, and women with less than five prenatal care visits, with diagnosed prenatal mood and/or anxiety disorders, and who smoked or used drugs

while pregnant were less likely to be screened for IPV. Women with premature births and low birthweight infants were also less likely to be screened for IPV.

The results of the multivariable logistic regression analyses examining the relationship between categories of missingness on the IPV screen question are provided in Table 3.2. Among women who were screened, differences emerged with regard to whether or not the public health nurse filled out the response to the IPV screen question (i.e., missing item on FF form vs. screened for IPV comparisons). In these models, adjusted odds ratios [AORs] greater than 1.0 indicate a higher likelihood of not being asked the violence screen question among women with a FF screen form (and AORs less than 1.0 indicate that the covariate is associated with a higher likelihood of being asked the violence screen question). For the most part, maternal age was not related to whether or not a woman had a documented response to the violence screen question among women who were screened. Women not in a registered marital or common-law union (AOR=1.15), with no children (AOR= 2.14) or more than one child living in the home at the time of birth (AOR=1.14 for 2 children and AOR=1.29 for 3 or more children), with lower education levels (AOR=1.12), or who were receiving social assistance and/or having financial difficulties (AOR=1.56) were significantly less likely to have a documented response to the IPV screen question (despite having a completed FF form). Women who smoked (AOR=1.42), used alcohol (AOR=1.16), or used drugs (AOR=1.68) during pregnancy, had a low number of prenatal care visits (AOR=1.34), or who delivered a preterm (AOR=1.21) or low birthweight (AOR=1.19) infant were also less likely to have a documented response to the IPV screen question (despite having a completed FF form). Conversely, women living in lower income quintile areas (below 60th percentile) and outside of Winnipeg were more likely to have a documented response to the IPV screen question than women living in the highest income

quintile or in Winnipeg (as evidenced by AORs less than 1.0).

In comparisons of missing the FF form (i.e., not screened at all) relative to being screened for IPV on the FF form, women older than 20 years of age were less likely to be missing the FF form than women less than 20 years of age (AORs ranged from 0.47 to 0.60). Women not in a registered marital or common-law union (AOR=1.35), with no children (AOR=5.73) or more than one child living in the home at the time of birth (AOR=1.11 for 2 children and AOR=1.44 for 3 or more children), living in lower area income quintile areas (AORs ranged from 1.19 to 1.48), and living in the Northern provincial region (AOR=1.70) were significantly more likely to be missing the FF form (i.e., not screened at all) than screened for IPV. Women living in other provincial regions (i.e., Southern, Interlake-Eastern, and Prairie Mountain-Western) were less likely to be missing the FF form than screened for IPV (AORs ranged from 0.39 to 0.78) compared to women living in Winnipeg. Women with a low number of prenatal care visits (AOR=1.61), and delivering preterm (AOR=1.46) or low birthweight (AOR=1.52) infants were also more likely to be missing the FF form than screened for IPV.

In comparing characteristics associated with missing an FF form (i.e., not screened at all) to women with a missing response to the IPV screen question on the FF form, women less than 20 years of age were more likely to have a missing FF form (vs. missing item on the FF form) than women 20 years of age and older. Women not in a registered marital or common law union (AOR=1.11), with 0 children living in the home (AOR=2.74), from lower income quintile areas (AORs ranged from 1.23 to 1.56), living in provincial regions outside of Winnipeg (AORs ranged from 2.77 to 13.10), and who had a low number of prenatal care visits (AOR=1.22) or who delivered a low birthweight infant (AOR=1.27) were also more likely to be missing the FF form (i.e., not screened at all).

Discussion

Several novel findings emerged from this study. First, at the time of cohort selection (2003 to 2006), the FF screen in Manitoba was largely successful, with 89.4% of families eligible for screening being assessed by public health nurses with the FF screen. However, the question on a history of violence (past or current) between parenting partners did not appear to be routinely assessed with regard to the implementation of the FF screen. Of all the screened women, 25.4% were missing a response to the IPV screen question on the FF form. This is concerning given that violence during pregnancy is associated with poor pregnancy, maternal, and infant outcomes.[3-9] Second, patterns of missingness on the IPV screen question appeared to be non-random. Young age, low income, single marital status, and substance use are all known risk factors for both IPV[1,10] as well as poor pregnancy outcomes.[27] In this study, these same characteristics appear to be related to categories of missingness with regard to the implementation of the FF screen, regardless of whether missingness was due to a missing IPV item or a missing FF form. Therefore, findings also suggest that a high risk subset of the Manitoba population was not reached by the FF screen (i.e., not screened for any risk factors), and even when screened (i.e., participate in the FF screen), they are less likely to have a documented response to the IPV screen question on the FF form. It is also important to recognize that in families experiencing IPV, it may be difficult for public health nurses to screen for IPV without compromising the new mother's safety.

Overall, women less than 20 years of age, not in a registered marital or common-law union, using substances during pregnancy, living in a lower income area, and who were receiving social assistance or are having financial difficulties were less likely to be screened for IPV. Thus, the FF screen, particularly the IPV screen item, does not seem to be reaching women

who are at most risk of experiencing IPV.[10,28] Covariates associated with not being screened for IPV were similar regardless of whether missingness was due to a missing FF form (i.e., not screened at all) or a missing item on the FF form (i.e., not asked the violence screen question). Focusing attention on improving overall FF screening rates in lower income families may help to identify families living in more disadvantaged circumstances who would likely benefit from additional supports offered by the FF program for families at risk for poor health outcomes.

In addition, women living in Winnipeg had markedly lower IPV screening rates (55.9%) than the other provincial regions (prevalence estimates ranged from 70.2% to 87.1% in most other areas). Among women participating in the FF screen, women living in Winnipeg also were significantly more likely to be missing a documented response to the IPV screen question on the FF form than women living in other provincial regions. It is difficult to speculate why the screening rate, both overall (with the exception of women living in Northern regions) and for IPV specifically, are much lower in Winnipeg than elsewhere. Research aimed at identifying barriers to the implementation of the FF screen in Winnipeg may help to address ways of improving overall screening rates specific to the Winnipeg area.

The higher prevalence of missing FF forms in Northern regions of the province is likely due to the underestimation of women living (or receiving health services) on reserve in northern Manitoba using administrative data. That is, using postal codes to identify First Nations, reserve communities likely underestimates the total number of families living on reserve because, for a few communities, a single postal code represents residents from both First Nations and non-First Nations communities. In these cases, residents were coded as not living on reserve, hence, likely underestimating families living on reserve in this study. Therefore, it seems likely that at least some of the "missing" FF forms in Northern regions of the province (many reserve communities

are located in northern regions of the province) represent families who were not eligible for FF screening.

In this study, women who were not screened for IPV had significantly increased odds of delivering premature and low birthweight infants. The purpose of the FF screen is to identify families at risk of poor child developmental outcomes in order to offer the supports necessary to achieve more positive outcomes,[24] but the implementation of the screen seems to be missing some families most at risk. It is not just that these families are less likely to be visited by public health nurses after the birth of their child, but also, even when visited, they are less likely to have a documented response to the IPV screen question. Families living in more disadvantaged circumstances face more challenges, and, thus, may be less willing or able to make time available for a public health nurse visit after birth, particularly if their newborn infant's health is compromised in some way. This could also help to explain the lower screening rates among young, non-married, and lower income women in this study. Public health nurses may be reluctant to inquire about IPV for many reasons including a lack of training, discomfort, or their own personal history of IPV.[6,13,14,29] As well, women's safety should be paramount in all IPV screening programs, so it may be difficult for public health nurses to screen women living in abusive situations without compromising their safety. Safety concerns could also potentially explain the lower IPV screen rates found in higher risk families.

The strengths of this study include the use a population-wide sample of women, which increases generalizability of the findings. As well, the linkage capabilities of the data housed in the Repository captures medical outcomes for virtually all women and their children residing in Manitoba, and allows one to follow the same sample of women and their children from the prenatal period to delivery regardless of prenatal care access or IPV screen response. However,

the study is also subject to a number of limitations. First, the single item screening question on a history of violence (past or current) between parenting partners cannot distinguish between different types of violence experienced, the exact timing of the violence, or the frequency and severity of the violence among women screening positive for IPV. Second, the exclusion of other important prenatal outcomes (e.g., miscarriage, perinatal death) could not be examined due to the nature of the screening policy in Manitoba (i.e., women are generally not screened until after the birth of a live infant). Fourth, high risk families (e.g., young mothers, mothers using alcohol or drugs during pregnancy) are more likely to have children apprehended at birth. In these cases, no FF screen is completed. Fourth, maternal prenatal mental health problems are limited to the treatment seeking population, and diagnoses are contingent upon accurate coding by physicians and other medical personnel. Fifth, many important risk and protective factors (e.g., pregnancy intention, race/ethnicity, household income, social support) are not available in the administrative databases. Finally, information on the FF screen was from 2003 through 2006, and may not accurately represent current FF screen practices.

Conclusion

The FF screen in Manitoba is largely successful at screening mothers of newborns for risk factors associated with poor child developmental outcomes – almost 90% of all mothers eligible for screening were screened. However, the IPV component of the FF screen was less routinely implemented with only 25.4% of women participating in the FF screen having a documented response to the IPV screen question. This is significant as patterns of missingness on the IPV screen question appear to be non-random with adolescent mothers, non-partnered women, more socioeconomically disadvantaged families, women using substances during pregnancy, and women with poorer pregnancy outcomes being less likely to be screened for IPV

than women at lower risk. In this study, only 5.7% of women were screened with the FF screen form during the prenatal period - the vast majority of women were screened after the birth of their child. However, virtually all women in this study had contact with a health care provider during the prenatal period (i.e., only 0.9% of women had no prenatal care visits documented in their medical records). Incorporating IPV screening into routine prenatal care, rather than only assessing IPV experiences after birth (as with the current FF screen), may help to better identify families in need of support and, ultimately, improve pregnancy outcomes and the longer term trajectory of women and their children.

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Table 3.1. Prevalence of Sociodemographic, Pregnancy-Related, and Birth Outcome Covariates Associated with Categories of Missingness on an Intimate Partner Violence Screen Item				
Covariate	Screened for IPV *N* = 30,558 (66.6%)	Not Screened: Missing Item on FF Form *N* = 10,379 (22.6%)	Not Screened: Missing FF Form *N* = 4,959 (10.8%)	Chi-Square
	% (n)	% (n)	% (n)	
Sociodemographic Covariates				
Maternal age at birth				
Less than 20 years	6.1 (1869)	6.8 (708)	13.0 (646)	
20 to 24 years	20.8 (6352)	18.8 (1953)	23.3 (1155)	
25 to 29 tears	31.6 (9657)	30.0 (3112)	29.0 (1438)	
30 to 34 years	28.0 (8560)	29.4 (3056)	23.0 (1138)	
35 to 39 years	11.4 (3474)	12.3 (1276)	9.8 (486)	
40 years and older	2.1 (646)	2.6 (274)	1.9 (96)	420.94**
Marital status				
Married/common-law	48.1 (14682)	41.3 (4281)	34.4 (1675)	
No registered union	51.9 (15835)	58.7 (6084)	65.6 (3191)	396.14**
Area-level income quintile				
1 (lowest)	19.2 (5844)	24.7 (2556)	26.7 (1319)	
2	20.1 (6139)	19.9 (2061)	20.6 (1018)	
3	21.3 (6486)	17.9 (1858)	18.6 (916)	
4	20.2 (6169)	19.2 (1985)	18.3 (901)	
5 (highest)	19.2 (5847)	18.3 (1898)	15.8 (780)	277.81**
Total children in home				
0	0.3 (87)	0.6 (59)	1.8 (88)	
1	42.5 (12961)	41.8 (4328)	41.3 (2009)	
2	33.9 (10336)	34.8 (3608)	31.1 (1514)	
3 or more	23.4 (7133)	22.9 (2370)	25.8 (1255)	219.66**
Provincial region of residence				
Winnipeg	49.6 (15144)	85.7 (8896)	62.7 (3107)	
Southern	22.3 (6800)	5.0 (517)	10.1 (499)	
Interlake-Eastern	8.4 (2555)	3.4 (352)	7.3 (360)	
Prairie Mountain-Western	15.4 (4708)	4.9 (504)	10.7 (530)	
Northern	4.4 (1351)	1.1 (110)	9.3 (463)	4772.09**
Low maternal education				
No	79.2 (23481)	80.2 (6106)	NA	
Yes	20.8 (6178)	19.8 (1510)	NA	3.72
Social assistance receipt/ financial difficulties				
No	85.1 (25552)	78.1 (6375)	NA	
Yes	14.9 (4486)	21.9 (1787)	NA	226.51**
Pregnancy-Related Covariates				
Low number of prenatal care visits				

No	93.6 (28590)	92.0 (9543)	87.7 (4348)	221.35**
Yes	6.4 (1965)	8.1 (836)	12.3 (610)	
Parity				
Primaparous	41.0 (12542)	39.7 (4119)	40.2 (1991)	
Multiparous	59.0 (18015)	60.3 (6259)	59.9 (2968)	6.45
Maternal prenatal mood or anxiety disorder				
No	87.2 (26644)	85.6 (8879)	85.3 (4152)	
Yes	12.8 (3914)	14.5 (1500)	14.7 (715)	26.12**
Maternal smoking during pregnancy				
No	81.4 (24524)	76.1 (6903)	NA	
Yes	18.6 (5612)	23.9 (2169)	NA	122.51**
Maternal alcohol use during pregnancy				
No	87.7 (26311)	87.1 (7427)	NA	
Yes	12.3 (3688)	12.9. (1098)	NA	2.10
Maternal drug use during pregnancy				
No	96.7 (28918)	94.2 (7856)	NA	
Yes	3.3 (977)	5.8 (485)	NA	115.00**
Birth Outcomes				
Child sex				
Male	51.1 (15627)	51.3 (5325)	51.8 (2553)	
Female	48.9 (14931)	48.7 (5054)	48.5 (2406)	0.25
Preterm birth				
No	94.4 (28838)	92.9 (9640)	91.1 (4516)	
Yes	5.6 (1720)	7.1 (739)	8.9 (443)	93.05**
Low birth weight				
No	96.4 (29459)	95.5 (9911)	93.7 (4646)	
Yes	3.6 (1099)	4.5 (468)	6.3 (313)	85.90**
High birth weight				
No	97.2 (29688)	97.0 (10068)	96.8 (4799)	
Yes	2.9 (870)	3.0 (311)	3.2 (160)	2.43
Small for gestational age				
No	92.7 (28328)	91.9 (9536)	92.2 (4563)	
Yes	7.3 (2227)	8.1 (842)	7.8 (385)	8.08
Large for gestational age				
No	85.8 (26221)	86.3 (8957)	85.7 (4241)	
Yes	14.2 (4334)	13.7 (1421)	14.3 (707)	1.74

Notes. IPV = intimate partner violence; FF = Families First screening form; NA = variable was not available due to missing FF screen form.

*$p < .01$; **$p < .001$

Table 3.2. Relationship between Categories of Missingness on an Intimate Partner Violence Screen Item and Sociodemographic, Pregnancy-Related, and Birth Outcome Covariates			
Covariate	Missing Item on FF Form vs. Screened for IPV[1]	Missing FF Form vs. Screened for IPV[1]	Missing FF Form vs. Missing Item on FF Form[2]
	AOR (99% CI)	AOR (99% CI)	AOR (99% CI)
Sociodemographic Covariates			
Maternal age at birth			
Less than 20 years	1.00	1.00	1.00
20 to 24 years	0.92 (0.80, 1.06)	0.60 (0.52, 0.70)**	0.67 (0.56, 0.80)**
25 to 29 tears	0.92 (0.80, 1.05)	0.53 (0.46, 0.62)**	0.61 (0.51, 0.73)**
30 to 34 years	0.88 (0.76, 1.01)	0.47 (0.40, 0.55)**	0.56 (0.46, 0.67)**
35 to 39 years	0.85 (0.72, 0.99)*	0.48 (0.40, 0.58)**	0.58 (0.47, 0.73)**
40 years and older	0.99 (0.79, 1.26)	0.51 (0.37, 0.71)**	0.51 (0.36, 0.73)**
Marital status			
Married/common-law	1.0	1.00	1.00
No registered union	1.15 (1.07, 1.22)**	1.35 (1.24, 1.48)**	1.11 (1.001, 1.23)*
Area-level income quintile			
1 (lowest)	0.88 (0.80, 0.98)*	1.48 (1.28, 1.71)**	1.56 (1.33, 1.84)**
2	0.84 (0.76, 0.94)**	1.29 (1.12, 1.49)**	1.39 (1.18, 1.64)**
3	0.84 (0.76, 0.93)**	1.23 (1.07, 1.42)**	1.41 (1.19, 1.67)**
4	0.95 (0.86, 1.05)	1.19 (1.03, 1.37)*	1.23 (1.04, 1.45)*
5 (highest)	1.00	1.00	1.00
Total children in home			
0	2.14 (1.33, 3.43)**	5.73 (3.91, 8.63)**	2.74 (1.73, 4.33)**
1	1.00	1.00	1.00
2	1.14 (1.06, 1.22)**	1.11 (1.01, 1.23)*	0.98 (0.87, 1.09)
3 or more	1.29 (1.19, 1.41)**	1.44 (1.29, 1.60)**	1.08 (0.95, 1.22)
Health region of residence			
Winnipeg	1.00	1.00	1.00
Southern Health	0.13 (0.11, 0.14)**	0.39 (0.34, 0.45)**	2.77 (2.32, 3.31)**
Interlake-Eastern	0.22 (0.19, 0.26)**	0.78 (0.66, 0.92)**	3.11 (2.53, 3.83)**

Prairie Mountain	0.19 (0.16, 0.21)**	0.54 (0.47, 0.61)**	2.78 (2.34, 3.31)**
Northern	0.12 (0.09, 0.16)**	1.70 (1.44, 2.00)**	13.10 (9.79, 17.54)**
Low maternal education			
No	1.00	NA	NA
Yes	1.12 (1.002, 1.24)*	NA	NA
Social assistance receipt/ financial difficulties			
No	1.00	NA	NA
Yes	1.56 (1.41, 1.74)**	NA	NA
Pregnancy-Related Covariates			
Low number of prenatal care visits			
No	1.00	1.00	1.00
Yes	1.34 (1.19, 1.52)**	1.61 (1.41, 1.84)**	1.22 (1.04, 1.43)*
Parity			
Primaparous	1.00	1.00	1.00
Multiparous	1.28 (1.10, 1.48)**	1.48 (1.24, 1.76)**	1.18 (0.97, 1.43)
Maternal prenatal mood or anxiety			
No	1.00	1.00	1.00
Yes	1.04 (0.95, 1.14)	1.07 (0.96, 1.21)	1.03 (0.90, 1.18)
Maternal smoking during pregnancy			
No	1.00	NA	NA
Yes	1.42 (1.30, 1.55)**	NA	NA
Maternal alcohol use during pregnancy			
No	1.00	NA	NA
Yes	1.16 (1.04, 1.29)**	NA	NA
Maternal drug use during pregnancy			
No	1.00	NA	NA
Yes	1.68 (1.42, 1.98)**	NA	NA

Birth Outcomes			
Child sex			
Male	1.00	1.00	1.00
Female	1.00 (0.94, 1.06)	0.99 (0.91, 1.07)	1.00 (0.91, 1.10)
Preterm birth			
No	1.00	1.00	1.00
Yes	1.21 (1.06, 1.37)**	1.46 (1.25, 1.70)**	1.13 (0.95, 1.35)
Low birth weight			
No	1.00	1.00	1.00
Yes	1.19 (1.02, 1.38)*	1.52 (1.27, 1.83)**	1.27 (1.03, 1.57)*
High birth weight			
No	1.00	1.00	1.00
Yes	1.12 (0.93, 1.35)	1.11 (0.88, 1.40)	1.03 (0.78, 1.34)
Small for gestational age			
No	1.00	1.00	1.00
Yes	1.05 (0.93, 1.17)	1.01 (0.87, 1.18)	0.97 (0.81, 1.16)
Large for gestational age			
No	1.00	1.00	1.00
Yes	1.00 (0.91, 1.09)	0.99 (0.88, 1.12)	1.00 (0.87, 1.14)

Notes. FF = Families First screening form; IPV = intimate partner violence; NA = variable was not available in data due to missing FF screen form; OR = odds ratio; AOR = adjusted odds ratio (i.e., adjusted for maternal age, marital status, total number of children in home, area-level income, and health region of residence).

[1]Screened for IPV is the reference group for the dependent variable in logistic regression models.

[2]Missing a response to the IPV screen question on the FF form is the reference group for the dependent variable in logistic regression models.

*$p < .01$; **$p < .001$

CHAPTER 4: MATERNAL PRENATAL MORBIDITIES, PREGNANCY COMPLICATIONS, AND PREGNANCY OUTCOMES

Chapter Overview

Manuscript Title: Maternal Prenatal Morbidities, Pregnancy Complications, and Pregnancy Outcomes Associated with Intimate Partner Violence Screen Response in the Early Postpartum Period

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Author Contributions: Tamara Taillieu developed the research questions and design of the study, coded all study variables, conducted the data analysis, interpreted the data, and wrote and revised the manuscript. Douglas Brownridge, Michelle Porter, and Marni Brownell contributed to the conception and design of the study, supervised data analysis, interpreted the data, and edited and revised the manuscript.

Overview: The purpose of this study was to examine differences in sociodemographic covariates, maternal morbidities, pregnancy complications, and adverse pregnancy outcomes based on the documented response to an intimate partner violence (IPV) screen item (i.e., negative IPV screen, positive IPV screen, not screened for IPV) assessed in the early postpartum period.

Abstract

Objective: To examine differences in sociodemographic covariates, maternal prenatal morbidities and complications, and pregnancy outcomes based on response to an intimate partner violence (IPV) screen item documented by public health nurses in early postpartum period.

Methods: Manitoban women giving birth to a live singleton infant from January 1, 2003 to December 31, 2006 were included in analyses (*N*=52,710). Data were part of a longitudinal cohort study examining longer-term maternal and child outcomes. Descriptive statistics and logistic regression were used to examine differences in sociodemographic covariates, prenatal morbidities and complications, and pregnancy outcomes based on IPV screen response (i.e., negative, positive, or not screened).

Results: Women screening positive for IPV (and women who were not screened for IPV) were more likely to be younger, not in a registered marital or common-law union, multiparous, living in lower income area, and to have a low number of prenatal care visits than women screening negative for IPV. Women screening positive for IPV (or who were not screened for IPV) were also significantly more likely to have a mood and/or anxiety disorder and a pregnancy-related hospitalization than women screening negative for IPV. Finally, women screening positive for IPV (or who were not screened for IPV) were significantly more likely to deliver a preterm or low birthweight infant and to have a longer newborn length of stay post-delivery than women screening negative for IPV.

Conclusion: Providing support to women screening positive for IPV (and improving IPV screening rates overall) may help to improve the longer-term developmental trajectory of women and their children.

Introduction

A wide range of prevalence estimates for intimate partner violence (IPV) during pregnancy have been reported in the literature. Differences in estimates vary according to sample characteristics, mode of inquiry, timing of the inquiry, and both the definition and measurement of violence.[1,2] However, most studies find that between 3 and 11% of women will experience physical violence during pregnancy.[2] IPV during pregnancy has been associated with a number of prenatal morbidities and complications,[3-12] as well as more adverse birth outcomes.[3,5-7,10-16] In turn, adverse birth outcomes, such as low birthweight and prematurity, have developmental consequences for the child after birth.[7] Given the magnitude of the problem, identification of factors associated with IPV during pregnancy is necessary to reduce its occurrence and to promote better maternal and child outcomes.

A number of sociodemographic risk factors have been associated with an increased risk of IPV during pregnancy. Similar to research on violence experiences of non-pregnant women, young age,[6,9,10,12,17,18] single or unmarried marital status,[9,10,13,17,18-23] separation or divorce during pregnancy,[18] low education,[6,12,17,18,22.23] low income,[13,14,19-22] and other proxy indicators of socioeconomic disadvantage[16-19] have been associated with an increased risk of IPV during pregnancy. Researchers have also speculated that abusive partners may interfere with a pregnant woman's access to prenatal care.[21] For example, late entry into prenatal care[3,6,17,25] and inadequate prenatal care[3,7,14,19,21] have both been associated with an increased risk of IPV during pregnancy. From a *social determinants of health* perspective, socioeconomic disadvantage is known to have a negative impact on health status overall[26] and has also been linked more specifically to adverse pregnancy outcomes.[27]

Women experiencing IPV during pregnancy are also more likely to use tobacco,[8-

[10,12,17,23,28] alcohol,[4,5,8,9,14,23,28] and/or drugs[4,8,9,21,28] during pregnancy compared to women who do not experience violence during pregnancy. These behavioural risks not only jeopardize the pregnant woman's health status, but are known risk factors for poor pregnancy outcomes.[3,7,13] IPV during pregnancy has also been associated with a number of maternal prenatal morbidities and complications including gestational diabetes and hypertension,[12] kidney and/or urinary tract infection,[11,12] preterm labour,[5,6,8,11,12] placenta problems,[4,6,11,12] premature rupture of membranes,[6,10,11] antepartum and postpartum hemorrhage,[6,9,10] and caesarean delivery.[6,11] Women experiencing IPV during pregnancy also report increased use of health services,[1] more antennal hospitalizations,[12] and longer maternal hospital stay after delivery[8] compared to women who do not experience IPV during pregnancy. Finally, IPV during pregnancy has also been linked to a number of adverse birth outcomes such as low birth weight,[5,6,10,11,12,14,15] premature delivery,[5,6,11,16] intrauterine growth restriction,[9] small-for-gestational age infants,[13,15,16] low 5 minute Apgar scores,[5] fetal distress,[6,11] and neonatal intensive care unit admissions.[5,12] Early identification and appropriate referral of pregnant women experiencing IPV may help to reduce these negative sequelae.

In Manitoba, public health policy, as part of the Families First (FF) program, is for public health nurses to screen families with newborns in the early postpartum period (i.e., within one week post-discharge) for a number of risk factors (e.g., prematurity, low birthweight, maternal young age, maternal substance use during pregnancy) associated with poor child developmental outcomes.[29] The FF screen also includes a question pertaining to a past or current history of violence between parenting partners.[29] Families deemed to be at higher risk by the FF screen (i.e., 3 or more risk factors present) can be referred to additional services (e.g., home visitation, mental health services, financial services) as part of the larger FF program. Women living in

First Nations (i.e., reserve) communities are not eligible for the FF screen due to jurisdictional issues related to health care delivery in Manitoba. For families living in First Nations (i.e., reserve) communities, health care falls under federal jurisdiction rather than provincial jurisdiction, and, as such, these families are not screened as part of the provincial FF program. All other Manitoban families with newborns are eligible for screening as part of the FF program. Approximately 83% of eligible families (i.e., families living off reserve) with newborns are screened by public health nurses with the FF screen,[30] suggesting that a substantial number of eligible families are not being screened.[29] This is important given research indicating that non-screened families appear to represent a particularly high risk subset of families in Manitoba.[29]

Most of the research examining the relationship between IPV during pregnancy and pregnancy outcomes has been conducted in the United States, and differences in national health care systems suggest that these findings may not generalize to the Canadian context. As well, the overreliance on small, non-representative, and high risk samples in this area further limits the generalizability of extant findings. Sample size restrictions often preclude the examination of low base rate events and many studies lack sufficient power to detect differences between women experiencing pregnancy violence and women who do not experience pregnancy violence. Finally, the relationship between violence during pregnancy and pregnancy outcomes has not been adequately addressed in Canadian research to date.

Therefore, the objectives of this study were to examine the relationship between a history of violence (past or current) between parenting partners and sociodemographic and prenatal covariates, maternal prenatal morbidities and complications, and pregnancy outcomes using a population-wide sample of Manitoban women. An important secondary objective was to examine these same characteristics and relationships in the subset of women who were not

screened for IPV relative to women screening negative for IPV. It was hypothesized that women with a positive IPV screen (and women who were not screened for IPV) in the early postpartum period would evidence greater sociodemographic risk, maternal prenatal morbidities, pregnancy complications, and adverse pregnancy outcomes than women screening negative for IPV in the early postpartum period.

Method

Population and Data Source

Administrative databases housed at the Manitoba Centre for Health Policy in the Manitoba Population Health Research Repository ("the Repository") provided the data for this study. These databases capture virtually all contacts by Manitoba residents involved in these systems.[29] Databases are linkable via an encrypted, numeric personal identifier that is encrypted in the same way across files.[29] Linkage capabilities also make it possible (via the personal identifier) to follow a cohort of individuals both retrospectively and prospectively. Information from Manitoba Health (i.e., hospital discharge abstracts, physician visits, prescription drug information, health insurance registry) and Healthy Child Manitoba (i.e., FF Screen) were linked to provide data for the current study.

All Manitoban women giving birth to a live singleton infant (weighing at least 400 grams and born at a minimum of 18 weeks gestation) in the province from January 1, 2003 to December 31, 2006 were included in analyses (N=52,710). Data were part of a larger longitudinal cohort study examining the longer-term developmental trajectory of women and their children into the postpartum period based on IPV screen response around the time of delivery. Women living in First Nations (i.e., reserve) communities were excluded from analyses due to differences in screening practices in First Nations communities in Manitoba[29,30]

(i.e., an area-level exclusion based on postal code at the time of birth). A final sample of *N*=45,896 was used for the analyses described below. This study was approved by the Manitoba Health Information Privacy Committee (HIPC No. 2015/2016-31) and the University of Manitoba Human Research Ethics Board (Ethics File No. H2015:355 [HS18922]).

Measures

Violence screen. Evidence suggests that IPV before pregnancy is strongly associated with IPV during pregnancy,[2,31] and that less than 1% of women with a history of IPV report experiencing violence for the first time in the postpartum period.[31] Therefore, an IPV screen item on the FF screen form was used as a proxy indicator of prenatal violence exposure. Specifically, public health nurses document whether or not there was a "current or history of violence between parenting partners" (yes or no) on the FF screen form in the early postpartum period (i.e., approximately one week post-discharge). Mothers and their children were divided into three groups based on response to the IPV screen item documented by the public health nurse on the FF screen form: (1) Negative screen for IPV; (2) Positive screen for IPV; and (3) Missing screen (i.e., either missing item on the FF form or missing FF form entirely).

Sociodemographic covariates. Sociodemographic covariates assessed at the time of birth (and that were also available for the missing screen group) included: maternal age (ordinal), marital status (i.e., registered legal marriage or common-law union in health insurance registry vs. no registered union in health insurance registry), area-level income quintile (based on postal code at the time of birth), total number of children in home (including the newborn), parity (primaparous vs. multiparous), and provincial region of residence (i.e., Winnipeg, Southern, Interlake-Eastern, Prairie Mountain-Western, and Northern). A map of provincial regions is available at https://www.gov.mb.ca/health/rha/map.html.

Prenatal care visits. Low number of prenatal care visits (yes or no) was defined as having less than five prenatal care visits prior to delivery.[32]

Maternal prenatal morbidities and complications. Maternal prenatal morbidities included: diagnosed maternal prenatal mood and/or anxiety disorder (yes or no), diagnosed maternal prenatal hypertension (yes or no), and diagnosed maternal prenatal diabetes (yes or no) in the year prior to delivery. Pregnancy and delivery complications included: any antenatal pregnancy-related hospitalization (yes or no), placenta previa/abruptio placenta (yes or no), breech birth/other fetal malpresentation (yes or no), induction of labour (yes or no), assisted delivery using forceps or vacuum extraction (yes or no), caesarean delivery (yes or no), fetal distress (yes or no), and maternal length of stay post-delivery (less than 3 days or 3 days or more). Pregnancy-related hospitalizations included any hospitalizations for: threatened preterm labour, antepartum hemorrhage, diabetes, hypertension, genitourinary complications, vomiting, premature rupture of membranes, known or suspected fetal problems, cervical incompetence, or abdominal pain in the gestation period.[32] Details on the distribution of individual types of pregnancy-related hospitalizations (and comparisons across IPV screener response groups) are available in Table S1 of the online supplementary material (p. 117 of this thesis). As well, a full list of diagnostic codes (hospital abstracts and medical claims) and Anatomical Therapeutic Chemical (ATC) codes (prescription drug information) used to compute diagnoses for all variables in this study are available in Appendix B. Dichotomous assessments (yes or no) of maternal smoking, alcohol use, and drug use during pregnancy were also documented by public health nurses on the FF screener form; however, these variables could not be assessed in comparisons involving mothers who were missing the FF screener form (i.e., not screened group).

Pregnancy outcomes. Pregnancy outcomes included: child sex (male or female), preterm birth (i.e., less than 37 weeks gestation), low birth weight (i.e., less than 2500 grams), high birth weight (i.e., more than 4500 grams), small-for-gestational age (i.e., birthweight at or below the 10th percentile based on Canadian standards for sex and gestational age),[33] large-for-gestational age (i.e., birthweight at or above the 90th percentile based on Canadian standards for sex and gestational age),[33] low 5 minute Apgar score (i.e., Apgar score of less than 7), admission to a neonatal intensive or special care unit (yes or no), and newborn length of stay (less than 3 days or 3 days or more).

Statistical Analyses

First, descriptive analyses were computed to examine the distribution of responses to the FF screen question on a history of violence (past or current) between parenting partners in the study population (i.e., negative IPV screen, positive IPV screen, and not screened for IPV). Next, cross-tabulations were computed to examine the distribution of sociodemographic covariates, prenatal care visits, maternal prenatal morbidities and complications, and pregnancy outcomes by IPV screener response status. Third, two series of logistic regression models were run to examine the association of sociodemographic covariates (independent variables) with IPV screen response category (dependent variable): (1) positive IPV screen vs. negative IPV screen, and (2) not screened for IPV vs. negative IPV screen. Fourth, two series of multivariable logistic regression models were run to examine the association between prenatal care visits, maternal prenatal morbidities, pregnancy complications, and pregnancy outcomes (dependent variables) with IPV screen response categories (independent variables): (1) positive IPV screen vs. negative IPV screen, and (2) not screened for IPV vs. negative IPV screen. Multivariable models adjusted for sociodemographic covariates (i.e., maternal age, marital status, total number of children in

home, parity, area-level income quintile, and provincial region of residence) that were available for all three groups. All of the sociodemographic covariates were significantly associated with IPV screen status at the bivariate level based on results from the Wald Chi-square tests of parameter estimates from the unadjusted logistic regression models. Sociodemographic covariates (in addition to the specific independent variable of interest) were entered into the logistic regression models simultaneously. To account for the increased risk of error associated with multiple comparisons (and the large sample size), results at a *p*-value of 0.01 (and corresponding 99% confidence intervals) were considered statistically significant. All data management, programming, and analyses were performed using SAS® version 9.4.

Results

In this study, 66.7% of mothers of newborns were screened for a history (past or current) of violence between parenting partners. In the screened group, 97.9% screened negative for IPV and 2.1% screened positive for IPV. In total, 33.3% of the study population was not screened for IPV (22.7% due to a missing item on the FF form and 10.7% due to not being screened in the FF program at all).

The results from the crosstabulations and logistic regression analyses examining the association between sociodemographic and covariates and IPV screen response group are provided in Table 4.1. In the positive IPV screen versus negative IPV screen comparisons, women more than 20 years of age had significantly lower odds of screening positive for IPV than women less than 20 years of age (Odds ratios [ORs] ranged from 0.18 to 0.62). Women not in a registered marital or common-law union (OR=10.69, 99% CI=7.40-15.43), living in a lower income quintile area (i.e., less than 60th percentile; ORs ranged from 1.66 to 4.68), who were multiparaous (OR=1.79, 99% CI=1.43, 2.25), and who had no children (OR=4.23, 99% CI=1.41-

12.76) or 3 or more children (OR=1.81, 99% CI=1.41-2.32) living in their home had significantly higher odds of screening positive for IPV than women in registered marital or common-law unions, living in the highest income quintile area, who were primaparous, and those with only the newborn in the home. Women living in the Southern (OR=0.42, 99% CI=0.31-0.58), Interlake-Eastern (OR=0.64, 99% CI=0.42-0.97), and Prairie Mountain-Western (OR=0.52, 99% CI = 0.37-073) regions of the province had significantly decreased odds of screening positive for IPV than women living in Winnipeg. Women living in the Northern region (OR=1.81, 99% CI=1.27-2.59) had significantly higher odds of screening positive for IPV than women living in Winnipeg.

The same pattern of findings was evident when comparing women who were not screened for IPV to women with a negative screen for IPV. Women more than 20 years of age had significantly lower odds of not being screened than women less than 20 years of age (ORs ranged from 0.62 to 0.75), and women not in a registered marital or common-law union (OR = 1.50, 99% CI=1.42-1.58), living in a lower income quintile area (i.e., less than 40th percentile; ORs ranged from 1.11 to 1.50), who were multiparous (OR=1.06, 99% CI=1.01-1.12), and who had no children (OR=3.64, 99% CI=2.54-5.21) living in their home had significantly higher odds of not being screening for IPV than women in registered marital or common-law unions, living in the highest income quintile area, who were primaparous, and those with only the newborn in the home. Women living in provincial regions outside of Winnipeg had decreased odds of not being screened for IPV than women living in Winnipeg (ORs ranged from 0.19 to 0.55).

The results from the crosstabulations and multivariable logistic regression analyses examining the association between maternal prenatal morbidities and pregnancy complications and IPV screen response groups are provided in Table 4.2. In the positive IPV screen versus

negative IPV screen comparisons, women screening positive for IPV were significantly more likely to have a low number of prenatal care visits (AOR [adjusted odds ratio]=2.30, 99% CI =1.76-3.02) than women screening negative for IPV. Women with a positive IPV screen had significantly higher odds of smoking (AOR=2.78, 99% CI=2.30-3.51), alcohol use (AOR=2.90, 99% CI=2.30-3.66), and drug use (AOR=4.24, 99% CI=3.19-5.65) during pregnancy than women screening negative for IPV. Women screening positive for IPV also had significantly higher odds of having a diagnosed mood and/or anxiety disorder in the year before delivery (AOR=2.59, 99% CI=2.05-3.27), a pregnancy-related hospitalization (AOR=1.37, 99% CI=1.10-1.69), and a maternal length of stay post-delivery of 3 or more days (AOR=1.34, 99% CI=1.07-1.66) than women screening negative for IPV.

For the not screened for IPV versus negative IPV screen comparisons, women who were not screened for IPV were more likely to have a low number of prenatal care visits (AOR=1.44, 99% CI=1.30-1.59) than women screening negative for IPV. Women who were not screened for IPV had significantly higher odds of having a pregnancy-related hospitalization (AOR=1.08, 99% CI=1.02-1.14) than women screening negative for IPV. Maternal substance (i.e., smoking, alcohol, or drug use) use during pregnancy was not assessed for women not screened by the FF screen.

The results from the crosstabulations and multivariable logistic regression analyses examining the association between pregnancy outcomes and IPV screen response group are provided in Table 4.3. In the positive IPV screen versus negative IPV screen comparisons, women with a positive IPV screen had significantly increased odds of delivering preterm (AOR=1.98, 99% CI= 1.41-2.79) and low birthweight (AOR=2.15, 99% CI=1.44-3.20) infants than women screening negative for IPV. The newborns of women screening positive for IPV

had significantly increased odds of having a length of stay post-delivery of 3 or more days (vs. less than 3 days; AOR=1.52, 99% CI=1.22-1.90) than newborns of women screening negative for IPV.

In the not screened for IPV versus negative IPV screen comparisons, women who were not screened for IPV had significantly increased odds of delivering a preterm (AOR=1.30, 99% CI=1.16-1.44) or low birthweight (AOR=1.32, 99% CI=1.16-1.51) infant than women screening negative for IPV. Newborns of mothers who were not screened for IPV also had significantly increased odds of having a 5 minute Apgar score of less than 7 (AOR=1.70, 99% CI=1.34-2.14), to be admitted to a neonatal intensive or special care unit (AOR=1.23, 99% CI=1.09-1.39), and to have a length of stay greater than 3 days (AOR=1.08, 99% CI=1.02-1.14) than newborns of mothers with a negative IPV screen.

A post-hoc analysis was conducted to examine whether the association between a positive IPV screen (vs. negative IPV screen) and adverse birth outcomes (i.e., prematurity, low birthweight, or newborn length of stay greater than 3 days) was attributable to maternal prenatal characteristics (i.e., diagnosed mood and/or anxiety disorder, any pregnancy-related hospitalization, or smoking, alcohol, or drug use during pregnancy) that were significantly related to a positive IPV screen (see Table 4.4). For these analyses, a series of multivariable logistic regression models were run to examine the extent to which each maternal prenatal characteristic reduced the odds of each adverse outcome among women screening positive for IPV (relative to women screening negative for IPV). Therefore, only independent variables that were significantly associated with a positive IPV screen (relative to a negative IPV screen) based on Wald chi-square tests of parameter estimates from the multivariate logistic regression models (as we were interested in effects that were independent of sociodemographic differences between

the positive and negative IPV screen groups) were considered in analyses. All models adjusted for sociodemographic covariates (i.e., maternal age, marital status, total number of children in home, parity, area-level income quintile, and provincial region of residence). Model 1 includes estimates adjusted for sociodemographic variables. In addition to sociodemographic adjustments, Model 2 adjusted for any maternal diagnosed mood and/or anxiety disorder in the year prior to delivery; Model 3 adjusted for any pregnancy-related hospitalization in the gestation period; Model 4 adjusted for maternal substance use (i.e., smoking, alcohol, or drug use; three separate covariates all entered into the model simultaneously) during pregnancy; and Model 5 entered all of the covariates simultaneously. As shown in Table 4.4, the inclusion of each of the covariates into the models (Models 2 through 4) attenuated the association between a positive IPV screen and each adverse birth outcome. When all covariates were entered into the model simultaneously (Model 5), a positive IPV screen remained independently associated with increased odds of delivering a preterm infant (AOR=1.58, 99% CI=1.07-2.33) and a newborn length of stay greater than 3 days (AOR=1.34, 99% CI=1.05-1.71).

Discussion

There are several novel findings from this study. First, in a population-wide sample of women giving birth in Manitoba, 2.1% of screened women screened positive for a history (past or current) of violence between parenting partners. This is important given that we also found that women screening positive for IPV were more likely to have a low number of prenatal care visits, to have a diagnosed mood and/or anxiety disorder in the year prior to delivery, to have a pregnancy-related hospitalization, to deliver preterm and low birthweight infants, and to deliver newborns with a longer hospital stay after delivery than women screening negative for IPV. Identifying and intervening with women experiencing IPV earlier (e.g., prenatally) rather than

later (i.e., after birth) might help to reduce some of the negative outcomes associated with violence during pregnancy. Second, a substantial proportion of women with newborns were not screened for IPV (33.3%) as part of the FF screen (either due to a missing response to the IPV item on the FF form or not being screened at all). Women who were not screened for IPV also tended to have more maternal prenatal morbidities and adverse pregnancy outcomes than women screening negative for IPV.

Sociodemographic covariates associated with a positive IPV screen are similar to risk factors associated with IPV more generally. Young age, non-married marital status, and lower socioeconomic status have all been associated with an increased risk for IPV among both pregnant and non-pregnant women.[2,6,9,10,12-14,17-23] In this study, these same sociodemographic characteristics were also associated with a greater likelihood of not being screened for IPV. Violence during pregnancy is one of the strongest predictors of postpartum violence,[2] and research has shown that children of non-screened families in Manitoba are twice as likely to enter child protective care than children from screened families,[29] which could be related to the increased risk of pregnancy violence continuing into the postpartum period. However, in families with IPV, it may also be difficult for public health nurses to ask women about IPV without compromising their safety. Finding safe and effective ways to intervene with women at higher risk of IPV whose needs are not being met within the existing system remains an important avenue for future research.

Women screening positive for IPV also had increased odds of being diagnosed with a mood and/or anxiety disorder in the year before delivery than women screening negative for IPV. The relationship between IPV during pregnancy and an increased risk of depression is fairly well established in the literature.[24,25,34-36] A large body of research also exists linking

violence experiences before or during pregnancy to an increased risk of depression in the postpartum period.[34-39] Postpartum depression is one of the most common mental disorders associated with childbirth and is a significant health concern.[40] As a matter of fact, population attributable fractions calculated from various studies suggest that the incidence of postpartum depression might decrease by 10.6% to 23.6% if violence against pregnant women was eliminated.[35,39,40]

Women screening positive for IPV, and non-screened women, also had significantly increased odds of having an antenatal pregnancy-related hospitalization, and to deliver a preterm or low birthweight infant than women with a negative IPV screen. This supports findings from other research.[5,6,10-12,14,15] Given known associations of infant prematurity and low birthweight with less optimal child outcomes,[7,41] providing early supports to these families may help to ameliorate the effects of adverse birth outcomes on long-term child developmental health. Newborns of women with positive IPV screens and non-screened women also had a greater length of hospital stay post-delivery than women screening negative for IPV, likely also indicting more compromised health status at birth. Additionally, the newborns of non-screened women had increased odds of having a low 5 minute Apgar score and to be admitted to a neonatal intensive care or special care unit than women screening negative for IPV. Socioeconomic differences between the negative IPV screen and non-screened groups could help to explain these adverse birth outcomes, particularly given the strong association of sociodemographic disadvantage with compromised health.[26,27] Also, women experiencing more challenging births (i.e., preterm, low birthweight, longer newborn length of stay, low newborn Apgar scores, and newborn neonatal intensive care and special care unit admissions) may be so concerned with their newborns' health that their ability to make time available to meet with public health nurses

shortly after birth is compromised; hence, offering a potential explanation for why this group of women is not screened as part of the FF program. However, both women screening positive for IPV and non-screened women seem to represent families in most need of additional support.

The mechanism linking IPV to adverse pregnancy outcomes is not well understood. Violence can be targeted at the pregnant women's abdomen, which may represent a direct causal pathway linking violence to adverse fetal outcomes.[3] Abdominal trauma may cause placental damage or premature rupture of membranes, which could then lead to preterm delivery and low birth weight.[9] IPV during pregnancy is also associated with stress,[15,24,25] and it seems likely that stress acts as the mediator between violence, physiological consequences, and poor pregnancy outcomes.[15,21] For example, stress affects the neuroendocrine system and hypothalamic-pituitary-adrenal production, which can restrict fetal growth and contribute to preterm labour.[3,15] In a study examining the neuroendocrine response to violence during pregnancy and pregnancy outcome, evidence was found for both a direct (via abdominal trauma) and an indirect (via stress as assessed by maternal salivary cortisol levels) pathway linking violence during pregnancy to decreased gestational age at delivery and low birth weight.[15]

Stress is also associated with engagement in risky health behaviours such as substance use during pregnancy which, in turn, is associated with low birth weight and preterm birth.[1,3,21,25] In this study, women screening positive for IPV also had significantly increased odds of smoking, alcohol use, and/or drugs use during pregnancy compared to women screening negative for IPV. Results from the post-hoc analysis suggested that the relationships between a positive IPV screen and premature delivery and longer newborn length of stay are not fully accounted for by maternal prenatal mental health problems, pregnancy-related hospitalizations, or maternal substance use during pregnancy. Future research aimed at delineating the specific pathways

through which IPV during pregnancy leads to adverse birth outcomes could be useful in the development of more targeted intervention strategies aimed at ameliorating the negative effects of prenatal violence exposure. It is also important to note that prenatal substance use among non-screened women could not be assessed in this study. Information on substance use in this specific population may help to clarify the profile of women not being screened in the FF program.

The strengths of this study include the use a population-wide sample of women that does not rely on prenatal care access or FF screen participation to generate comparison groups. As well, the linkage capabilities of data housed in the Repository allow the same sample to be followed from the prenatal period to delivery. Importantly, we were also able to examine the outcomes of women who did not have a completed FF screen or were missing the IPV screen item on the FF form. However, this study is also subject to a number of limitations. First, use of a single screen item to assess IPV needs to be viewed as an important limitation. The single item IPV screen likely underestimates the true prevalence of IPV in the study population. The IPV screen item also does not differentiate between types of violence, the timing of the violence, or the frequency and severity of the violence. Second, because the FF screen is primarily implemented after the birth of a live infant, many important prenatal outcomes (e.g., miscarriage, fetal death) could not be examined in relation to the IPV screen item. Third, many important risk and protective factors related to IPV during pregnancy (e.g., pregnancy intention, household income, race/ethnicity, social support) were not available in the data. Fourth, assessed maternal health conditions are limited to the treatment seeking population, and diagnoses are contingent upon accurate coding by physicians and other medical personnel. Finally, the baseline FF screen information was from 2003-2006, and may not accurately represent current screen practices.

Conclusion

Ensuring optimal maternal and child health should be an integral goal of any population health strategy.[42] The FF screen implemented in Manitoba is designed to help achieve this goal by identifying and offering support to families at a higher risk of more adverse child developmental outcomes.[29] In this study, women screening positive for IPV, as well as women who are not screened for IPV, appear to experience more maternal morbidities, pregnancy complications, and adverse pregnancy outcomes than women screening negative for IPV. Providing support to women screening positive for IPV may help to improve the longer-term developmental trajectory of these women and their children. However, an issue with the FF screen is that, although many new mothers are screened in the program (89.3% of new mothers were screened), the question on IPV is less consistently documented on the FF form (22.7% of new mothers were screened, but missing a response to the violence screener question). This is concerning given that women who were not screened for IPV also experienced poorer pregnancy outcomes. Identifying factors that impede the universal implementation of the IPV screening question as part of the FF program remains an important avenue for future research.

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Table 4.1. Sociodemographic Covariates by Intimate Partner Violence Screen Response					
Covariate	**Negative IPV Screen** *N* = 29,902	**Positive IPV Screen** *N* = 656	**Not Screened** *N* = 15,338	**Positive IPV Screen vs. Negative IPV Screen[a]**	**Not Screened vs. Negative IPV Screen[a]**
	% (n)	% (n)	% (n)	OR (99% CI)	OR (99% CI)
Maternal age at birth					
Less than 20 years	5.9 (1757)	17.1 (112)	8.8 (1354)	1.00	1.00
20 to 24 years	20.4 (6110)	36.9 (242)	20.3 (3108)	0.62 (0.46, 0.84)**	0.66 (0.59, 0.74)**
25 to 29 years	31.8 (9504)	23.3 (153)	29.7 (4550)	0.25 (0.18, 0.35)**	0.62 (0.56, 0.69)**
30 to 34 years	28.3 (8458)	15.6 (102)	27.3 (4194)	0.19 (0.13, 0.27)**	0.64 (0.58, 0.72)**
35 to 39 years	11.5 (3435)	6.0 (39)	11.5 (1762)	0.18 (0.11, 0.29)**	0.67 (0.59, 0.75)**
40 years and older	2.1 (638)	1.2 (8)	2.4 (370)	0.20 (0.08, 0.51)**	0.75 (0.62, 0.91)**
Marital status					
Married/Common-law	49.0 (14628)	8.2 (54)	39.1 (5956)	1.00	1.00
No registered union	51.0 (15234)	91.8 (601)	60.9 (9275)	10.69 (7.40, 15.43)**	1.50 (1.42, 1.58)**
Area-level income quintile					
1 (lowest)	18.7 (5578)	40.7 (266)	25.3 (3875)	4.68 (3.22, 6.80)**	1.50 (1.39, 1.63)**
2	20.2 (6011)	19.6 (128)	20.1 (3079)	2.09 (1.39, 3.14)**	1.11 (1.02, 1.20)*
3	21.4 (6378)	16.5 (108)	18.1 (2774)	1.66 (1.09, 2.53)*	0.94 (0.86, 1.02)
4	20.4 (6076)	14.2 (93)	18.9 (2886)	1.50 (0.98, 2.31)	1.03 (0.94, 1.12)
5 (highest)	19.4 (5788)	9.0 (59)	17.5 (2678)	1.00	1.00
Total children in home					
0	0.3 (81)	0.9 (6)	1.0 (147)	4.23 (1.41, 12.76)**	3.64 (2.54, 5.21)**
1	42.7 (12738)	34.1 (223)	41.6 (6337)	1.00	1.00
2	33.9 (10129)	31.6 (207)	33.6 (5122)	1.17 (0.91, 1.50)	1.02 (0.96, 1.08)
3 or more	23.2 (6914)	33.4 (219)	23.8 (3625)	1.81 (1.41, 2.32)**	1.05 (0.99, 1.13)
Parity					
Primaparous	41.3 (12357)	28.2 (185)	39.8 (6110)	1.00	1.00
Multiparous	58.7 (17544)	71.8 (471)	60.2 (9227)	1.79 (1.43, 2.25)**	1.06 (1.01, 1.12)*
Provincial region of residence					
Winnipeg	49.3 (14740)	61.6 (404)	78.3 (12003)	1.00	1.00
Southern	22.5 (6722)	11.9 (78)	6.6 (1016)	0.42 (0.31, 0.58)**	0.19 (0.17, 0.20)**
Interlake-Eastern	8.4 (2511)	6.7 (44)	4.6 (712)	0.64 (0.42, 0.97)*	0.35 (0.31, 0.39)**

Prairie Mountain-Western	15.5 (4642)	10.1 (66)	6.7 (1034)	0.52 (0.37, 0.73)**	0.27 (0.25, 0.30)**
Northern	4.3 (1287)	9.8 (64)	3.7 (573)	1.81 (1.27, 2.59)**	0.55 (0.48, 0.63)**

Notes. IPV = intimate partner violence.

[a]A negative IPV screen is the reference group for the dependent variable in the logistic regression model.

*$p < .01$; **$p < .001$

Table 4.2. Relationship between Prenatal Care Visits, Maternal Prenatal Morbidities, and Pregnancy Complications and Intimate Partner Violence Screen Response					
Morbidity or Complication	**Negative IPV Screen** *N* = 29,902	**Positive IPV Screen** *N* = 656	**Not Screened** *N* = 15,338	**Positive IPV Screen vs. Negative IPV Screen[a]**	**Not Screened vs. Negative IPV Screen[a]**
	% (n)	% (n)	% (n)	AOR (95% CI)	AOR (95% CI)
Low number of prenatal care visits					
No	93.9 (28070)	79.3 (520)	90.6 (13891)	1.00	1.00
Yes	6.1 (1829)	20.7 (136)	9.4 (1446)	2.30 (1.76, 3.02)**	1.44 (1.30, 1.59)**
Smoking during pregnancy					
No	82.3 (24270)	40.3 (5235)	NA	1.00	NA
Yes	17.7 (254)	59.8 (377)	NA	2.78 (2.20, 3.51)**	NA
Alcohol use during pregnancy					
No	88.2 (25933)	62.2 (3458)	NA	1.00	NA
Yes	11.8 (378)	37.8 (230)	NA	2.90 (2.30, 3.66)**	NA
Drug use during pregnancy					
No	97.2 (28458)	76.0 (832)	NA	1.00	NA
Yes	2.8 (460)	24.0 (145)	NA	4.24 (3.19, 5.65)**	NA
Maternal mood or anxiety disorder					
No	87.6 (26182)	70.4 (462)	85.5 (13031)	1.00	1.00
Yes	12.4 (3720)	29.6 (194)	14.5 (2215)	2.59 (2.05, 3.27)**	1.08 (1.00, 1.17)
Maternal hypertension					
No	89.3 (26714)	91.0 (597)	90.7 (13831)	1.00	1.00
Yes	10.7 (3188)	9.0 (59)	9.3 (1415)	1.00 (0.69, 1.43)	0.94 (0.86, 1.03)
Maternal diabetes					
No	97.2 (29063)	96.7 (634)	96.7 (14746)	1.00	1.00
Yes	2.8 (839)	3.4 (22)	3.3 (500)	1.36 (0.76, 2.44)	1.12 (0.96, 1.31)
Placenta previa/					

Abruptio placenta					
No	98.1 (29338)	98.0 (643)	98.0 (14940)	1.00	1.00
Yes	1.9 (564)	2.0 (13)	2.0 (306)	1.01 (0.48, 2.12)	1.08 (0.89, 1.31)
Any pregnancy-related hospitalization					
No	66.6 (19925)	60.2 (395)	65.7 (10014)	1.00	1.00
Yes	33.4 (9977)	39.8 (261)	34.3 (5232)	1.37 (1.10, 1.69)**	1.08 (1.02, 1.14)**
Breech birth/other malpresentation					
No	96.5 (28848)	96.7 (634)	96.6 (14820)	1.00	1.00
Yes	3.5 (1054)	3.4 (22)	3.4 (518)	1.48 (0.83, 2.64)	1.03 (0.89, 1.20)
Induction of labour					
No	73.4 (21932)	78.1 (512)	74.5 (11419)	1.00	1.00
Yes	26.7 (7970)	22.0 (144)	25.6 (3919)	0.84 (0.65, 1.08)	1.00 (0.94, 1.07)
Assisted vaginal delivery					
No	92.9 (27774)	95.7 (628)	93.2 (14300)	1.00	1.00
Yes	7.1 (2128)	4.3 (28)	6.8 (1038)	0.81 (0.48, 1.36)	0.95 (0.86, 1.06)
Caesarean delivery					
No	79.1 (23655)	84.5 (554)	80.0 (12276)	1.00	1.00
Yes	20.9 (6247)	15.6 (102)	20.0 (3062)	0.97 (0.72, 1.29)	1.05 (0.98, 1.12)
Fetal distress					
No	91.9 (27469)	94.5 (620)	92.7 (14125)	1.00	1.00
Yes	8.1 (2433)	5.5 (36)	7.4 (1121)	0.76 (0.48, 1.20)	0.96 (0.87, 1.07)
Maternal length of stay post-delivery					
Less than 3 days	53.5 (16000)	53.5 (351)	54.6 (8368)	1.00	1.00
3 days or more	46.5 (13902)	46.5 (305)	45.4 (6970)	1.34 (1.07, 1.66)**	1.02 (0.97, 1.08)

Notes. IPV = intimate partner violence; AOR = odds ratio adjusted for sociodemographic variables (i.e., maternal age, marital status, total number of children in home, parity, area-level income quintile, provincial region of residence); NA = variable not available due to missing Families First screen form.

[a]A negative IPV screen is the reference group for the independent variable in the logistic regression model.

*$p < .01$; **$p < .001$

Table 4.3. Relationship between Pregnancy Outcomes and Intimate Partner Violence Screen Response					
Pregnancy Outcome	**Negative IPV Screen** *N* = 29,902	**Positive IPV Screen** *N* = 656	**Not Screened** *N* = 15,338	**Positive IPV Screen vs. Negative IPV Screen[a]**	**Not Screened vs. Negative IPV Screen[a]**
	n (%)	n (%)	n (%)	AOR (99% CI)	AOR (99% CI)
Child sex					
Male	51.1 (15267)	54.9 (360)	51.4 (7878)	1.00	1.00
Female	48.9 (14635)	45.1 (296)	48.6 (7460)	0.83 (0.67, 1.02)	0.99 (0.94, 1.04)
Preterm birth					
No	94.5 (28253)	89.2 (585)	92.3 (14156)	1.00	1.00
Yes	5.5 (1649)	10.8 (71)	7.7 (1182)	1.98 (1.41, 2.79)**	1.30 (1.16, 1.44)**
Low birthweight					
No	96.5 (28853)	92.4 (606)	94.9 (14557)	1.00	1.00
Yes	3.5 (1049)	7.6 (50)	5.1 (781)	2.15 (1.44, 3.20)**	1.32 (1.16, 1.51)**
High birthweight					
No	97.2 (29056)	96.3 (632)	96.9 (14867)	1.00	1.00
Yes	2.8 (846)	3.7 (24)	3.1 (471)	1.13 (0.65, 1.97)	1.11 (0.95, 1.31)
Small for gestational age					
No	92.8 (27736)	90.2 (592)	92.0 (14099)	1.00	1.00
Yes	7.2 (2163)	9.8 (64)	8.0 (1227)	1.34 (0.94, 1.91)	1.05 (0.95, 1.16)
Large for gestational age					
No	85.8 (25666)	84.6 (555)	86.1 (13198)	1.00	1.00
Yes	14.2 (4233)	15.4 (101)	13.9 (2128)	1.02 (0.77, 1.37)	1.00 (0.93, 1.08)
Low 5 minute Apgar score					
No	99.0 (29588)	98.8 (647)	98.3 (15044)	1.00	1.00
Yes	1.0 (290)	1.2 (8)	1.7 (262)	1.21 (0.47, 3.11)	1.70 (1.34, 2.14)**
Admission to NICU					
No	95.0 (28408)	94.4 (619)	94.0 (14417)	1.00	1.00
Yes	5.0 (1494)	5.6 (37)	6.0 (921)	1.42 (0.90, 2.24)	1.23 (1.09, 1.39)**
Newborn length of stay post-birth					
Less than 3 days	66.9 (20009)	63.7 (418)	66.7 (10230)	1.00	1.00
3 days or more	33.1 (9893)	36.3 (238)	33.3 (5108)	1.52 (1.22, 1.90)**	1.08 (1.02, 1.14)**

Notes. IPV = intimate partner violence; AOR = odds ratio adjusted for sociodemographic variables (i.e., maternal age, marital status, total number of children in home, parity, area-level income quintile, provincial region of residence).
[a]A negative IPV screen is the reference group for the independent variable in the logistic regression model.
*p < .01; **p < .001

Table 4.4. Post-Hoc Analyses Examining if the Relationship between a Positive IPV screen (vs. Negative IPV Screen) is Explained by Maternal Morbidities and Pregnancy-Related Covariates

Birth Outcome	**Model 1:** Sociodemographic covariates	**Model 2:** Maternal mood or anxiety disorder	**Model 3:** Pregnancy-related hospitalization	**Model 4:** Substance use during pregnancy	**Model 5:** Full model
	AOR (99% CI)	AOR (99% CI)	AOR (99% CI)	AOR (99% CI)	AOR (99% CI)
Preterm birth	1.98 (1.41, 2.79)**	1.95 (1.39, 2.75)**	1.87 (1.32, 2.65)**	1.74 (1.19, 2.54)**	1.58 (1.07, 2.33)*
Low birthweight	2.15 (1.44, 3.20)**	2.05 (1.37, 3.06)**	1.95 (1.30, 2.94)**	1.65 (1.06, 2.57)*	1.48 (0.94, 2.32)
Newborn LOS > 3 days	1.52 (1.22, 1.90)**	1.42 (1.13, 1.77)**	1.41 (1.13, 1.76)**	1.42 (1.12, 1.80)**	1.34 (1.05, 1.71)*

Notes. IPV = intimate partner violence; LOS = length of stay; AOR = adjusted odds ratio. All models adjust for sociodemographic (SES) variables (i.e., maternal age, marital status, total number of children in home, parity, area-level income quintile, provincial region of residence).
Model 1: Adjusts for SES variables.
Model 2: Adjusts for SES variables plus any maternal mood and/or anxiety disorder.
Model 3: Adjusts for SES variables plus any pregnancy-related hospitalization.
Model 4: Adjusts for SES variables plus any smoking, alcohol use, and/or drug use during pregnancy.
Model 5: Adjusts for all aforementioned variables simultaneously (i.e., SES variables; any maternal mood and/or anxiety disorder; any pregnancy-related hospitalization; and any smoking, alcohol use, and/or drug use during pregnancy).
*p < .01; **p < .001

Supplementary Online Table S1. Relationship between Maternal Pregnancy-Related Hospitalizations and Intimate Partner Violence Screen Response					
	Negative IPV Screen	**Positive IPV Screen**	**Not Screened**	**Positive IPV Screen vs. Negative IPV Screen[a]**	**Not Screened vs. Negative IPV Screen[a]**
Threatened preterm labour					
No	94.6 (28287)	89.0 (584)	94.5 (14406)	1.00	1.00
Yes	5.4 (1615)	11.0 (72)	5.5 (840)	1.78 (1.24, 2.46)**	1.17 (1.04, 1.33)**
Antepartum hemorrhage					
No	97.4 (29111)	96.5 (633)	96.9 (14772)	1.00	1.00
Yes	2.7 (791)	3.5 (23)	3.1 (474)	1.21 (0.69, 2.13)	1.21 (1.03, 1.42)*
Diabetes					
No	99.7 (29798)	98.6 (647)	99.6 (15179)	1.00	1.00
Yes	0.4 (104)	1.4 (9)	0.4 (67)	3.68 (1.35, 10.04)**	1.54 (1.002, 2.37)*
Hypertension					
No	97.1 (29044)	97.7 (641)	97.9 (14920)	1.00	1.00
Yes	2.9 (858)	2.3 (15)	2.1 (326)	1.13 (0.57, 2.26)	0.84 (0.71, 1.01)
Genitourinary complications					
No	98.7 (29511)	96.8 (635)	98.7 (15040)	1.00	1.00
Yes	1.3 (391)	3.2 (21)	1.4 (206)	1.54 (0.84, 2.84)	1.14 (0.90, 1.45)
Vomiting					
No	99.2 (29655)	98.9 (649)	99.3 (15142)	1.00	1.00
Yes	0.8 (247)	1.1 (7)	0.7 (104)	1.07 (0.39, 2.94)	0.82 (0.60, 1.13)
Premature rupture of membranes					
No	86.6 (25883)	86.3 (566)	85.0 (12953)	1.00	1.00
Yes	13.4 (4019)	13.7 (90)	15.0 (2293)	1.09 (0.80, 1.47)	1.03 (0.95, 1.11)
Known/suspected fetal problems					
No	87.8 (26253)	89.2 (585)	88.7 (13518)	1.00	1.00
Yes	12.2 (3649)	10.8 (71)	11.3 (1728)	0.98 (0.70, 1.38)	1.03 (0.95, 1.13)
Cervical incompetence					

No	99.7 (29802)	---[b]	99.6 (15188)	---[b]	1.00
Yes	0.3 (100)	---[b]	0.4 (58)	---[b]	1.11 (0.71, 1.74)
Abdominal pain					
No	98.9 (29570)	96.2 (631)	98.6 (15031)	1.00	1.00
Yes	1.1 (332)	3.8 (25)	1.4 (215)	2.19 (1.24, 3.85)**	1.19 (0.93, 1.51)

Notes. IPV = intimate partner violence; AOR = odds ratio adjusted for sociodemographic variables (i.e., maternal age, marital status, total number of children in home, parity, area-level income quintile, provincial region of residence).

[a]A negative IPV screen is the reference group for the independent variable in the logistic regression model.

[b]Information from these cells was not released in accordance with Manitoba Centre for Health Policy data release guidelines in order to protect participant confidentiality.

*$p < .01$; **$p < .001$

CHAPTER 5: MATERNAL AND CHILD OUTCOMES FROM BIRTH TO 5 YEARS POST-DELIVERY

Chapter Overview

Manuscript Title: Screening for Intimate Partner Violence in the Early Postpartum Period: Maternal and Child Health and Social Outcomes from Birth to 5 Years Post-Delivery

Authors: Tamara L. Taillieu, Douglas A. Brownridge, Michelle M. Porter, & Marni Brownell

Author Contributions: Tamara Taillieu developed the research questions and design of the study, coded all study variables, conducted the data analysis, interpreted the data, and wrote and revised the manuscript. Douglas Brownridge, Michelle Porter, and Marni Brownell contributed to the conception and design of the study, supervised data analysis, interpreted the data, and edited and revised the manuscript.

Overview: The purpose of this study was to examine maternal and child health and social outcomes from birth to 5-years post-delivery based on the documented response to an intimate partner violence (IPV) screen item (i.e., negative IPV screen, positive IPV screen, not screened for IPV) assessed in the early postpartum period. Outcomes assessed included maternal postpartum physical and mental health, child postpartum physical and mental health, postpartum child welfare organization involvement, and child readiness for school assessments at kindergarten entry.

Abstract

Intimate partner violence (IPV) during pregnancy is a substantial public health concern, yet little is known about the developmental trajectory of these women and their children after birth. The purpose of this study was to examine maternal and child health as well as social outcomes from birth to 5-years post-delivery associated with a positive (vs. negative) maternal IPV screen around the time of delivery. Manitoban women giving birth to a live singleton infant from January 1, 2003 to December 31, 2006 were followed from birth to 5-years post-delivery (*N*=52,710). Administrative databases from the Manitoba Centre for Health Policy provided data for the study. Descriptive statistics and logistic regression were used to examine relationships between IPV screen response around the time of birth with maternal and child health and social outcomes. Women screening positive for IPV had increased odds of diagnosed mood/anxiety disorders, personality disorders, substance use disorders, diabetes, respiratory morbidity, and intentional/non-intentional injury hospitalizations (adjusted odds ratio [AOR] range 1.81-5.59). Children of women screening positive for IPV had increased odds of diagnosed attention deficit-hyperactivity disorder, lower respiratory infections, and injury hospitalizations (AOR range 1.53-2.00), child welfare organization contact (AOR=8.84), and to be less ready for school across domains of functioning (AOR range 1.69-1.93) than children of mothers screening negative for IPV. Early intervention with families experiencing IPV might help to improve maternal and child outcomes in the postpartum period.

Introduction

Intimate partner violence (IPV) remains one of the leading causes of injury among women.[1,2] Ten percent of all hospitalizations during pregnancy are a direct result of injuries sustained from IPV.[2] Violence during pregnancy is a substantial public health issue as it not only negatively impacts maternal health,[1-8] but can also have consequences for the developing child.[9] Violence during pregnancy has been associated with a number of maternal prenatal morbidities and complications.[3,4,9-14] Women experiencing violence during pregnancy are also more likely than women who do not experience pregnancy violence to use tobacco, alcohol, and drugs during pregnancy.[4,10-14] All of these factors likely contribute to the increased incidence of adverse pregnancy outcomes among women experiencing violence during pregnancy.[3,9] However, because most research in the area focuses on more immediate outcomes (e.g., pregnancy outcomes), and the same sample of women and children is rarely followed into the post-partum period, relatively little is known about the longer-term impact of pregnancy violence on maternal and child developmental health.

A large body of research exists linking violence experiences before or during pregnancy to an increased risk of depression in the post-partum period.[5-8,15,16] Violence during pregnancy has also been linked to a number of other mental health problems including anxiety,[17,18] post-traumatic stress disorder ,[6,7,18,19] obsessive-compulsive symptoms,[18] stress,[18] and suicidal behaviours.[20] Less is known about the association between violence during pregnancy and longer-term maternal physical health; although the IPV literature, more generally, suggests that IPV can have a substantial negative impact on women's physical health.[1,2,21-23]

Little is also known about the specific impact of prenatal violence exposure on child developmental health after birth as the longer-term effects of pregnancy violence have not been

adequately addressed in research to date. Also, more generally, there remains a scarcity of research on the impact of violence against women on children's physical health.[24] In the limited research explicitly examining this relationship, IPV during pregnancy has been associated with increased infant outpatient physician visits and emergency department visits at 2 months of age.[11] Any intimate partner violence at baseline (past month/assessed shortly after birth) or follow-up (at 1 year postpartum) has been associated with poorer infant health and a more difficult infant temperament at age 1.[8,25] Chronic intimate partner violence (during both pregnancy and/or infancy and early childhood) has been associated with child obesity at age 5.[26] Early postnatal abuse has been associated with infant respiratory infections and diarrhea over the first 5 months of life,[27] and lifetime exposure to any form of family violence has been associated with fetal and early childhood growth impairment.[24]

In a large cohort study examining the impact of pregnancy violence on maternal mental health and child behaviour problems in the United Kingdom, pregnancy violence predicted child behaviour problems (hyperactivity, conduct, emotion, and pro-social domains) at 42 months of age in bivariate models, but this relationship was mediated by maternal depression and postnatal violence exposure.[15] In this study, child behaviour problems were also associated with a number of other factors (e.g., low maternal age at birth, lower education, lower income, non-homeowner, smoking and alcohol use, small-for-gestational age infants, and paternal depression) in bivariate analyses. This highlights the importance of disentangling the effects of socioeconomic disadvantage, pregnancy outcomes, maternal mental health problems, and postpartum violence exposure on later child behaviour problems as each factor exerts a profound influence on child developmental health.[15]

The fact that violence during pregnancy has been associated with adverse pregnancy outcomes may also contribute to developmental problems in children who are exposed to violence prenatally. Many of the adverse pregnancy outcomes associated with violence during pregnancy (e.g., low birth weight and preterm birth) have been associated with developmental problems in children. For example, preterm and low birth weight infants are at risk for a number of problems including mortality, growth impairment, frequent and chronic illness, inattention, hyperactivity, language delays, cognitive impairments and academic difficulties, as well as emotional and behavioural problems that persist throughout childhood and adolescence.[28-30] Therefore, the mechanism linking prenatal violence exposure to suboptimal child development could be through its impact on pregnancy outcome. As a matter of fact, there are a number of other biological and psychological reasons for hypothesizing that violence during pregnancy could be associated with long-term developmental consequences for the child.[15]

First, the effects of maternal prenatal stress may alter developing fetus and, therefore, have an influence on children's subsequent functioning.[15] Approximately 40-50% of preterm births are idiopathic, and it has been hypothesized that these unknown mechanisms may be related to the effects of prenatal stress on the developing fetus.[31] Maternal stress hormones (i.e., cortisol) may cross the placental barrier and affect amniotic cortisol levels which, in turn, affect fetal development and pregnancy outcome.[32-34] Prenatal exposure to maternal stress hormones can result in early programming of brain functions with permanent change in neuroendocrine regulation and behaviour in offspring.[29,34] As well, disruption or chronic activation of the neuroendocrine system early in development (even prenatally) can alter the functional status of the developing immune system, which may have long-term physical health consequences for the developing fetus.[35]

Second, violence during the prenatal period has been shown to be associated with maternal physical and mental health problems both during pregnancy[2,8,15,18,19] and postpartum.[5,7,8,14,15] Maternal prenatal stress, anxiety, and depression have been associated with child development problems across multiple domains of functioning.[36] Maternal mood and/or anxiety disorder during pregnancy has also been found to predict parenting stress at 3 and 6 months postpartum,[37] observed child aggressiveness at 12 months of age,[38] and child psychiatric disorders at age 6.[39] Inconsistent findings are reported in the literature regarding the extent to which the association between pregnancy violence and negative child outcomes is mediated by maternal mental health problems, with some studies find no mediating effect[11,40] and others reporting independent mediating effects for both maternal mental health problems and pregnancy[19] or postpartum[15] partner violence exposure. Therefore, the relationship between prenatal violence and child developmental problems might be mediated by maternal health problems,[15] although it seems likely that postpartum violence risk also plays a role in the relationship between prenatal violence exposure and child developmental health.

Thus, another potential mechanism through which prenatal violence may have an impact on children after birth is through the increased risk that violence between parenting partners will continue in the postpartum period. Violence during pregnancy is a strong predictor of postpartum violence.[15,41,42] In a study examining the patterns of physical violence before (past year), during, and after pregnancy, Martin et al.[42] reported that less than 1% of the women reporting a history of violence reported experiencing physical violence for the first time in the postpartum period. Indeed, the American Academy of Pediatrics[43] has urged pediatricians to routinely screen all women for IPV as an important component in the primary prevention of child abuse. Even in the absence of direct victimization, exposure to IPV has been shown to

increase the risk of child developmental problems across multiple domains of functioning.[2,44,45] Thus postpartum violence risk is also important to consider when examining the long-term impact of pregnancy violence on maternal and child outcomes. This study extends the existing body of literature on child exposure to IPV by examining the extent to which differences in developmental outcomes can be traced to violence that occurs in the prenatal period.

In Manitoba, government policy as part of the Families First (FF) program is for public health nurses to screen families with newborns within one week post-delivery for a number of risk factors (e.g., maternal young age, financial difficulties, mental health problems, substance use, birth outcomes) associated with adverse child developmental outcomes.[46] The FF screen form also includes a question pertaining to a past or current history of violence between parenting partners. The overall goal of this study was to examine longer-term maternal and child health as well as social outcomes associated with IPV screen response around the time of birth (i.e., positive screen for IPV, negative screen for IPV, not screened for IPV) in a population-wide sample of women and their children. Specifically, the objectives of this study were to: (1) examine the relationship between a history of violence (past or current) between parenting partners and maternal and child health (e.g., mental health, physical health, injury hospitalizations) as well as social (e.g., child welfare organization involvement, child readiness for school) outcomes from birth to 5 years post-delivery; (2) examine these same characteristics in the subset of women who were not screened for IPV around the time of birth relative to the subset of women screening negative for IPV; and (3) examine pathways (i.e., socioeconomic factors, pregnancy outcome, maternal and child postpartum health, postpartum child welfare involvement and violence and injury risk) through which a positive maternal IPV screen around the time of birth impacts child functioning across multiple domains at kindergarten entry. It was

hypothesized that women screening positive for IPV (and women who were not screened for IPV) around the time of birth would have poorer mental and physical health outcomes than women screening negative for IPV in the postpartum period (i.e., from birth to 5-years post-delivery). Further, it was hypothesized that children born to women screening positive for IPV (and children born to mothers who were not screened for IPV) around the time of birth would have poorer mental and physical health outcomes and greater child welfare organization involvement in the postpartum period (i.e., from birth to 5-years post-delivery), and be less ready for school at kindergarten entry than children born to mothers screening negative for violence. Finally, among children born to women who were screened for IPV, a positive IPV screen around the time of birth would remain independently associated with children's readiness for school evidence assessments (i.e., evidence for fetal programming effects) after accounting for indicators of sociodemographic disadvantage, adverse pregnancy outcomes, maternal postpartum health problems, child postpartum health problems, and proxy indicators of postpartum violence and injury risk.

Method

Population and Data Source

Administrative databases housed at the Manitoba Centre for Health Policy in the Manitoba Population Health Research Repository ("the Repository") provided the data for this study. Specifically, information from Manitoba Health (hospitalizations, physician visits, prescription drug use, health insurance registry), Healthy Child Manitoba (FF screen, Early Development Instrument databases), and Family Services (child welfare organization involvement) was linked via a unique, numeric personal identification number that is encrypted the same way across all files housed in the Repository (to allow for data linkage and to follow

individuals over time).[46]

All Manitoban women giving birth to a live singleton infant (weighing at least 400 grams and born at a minimum of 18 weeks gestation) in the province from January 1, 2003 to December 31, 2006 were included in analyses (N=52,710). Women living in First Nations (i.e., reserve) communities are not screened as part of the provincial FF program due to jurisdictional issues related to health care in Manitoba (i.e., health care falls under federal vs. provincial jurisdiction for reserve communities).[46] Therefore, women living in First Nations (i.e., reserve) communities (*n*=6,814) were excluded from the baseline sample (based on postal code at time of birth). We further excluded children who were not living in the home of the registered family head at the time of birth (*n*=234) as well as mothers and/or children without continuous Manitoba Health insurance coverage (e.g., moved out of province, deaths) over the study period (*n*=5,611). This resulted in a final sample of *N*=40,051 families included over the follow-up period. A comparison of sociodemographic covariates and birth outcomes between baseline and follow-up samples are available in the supplementary online Table S2 (page 154 of this thesis). In short, no significant differences were noted between the baseline and follow-up samples with regard to violence screen response, socioeconomic covariates, or adverse birth outcomes. This study was approved by the Manitoba Health Information Privacy Committee (HIPC No. 2015/2016-31) and the University of Manitoba Human Research Ethics Board (Ethics File No. H2015:355 [HS18922]).

Measures

Baseline measures. All baseline measures were assessed at the time of birth. Baseline sociodemographic covariates included: maternal age (ordinal), child sex (male or female), marital status (i.e., registered legal marriage or common-law union in health registry vs. no

registered union in health insurance registry), area-level income quintile (based on postal code at time of birth), total children in the home (including the newborn), and provincial region of residence (i.e., City of Winnipeg, Southern, Interlake-Eastern, Prairie Mountain-Western, and Northern) A map of provincial regions is available at https://www.gov.mb.ca/health/rha/map.html. Birth outcomes included: low birthweight (i.e., less than 2500 grams), preterm birth (i.e., less than 37 weeks gestation), small for gestational age (i.e., birthweight at or below the 10th percentile based on Canadian standards for sex and gestational age),[47] neonatal intensive care unit admission (yes or no), and newborn length of stay greater than 3 days (yes or no).

Violence screen. As part of the FF screen, public health nurses document whether or not there was a "current or history of violence between parenting partners" (yes or no) on the FF screen form around the time of delivery (i.e., attempts are made to screen all eligible families with a newborn within one week post-discharge). In this study, mothers and their children were divided into three groups based on response to the IPV screen question (i.e., negative IPV screen, positive IPV screen, and not screened for IPV).

Maternal health outcomes. Maternal mental health outcomes assessed included diagnosed: mood and/or anxiety disorder (yes/no), personality disorder (yes/no), and substance use disorder (yes/no). Maternal physical health conditions included diagnosed: diabetes (yes/no); hypertension (yes/no); respiratory morbidity (i.e., asthma, bronchitis, bronchiolitis, emphysema, and/or chronic airway obstruction) (yes/no); intentional (self-inflicted and violence by others) injury hospitalization (yes/no); and non-intentional injury hospitalization (yes/no). All maternal health conditions were assessed from delivery to 5-years post-delivery. See Appendix B for a full list of diagnostic codes (hospital abstracts and physician visits) and Anatomical

Therapeutic Chemical (ATC) codes (prescription drug information) used to compute diagnoses for all variables.

Child health outcomes. Child mental or behavioural outcomes included diagnosed: mood and/or anxiety disorder (yes/no), autism spectrum disorder (yes/no), and attention deficit-hyperactivity disorder (yes/no). Child physical health outcomes included diagnosed: congenital anomalies (yes/no); lower respiratory tract infection (yes/no); and injury hospitalization (yes/no). See Appendix B for a full list of diagnostic codes (hospital abstracts and medical claims) and Anatomical Therapeutic Chemical (ATC) codes (prescription drug information) used to compute diagnoses for all variables.

Child welfare organization involvement. Two measures of child welfare organization involvement were assessed (from birth to 5 year post-delivery): (1) child's family is/was receiving services from Child and Family Services (yes/no), and (2) the child is/was taken into care by Child and Family Services (yes/no).

Child school readiness at kindergarten entry. Child's school readiness was based on the child's Early Development Instrument (EDI) assessment at kindergarten entry. The EDI is a population-based measure of school readiness filled out by kindergarten teachers when the child is approximately 5 years old. The EDI assesses a child's readiness across five domains (physical health and well-being, social competence, emotional maturity, language and cognitive development, and communication skills and general knowledge).[48] Dichotomous assessments (ready vs. not ready) can be determined for each separate domain (children scoring in the 10th percentile or lower are deemed to be 'not ready') as well as for an overall assessment of school readiness (ready vs. not ready) that is based on whether the child scores in the 10th percentile or lower in at least one domain (i.e., not ready). Finally, a multiple challenge index (the child

scores at the 10th percentile or below in at least three different domains) can be used to indicate children who may be particularly vulnerable for poor outcomes.[48] This study assessed school readiness across the five domains individually, the overall assessment of school readiness, and the multiple challenge index as indicators of school readiness at kindergarten entry. In Manitoba, population wide assessments are only conducted every second year, therefore only children entering kindergarten in 2009, 2011, and 2013 (*N*=16,767) were included in child school readiness analyses. All children with an EDI assessment were included in analyses examining the relationship between IPV screen status around the time of delivery and school readiness during their kindergarten year, regardless of child age at the time of the EDI assessment. Thus, analyses examining school readiness extended beyond 5 years after birth for some children and included children up to 7 years of age.

Statistical Analyses

First, crosstabulations using chi square tests of association were computed to examine differences in baseline sociodemographic covariates and birth outcomes based on IPV screen response status (i.e., negative IPV screen, positive IPV screen, not screened for IPV). Second, descriptive statistics were computed to examine the distribution of maternal health outcomes, child health outcomes, child welfare involvement, and an assessment of the child's school readiness by IPV screen response status. Third, a series of multivariable logistic regression models were run (i.e., positive IPV screen vs. negative IPV screen; not screened for IPV vs. negative IPV screen) to examine the relationship between IPV screen response at the time of birth (independent variable) and maternal health outcomes, child health outcomes, and child welfare organization involvement (dependent variables). Multivariate models adjusted for baseline (i.e., at time of birth) sociodemographic covariates (i.e., maternal age, child sex, marital

status, area-level income quintile, total number of children at home, and provincial region of residence). All of the aforementioned sociodemographic covariates were significantly associated with IPV response group at the bivariate level (based on Chi-square tests of association from cross-tabulations) and entered into the logistic regression models simultaneously. Fourth, a series of multivariable logistic regression models were run (i.e., positive IPV screen vs. negative IPV screen; not screened for IPV vs. negative IPV screen) to examine the relationship between IPV screen response at the time of birth (independent variable) and the EDI assessment of children's readiness for school at kindergarten entry across domains of functioning (dependent variables). Multivariable models adjusted for baseline (i.e., at time of birth) sociodemographic covariates (i.e., maternal age, child sex, marital status, area-level income quintile, total number of children at home, and provincial region of residence). All covariates were entered into the logistic regression models simultaneously.

Finally, among families who were screened for IPV around the time of birth (positive IPV screen vs. negative IPV screen), sequential multivarible logistic regression models were run to examine the relationship between a positive (vs. negative) IPV screen around the time of birth and categories of risk factors (i.e., sociodemographic factors, adverse pregnancy outcomes, maternal health problems, child health problems, and/or postpartum child welfare contact and violence and injury risk) through which a history of current or past violence between parenting partners might lead to compromised school readiness at kindergarten entry. Variables were chosen for inclusion in logistic regression models based on theorized pathways that could account for the relationship between prenatal violence exposure (as indicated by a positive IPV screen in the early postpartum period) and adverse child functioning across multiple domains at kindergarten entry (based on EDI assessments). Theorized pathways included sociodemographic

disadvantage, adverse birth outcomes, maternal postpartum health problems, child health problems, and postpartum violence risk. In each set of models, all covariates were entered simultaneously and were retained in the model regardless of statistical significance (as all theoretically relevant to understanding the relationship between prenatal violence exposure and adverse child functioning at kindergarten entry). Model 1 adjusted for child sex only. Model 2 adjusted for child sex plus baseline sociodemographic covariates (i.e., maternal age, marital status, area-level income quintile, total children in home, health region of residence). Model 3 adjusted for child sex plus adverse birth outcomes (i.e., low birthweight, preterm birth, small for gestational age, neonatal intensive care unit admission, newborn length of stay greater than 3 days). Model 4 adjusted for child sex plus maternal postpartum health outcomes (i.e., mood/anxiety disorder, personality disorder, substance use disorder, diabetes, hypertension, respiratory morbidity). Model 5 adjusted for child sex plus child health outcomes (i.e., mood/anxiety disorder, attention deficit-hyperactivity disorder, congenital anomaly, lower respiratory tract infection). Model 6 adjusted for child sex plus postpartum child welfare involvement (i.e., family receiving services, child in care), postpartum violence, and injury risk (i.e., maternal intentional and non-intentional injury hospitalizations, child injury hospitalization). Model 7 (i.e., the Full Model) adjusted for all covariates simultaneously (i.e., all the covariates contained in Models 1 through 6 were entered into the Full Model).

To account for the increased risk of error associated with multiple comparisons, results at a *p*-value of 0.01 (and corresponding 99% confidence intervals) were considered statistically significant. All data management, programming, and analyses were performed using SAS® version 9.4.

Results

The distribution of baseline sociodemographic characteristics by IPV screen response is provided in Table 5.1. As shown in Table 5.1, women screening positive for IPV or who were not screened for IPV tended to be younger, not in a registered marital or common-law union, living in a lower income area, and had more children living in the home at the time of delivery than women screening negative for IPV. Women screening positive for IPV or who were not screened for IPV were also more likely to deliver low birthweight and preterm infants than women screening negative for IPV around the time of birth.

The results from the multivariate logistic regression analyses examining the association between IPV screen response group and postpartum maternal health, child heath, and child welfare organization involvement are provided in Table 5.2. In the positive IPV screen versus negative IPV screen comparisons, women who screened positive for IPV around the time of delivery had significantly increased odds of being diagnosed with a mood or anxiety disorder (Adjusted Odds Ratio [AOR]=2.68, 99% Confidence Interval [CI]=2.13-3.37), personality disorder (AOR=5.59, 99% CI=3.19-9.80), substance use disorder (AOR=3.35, 99% CI=2.52-4.46), diabetes (AOR=2.02, 99% CI=1.29-3.14), respiratory morbidity (AOR=1.81, 99% CI=1.44-2.27), and to have been hospitalized for both intentional (AOR=3.08, 99% CI=1.54-6.17) and non-intentional (AOR=2.28, 99% CI=1.32-3.94) injuries in the 5-years after delivery. Children of mothers screening positive for IPV around the time of delivery had significantly increased odds of being diagnosed with attention deficit-hyperactivity disorder (AOR=1.86, 99% CI=1.06-3.27), lower respiratory tract infections (AOR=1.53, 99% CI=1.21, 1.93), and to have been hospitalized for an injury (AOR=2.00, 99% CI=1.14, 3.51) in the 5-years after birth than children born to mothers screening negative for IPV. In the not screened for IPV versus negative

IPV screen comparisons, women who were not screened for IPV around the time of delivery had significantly increased odds of being diagnosed with a mood or anxiety disorder (AOR=1.14, 99% CI=1.06-1.23), substance use disorder (AOR=1.51, 99% CI=1.33-1.71), and to have been hospitalized for an intentional injury (AOR=1.87, 99% CI=1.32-2.66) in the 5-years after delivery than women screening negative for IPV. There were no significant differences in child health outcomes between children born to mothers who were not screened for IPV and children born to mothers screening negative for IPV in the 5-years after delivery. The children of mothers screening positive for IPV and children of mothers who were not screened for IPV were significantly more likely to be receiving services from child welfare organizations (AORs=8.84 and 1.40, respectively) than children of mothers who screened negative for IPV around the time of birth.

The results from the mutivariable logistic regression analyses examining the association between IPV screen response group and child readiness for school at kindergarten entry are provided in Table 5.3. In the positive IPV screen versus negative IPV screen comparisons, children of mothers who screened positive for IPV around the time of delivery had significantly increased odds of being not ready for school across all domains of functioning (AORs ranged from 1.69 to 1.85), to be low on at least one domain of functioning (AOR=1.89, 99% CI=1.30-2.75), and to be not ready on three or more domains of functioning (AOR=1.93, 99% CI=1.22-3.05) than children of mothers who screened negative for IPV around the time of delivery. Children of mothers who were not screened for IPV around the time of delivery had significantly increased odds of being not ready for school in the communication/general knowledge, language/cognitive, and social domains (AORs 1.27, 1.26, and 1.20, respectively), to be low on at least one domain of functioning (AOR=1.20, 99% CI=1.08-1.33), and to be not ready on three

or more domains of functioning (AOR=1.21, 99% CI=1.03-1.42) than children of mothers who screened negative for IPV around the time of delivery.

The results of the sequential logistic regression models examining the relationship between a positive (vs. negative) IPV screen around the time of delivery and child school readiness at kindergarten entry are provided in Table 5.4. As shown in Table 5.4, a positive screen for IPV around the time of delivery remained significantly associated with a child being not ready for school across multiple domains of functioning, in at least one domain of functioning, and in three or more domains of functioning after adjustment for child sex (Model 1 AOR range 2.76-3.62), baseline sociodemographic covariates (Model 2 AOR range 1.69-1.93), pregnancy outcomes (Model 3 AOR range 2.68-3.50), postpartum maternal (Model 4 AOR range 2.33-2.85) and child (Model 5 AOR range 2.67-3.50) health outcomes, and postpartum child welfare organization involvement and violence/injury risk (Model 6 AOR range 1.55-1.68). Although odds were attenuated in all models (Models 2-6) relative to the model adjusting only for child sex (Model 1), the greatest reduction in odds appeared to be related to baseline sociodemographic factors (Model 2) and postpartum child welfare organization involvement and postpartum violence/injury risk (Model 6). When all covariates were entered into the logistic regression model simultaneously (Full Model), the relationship between a positive (vs. negative) IPV screen around the time of birth and child school readiness across domains of functioning became non-significant.

Discussion

The purpose of this study was to examine maternal and child health and social outcomes from birth to 5-years post-delivery associated with a positive maternal (or missing) IPV screen around the time of delivery. Several novel findings emerged from this study. First, a positive

screen for IPV around the time of delivery was associated with compromised maternal and child physical and mental health outcomes in the postpartum period. Second, women who were not screened for IPV around the time of delivery also had significantly increased odds of having a diagnosed mood or anxiety disorder, substance use disorder, and to have an intentionally inflicted injury hospitalization in the 5-years postpartum than women screening negative for IPV. Third, the families of women screening positive for IPV and women who were not screened for IPV around the time of delivery were also more likely to be receiving services form child welfare organizations in the postpartum period than women screening negative for IPV. Fourth, women screening positive for IPV and, to a lesser extent, women who were not screened for IPV around the time of delivery had children who were less ready for school at kindergarten entry than women screening negative for IPV. Finally, among women who were screened for IPV, the relationship between a positive screen for IPV around the time of delivery and children being less ready for school across multiple domains of functioning was no longer significant after adjustment for sociodemographic covariates, pregnancy outcomes, maternal and child postpartum health, and proxy indicators of postpartum violence and injury risk.

Similar to other research, this study suggests that IPV can have a negative impact on maternal physical and mental health.[1-8,21-23] Mothers who screened positive for IPV around the time of delivery had increased odds of diagnosed mood and/or anxiety disorders, personality disorders, substance use disorders, diabetes, and respiratory morbidity than women screening negative for IPV. The longer-term outcomes of women screening positive for IPV around the time of pregnancy has not been adequately addressed in research to date. What this study also adds is an examination of longer-term outcomes of women who were not screened for IPV around the time of delivery. In this study, women who were not screened for IPV had increased

odds of diagnosed mood and/or anxiety and substance use disorders than women screening negative for IPV. Compromised maternal mental health likely impacts a mother's ability to parent effectively in the postpartum period[17,44,49] and might lead to disruptions in attachment and weaker mother-infant bonds.[15] Interventions aimed at promoting mental health among postpartum women might help to improve the longer-term developmental trajectory of women and their children.

Children of mothers screening positive for IPV around the time of delivery were also found to have more compromised health outcomes in the 5-years after delivery than children of mothers screening negative for IPV. Specifically, these children had higher odds of being diagnosed with attention deficit-hyperactivity disorder, lower respiratory tract infections, and to have an injury hospitalization than children of mothers screening negative for IPV. These same compromised child health outcomes were not noted among children of mothers who were not screened for IPV around the time of birth. This is surprising given evidence that women in this sample who were not screened for IPV around the time of birth tended to deliver infants with more adverse birth outcomes (e.g., preterm births, low birthweight) than women screening negative for IPV. Research has also suggested that non-screened families in Manitoba may represent a particularly high risk subset of the population,[46] yet this does not seem to translate into an increased risk of the longer-term adverse child health outcomes assessed in this study. Research identifying factors related to public health nurses' decisions to screen or not screen for IPV (e.g., concerns about the safety of women who may be experiencing IPV, difficulties accessing families facing challenging circumstances such as sociodemographic disadvantage or compromised neonatal health, systemic barriers, personal barriers) may help to clarify the profile of families who are not being screened for IPV around the time of birth in Manitoba as well as

factors associated with longer-term developmental outcomes among this group. As well, it is not clear whether mothers experiencing violence present to the healthcare system with their children differently than mothers not experiencing violence, which is another potential explanation for differences in child health outcomes found among the positive IPV screen and negative IPV screen groups in this study.

Children of mothers screening positive for IPV and, to a lesser extent, children of mothers who were not screened for IPV around the time of birth were found to be less ready for school at kindergarten entry across multiple domains of functioning than children of mothers who screened negative for IPV. This relationship could be due, in part, to the effects of stress on the developing fetus whereby maternal stress hormones (i.e., cortisol) cross the placental barrier, affecting amniotic cortisol levels and fetal development.[32-34] Amniotic cortisol levels have been found to be associated with low birth weight which, in turn, predict infant fear and distress at 3 months of age.[33] Amniotic cortisol has also been found to be negatively associated with cognitive ability at 17 months of age, but only among insecurely (vs. securely) attached infants.[50] In studies using self-reported measures of maternal prenatal stress and/or anxiety, prenatal exposure has been linked to poorer motor skills, physical development, and cognitive development at 8 months of age;[51] poorer mental development and observed fearfulness in infants aged 14 to 19 months;[50] poorer verbal cognitive function at 18 months, non-verbal cognitive development at 24 months, and decreased self-regulation at 37 months;[52] child internalizing and externalizing behaviour problems at 4 years of age,[40] and attention-deficit/ hyperactivity disorder at age 7.[53] Thus, prenatal stress exposure could be one of the mechanisms leading to children of women screening positive for IPV, and perhaps also for women who were

not screened for IPV, around the time of pregnancy to be less ready for school at kindergarten entry than women screening negative for IPV.

In addition, both women screening positive for IPV and women who were not screened for IPV had increased odds of having an intentional injury hospitalization and to report child welfare involvement in the 5-years post-delivery than women screening negative for IPV, which could suggest a continuation of IPV experienced prenatally into the postpartum period. The strong association of pregnancy violence with postpartum violence[15,41,42] reported in the literature also lends support to this assertion. It could also be that a positive IPV screen in the early postpartum period is the catalyst that initiates child welfare organization contact in the postpartum period. However, it must be noted that indicators used in this study are only proxy measures of postpartum violence and injury risk. We were unable to separate out child intentional from non-intentional injury hospitalizations, and there are many reasons other than child maltreatment that might result in child welfare organization contact. That being said, among women who were screened for IPV, sociodemographic disadvantage and postpartum child welfare contact and violence/injury risk seemed to be most strongly related to a reduction in the odds of being less ready for school across communication/general knowledge, emotional, language/cognitive, physical, and social domains of functioning. Therefore, addressing sociodemographic disadvantage, preventing and intervening in cases of IPV and child maltreatment, and ensuring appropriate referrals to effective services after child welfare contact appear to represent important intervention targets for increasing child readiness for school across multiple domains of functioning.

The strengths of this study include the use of a population-wide sample of women and their children that could be followed from birth to 5-years post-delivery. However, findings

must also be viewed in light of a number of limitations. First, the use of a single screen item regarding a past or current history of violence between parenting partners to assess IPV status around the time of pregnancy needs to be viewed as a major limitation as single item measures of IPV likely underestimate the true prevalence of IPV exposure among women. Studies using violence measures that include multiple items, report on different types of violence, and that are implemented over multiple time points find higher prevalence estimates of IPV than studies relying on a single item to assess IPV implemented at a single time point.[41] Second, the exact timing (e.g., before or during pregnancy), type (e.g., physical, sexual, emotional), or the frequency and severity of IPV could not be determined. All of these factors could have had an impact on the outcomes assessed in this study. Third, health outcomes assessed in this study were limited to the treatment seeking population, and are contingent on accurate coding of physicians and other health care professionals. Fourth, proxy indicators of postpartum violence exposure were used in this study (i.e., child welfare organization involvement, maternal intentional and non-intentional injury hospitalizations, child injury hospitalizations), which likely grossly underestimate cases of IPV or child maltreatment. Relatedly, families at the highest risk of IPV and child maltreatment are also most likely to have children taken into care at birth. It is unlikely that these families would have completed the FF screen (as most families are not screened until after birth). Finally, many important risk and protective factors (e.g., parental education, access to early childhood education programs, social support, race/ethnicity, household income) were unavailable in the data.

Conclusion

In this study, a positive screen for IPV around the time of birth was associated with poorer maternal and child health outcomes, increased child welfare involvement, and children

being less ready for school at kindergarten entry relative to families with no documented history of IPV on the FF screen form. To a lesser extent, these same compromised outcomes were noted among women who were not screened for IPV around the time of birth. Interventions aimed at improving maternal health and well-being in the postpartum period, addressing socioeconomic disadvantage, and reducing the need for child welfare organization involvement through programs aimed at the primary prevention of all forms of family violence might help to improve the longer-term developmental trajectory of women and their children.

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Table 5.1. Sociodemographic Characteristics and Birth Outcomes of the Sample by Intimate Partner Violence Screen Response Around the Time of Delivery				
	Negative IPV Screen *N* = 26,306 (65.7%)	**Positive IPV Screen** *N* = 561 (1.4%)	**Not Screened for IPV** *N* = 13,184 (32.9%)	**Chi-square**
Maternal age at birth				
Less than 20 years	5.8 (1514)	16.9 (95)	8.4 (1111)	
20 to 24 years	19.9 (5245)	37.6 (211)	20.0 (2632)	
25 to 29 years	31.7 (8331)	22.8 (128)	29.5 (3883)	
30 to 34 years	28.7 (7537)	15.7 (88)	27.8 (3669)	
35 to 39 years	11.7 (3088)	5.7 (32)	11.9 (1567)	
40 years and older	2.3 (591)	1.3 (7)	2.4 (322)	345.32**
Child sex				
Male	51.1 (13452)	55.3 (310)	51.2 (6753)	
Female	48.9 (12854)	44.7 (251)	48.8 (6431)	3.74
Marital status at birth				
Married/common-law	48.4 (12708)	7.9 (44)	38.6 (5050)	
No registered union	51.6 (13558)	92.1 (516)	61.4 (8028)	647.62**
Area-level income quintile				
1 (lowest)	18.1 (4757)	41.6 (233)	24.6 (3240)	
2	20.5 (5368)	18.8 (105)	20.4 (2687)	
3	21.4 (5613)	17.0 (95)	18.0 (2372)	
4	20.5 (5369)	13.9 (78)	19.2 (2519)	
5 (highest)	19.6 (5139)	8.8 (49)	17.7 (2330)	418.95**
Total children in home				
1	42.6 (11179)	33.6 (188)	41.3 (5400)	
2	34.1 (8951)	31.8 (178)	34.5 (4513)	
3 or more	23.4 (6136)	34.6 (194)	24.2 (3165)	45.11**
Provincial region of residence				
City of Winnipeg	49.1 (12921)	62.6 (351)	78.7 (10370)	
Southern	22.7 (5963)	11.6 (65)	6.5 (862)	
Interlake-Eastern	8.9 (2332)	6.2 (35)	4.6 (608)	
Prairie Mountain-Western	15.4 (4037)	9.5 (53)	6.5 (859)	
Northern	4.0 (1053)	10.2 (57)	3.7 (485)	3467.88**
Low birthweight				
No	96.5 (25391)	92.9 (521)	95.7 (12619)	
Yes	3.5 (915)	7.1 (40)	4.3 (565)	33.00**
Preterm birth				
No	94.4 (24840)	89.5 (502)	93.0 (12259)	
Yes	5.6 (1466)	10.5 (59)	7.0 (925)	51.03**
Small for gestational age				
No	92.9 (24425)	90.4 (507)	92.2 (12157)	
Yes	7.1 (1878)	9.6 (54)	7.8 (1027)	9.58*
NICU admission				

No	95.1 (25006)	94.5 (530)	94.4 (12446)	
Yes	4.9 (1300)	5.5 (31)	5.6 (738)	7.86
Newborn LOS > 3 days				
No	66.7 (17552)	65.1 (365)	66.8 (8808)	
Yes	33.3 (8754)	34.9 (196)	33.2 (4376)	0.74

Notes. IPV = intimate partner violence; NICU = neonatal intensive care unit; LOS = length of stay.
*$p < .01$; **$p < .001$

Table 5.2. Maternal and Child Health Outcomes and Child Welfare Organization Involvement in the 5 Years Postpartum by Intimate Partner Violence Screen Response Around the Time of Delivery					
Dependent Variables	**Negative IPV Screen** *N* = 26,306 (65.7%)	**Positive IPV Screen** *N* = 561 (1.4%)	**Not Screened for IPV** *N* = 13,184 (32.9%)	**Positive IPV Screen vs. Negative IPV Screen[a]**	**Not Screened vs. Negative IPV Screen[a]**
	% (n)	% (n)	% (n)	AOR (95% CI)	AOR (95% CI)
Maternal Health Outcomes					
Mood or anxiety disorder					
No	82.4 (21664)	55.1 (309)	79.1 (10430)	1.00	1.00
Yes	17.7 (4642)	44.9 (252)	20.9 (2754)	2.68 (2.13, 3.37)**	1.14 (1.06, 1.23)**
Personality disorder					
No	99.5 (26161)	94.7 (531)	99.1 (13065)	1.00	1.00
Yes	0.6 (145)	5.4 (30)	0.9 (119)	5.59 (3.19, 9.80)**	1.25 (0.90, 1.74)
Substance use disorder					
No	95.7 (25179)	77.0 (432)	92.7 (12216)	1.00	1.00
Yes	4.3 (1127)	23.0 (129)	7.3 (968)	3.35 (2.52, 4.46)**	1.51 (1.33, 1.71)**
Diabetes					
No	96.6 (25423)	92.7 (520)	95.8 (12631)	1.00	1.00
Yes	3.4 (883)	7.3 (41)	4.2 (553)	2.02 (1.29, 3.14)**	1.14 (0.98, 1.32)
Hypertension					
No	89.3 (23478)	87.5 (491)	88.6 (11809)	1.00	1.00
Yes	10.8 (2828)	12.5 (70)	10.4 (1375)	1.34 (0.95, 1.89)	1.01 (0.92, 1.11)
Respiratory morbidity					
No	69.6 (18315)	49.7 (279)	65.6 (8654)	1.00	1.00
Yes	30.4 (7991)	50.3 (282)	34.4 (4530)	1.81 (1.44, 2.27)**	1.05 (0.99, 1.12)
Intentional Injury Hospitalization					
No	99.6 (26200)	96.8 (543)	99.0 (13047)	1.00	1.00
Yes	0.4 (106)	3.2 (18)	1.0 (137)	3.08 (1.54, 6.17)**	1.87 (1.32, 2.66)**
Non-Intentional Injury Hospitalization					
No	98.7 (25951)	95.2 (534)	98.2 (12943)	1.00	1.00

Yes	1.4 (355)	4.8 (27)	1.8 (241)	2.28 (1.32, 3.94)**	1.19 (0.94, 1.49)
Child Health Outcomes					
Mood or anxiety disorder					
No	98.8 (25978)	97.5 (547)	98.5 (12992)	1.00	1.00
Yes	1.3 (328)	2.5 (14)	1.5 (192)	2.00 (0.96, 4.17)	1.13 (0.88, 1.44)
Autism spectrum disorder					
No	99.2 (26101)	---[b]	99.0 (13049)	---[b]	1.00
Yes	0.8 (205)	---[b]	1.0 (135)	---[b]	1.15 (0.86, 1.56)
Attention deficit-hyperactivity disorder					
No	98.5 (25910)	95.5 (536)	97.8 (12896)	1.00	1.00
Yes	1.5 (396)	4.5 (25)	2.2 (288)	1.86 (1.06, 3.27)*	1.19 (0.96, 1.46)
Congenital anomaly					
No	90.0 (23666)	88.8 (498)	89.3 (11775)	1.00	1.00
Yes	10.0 (2640)	11.2 (63)	10.7 (1409)	1.22 (0.85, 1.74)	1.06 (0.97, 1.17)
Lower respiratory tract Infection					
No	55.5 (14610)	38.3 (215)	53.7 (7082)	1.00	1.00
Yes	44.5 (11696)	61.7 (346)	46.3 (6102)	1.53 (1.21, 1.93)**	1.05 (0.99, 1.12)
Injury hospitalization[c]					
No	98.3 (25856)	95.5 (536)	98.3 (12957)	1.00	1.00
Yes	1.7 (450)	4.5 (25)	1.7 (227)	2.00 (1.14, 3.51)*	1.01 (0.81, 1.26)
Child Welfare Organization Involvement					
Family receiving services[d]					
No	85.6 (22158)	24.8 (137)	76.4 (9907)	1.00	1.00
Yes	14.4 (3719)	75.2 (416)	23.6 (3067)	8.84 (6.58, 11.86)**	1.40 (1.29, 1.53)**
Child in care					
No	98.1 (22158)	94.5 (137)	97.9 (9907)	1.00	1.00
Yes	1.9 (429)	5.5 (8)	2.1 (210)	1.76 (0.67, 4.61)	0.95 (0.76, 1.20)

Notes. IPV = intimate partner violence. AOR = adjusted odds ratio (i.e., adjusted for baseline sociodemographic covariates at time of birth including maternal age, marital status, area-level income quintile, total number of children in home, provincial region of residence, and child sex).

[a]A negative IPV screen is the reference group for the independent variable in the logistic regression model.
[b]To protect confidentiality, estimates were not released as did not meet minimum cell count requirements as per Manitoba Centre for Health Policy data release guidelines.
[c]To protect confidentiality (and in accordance with Manitoba Centre for Health Policy data release guidelines), both intentional and non-intentional child injury hospitalizations were combined into a single injury hospitalization variable.
[d]Does not include cases where children were taken into child protective care.
*$p < .01$; **$p < .001$

Table 5.3. Child School Readiness at Kindergarten Entry by Intimate Partner Violence Screen Response Around the Time of Delivery					
EDI Domain of Functioning	**Negative IPV Screen** *N* = 11,114 (66.3%)	**Positive IPV Screen** *N* = 227 (1.4%)	**Not Screened for IPV** *N* = 5,426 (32.4%)	**Positive IPV Screen vs. Negative IPV Screen[a]**	**Not Screened vs. Negative IPV Screen[a]**
	% (n)	% (n)	% (n)	AOR (99% CI)	AOR (99% CI)
Communication/General Knowledge					
Ready	89.2 (9802)	74.7 (162)	85.8 (4592)	1.00	1.00
Not ready	10.8 (1182)	25.4 (55)	14.2 (762)	1.72 (1.11, 2.65)*	1.27 (1.10, 1.45)**
Emotional					
Ready	87.8 (9580)	71.0 (154)	85.3 (4543)	1.00	1.00
Not Ready	12.2 (1335)	29.0 (63)	14.7 (782)	1.85 (1.22, 2.81)**	1.11 (0.97, 1.27)
Language/Cognitive					
Ready	90.4 (9886)	74.7 (162)	87.0 (4639)	1.00	1.00
Not Ready	9.6 (1049)	25.4 (55)	13.0 (692)	1.69 (1.09, 2.62)*	1.26 (1.09, 1.45)**
Physical					
Ready	88.8 (9724)	71.4 (155)	85.8 (4575)	1.00	1.00
Not Ready	11.2 (1225)	28.6 (62)	14.2 (759)	1.73 (1.14, 2.62)**	1.14 (0.99, 1.30)
Social					
Ready	90.6 (9945)	75.1 (163)	87.4 (4678)	1.00	1.00
Not Ready	9.4 (1034)	24.9 (54)	12.6 (674)	1.77 (1.14, 2.74)**	1.20 (1.04, 1.38)*
Low on at least one domain					
No	74.1 (8143)	47.0 (102)	68.2 (3653)	1.00	1.00
Yes	25.9 (2845)	53.0 (115)	31.8 (1703)	1.89 (1.30, 2.75)**	1.20 (1.08, 1.33)**
Low on 3 or more domains					
No	92.5 (10164)	77.0 (167)	89.9 (4814)	1.00	1.00
Yes	7.5 (824)	23.0 (50)	10.1 (542)	1.93 (1.22, 3.05)**	1.21 (1.03, 1.42)*

Notes. EDI = Early Development Instrument; IPV = intimate partner violence; AOR = adjusted odds ratio (i.e., adjusted for baseline sociodemographic covariates at time of birth including maternal age, marital status, area-level income quintile, total number of children in home, provincial region of residence, and child sex) as well as child age (in days) at time of EDI assessment.
[a]A negative IPV screen is the reference group for the independent variable in the logistic regression model.
[b]AORs adjusting for baseline sociodemographic covariates at the time of birth for positive IPV vs. negative IPV screen comparisons are available in Table 4.
*$p < .01$; **$p < .001$

Table 5.4. Results of Sequential Logistic Regression Models for Relationship between a Positive IPV Screen vs. Negative IPV Screen on Child Readiness for School at Kindergarten Entry Across Domains of Functioning

EDI Domain of Functioning	**Model 1: Adjusted for child sex**	**Model 2: Sociodemographic Covariates**	**Model 3: Pregnancy Outcomes**	**Model 4: Maternal Health**	**Model 5: Child Health**	**Model 6: Postpartum Violence Risk**	**Full Model**
	AOR (99% CI)	AOR (99% CI)	AOR (99% CI)	AOR (99% CI)	AOR (99% CI)	AOR (99% CI)	AOR (99% CI)
Communication/ General Knowledge	2.76** (1.83, 4.17)	1.72* (1.11, 2.65)	2.68** (1.77, 4.06)	2.51** (1.64, 3.84)	2.67** (1.76, 4.05)	1.59* (1.03, 2.46)	1.39 (0.89, 2.17)
Emotional	2.89** (1.93, 4.33)	1.85** (1.22, 2.81)	2.84** (1.89, 4.25)	2.33** (1.53, 3.54)	2.77** (1.84, 4.18)	1.66* (1.08, 2.53)	1.38 (0.89, 2.14)
Language/Cognitive	3.14** (2.07, 4.75)	1.69* (1.09, 2.62)	3.02** (1.99, 4.59)	2.53** (1.64, 3.89)	3.01** (1.98, 4.58)	1.55* (1.002, 2.40)	1.28 (0.81, 2.02)
Physical	3.12** (2.10, 4.64)	1.73** (1.14, 2.62)	2.99** (2.01, 4.46)	2.53** (1.67, 3.81)	2.99** (2.00, 4.48)	1.49 (0.98, 2.26)	1.22 (0.79, 1.89)
Social	3.12** (2.05, 4.76)	1.77** (1.14, 2.74)	3.05** (2.00, 4.65)	2.48** (1.61, 3.84)	3.01** (1.96, 4.62)	1.55 (0.99, 2.41)	1.27 (0.80, 2.01)
Low on at least 1 domain	3.21** (2.24, 4.61)	1.89** (1.30, 2.75)	3.13** (2.18, 4.50)	2.72** (1.88, 3.95)	3.10** (2.15, 4.46)	1.65** (1.13, 2.42)	1.37 (0.92, 2.02)
Low on 3 or more domains	3.62** (2.35, 5.59)	1.93** (1.22, 3.05)	3.50** (2.26, 5.41)	2.85** (1.82, 4.48)	3.50** (2.25, 5.44)	1.68* (1.06, 2.66)	1.39 (0.86, 2.23)

Notes. Model 1: Adjusted for child sex at time of EDI assessment.
Model 2: Adjusted for Model 1 plus baseline sociodemographic covariates (i.e., maternal age, marital status, area-level income quintile, total children in home, and provincial region of residence) at time of birth.
Model 3: Adjusted for Model 1 plus baseline pregnancy outcomes (i.e., low birthweight, preterm birth, small for gestational age, neonatal intensive care unit admission, and newborn length of stay greater than 3 days).
Model 4: Adjusted for Model 1 plus maternal health outcomes (i.e., mood/anxiety disorder, personal disorder, substance use disorder, diabetes, hypertension, and respiratory morbidity) in 5-years postpartum.
Model 5: Adjusted for Model 1 plus child health outcomes (i.e., mood/anxiety disorder, attention deficit-hyperactivity disorder, congenital anomalies, and lower respiratory tract infection) in 5-years since birth.
Model 6: Adjusted for Model 1 plus postpartum violence and injury risk (i.e., family receiving services from child welfare organization, child in care, maternal intentional or non-intentional injury hospitalization, and child injury hospitalization).
Full Model: All covariates entered into the model simultaneously.
*$p < .01$; **$p < .001$

Online Supplementary Table S2. Sociodemographic Covariates and Birth Outcomes in Baseline vs. Follow-Up Sample			
Covariate	Baseline *N* = 45,896 % (n)	Follow-up *N* = 40,051 % (n)	Chi-Square (df) p-value
Violence Screener Response			
Negative IPV Screen	65.15 (29902)	65.68 (26306)	
Positive IPV Screen	1.42 (656)	1.40 (561)	
Not Screened for IPV	33.42 (15338)	32.92 (13184)	2.66 (2) *p* = 0.2647
Sociodemographic Covariates			
Maternal age at birth			
Less than 20 years	7.02 (3223)	6.79 (2720)	
20 to 24 years	20.61 (9460)	20.19 (8088)	
25 to 29 tears	30.95 (14207)	30.82 (12342)	
30 to 34 years	27.79 (12754)	28.20 (11294)	
35 to 39 years	11.41 (5236)	11.70 (4687)	
40 years and older	2.21 (1016)	2.30 (920)	7.16 (5) *p* = 0.2090
Marital status			
Married/common-law	45.11 (20638)	44.61 (17802)	
No registered union	54.89 (25110)	55.39 (22102)	2.16 (1) *p* = 0.1420
Area-level income quintile			
1 (lowest)	21.23 (9719)	20.60 (8230)	
2	20.14 (9218)	20.42 (8160)	
3	20.23 (9260)	20.22 (8080)	
4	19.78 (9055)	19.94 (7966)	
5 (highest)	18.62 (8525)	18.82 (7518)	5.64 (4) *p* = 0.2281
Total children in home			
0	0.51 (234)	EXCLUDED	
1	42.18 (19298)	42.02 (16767)	
2	33.79 (15458)	34.19 (13642)	
3 or more	23.52 (10758)	23.79 (9495)	1.27 (2) *p* = 0.5298
Health region of residence			
Winnipeg	59.15 (27147)	59.03 (23642)	
Southern	17.03 (7816)	17.20 (6890)	
Interlake-Eastern	7.12 (3267)	7.43 (2975)	
Prairie Mountain	12.51 (5742)	12.36 (4949)	
Northern	4.19 (1924)	3.98 (1595)	5.96 (4) *p* = 0.2024
Child sex			
Male	51.21 (23505)	51.22 (20515)	
Female	48.79 (22391)	48.78 (19536)	0.001 (1) *p* = 0.9800
Birth Outcomes			
Preterm birth			
No	93.68 (42994)	93.88 (37601)	
Yes	6.32 (2902)	6.12 (2450)	1.55 (1) *p* = 0.2130
Low birth weight			
No	95.90 (44016)	96.20 (38531)	

Yes	4.10 (1880)	3.80 (1520)	5.10 (1) *p* = 0.0239
Small for gestational age			
No	92.47 (42427)	92.61 (37089)	
Yes	7.53 (3454)	7.39 (2959)	0.60 (1) *p* = 0.4375
NICU admission			
No	94.66 (43444)	94.83 (37982)	1.34 (1) *p* = 0.2473
Yes	5.34 (2452)	5.17 (2069)	
Newborn LOS > 3 days			
No	66.80 (30657)	66.73 (26725)	
Yes	33.20 (15239)	33.27 (13326)	0.05 (1) *p* = 0.8298

Notes. IPV = intimate partner violence; NICU = neonatal intensive care unit; LOS = length of stay.

CHAPTER 6: OVERALL SUMMARY AND CONCLUSIONS

Summary of Findings

The overall goal of this study was to examine maternal and child outcomes from the prenatal period to 5-years after birth associated with a positive (or missing) intimate partner violence (IPV) screen response documented by public health nurses around the time of birth. It was hypothesized that mothers (and their children) who screened positive for IPV or who were missing a response to the IPV screen question around the time of birth would have more pregnancy complications, maternal prenatal morbidities, adverse birth outcomes, poorer health in the postpartum period, more child welfare involvement, and their children would be less ready for school compared to mothers and children with a negative IPV screen around the time of birth. Hypotheses were largely supported (see Table 6.1). A positive screen for violence around the time of birth was significantly associated with adverse developmental outcomes up to 5-years post-delivery. In addition, women (and their children) who were not screened for IPV around the time of birth also had poorer outcomes than women (and their children) who screened negative for IPV. That being said, there are several unique findings that emerged from this study that warrant further attention and provide directions for future research.

Implications and Directions for Future Research

FF Screen Process

Important findings emerged with regard to the implementation of the FF screen in Manitoba, at least as implemented at the time of the baseline data (2003 to 2006). First, the FF screen largely reached most families with newborns: 89.4% of all eligible families were screened by public health nurses around the time of birth. However, among women who were screened, a substantial proportion were missing a documented response to the violence question on the FF

screen form: 1 in every 4 women (25.4%) with a FF screen form did not have a documented response to the violence screen question. Further, the prevalence of missing IPV screen items among women with a FF form seemed particularly high in the Winnipeg area (37.0%) relative to other areas of the province. This points to a need for research examining reasons for not asking about IPV as part of the population-wide FF screen program in Manitoba, with particular attention to barriers existing in the Winnipeg area.

There are a number of barriers to screening for IPV reported in the literature, including a lack of time, a lack of training, and inadequate resources[1-8] As well, a women's safety should be paramount in all IPV screening programs, so it may be difficult to screen some women living in abusive situations without compromising their safety. The inability to meet with the woman privately;[6,9-11] concerns about privacy, confidentiality, and mandatory reporting requirements;[5] a lack of administrative and institutional support;[6,7] personal history of IPV;[6] and language or cultural barriers[10,11] have also been identified as factors impacting health care professionals adherence to IPV screening policy and practice recommendations. Identifying barriers to the universal implementation of IPV screens, both generally and specific to the Manitoban context, remains an important avenue for research.

Second, the FF screen is largely implemented after birth (only 5.7% of women from the baseline sample were screened prenatally). Given the association between a positive IPV screen (and not being screened for IPV) with negative pregnancy outcomes found in this study, and reported elsewhere,[12-23] it might be more prudent to screen women for IPV during routine prenatal care rather than only after birth. That is not to say that the FF screen should not be implemented as it is clearly an important part of a larger public health initiative aimed at improving the health and well-being of Manitoban families; but rather is meant to suggest that

physicians and other health care providers should incorporate routine IPV screening into their care plans for pregnant women.

In this study, less than 1% of all women had no documented prenatal care visits in their medical records. This suggests that virtually all Manitoban women come into contact with a health care provider during the prenatal period. The pregnancy period offers a unique possibility to intervene in cases of IPV because prenatal care encompasses multiple visits, reaches almost all pregnant women, and targets the age group most at risk for violence.[24] Pregnancy has also been called the "window of opportunity" to intervene in cases of IPV because pregnant women are often motivated to make behavioural changes to ensure the health of their unborn children, many support services are available to pregnant women that may not be available at other times in their lives, and pregnancy may be the only time that women have regular contact with their health care providers.[25] Educating and training health care professionals about the nature of IPV, and how to best respond to IPV, are integral components of a more comprehensive type of health care. The United States Preventive Services Task Force[26] has concluded that interventions aimed at improving outcomes for pregnant women experiencing violence have been proven sufficiently effective to warrant universal screening for IPV. Counselling sessions, information cards, referrals to community services, mentor support, and home visitation programs were identified as interventions that have been implemented to improve the circumstances and outcomes for women experiencing IPV.[26] Improved outcomes from the review included reduced IPV during pregnancy and postpartum, improved pregnancy outcomes, decreased pregnancy coercion, and fewer unsafe relationships.[26] In this study, a positive IPV screen around the time of delivery was associated with adverse maternal and child outcomes from birth to 5-years postpartum. Identifying and intervening with women experiencing IPV earlier (i.e., prenatally) rather than

later (i.e., after delivery) might help to improve the long-term developmental trajectory of these women and their children.

Third, Manitoban families identified as high risk by the FF screen (i.e., 3 or more risk factors out of the 38 assessed is indicative of a positive overall FF screen) can be referred to additional services (e.g., home visitation, parenting programs, financial or mental health services) through the FF program.[27] This seems appropriate. However, it also seems that a documented history of past or current violence between parenting partners might warrant particular consideration in and of itself. That is, a positive screen for IPV should indicate a potential need for additional services. Further, it is not enough to only ask women about their IPV experiences; women disclosing IPV to health care providers also need to be referred to appropriate and effective services. Even relatively brief intervention programs for high risk pregnant women experiencing abuse (i.e., 30 minute sessions on types of IPV, the cycle of abuse, preventive options, danger assessment, and safety planning 4 to 8 times over the course of routine prenatal care) have been shown to significantly reduce IPV and improve pregnancy outcomes.[28] Additional research examining the effectiveness of various interventions, both prenatally and in postpartum period, is needed in order to determine how to best improve the lives of women and their children experiencing violence.

Women Who are Not Screened for IPV

Future research should be aimed at developing a better profile of women who are not screened for IPV as part of the FF screen in Manitoba. Women who were not screened for IPV around the time of delivery were also found to have more prenatal morbidities (i.e., low number of prenatal care visits, pregnancy related hospitalizations) and adverse birth outcomes (i.e., preterm births, low birth weight infants, low 5 minute Apgar scores, neonatal intensive care unit

admissions, and longer newborn length of stay after birth) than women screening negative for IPV around the time of delivery. Again, these findings point to the need to incorporate screening into routine prenatal care. Although these women were not screened as part of the FF screen, they did in fact have contact with prenatal care providers during their pregnancy. Thus providing the "window of opportunity" to intervene earlier with regard to promoting better pregnancy outcomes.

In this study, we were unable to develop a clear profile of women who were not screened for IPV around the time of delivery. It remains unclear whether or not these women were more or less likely to have a history of IPV relative to the screened group. For example, although evidence from this study suggests that the non-screened group shared some characteristics with women at risk of experiencing IPV (e.g., young, unmarried, lower income),[29-32] they also tended to experience more adverse birth outcomes than women who screened negative for IPV around the time of delivery. Therefore, it seems likely that non-screened women are not a homogenous group. For example, in families with IPV it may be difficult for public health nurses to ask about IPV without compromising women's safety, which could represent the particularly high risk subset of women who are not screened for IPV. In other families that are experiencing more compromised newborn health concerns, women may be too preoccupied with their newborns' health concerns to make time for a public health visit. As previously discussed, there are also several other barriers to IPV screening that likely influenced implementation of the IPV screen item by public health nurses.

In this study, there also appeared to be some differences between the missing FF form and missing FF item groups, with women not being screened at all (i.e., missing the FF form) representing a particularly high risk subset of the population. Compared to women who were

missing a documented response to the IPV item on the FF form, women who were not screened at all were younger, less likely to be in a registered marital or common-law union, and more likely to be living in lower income areas, to have no children living in the home (including the newborn) of the registered family head at the time of birth, and to have a low number of prenatal care visits than women who screened negative for IPV. Researchers have speculated that abusive partners interfere with a pregnant woman's access to prenatal care,[33] and inadequate prenatal care has been associated with an increased risk of IPV during pregnancy.[18,33-36] The finding that these women were more likely to have a low number of prenatal care visits could be indicative of an increased likelihood of involvement in a violent relationship. If this is the case, it also seems likely that an abusive partner would also interfere with public health nurse visits after the birth of their child. As well, one potential explanation for the finding that women who were not screened at all were more likely to have no children living in the home (including the newborn) is that these children may have been taken into child protective care at birth. Families with children in care would not be screened by public health nurses because, for the most part, the FF screen does not happen until the early postpartum period. Both of these findings might help to explain why some women are missing the FF screen entirely.

It is also important to note that for women who were not screened for IPV around the time of delivery, compromised developmental outcomes extended into the postpartum period. Mothers had more postpartum mental health problems, families were more likely to be involved with child welfare services, and children were less ready for school at kindergarten entry than women screening negative for IPV around the time of delivery. Therefore it would seem that these women, regardless of not being screened, would benefit from additional supports to promote a better developmental trajectory for themselves and their children.

Compromised Maternal and Child Outcomes in the Postpartum Period

This study extends current findings on violence during pregnancy by examining the longer-term outcomes of women and their children associated with a positive IPV screen around the time of birth. As hypothesized, a positive screen for IPV was associated with poorer maternal and child health, more child welfare organization involvement, and children being less ready for school in the 5-years post-delivery. A major advantage of the use of administrative data in this study is that it also allowed the follow-up of women and their children who were not screened for violence, which is not possible with many other study designs. Women who were not screened for IPV around the time of delivery also tended to have poorer maternal mental health in postpartum period, more child welfare organization involvement, and children who were less ready for school than women screening negative for IPV around the time of delivery. The fact that women who were not screened also had increased odds of mood and/or anxiety and substance use disorders and intentional injury hospitalizations, as well as more child welfare organization contact, in the postpartum period hint to the possibility of IPV history. It could also be that these women face a host of other challenges in their lives – many factors are associated with these outcomes. If this is the case, then it makes sense that children of these mothers might be less ready for school because sociodemographic disadvantage,[37] parental mental disorders,[38-42] adverse birth outcomes,[15,37,43-48] and postpartum violence risk[49-53] have all been associated with functional problems among children.

One major difference between the positive IPV screen and missing IPV screen groups was regarding child postpartum health outcomes. Children of mothers screening positive for IPV had more compromised health outcomes (i.e., attention deficit-hyperactivity disorder, lower respiratory tract infections, and injury hospitalizations) that were not noted among children of

mothers who were not screened for IPV around the time of delivery. This is surprising given this study's findings that children of mothers who were not screened for IPV had more compromised birth outcomes, particularly given evidence that premature birth and low birthweight have been shown to influence children's subsequent physical health outcomes.[43] Another difference was that problems with readiness for school were found across all domains of functioning (i.e., communication/general knowledge, language/cognitive development, emotional maturity, social competence, physical health and well-being) among children of mothers who screened positive for IPV whereas effects seemed more specific among children of mothers who were not screened for IPV around the time of birth (i.e., significant relationships were only found for communication/general knowledge, language/cognitive development, and social competence domains of functioning among children of mothers who were not screened for IPV). Perhaps the potential heterogeneity of the non-screened group of families can partially explain the less robust and less consistent association between a missing IPV screen and children's lack of readiness at school entry.

The fact that the physical health and well-being (assessed at kindergarten entry) of children born to mothers who were not screened for IPV was not significantly different than the physical health and well-being of children born to mothers screening negative for IPV could be related to the fact that the overall health (e.g., diagnosed mood/anxiety disorders, attention deficit-hyperactivity disorders, lower respiratory tract infections, injury hospitalizations) of these two groups of children was similar in the postpartum period. However, the finding that child postpartum health was similar in both the negative IPV screen and non-screened groups is surprising, particularly given the prevalence of adverse birth outcomes among non-screened women, and the similarities between the positive IPV screen and non-screened groups for most

of the adverse outcomes assessed in this study. It is also difficult to explain the differences in emotional maturity that emerged between these two groups. For both groups, the effects of stress on the developing fetus might help to explain the lack of school readiness in specific domains of function (e.g., communication/general knowledge, language/cognitive development). Prenatal exposure to maternal stress hormones can result in early programming of brain functions with permanent change in neuroendocrine regulation and behaviour in offspring.[44,54-56] In addition, a report from the Manitoba Centre for Health Policy (MCHP)[37] identified three separate subgroups of children in Manitoba as being particularly vulnerable to compromised Early Development Instrument outcomes – children born to adolescent mothers, children in families receiving income assistance, and children in families involved with the child welfare system. These subgroups seem consistent with the profile of children in families born to both mothers screening positive for IPV and who were not screened for IPV around the time of delivery. The MCHP report concluded that significant investment in early childhood development at a population-wide level (starting in the prenatal period) is required to prevent children's early developmental vulnerability and to promote more positive developmental outcomes.[37] Findings from this series of studies also highlight the need for investments in maternal and child health programs and policies at the population level.

Mechanisms Leading to Adverse Developmental Outcomes

It was speculated that various pathways might be responsible for the relationship between a positive maternal IPV screen at the time of delivery and children's lack of readiness for school across multiple domains of functioning at kindergarten entry. Hypothesized pathways included socioeconomic disadvantage, adverse pregnancy outcomes, compromised postpartum maternal health, compromised postpartum child health, and postpartum violence exposure. Contrary to

expectations, neither adverse pregnancy outcomes nor compromised maternal or child health in the postpartum period substantively reduced the odds of being less ready for school across domains of functioning. It was also hypothesized that a positive IPV screen around the time of delivery would continue to exert independent effects on children's school readiness in fully adjusted models. However, the inclusion of all the covariates into the models reduced the odds to non-significance. It could be effects of stress on the developing fetus, rather than pregnancy outcomes or maternal mental postpartum health outcomes per se, that help to explain these findings. That is, it could be that fetal exposure to maternal stress exerts a direct effect on children's subsequent functioning that is not fully accounted for by the impact of prenatal stress exposure on pregnancy and postpartum outcomes. Other research has found that relationships between violence during pregnancy and child developmental outcomes are largely mediated by maternal prenatal mental health problems and/or postpartum violence risk.[42,57-59]

Socioeconomic disadvantage and proxy indicators of postpartum violence and injury risk (i.e., child welfare organization contact, maternal intentional and non-intentional injury hospitalizations, child injury hospitalization) seemed especially important for understanding the relationship between a positive IPV screen around the time of delivery and children's functional problems at school entry. These two factors attenuated the odds of adverse school functioning related to a positive IPV screen more than any other category of covariates (i.e., adverse birth outcomes, maternal postpartum health problems, child postpartum health problems) in the series of sequential logistic regression models. This lends support to the finding that the relationship between prenatal violence exposures on child developmental outcomes is largely mediated by socioeconomic disadvantage and postpartum violence risk. Socioeconomic disadvantage is known to have a negative impact on health and well-being across the lifespan.[60] Socioeconomic

disadvantage is also strongly related to school outcomes.[37,61-64] Thus, the relationship between a positive screen for IPV and children's lack of readiness for school at kindergarten entry might exist due to the strong association of IPV with indicators of socioeconomic disadvantage[29-32] rather than due to IPV exposure directly.

Social learning mechanisms are another potential theoretical explanation for the link between violence exposure and poor adjustment at kindergarten entry, particularly given the finding that postpartum violence exposure had a substantial impact on reducing the odds between a positive IPV screen around the time of delivery and children's lack of readiness for school. According to social learning tenets, children learn to be aggressive and violent by observing and imitating role models,[65] which likely affects their level of social competence at school entry. It could also be that prenatal or postnatal violence exposure interferes with the development of a secure attachment bond between mothers and their children.[22,42,66-70] Therefore, attachment issues could also help to explain the relationship between a positive IPV screen and children's lack of school readiness across various domains of functioning. Research has shown that insecure attachment is associated with negative outcomes across the lifespan.[71-76] Future research aimed at identifying the precise mechanisms through which a positive screen for IPV around the time of delivery leads to negative longer-term outcomes seen among exposed children might help to identify important intervention targets aimed at reducing vulnerabilities and promoting better developmental outcomes.

Strengths and Limitations

The strengths of this series of studies include the use of a population-wide sample of women and their children that could be followed from the prenatal period to 5-years post-delivery. The use of a population-wide sample of women increases generalizability of the

findings, facilitates the examination of low base-rate events, and allows for the use of more complex multivariate methods to better understand the pathways through which pregnancy violence leads to poor developmental outcomes. Also, this series of studies does not rely on prenatal care access (as in most samples) to generate comparison groups due to the population-wide nature of the study design. The use of administrative data also allowed the follow-up of women and their children who were not screened for IPV, providing valuable insight into the developmental trajectory of these women and their children who would normally be non-participants in most other research designs. The linkage capabilities of the data housed in the Repository allow virtually all women and their children residing in Manitoba to be followed over time regardless of prenatal care access or IPV screen response. Finally, the use of administrative data removes participant recall bias as a potential source of measurement error and the use of physician-generated diagnoses may be more objective than self-reported measures of health and well-being.

This series of studies is also subject to a number of limitations. The use of a single item regarding a past or current history of violence between parenting partners to assess IPV status around the time of pregnancy needs to be viewed as a major limitation. Single item measures of IPV likely underestimate the true prevalence of IPV exposure among women. Studies using violence measures that include multiple items, report on different types of violence, and that are implemented over multiple time points find higher prevalence estimates of IPV than studies relying on a single item to assess IPV implemented at a single time point.[29] Further, public health nurses may be reluctant to enquire about, and woman may be reluctant to disclose, IPV occurring around the time of pregnancy. Thus, it is likely that the IPV prevalence estimate found in this study (2.1%) represents a very conservative estimate of IPV. As well, the exact timing

(e.g., before or during pregnancy), type (e.g., physical, sexual, emotional), or frequency and severity of IPV could not be determined. All of these factors likely had an impact on the outcomes assessed in this study. Incorporating more detailed assessments of IPV experiences into the FF screen, or as part of routine prenatal care, may help to better delineate how IPV influences short- and long-term maternal and child health and social outcomes.

The proxy measures of postpartum violence risk used in this study (i.e., maternal intentional injury hospitalizations, maternal non-intentional injury hospitalizations, child injury hospitalizations, and child welfare organization involvement) likely underestimated the actual prevalence of postpartum violence because: (1) many violence-related incidents likely do not require hospitalization; (2) injuries sustained that require hospitalization may not be recognized as intentionally-inflicted (hence the inclusion of all injury hospitalizations into the measure, which may have overestimated postpartum violence risk); (3) a substantial proportion of family violence is not reported to official agencies;[78,79] and (4) the majority of referrals to child welfare organizations are for neglect rather than for physical child abuse or exposure to IPV.[80]

Physical and mental health conditions are limited to the treatment-seeking population, and diagnoses are contingent upon accurate (and somewhat subjective) coding by physicians and other health care personnel. As well, the exclusion of other important pregnancy outcomes (e.g., miscarriage, abortion, perinatal death, pregnancy intention) that have been associated with violence during pregnancy[13,14,81-88] could not be examined in relation to IPV screen response due to the nature of current screening policy in Manitoba (i.e., woman are not screened until after the birth of a live infant and screens are not done among women whose pregnancy does not result in a live birth). As well, many important risk and protective factors (e.g., pregnancy intention, race/ethnicity, self-reported subjective assessment of stress, mother-child attachment, early

caregiving environment, parenting practices, social support, paternal characteristics) were not available in the administrative databases. Finally, because the baseline data represented FF screen practices in 2003 through 2006, findings may not accurately represent current screen practices. However, it was also necessary to have a baseline sample that allowed for the longer-term follow-up of women and children into the postpartum period in order to examine key hypotheses.

Conclusion

In this study, women screening positive for IPV and women who were not screened for IPV around the time of delivery had more compromised developmental outcomes during the prenatal period, at birth, and up to 5-years postpartum. Identifying and intervening with pregnant women living in challenging circumstances earlier (i.e., during routine prenatal care) rather than only assessing developmental risk factors after birth (i.e., existing FF screen practice) may help to improve both the short-term and long-term developmental outcomes for women and their children. Additionally, incorporating screening assessments into routine prenatal care (by physicians and other health care providers providing care to pregnant women) likely would help foster a connection with women who are not currently part of the FF screen (i.e., those that are not screened at all). This is important given findings that the not screened at all group (i.e., those without a FF form) seem to represent a particularly high risk subset of the Manitoban population. That is not to say that the FF screen should be abandoned. It clearly represents an important population health initiative aimed at improving the health and well-being of children and their families. Instead, findings suggests that shifts in more general Canadian policy and practice recommendations[89] regarding the overall provision of health care for pregnant women from a

targeted to more universal approach to IPV screening might also translate into improved maternal and child health outcomes at a population level.

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Table 6.1. Support or Negation for Primary Research Hypotheses	
Hypotheses	**Research Support or Negation**
1A: The pattern of missing data with regard to overall screening practices, and the violence screening question specifically, will be non-random.	**1A: Supported**
1B: Compared to families who are screened for violence, families who are not screened at all will represent a high risk subset of Manitoba families (e.g., young maternal age, low income, unmarried, poor pregnancy outcomes).	**1B: Supported**
1C: Compared to families who are screened for violence, families who are screened, but are missing a documented response to the violence screen question, will represent both high risk and low risk subsets of Manitoba families.	**1C: Partially Supported** A low risk subset of families was not detected among those missing a response to IPV screen question.
2A: Women screening positive for IPV around the time of delivery will evidence greater sociodemographic risk, maternal morbidities, pregnancy complications, and adverse birth outcomes than women screening negative for IPV around the time of delivery.	**2A: Largely Supported** Exception: Many of the hypothesized pregnancy complications (e.g., hypertension, breech birth, assisted delivery, fetal distress) were not significantly associated with a positive IPV screen.
2B: Women who were not screened for IPV around the time of delivery will evidence greater sociodemographic risk, maternal morbidities, pregnancy complications, and adverse birth outcomes than women screening negative for IPV around the time of delivery.	**2B: Partially Supported** For the most part, maternal prenatal morbidities and pregnancy complications were not significantly associated with not being screened for IPV.
2C: The relationship between a positive IPV screen response (vs. negative IPV screen) and adverse birth outcome will persist after controlling for sociodemographic covariates, pregnancy complications, and maternal prenatal morbidities (post-hoc analysis).	**2C: Partially Supported** A positive IPV screen remained independently associated with preterm birth and longer newborn LOS after adjustments; however, the relationship between a positive IPV screen and low birthweight became non-significant in adjusted model.
3A: Women screening positive for IPV around the time of delivery will have more adverse mental and physical health outcomes than women screening negative for IPV from birth to 5 years post-delivery.	**3A: Supported**

3B: Women who were not screened for IPV around the time of delivery will have more adverse mental and physical health outcomes than women screening negative for IPV from birth to 5 years post-delivery.	**3B: Partially Supported** Effects seemed specific to mental health outcomes and intentional injury hospitalizations. Differences were not detected for physical health outcomes.
3C: Children born to women screening positive for IPV around the time of delivery will have more adverse mental and physical health outcomes than children born to women screening negative for IPV from birth to 5 years post-delivery.	**3C: Supported**
3D: Children born to women who were not screened for IPV around the time of delivery will have more adverse mental and physical health outcomes than children born to women screening negative for IPV from birth to 5 years post-delivery.	**3D: Negated**
3E: Children born to women screening positive for IPV around the time of delivery will evidence greater child welfare organization contact, will be more likely to enter child protective care, and be less ready for school at kindergarten entry than children born to women screening negative for IPV.	**3E: Largely Supported** Exception: A positive screen for IPV was not significantly associated with the child being taken into protective care.
3F: Children born to women who were not screened for IPV around the time of delivery will evidence greater child welfare organization contact, will be more likely to enter child protective care, and be less ready for school at kindergarten entry than children born to women screening negative for IPV.	**3F: Largely Supported** Exception: Not being screened for IPV was not significantly associated with the child being taken into protective care.
3G: Among children born to women who were screened for IPV, a positive screen for IPV (vs. negative screen) around the time of delivery will remain independently associated with children's readiness for school assessment at kindergarten entry after controlling for sociodemographic disadvantage, adverse pregnancy outcome, maternal postpartum health problems, child health problems, and postpartum violence risk. It is also hypothesized that these covariates will substantially attenuate the relationship between a positive IPV screen (vs. negative screen) around the time of delivery and children's readiness for school at kindergarten.	**3G: Partially Supported** Although groups of risk factors did attenuate the odds of being less ready for school (especially sociodemographic covariates and postpartum violence/injury risk), the relationship between a positive IPV screen and being less ready for school was not significant in the fully adjusted model.

Notes. IPV = intimate partner violence; LOS = length of stay.

APPENDIX A: **GLOSSARY OF TERMS**

TERM	DEFINITION	SOURCE
Abortion	"Loss of pregnancy before the fetus is viable outside the uterus; miscarriage" (Olds et al., 2004). An abortion can be spontaneous (i.e., occurs naturally, miscarriage; Olds et al., 2004) or induced (i.e., pregnancy is intentionally terminated early via surgical procedure or medication; MCHP, 2012). (See Induced Abortion, Miscarriage, Spontaneous Abortion)	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Abruptio placenta	"Partial or total premature separation of a normally implanted placenta" (Olds et al., 2004).	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Antenatal hospitalization	"An admission to hospital for physical or psychological conditions resulting from, or aggravated by, pregnancy which does not lead to delivery. It is an indicator of maternal morbidity" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Antepartum	"Time between conception and the onset of labor, usually used to describe the period during which a woman in pregnant" (Olds et al., 2004).	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Antepartum hemorrhage	"A significant amount of bleeding from the uterus occurring prior to childbirth" (Magann et al., 2005). (see Hemorrhage, Postpartum hemorrhage)	MCHP (2012) Glossary Definition as cited in Magann et al. (2005)[1,3]
Anxiety disorders	"A group of psychiatric conditions involving excessive anxiety (i.e. excessive feelings of apprehension or fear) that persist to the point that they interfere with daily life for an extended period of time" (MCHP, 2012). In the MCHP definition, anxiety disorders include anxiety states, phobic disorders, and/or obsessive-compulsive disorders.	MCHP (2012) Glossary Definition[1]

Apgar score	Apgar scores measure the physiological well–being of the newborn. A score of 0, 1, or 2 is given for each of five vital signs (appearance, pulse, reflex, muscle tone, and breathing pattern) that are assessed at one and five minutes after birth. These five scores are added up to give a total score between 0 and 10.	MCHP (2012) Glossary Definition[1]
Appropriate-for-gestational age (AGA)	"A birth is considered appropriate for gestational age if the birth weight is between the 10th and 90th percentiles for the infant's gestational age and sex" (MCHP, 2012). (See Size for Gestational Age)	MCHP (2012) Glossary Definition based on Kramer et al. (2001)[1,4]
Assisted vaginal birth	"Vaginal births that were assisted by the means of forceps or vacuum extraction" (MCHP, 2012)	MCHP (2012) Glossary Definition[1]
Asthma	"A disease in which inflammation of the airways causes airflow into and out of the lungs to be restricted" (MCHP, 2012, Glossary Definition). It is characterized by "periodic attacks of wheezing, shortness of breath, chest tightness, and coughing" (MCHP, 2014, Concept Description).	MCHP (2012) Glossary Definition and MCHP (2012) Concept Description[1]
Attention deficit-hyperactivity disorder (ADHD)	"A neurobehavioral developmental disorder that is characterized by a persistent pattern of impulsiveness, hyperactivity and absence of attention in children. The disorder is often identified during school ages and symptoms may continue into adulthood. ADHD occurs twice as commonly in boys as in girls" (MCHP, 2012).	MCHP (2012) Glossary Definition based on American Psychological Association (2000)[1,5]
Autism spectrum disorder	"A pervasive developmental disorder that typically affects a person's social interactions and ability to communicate, and may be evident by repetitive behaviours or a strong attachment to routine. The severity ranges from mild to severe and it includes diagnoses of Autistic Disorder, Pervasive Developmental Disorder-Not Otherwise Specified, and Asperger's Disorder" (MCHP,	MCHP (2012) Glossary Definition based on Autism Society Canada (2005)[1,6]

	2012).	
Breech birth	"The birth of a baby from a breech presentation" (MCHP, 2012) (see Breech Presentation)	MCHP (2012) Glossary Definition[1]
Breech presentation	"A birth in which the buttocks and/or feet are presented instead of the head" (Olds et al., 2004).	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Caesarean birth	"Birth of fetus accomplished by performing a surgical incision through the maternal abdomen and uterus" (Olds et al., 2004).	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Child mortality	"The death of children aged 1 to 19 years, as reported in the Vital Statistics database. The child mortality rate is the number of deaths in a given year, expressed either per 1000 or 100,000 children in this age group" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Children in care (CIC)	"Children in care are children who are removed from their families of origin and placed in the care of another adult(s) (not a parent or guardian) due to concerns about the proper provision of care in the family of origin. There are situations where a family in unable or unfit to properly look after their child(ren) for a variety of reasons including abuse and neglect, illness, death, conflict in their family, disability, or emotional problems. Children can be placed in foster care through voluntary placement, voluntary surrender of guardianship, apprehension, or order of guardianship. CIC does not include children who remain with or are returned to a parent or guardian under an order of supervision" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Children in a family receiving services from Child and Family Services	"Children whose health or emotional well-being is thought to be endangered, but who remain in a family that receives a service from Child and Family Services (CFS). Services requested by the family or received upon 'recommendation' by CFS are intended	MCHP (2012) Glossary Definition[1]

(CFS)	to serve as aid in the resolution of family matters" (MCHP, 2012).	
Congenital anomalies	"An abnormality of structure, function or body metabolism that is present at birth (even if not diagnosed until later in life) and results in physical or mental disability, or is fatal" (MCHP, 2012).	MCHP (2012) Glossary Definition based on March of Dimes Resource Center (1998)[1,7]
Diabetes/ Diabetes mellitus	"A chronic condition in which the pancreas no longer produces enough insulin (Type I Diabetes) or when cells stop responding to the insulin that is produced (Type II Diabetes), so that glucose in the blood cannot be absorbed into the cells of the body. Diabetes Mellitus affects may organs and body functions, especially those involved in metabolism, and can cause serious health complications including renal failure, heart disease, stroke, and blindness. Symptoms include frequent urination, fatigue, excessive thirst, and hunger. Also called insulin-dependent diabetes, Type I diabetes begins most commonly in childhood or adolescence and is controlled by regular insulin injections. The more common form of diabetes, Type II, can usually be controlled with diet and oral medication. Another form of diabetes called gestational diabetes can develop during pregnancy and generally resolves after the baby is delivered" (MCHP, 2012). (See Gestational Diabetes, Maternal Diabetes)	MCHP (2012) Glossary Definition[1]
Eclampsia	"A major complication of pregnancy. Its cause is unknown; it occurs more often in the primigravida and is accompanied by elevated blood pressure, albuminurla, oliguria, tonic and clonic convulsions and coma. It may occur during pregnancy (usually after the 20th week of gestation) or within 48 hours of childbirth" (Olds et al., 2004). (See Preeclampsia)	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]

Fetal death	"Death of a baby before delivery. Also referred to as Stillborn or Stillbirth" (MCHP, 2012). **Note**: Heaman et al. (2012) identified a stillbirth as a fetal death with a gestation of 20 weeks or greater and a birth weight of at least 500 grams. (See Stillbirth, Stillborn/Stillborn Birth)	MCHP (2012) Glossary Definition[1] See also Heaman et al. (2012)[8]
Fetal distress	"Evidence that the fetus is in jeopardy, such as a change in fetal activity or heart rate" (Olds et al., 2004).	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Fetal malpresentation	"Presenting of the fetus to the lower pole of the uterus during childbirth in a position other than cephalic (head end of the body). Malpresentations strictly include breech and shoulder presentation (transverse lie), but can also incorporate face and brow presentations" (MCHP, 2012).	MCHP (2012) Glossary Definition based on Simm (2007)[1,9]
Forceps	"Obstetric instrument occasionally used to aid in childbirth" (Olds et al., 2004).	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Fragile infant	"A live-born infant with an extremely low birth weight (less than 500 grams) or an extremely short gestational age (less than 22 weeks). Survival rates of these infants may be unstable compared to other live-born infants" (MCHP, 2012). **Note:** In this study, live-born infants less than 400 grams or born at less than 18 weeks of age (i.e., deemed fragile) were excluded from analyses due to low probability of survival.	MCHP (2012) Glossary Definition[1]
Gestation	"Period of intrauterine development from conception through birth; pregnancy" (Olds et al., 2004).	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Gestational age	"Gestational age is approximated from the age of a newborn infant from the first day of a women's last menstrual period to birth and is often reported in weeks of gestation. The	MCHP (2012) Glossary Definition[1]

	average gestational age of a newborn is 37 weeks" (MCHP, 2012).	
Gestational diabetes	"A form of diabetes of variable severity with onset or first recognition during pregnancy" (Olds et al., 2004). (See Diabetes/Diabetes Mellitus, Maternal Diabetes)	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Gravida	"Any pregnancy, regardless of duration, including present pregnancy. The term gravida and para refer to pregnancies, not to the fetus. Thus twins, triplets and other multiple fetuses count as one pregnancy and one birth" (Olds et al., 2004). (See Nulligravida, Multigravida, Primigravida)	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Hemorrhage	"a copious discharge of blood from the blood vessels" (MedlinePlus, 2012) (see Antepartum Hemorrhage, Postpartum Hemorrhage)	MedlinePlus (2012)[10]
Hypertension	"Primary hypertension is often referred to as high blood pressure. The term 'tension' in hypertension describes the vascular tone of the smooth muscles in the artery and arteriole walls. Hypertension is a major health problem, especially because it often has no symptoms. If left untreated, hypertension can lead to heart attack (acute myocardial infarction (AMI)), stroke, enlarged heart, or kidney damage" (MCHP, 2012). (See Maternal Hypertension)	MCHP (2012) Glossary Definition[1]
Induced abortion	"A pregnancy that is intentionally terminated early, using either a surgical procedure or medication" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Induction of labour	"Labour induction is the act of stimulating labour contractions to begin the birthing process, through either physical or medical means. Physical methods of induction include	MCHP (2012) Glossary Definition[1]

	the artificial rupture of the membranes to break the water, Medical methods include the intravenous administration of the chemical oxytocin to initiate labour. Note that induction of labour is akin to the term **augmentation of labour** in method, but induction is only carried out before the onset of labour" (MCHP, 2012).	
Infant mortality	"An indicator of death among infants within one year of birth. This may include or exclude fragile infants, who are more likely to die. Short gestation periods have been defined as either < 20 weeks, or more recently < 22 weeks. Infant mortality is seen as an indicator of health status, level of health care in an area, and the effectiveness of prenatal care" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Intrapartum	"The time from the onset of true labor until the birth of the infant and expulsion of the placenta" (Olds et al., 2004).	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Intrauterine growth restriction (IUGR)	"The occurrence of poor fetal growth which may happen through a number of mechanisms" (Public Health Agency of Canada, 2008, p. 130). "IUGR is different than Small-for-Gestational-Age (SGA) as SGA refers to size after a baby is born" (MCHP, 2012).	MCHP (2012) Glossary Definition as cited in Public Health Agency of Canada (2008)[1,11]
Large-for-gestational-age (LGA)	"Infants that are at or above the 90th percentile in birth weight, from an infant population of the same sex and gestational age" (MCHP, 2012). (See Size for Gestational Age)	MCHP (2012) Glossary Definition based on Kramer et al. (2001)[1,4]
Length of stay	"The number of days of care counted from the admission date to the separation (discharge) date for patients/residents within a healthcare facility. This could be in a hospital or personal care home" (MCHP, 2012). In this research, this includes the entire hospital episode (e.g., includes transfers	MCHP (2012) Glossary Definition[1]

	between hospitals)" (MCHP, 2012).	
Lower respiratory tract infection	"Infection affecting the lower part of the breathing system (the breathing tubes and lungs). The diagnosis-based definition for five years of age and older is at least one diagnosis over one year for lower respiratory tract infection. The definition for age less than five years is at least one diagnosis over one year for lower respiratory tract infection, as defined above or Asthma" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Maternal diabetes	"A composite variable created that includes a diagnosis of Type 1 or Type 2 diabetes or gestational diabetes [in the year prior to delivery]" (MCHP, 2012). (see Diabetes/Diabetes Mellitus, Gestational Diabetes)	MCHP (2012) Glossary Definition[1]
Maternal hypertension	"A composite variable created that includes primary hypertension as well as hypertensive disorders in pregnancy occurring in the one year prior to birth" (MCHP, 2012). (see Hypertension)	MCHP (2012) Glossary Definition[1]
Miscarriage	"Abortion that occurs naturally" (Olds et al., 2004). Also called spontaneous abortion. (see Spontaneous Abortion)	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Mood disorder	"Mood disorder is the term given for a group of diagnoses in the Diagnostic and Statistical Manual of Mental Disorders (DSM) classification system where a disturbance in a person's mood is hypothesized to be the main underlying feature" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Morbidity	"Morbidity is any departure, subjective or objective, from a state of physiological or psychological well-being (i.e. sickness or illness)" (MCHP, 2012).	MCHP (2012) Glossary Definition as based on Last (2001)[1,12]
Multigravida	"A woman who is in her second or any subsequent pregnancy" (Olds et al., 2004).	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]

	(See Gravida, Nulligravida, Primigravida)	
Multipara	"A woman who has had two or more births at more than 20 weeks gestation" (Olds et al., 2004). (See Para, Nullipara, Primipara)	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Neonatal	Defined as age from birth to 28 days (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Neonatal morbidity	"The risk of death during the newborn period – the first 28 days of life" (Olds et al., 2004).	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Neonatal mortality rate	"The number of deaths of live born babies weighing 500 grams or more within 27 days of birth per 1,000 live births. **Note:** This weight is consistent with definitions used by the Public Health Agency of Canada" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Neonatal special care unit (SCU) admission	"A live born baby [is] considered to have a SCU admission if there was any admission to a SCU during the birth hospitalization, which [is] noted by the presence of the SCU unit 50 (Neonatal Intensive Care Unit (NICU)) or SCU unit 98" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Nulligravida	A woman who has never been pregnant (MedlinePlus, 2012). (See Gravida, Multigravida, Primigravida)	MedlinePlus (2012)[10]
Nullipara	"A woman who has not given birth at more than 20 weeks gestation" (Olds et al., 2004). (See Multipara, Para, Primipara)	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Para	"Birth after 20 weeks' gestation, regardless of whether the infant is born alive or dead. The terms gravida and para refer to pregnancies, not to the fetus. Thus twins, triplets and other multiple fetuses count as one pregnancy and one birth" (Olds et al., 2004). (See Multipara, Nullipara, Primipara)	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]

Parity	"The number of times a woman has given birth after 20 weeks' gestation. A multiple birth is counted as one birth and stillbirths are included" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Personality disorder	"A class of mental illnesses characterized by chronic behavioral and relationship patterns that can often cause serious personal and social difficulties, as well as a general impairment in functioning" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Placenta	"Specialized disk-shaped organ that connects the fetus to the uterine wall for gas and nutrient exchange. Also called afterbirth" (Olds et al., 2004).	MCHP (2014) Glossary Definition as cited in Olds et al. (2004)[1,2]
Placenta previa	"An abnormal implantation of the placenta at or near the internal opening of the uterine cervix so that it tends to precede the child at birth usually causing severe maternal hemorrhage" (MedlinePlus, 2012).	MedlinePlus (2012)[10]
Postnatal	"Occurring or being after birth" (MedlinePlus, 2012).	MedlinePlus (2012)[10]
Post-neonatal	"Defined as age 29 days to 1 year" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Post-neonatal mortality rate	"The number of deaths of live born babies weighing 500 grams or more between 28 and 364 days after birth per 1,000 live births. **Note:** This weight is consistent with definitions used by the Public Health Agency of Canada" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Postpartum	"The period of time after childbirth and/or delivery" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Postpartum hemorrhage	"Postpartum haemorrhage (PPH) is commonly defined as a blood loss of 500 ml or more within 24 hours after birth" (World Health Organization, 2012, p. 3). (see Antepartum Hemorrhage, Hemorrhage)	World Health Organization (2012)[13]
Post-term birth	"A birth where the gestational age of the infant is 42 or more weeks" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]

Preeclampsia	"Toxemia of pregnancy, characterized by hypertension, albuminuria, and edoma" (Olds et al., 2004). (See Eclampsia)	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Premature rupture if membranes (PROM)	"When the amniotic sac breaks or leaks before labour begins. Preterm PROM is when this occurs before 37 weeks of gestation" (MCHP, 2012).	MCHP (2012) Glossary Definition based on Society of Obstetricians and Gynaecologists of Canada (n.d.)[1,14]
Prenatal	"Occurring, existing, performed, or used before birth" (MedlinePlus, 2012).	MedlinePlus (2012)[10]
Prenatal care/ Prenatal care visits	"A series of regular contacts between a healthcare provider, typically a physician, and a pregnant women, that take place at schedules intervals between the confirmation of pregnancy and the initiation of labour. The primary function of this care is to monitor the progress of pregnancy to identify complications, to provide information to the women on beneficial practices, and to co-ordinate the involvement of other providers in the mother's labour and the delivery of the newborn" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Preterm birth	"A live birth where the gestational age of the infant is less than 37 weeks. Preterm births are frequently categorized as early preterm [gestational age less than 34 weeks] and late preterm [gestational age between 34 and 36 weeks]" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Primigravida	"A woman who is pregnant for the first time" (Olds et al., 2004). (See Gravida, Multigravida, Nulligravida)	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Primipara	"A woman who has had one birth at more than 20 weeks' gestation, regardless of whether the infant is born alive or dead" (Olds et al., 2004). (See Multipara, Nullipara, Para)	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]

Respiratory Morbidity	"Total respiratory morbidity (TRM) is a measure of the burden of all types of respiratory illness in the population, and includes any of the following respiratory illnesses: asthma, chronic or acute bronchitis, emphysema, chronic airway obstruction or chronic obstructive pulmonary disease (COPD). This combination of diagnoses is used to overcome problems resulting from physicians (or specialists) using different diagnosis codes for the same underlying illness (e.g., asthma versus chronic bronchitis)" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Separation(s)	"A separation from a health care facility occurs anytime a patient (or resident) leaves because of death, discharge, sign-out against medical advice or transfer. The number of separations is the most commonly used measure of the utilization of hospital services. Separations, rather than admissions, are used because hospital discharge abstracts for inpatient care are based on information gathered at the time of discharge. In some cases, both inpatient and surgical outpatient records are included. In addition, hospital separations may not include newborn separations, since this would essentially result in a double counting (the mother and the baby being discharged). The terms **'separation', 'discharge', 'hospital discharge', hospital separation' and 'stay'** are used interchangeably" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Size for gestational age	"Size for gestational age is a measure of fetal growth, where small-for-gestational age is considered an indicator of fetal growth restriction and a marker for increased infant mortality and morbidity risk, and large-for-gestational age is an indicator of accelerated fetal growth and a marker for increased risk of birth complications and infant morbidity" (MCHP, 2012).	MCHP (2012) Glossary Definition based on Health Canada (2000/2003)[1,15,16]

	(See Appropriate-for-Gestational Age, Large-for-Gestational Age, Small-for-Gestational Age)	
Small-for-gestational age (SGA)	"Infants that are at or below the 10th percentile in birth weight, from an infant population of the same sex and gestational age" (MCHP, 2012). (See Size for Gestational Age)	MCHP (2012) Glossary Definition based on Kramer et al. (2001)[1,4]
Spontaneous abortion	"Abortion that occurs naturally. Also called miscarriage" (Olds et al., 2004). (See Abortion, Miscarriage)	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Spontaneous vaginal birth	"A vaginal birth that is not coded as a caesarean birth (C-section) and not assisted by forceps or vacuum extraction" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Stillbirth	"Death of a baby before delivery. Also referred to as Stillborn or fetal death" (MCHP, 2012). **Note**: In Heaman et al (2012), a stillbirth was identified as a fetal death with a gestation of 20 weeks or greater or a birth weight of at least 500 grams. (See Fetal Death, Stillborn/Stillborn Birth)	MCHP (2012) Glossary Definition[1] See also Heaman et al. (2012)[8]
Stillborn/ Stillborn birth	"A fetus weighing 500 g or more, or of gestational age 20 weeks or more with no sign of life after birth" (MCHP, 2012). (See Fetal Death, Stillbirth)	MCHP (2012) Glossary Definition[1]
Substance abuse	"The excess use of and reliance on a drug, alcohol, or other chemical that leads to severe negative effects on the individual's health and well-being or to the welfare of others" (MCHP, 2012).	MCHP (2012) Glossary Definition[1]
Term birth	"Birth where the gestational age of the infant is 37 to 41 weeks. Can be further divided to capture early term (37 to 39 weeks) births" (MCHP, 2012).	MCHP (2012)[1] Glossary Definition

Trimester	"Three months, or one third of the gestational time for pregnancy" (Olds et al., 2004).	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]
Vacuum extraction	"An obstetric procedure used to assist in the birth of a fetus by applying suction to the fetal head with a soft suction cup attached to a suction bottle (pump) by tubing and placing the device against the occiput of the fetal head" (Olds et al., 2004).	MCHP (2012) Glossary Definition as cited in Olds et al. (2004)[1,2]

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APPENDIX B: STUDY VARIABLES AND DATA SOURCES

VARIABLE	OPERATIONALIZATION	DATA SOURCE
Violence Screen Item		
Violence screen	Violence screen response (dichotomous): "Current or history of violence between parenting partners" (yes/no) For study 1 (screened vs. not screened), documented violence screen responses were categorized as follows: (1) screened for violence, (2) not screened for violence (missing violence screen item on Families First screen form), and (3) not screened at all (missing Families First screen form). For study 2 and 3 (short- and long-term outcomes associated with violence screen response), documented violence screen responses were categorized as follows" (1) negative violence screen, (2) positive violence screen, and (3) not screened for violence (due to either missing violence item or missing Families First screen form)	Families First Screen (Q34)
Sociodemographic Variables		
Maternal age at birth	Maternal age at the time of birth (ordinal): less than 20 years, 20 to 24 years, 25 to 29 years, 30 to 34 years, 35 to 39 years, and 40 years and older. Computed based on mother's age (continuous) on delivery date	Hospital Abstracts (hospital birth record abstract)
Maternal low education (at birth)	Maternal low education (dichotomous): "Mother's highest level of education completed is less than grade 12" (yes/no)	Families First Screen (Q14)
Marital status (at birth)	Marital status (dichotomous): registered marital/common law union in registry vs. no registered marital/common-law union in registry Note: Variable likely underestimates number of marital/common-law unions as only includes those that	Manitoba Health Insurance Registry

	have been reported to Manitoba Health	
Area level income quintile (at birth)	Area-level income quintile (ordinal): Each income quintile contained approximately 20% of the study population and was ranked from poorest (quintile 1) to wealthiest (quintile 5). To compute income quintiles, quintiles are first divided into 2 population categories: urban (Winnipeg and Brandon) and rural (all other Manitoba areas), and then 5 groups (i.e., quintiles) within each category, with approximately 20% of the population in each group. Area-level income is determined first based on the municipal code/postal code provided in the Manitoba Health Insurance Registry, which is then linked to the average household income level in the Census using the postal code conversion file.[1] Coding of this variable was completed by Manitoba Centre for Health Policy and included in the mom-baby birth record (i.e., hospital discharge) dataset.	Manitoba Health Insurance Registry, 2006 Census
Social assistance/ financial difficulties	Social assistance/financial difficulties (dichotomous): "On social assistance/income support or financial difficulties" (yes/no)	Families First Screen (Q15)
Provincial region of residence (at birth)	Based on Manitoba Regional Health Authority (RHA) of residence (categorical): Winnipeg Regional Health Authority (RHA), Southern Health, Interlake-Eastern RHA, Prairie Mountain Health, and Northern RHA. Region of residence is determined first based on the municipal code and further subdivided by the postal code provided in the Manitoba Health Insurance Registry. Coding of this variable was completed by Manitoba Centre for Health Policy and included in the mom-baby birth record (i.e., hospital discharge) dataset.	Manitoba Health Insurance Registry
Total number of children in home (at birth)	The total number of children in home (ordinal) at the time of birth: 0, 1, 2, 3 or more The total number of children in home at the time of birth was computed from information in Manitoba Health Insurance Registry (child) and includes all children living in the home of the registered family head at the	Manitoba Health Insurance Registry

	time of the child's birth. Includes the newborn, other biological children, step-children, and grandchildren.	
Pregnancy-Related Risk Factors		
Low number of prenatal visits	Low number of prenatal care visits (dichotomous): 5 or more prenatal visits prior to delivery (recommended) vs. less than 5 prenatal visits prior to delivery (less than the recommended number of visits).[2] Coding of this variable was computed prior to being deposited into the Manitoba Centre for Health Policy Repository), and was included in the mom-baby birth record (i.e., hospital discharge) dataset.	Hospital Abstracts (hospital birth record abstract)
Parity	Parity (dichotomous): primiparous vs. multiparous. The field code obpara from the hospital abstract was used to identify whether the woman is primapara (coded as 0 in field) or multipara (coded as 1 in field).	Hospital Abstracts (hospital birth record abstract)
Smoking during pregnancy	Maternal smoking during pregnancy (dichotomous): "Maternal smoking during pregnancy" (yes/no)	Families First Screen (Q12)
Alcohol use during pregnancy	Maternal alcohol use during pregnancy (dichotomous): "Alcohol use by mother during pregnancy" (yes/no)	Families First Screen (Q6)
Drug use during pregnancy	Maternal drug use during pregnancy (dichotomous): "Drug use by mother during pregnancy" (yes/no). **Note:** Public health nurses are instructed to include illegal drug use during pregnancy, and to exclude non-teratogenic prescription drugs and/or small amounts of over-the-counter drugs on the Families First Screen form.	Families First Screen (Q7)
Maternal Prenatal Morbidities and Pregnancy Complications		
Maternal mood and/or anxiety disorder (prenatal)	Maternal mood and/or anxiety disorder in the year prior to delivery (dichotomous): diagnosed maternal prenatal mood and/or anxiety disorder (yes/no). Consistent with Heaman et al. (2012),[2] maternal prenatal mood and/or anxiety disorder (i.e., maternal	Hospital Abstracts, Medical Services (physician

	prenatal psychological distress in Heaman)[2] was determined if in the year prior to delivery (vs. in 8 months prior to delivery in Heaman)[2] the woman met any of the following criteria: (1) one or more hospitalizations with a diagnosis for depressive disorder, affective psychoses, neurotic depression, or adjustment reaction (ICD-9-CM codes 296.1-296.8, 300.4, 309, 311; ICD-10-CA codes F31, F32, F33, F34.1, F38.0, F38.1, F41.2, F43.1, F43.2, F43.8,F53.0, F93.0) **OR** (2) one or more physician visits with a diagnosis for depressive disorder, affective psychoses, or adjustment reaction (ICD-9-CM codes 296, 309 or 311) **OR** (3) one or more prescriptions for an antidepressant or mood stabilizer (ATC codes N03AB02, N03AB52, N03AF01, N05AN01, N06A) **OR** (4) one or more physician visits with a diagnosis for anxiety disorders (ICD-9-CM code 300) AND one or more prescriptions for an antidepressant or mood stabilizer (ATC codes N03AB02, N03AB52, N03AF01, N05AN01, N06A) **OR** (5) one or more hospitalizations with a diagnosis for anxiety states, phobic disorders, or obsessive-compulsive disorders (ICD-9-CM codes 300.0, 300.2, 300.3; ICD-10-CA codes F40, F41.0, F41.1, F41.3, F41.8, F41.9, F42) **OR** (6) two or more physician visits with a diagnosis for anxiety disorders (ICD-9-CM code 300).[2] **Note**: A full list of medications[3] (based on currently available ATC codes and Drug Identification Numbers used to treat the aforementioned conditions) used to compute the mood and/or anxiety disorder variable is available at: http://mchp-appserv.cpe.umanitoba.ca/viewConcept.php?conceptID=1391	claims), Drug Program Information Network
Maternal hypertension (prenatal)	Maternal hypertension in the year prior to delivery (dichotomous): diagnosed maternal hypertension in the year prior to delivery (yes/no). Consistent with Heaman et al. (2012),[2] maternal prenatal hypertension was determined according to the following criteria: (1) at least one physician visit or hospitalization in the year prior to delivery (ICD-9-CM codes 401-405; ICD-10-CA codes I10-I13, I15) **OR** (2)	Hospital Abstracts, Medical Services (physician claims), Drug Program Information

	two or more prescriptions for hypertension drugs – Antihypertensives (C02AB01, C02AB02, C02AC01, C02CA04, C02CA05, C02DB02, C02DC01, C02KX01, C02LA01, C02LB01, G04CA03); Diuretics (C03AA03, C03BA04, C03BA11, C03CA01, C03CA02, C03CC01, C03DA01, C03DB01, C03DB02, C03EA01); Beta Blocking Agents (C07AA02, C07AA03, C07AA05, C07AA06, C07AA12, C07AB02, C07AB03, C07AB04, C07AB07, C07AG01, C07BA05, C07BA06, C07CA03, C07CB03); Calcium Channel Blockers (C08CA01, C08CA02, C08CA04, C08CA05, C08CA06, C08DA01, C08DB01); Agents Acting on the Renin–Angiotensin System (C09AA01, C09AA02, C09AA03, C09AA04, C09AA05, C09AA06, C09AA07, C09AA08, C09AA09, C09AA10, C09BA02, C09BA03, C09BA04, C09BA06, C09BA08, C09CA01, C09CA02, C09CA03, C09CA04, C09CA06, C09CA07, C09DA01, C09DA02, C09DA03, C09DA04, C09DA06, C09DA07) in the year prior to delivery, **OR** (3) at least on physician visit or hospitalization in the gestation period for hypertension (ICD-9-CM code 642 or ICD-10-CA code O10-O16).[2]	Network
Maternal diabetes (prenatal)	Maternal diabetes in the year prior to delivery (dichotomous): diagnosed maternal diabetes in the year prior to delivery (yes/no). Similar to Heaman (2012),[2] maternal diabetes in the year prior to delivery was determined according to the following criteria: (1) one or more hospitalizations with the diagnosis code 250 (ICD-9-CM) or E10-E14 (ICD-10-CA) in the year prior to delivery **OR** (2) one or more physician claims with a diagnosis code 250 in the year prior to delivery **OR** (3) one or more prescriptions for diabetic drugs including Insulins and Analogues (A10A); Blood Glucose Lowering Drugs excluding Insulin (A10BA02, A10BB01, A10BB02, A10BB03, A10BB09, A10BB12, A10BB31, A10BD03, A10BF01, A10BG02, A10BG03, A10BX02, A10BX03) in the year prior to delivery **OR** (4) one or more hospitalizations with gestational diabetes in the gestation period (ICD-9-CM: 648.0, 648.8, ICD-10-CA: O24).[2]	Hospital Abstracts, Medical Services (physician claims), Drug Program Information Network

	Note: This operationalization of maternal diabetes differs from the operationalization of maternal diabetes in Heaman et al. (2012)[2] in that (1) diagnoses are limited to a one year (vs. three year) time frame in this study **AND** (2) only a single physician visit with a diagnostic code of 250 (vs. two or more in Heaman et al. analysis)[2] is required to document presence of maternal diabetes. **Note**: The full list of medications (based on currently available ATC codes and Drug Identification Numbers used to treat the aforementioned conditions) used to compute the mood and/or anxiety disorder variables is available at:[3] http://mchp-appserv.cpe.umanitoba.ca/concept/MB_Kids_2012_Diabetes_DIN_List_DPIN.pdf	
Placenta previa/abruptio placenta	Placenta previa/abruption placenta (dichotomous): Placenta previa/abruption placenta (yes/no). A woman will be identified as having placenta previa/abruption placenta by the presence of the ICD-9-CM code 641 or ICD-10-CA codesO44 and O45 on the hospital abstract.[2]	Hospital Abstracts
Any pregnancy-related hospitalization	Any pregnancy-related hospitalization (dichotomous): Any pregnancy-related hospitalization (yes/no). Conditions were chosen based on Heaman et al. (2012),[2] and included the most common conditions resulting in hospitalization during the antenatal period. Each hospital episode was defined as a single, continuous stay in the hospital system regardless of transfers between hospitals. A woman was coded as having an antenatal (non-delivery) pregnancy-related hospitalization if at any time from initial date of pregnancy up to, but not including, the delivery hospitalization she was hospitalized for any of the following conditions: Threatened preterm labour (ICD-9-CM codes 644.0, 644.1, 644.2; ICD-10-CA codes O47.003, O47.103, O47.903); antenatal hemorrhage (ICD-9-CM codes 640.0, 640.8, 640.9, 641.0, 641.1, 641.2, 641.8, 641.9; ICD-10-CA codes O46.9, O20.0, O44.1, O44.0, O45.9,	Hospital Abstracts

	O46.8, O20.9, O45.8, O20.8, O67.9); diabetes (ICD-9-CM codes 250, 648.03, 648.83; ICD-10-CA codes O24.803, O24.603, O24.503, O24.703); hypertensive disorders (ICD-9-CM codes 642.0-642.9; ICD-10-CA codes O13.003, O14.003, O16.003, O10.0, O11.033, O10.4, O15.0, O10.2M O13.001); genitourinary complications (ICD-9-CM codes 583.89, 584.9, 591, 592.0, 599.0, 646.6; ICD-10-CA codes 23.0, O23.4, O23.9, O23.5, N12, O23.3, O23.1, N19, N20.0, N13.2, N39.0); vomiting (ICD-9-CM codes 643.0-643.9; ICD-10-CA codes O21.0, O21.1, 021.2, 021.9, 021.8); premature rupture of membranes (ICD-9-CM codes 658.1, 658.2; ICD-10-CA codes O42, O75.6); known and suspected fetal problems (ICD9-CM codes 655, 656, 659.7; ICD-10-CA codes O35, O36, O37, O43, O68); cervical incompetence (ICD-9-CM code 654.5; ICD-10-CA code O34.3); and abdominal pain (ICD-9-CM codes 789.0-789.9; ICD-10-CA codes R10.4, R10.30, R10.39, R10.10, R10.12, R10.2).[2]	
Breech birth/ Other malpresentation	Breech birth/other malpresentation during delivery (dichotomous): Breech birth/other malpresentatin (yes/no). A breech birth was identified as the presence of one or more of the following codes on the hospital discharge abstract form: ICD-9-CM codes 652.1, 652.2, 660.0 or ICD–10–CA codes O32.1, O33, O64.1, and O83.0.[2]	Hospital Abstracts (hospital birth record abstract)
Induction of labour	Induction of labour during delivery (dichotomous): Induction of labour (yes/no). Consistent with Heaman et al. (2012),[2] a women was considered to have received an induction of labour by the presence of the ICD-9-CM codes 73.01, 73.1, 73.4, 73.09 or the ICD-10-CA Canadian Classification of Intervention (CCI) code of 5.AC.30.^^ (i.e., 5AC.30.AL–12, 5.AC.30.CA–12, 5.AC.30.CK–12, 5.AC.30.GU–12, 5.AC.30.HA–12, 5.AC.30.YA–12, 5.AC.30.YB–12, 5.AC.30.ZZ–12, 5.AC.30.AN, 5.AC.30.AZ, 5.AC.30.CA–Z9, 5.AC.30.CK, 5.AC.30.CK–A2, 5.AC.30.CK–BD, 5.AC.30.CK–W6, and 5.AC.30.AP).[2]	Hospital Abstracts
Assisted vaginal	Assisted vaginal delivery (forceps or vacuum extraction)	Hospital

delivery (forceps/vacuum extraction)	(dichotomous): Assisted vaginal delivery (yes/no). Consistent with Heaman et al. (2012),[2] a delivery was considered an assisted vaginal delivery by (1) the absence of a code indicating a caesarean birth (see caesarean birth measure) **AND** (2) the presence of one or more of the following codes: ICD–9–CM: 72.0, 72.1, 72.2, 72.3, 72.4, 72.71, 72.7, or 72.79; ICD–10–CA: 5.MD.53.KL, 5.MD.53.KK, 5.MD.53.KN, 5.MD.53.KM, 5.MD.53.KJ, 5.MD.53.KH, 5.MD.55.^^, 5.MD.54.^^, 5.MD.53.KS, 5.MD.53.KP, 5.MD.53.JE, 5.MD.53.JD on the hospital discharge abstract.[2]	Abstracts (hospital birth abstract)
Caesarean delivery	Caesarean delivery (dichotomous): Caesarean delivery (yes/no). The hospital birth record abstract contained a variable indicating whether the neonate was delivered by caesarean delivery (yes/no).	Hospital Abstracts (hospital birth record abstract)
Maternal number of days hospitalization (length of stay) post-delivery	Maternal length of stay post-delivery (dichotomous): less than 3 days, 3 days or more. Maternal length of stay will be calculated as the total number of days of care for an inpatient hospitalization associated with a live birth (including labour, delivery, and postpartum) per maternal birth record, calculated by subtracting the discharge date from the admission date. Direct transfers between hospitals are included in the calculation of length of stay.[2]	Hospital Abstracts (hospital birth record abstract)
Birth Outcomes		
Child sex	Indicated on the newborn's birth hospitalization record in the field labelled sex (male or female)	Hospital Abstracts (hospital birth record abstract)
Birth Weight **Specific outcomes include:** **(1) low birth weight**	Birth weight (ordinal, 3 levels): low birth weight (less than 2500 grams), normal birth weight (between 2500 and 4500 grams), and high birth weight (more than 4500 grams). Low birth weight (dichotomous): low birth weight/less	Hospital Abstracts (hospital birth record abstract)

(2) high birth weight	than 2500 grams (yes/no). High birth weight (dichotomous): high birth weight/more than 4500 grams (yes/no)	
Gestational size at birth **Specific outcomes include:** **(1) small-for-gestational age** **(2) large-for-gestational age.**	Gestational size at birth (ordinal, 3 level): small-for-gestational age (birth weight was less than the standard 10th percentile for their gestational age and sex based on a Canadian standard), appropriate for gestational age (birth weight between the 10th and 90th percentile for gestational age and sex based on a Canadian standard), and large-for-gestational age (birth weight was more than the standard 90th percentile for their gestational age and sex based on Canadian standard).[4] Small-for-gestational age (dichotomous): small-for-gestational age/less than 10th percentile for gestational age and sex (yes/no). Large-for-gestational age (dichotomous): large-for-gestational age/more than 90th percentile for gestational age and sex (yes/no).	Hospital Abstracts (hospital birth record abstract)
Gestational age at birth **Specific outcomes include:** **(1) preterm birth** **(2) post-term birth**	Gestational age at birth is defined as the number of completed weeks of gestation at the time of delivery, and was calculated by date of pregnancy and date of birth (from hospital abstract). Gestational age at birth (ordinal, 3 level): Preterm birth (less than 37 completed weeks of gestation), regular term birth (between 37 and 42 completed weeks of gestation), and pos-tterm birth (more than 42 completed weeks of gestation). Preterm birth (dichotomous): preterm birth/less than 37 weeks gestation (yes/no). Post-term birth (dichotomous): post-term birth/more than 42 weeks gestation (yes/no).	Hospital Abstracts (hospital birth record abstract)
5 minute Apgar score	5 minute Apgar score (dichotomous): Apgar score 7 or more, Apgar score less than 7. **Note**: Consistent with Heaman et al. (2012),[2] an Apgar score of less than 7 at 5 minutes was considered	Hospital Abstracts (hospital birth record abstract)

	indicative of poor physiological well-being.	
Admission to the neonatal intensive care unit	Admission to the neonatal intensive care unit (dichotomous): Neonatal intensive care unit admission (yes/no). A live born baby was considered to have a neonatal intensive care unit admission if there was any admission to a neonatal intensive care unit during the birth hospitalization, as indicated by the presence of the ACU unit 50 (Neonatal Intensive Care Nursing Unit) and SCU unit 98.[2] Note: A computed version of this variable was available in the mom-baby hospital birth record discharge abstract.	Hospital Abstracts (hospital birth record abstract)
Newborn number of days hospitalization (length of stay) post-delivery	Newborn length of stay post-delivery (dichotomous): less than 3 days, 3 days or more. Newborn length of stay was calculated as the total number of days of care for an inpatient hospitalization after birth, calculated by subtracting the discharge date from the birth date. Direct transfers between hospitals are included in the calculation of length of stay.[2]	Hospital Abstracts (hospital birth record abstract)
Fetal distress	Fetal distress (dichotomous): Fetal distress (yes/no). Fetal distress was indicated by the presence of the following codes on the hospital birth abstract: ICD-9-CM: 656.3, 656.8; ICD-10-CA O68.	Hospital Abstracts
Maternal Postpartum Health Outcomes		
Maternal mood and anxiety disorder (postpartum)	Maternal mood and/or anxiety disorder from index birth to 5 years post-delivery (dichotomous): Maternal diagnosed mood/anxiety disorder (yes/no). Consistent with several Manitoba Centre for Health Policy deliverables,[3,5-8] maternal mood and/or anxiety disorder was determined if the women met any of the following criteria (in the period from the index birth to 5 years post-delivery): (1) one or more hospitalizations with a diagnosis for depressive disorder, affective psychoses, neurotic depression or adjustment reaction	Hospital Abstracts, Medical Services (physician claims), Drug Program Information Network

	(ICD-9-CM codes 296.1-296.8, 300.4, 309 or 311; ICD-10-CA codes F31, F32, F33, F34.1, F38.0, F38.1, F41.2, F43.1, F43.2, F43.8, F53.0, F93.0) or with a diagnosis for an anxiety state, phobic disorders or obsessive-compulsive disorders (ICD-9-CM codes 300.0, 300.2, 300.3, 300.7; ICD-10-CA codes F40, F41.0, F41.1, F41.3, F41.8, F41.9, F42, F45.2) **OR** (2) one or more hospitalizations with a diagnosis for anxiety disorders (ICD-9-CM code 300; ICD-10-CA codes F32, F34.1, F40, F41, F42, F44, F45.0, F45.1, F45.2, F48, F68.0), or F99 AND one or more prescriptions for an antidepressant or mood stabilizer, including medications with the ATC codes N05AN01, N05BA, N06A **OR** (3) one or more physician visits with a diagnosis for depressive disorder or affective psychoses (ICD-9-CM codes 296, 311) **OR** (4) one or more physician visits with a diagnosis for anxiety disorders (ICD-9-CM code 300) AND one or more prescriptions for an antidepressant or mood stabilizer, including medications with the ATC codes N05AN01, N05BA, N06A **OR** (5) three or more physician visits with a diagnosis for anxiety disorders or adjustment reaction (ICD-9-CM code 300, 309).[3,5-8] **Note**: A full list of medications (based on currently available ATC codes and Drug Identification Numbers used to treat the aforementioned conditions) used to compute the mood and/or anxiety disorder variables is available at:[3] http://mchp-appserv.cpe.umanitoba.ca/viewConcept.php?conceptID=1391	
Maternal personality disorder (postpartum)	Maternal personality disorder from index birth to 5 years post-delivery (dichotomous): Maternal diagnosed personality disorder (yes/no). Consistent with Martens et al. (2004),[9] maternal personality disorder (from the index birth to 5 years post-delivery) was determined based on the following criteria: (1) one or more hospitalizations with a diagnosis of personality disorder: ICD-9-CM code 301 or ICD-10-CA codes F34.0, F60, F61, F62, F68.1,	Hospital Abstracts, Medical Services (physician claims)

	F68.8, or F69; **OR** (2) one or more physician visits with a diagnosis of personality disorder: ICD-9-CM code 301.[9] **Note:** The use of administrative data likely underestimates the prevalence of personality disorder in the population as the measure is limited to the treatment seeking population, clients are unlikely to be hospitalized, clients may seek treatment outside the formal health care system, and a high degree of comorbidity among personality disorders may lead to undercoding, especially with regard to physician claims.[9]	
Maternal substance abuse (postpartum)	Maternal substance abuse from index birth to 5 years post-delivery (dichotomous): Maternal substance abuse (yes/no). Consistent with Martens et al. (2004),[9] maternal substance abuse from the index birth to 5 years post-delivery was determined if a woman meets the following criteria: the presence of any of the ICD-9-CM codes 291 (alcoholic psychoses), 292 (drug psychoses), 303 (alcohol dependence), 304 (drug dependence), or 305 (nondependent abuse of drugs) or ICD-10-CA codes F10-F19 and F55 in physician claims records or hospital abstracts.[9]	Hospital Abstracts, Medical Services (physician claims)
Maternal diabetes (postpartum)	Diabetes in mothers from the index birth to 5 years post-delivery (dichotomous): Diabetes (yes/no). Consistent with several Manitoba Centre for Health Policy (MCHP) deliverables,[3,10-15] the presence of maternal diabetes from birth to 5 years post-delivery was determined based on the following criteria: (1) one or more hospitalizations with a diabetes diagnosis (ICD-9-CM: 250 or ICD-10-CA: E10-E14); **OR** (2) two or more physician visits with a diabetes diagnosis (ICD-9-CM: 250); **OR** (3) two or more prescriptions for a diabetes medication.[3,10-15] **Note:** In most MCHP deliverables, prevalence was assessed based on 3 years of data (vs. 5 years in this study). **Note:** A full list of medications (based on currently	Hospital Abstracts, Medical Services (physician claims), Drug Program Information Network

	available ATC codes and Drug Identification Numbers used to treat the aforementioned conditions) used to compute the diabetes diagnosis variables is available at:[3] http://mchp-appserv.cpe.umanitoba.ca/concept/MB_Kids_2012_Diabetes_DIN_List_DPIN.pdf	
Maternal hypertension (postpartum)	Hypertension in mothers from the index birth to 5 years post-delivery (dichotomous): Hypertension (yes/no). Consistent with several Manitoba Centre for Health Policy (MCHP) deliverables,[10-12,14,16] the presence of maternal hypertension from birth to 5 years post-delivery was determined based on the following criteria: (1) one or more hospitalizations with a diagnosis of hypertension: ICD-9-CM codes 401-405 OR ICD-10-CA codes I10-I13, I15; **OR** (2) one or more physician visits with a diagnosis of hypertension: ICD-9-CM codes 401-405; **OR** (3) two or more prescriptions for hypertension drugs including - Antihypertensives (C02AB01, C02AB02, C02AC01, C02CA04, C02CA05, C02DB02, C02DC01, C02KX01, C02LA01, C02LB01, G04CA03); Diuretics (C03AA03, C03BA04, C03BA11, C03CA01, C03CA02, C03CC01, C03DA01, C03DB01, C03DB02, C03EA01); Beta Blocking Agents (C07AA02, C07AA03, C07AA05, C07AA06, C07AA12, C07AB02, C07AB03, C07AB04, C07AB07, C07AG01, C07BA05, C07BA06, C07CA03, C07CB03); Calcium Channel Blockers (C08CA01, C08CA02, C08CA04, C08CA05, C08CA06, C08DA01, C08DB01); Agents Acting on the Renin–Angiotensin System (C09AA01, C09AA02, C09AA03, C09AA04, C09AA05, C09AA06, C09AA07, C09AA08, C09AA09, C09AA10, C09BA02, C09BA03, C09BA04, C09BA06, C09BA08, C09CA01, C09CA02, C09CA03, C09CA04, C09CA06, C09CA07, C09DA01, C09DA02, C09DA03, C09DA04, C09DA06, C09DA07).[10-12,14,16] **Note:** In MCHP deliverables, diagnoses were based on above mentioned criteria being met over a 1 year period (vs. 5 year period in this study).	Hospital Abstracts, Medical Services (physician claims), Drug Program Information Network
Maternal respiratory morbidity	Total respiratory morbidity in mothers from the index birth to 5 years post-delivery (dichotomous):	Hospital Abstracts, Medical

(postpartum)	Respiratory morbidity (yes/no). Consistent with several MCHP reports/deliverables,[9-11,14,16] the presence of maternal respiratory morbidity from the index birth to 5 years post-delivery was determined based on the following criteria: one or more hospitalizations or physician visits with diagnostic codes for asthma (ICD-9-CM code 493; ICD-10-CA code J45), bronchitis and bronchiolitis (ICD-9-M codes 466, 490, and 491; ICD-10-CM codes (J20, J21, J40, J41, and J42), emphysema (ICD-9-CM code 492; ICD-10-CA code J43), and chronic airway obstruction (ICD-9-CM code 496; ICD-10-CA code J44).[9-11,14,16]	Services (physician claims)
Maternal intentional injury hospitalizations (postpartum)	Maternal hospitalizations for intentional injuries (this includes injuries inflicted by self or others) from the index birth to 5 years post-delivery (dichotomous): Hospitalization for intentional injury (yes/no). Hospitalizations for intentional injuries was based on hospitalizations lasting one day or longer that resulted in an injury as indicated by the presence of one of the ICD-9-CM E-Codes (E-Code = external cause of injury code) or ICD-10-CA V, W, X, Y-Codes listed in the hospital discharge abstract. The ICD-9-CM E-Codes E950-E959 or ICD-10-CA codes X60-X84 (suicide and self-inflicted injury) and ICD-9-CM E-Codes E960-E968, E928.3 or ICD-10-CA codes X85-Y09, W50 (homicide and injuries inflicted by others) were used to determine whether intentional injury hospitalizations. This definition excludes injuries due to legal interventions (ICD-9-CM E-Codes E970-E978 or ICD-10-CA code Y35) or war operations (ICD-9-CM E-Codes E990-E999 or ICD-10-CA code Y36).	Hospital Abstracts
Maternal non-intentional injury hospitalizations (postpartum)	Maternal hospitalizations for non-intentional injuries from the index birth to 5 years post-delivery (dichotomous): Hospitalization for non-intentional injury (yes/no). Hospitalizations for non-intentional injuries was based on hospitalizations lasting one day or longer that resulted in an injury as indicated by the presence of any of the ICD-9-CM E-Codes (E-Code = external cause of injury code) or ICD-10-CA V, W, X, Y-Codes listed in	Hospital Abstracts

	the hospital discharge abstract. Included are hospitalizations due to motor vehicle accidents (ICD-9-CM codes E810-E819, E822-E825 or ICD-10-CA codes V03-V04, V13-V14, V20-V29, V33-V34, V40-V79, V80.4, V81.0-V81.1, V82.0-V82.1, V87.2-V87.5, V88.2-V88.5, V89), other vehicle accidents (ICD-9-CM codes E800-E807, E820-E821, E826-E829, E831, E833-E838, E840-E848 or ICD-10-CA codes V01-V02, V05, V09, V10-V12, V15-V19, V30-V32, V35-V39, V80.0-V80.3, V80.5-V80.9, V81.2-V81.9, V82.2-V82.9, V86, V87.0-V87.1, V88.6-V88.9, V91, V94, V96, V97, V98-V99), poisoning (ICD-9-CM codes E850-E858. E860-E869, E980-E982 or ICD-10-CA codes X20-X29, X40-X49), accidental falls (ICD-9-CM codes E880-E885, E886.9, E888 or ICD-10-CA codes W00-W19), accidents caused by fire and flames/hot substances (ICD-9-CM codes E890-E899 or ICD-10-CA codes X00-X19), accidents due to natural and environmental factors (E900-E909, E928.0-E928.2, E928.6 or ICD-10-CA codes W42, W43, W92-W99, X30-X39), choking, suffocation and constriction (ICD-9-CM codes E911-E913, E928.4, E928.5 or ICD-10-CA codes W75-W84), sports injuries (ICD-9-CM codes E886.0, E917.0, E917.5), late effects of injury (ICD-9-CM codes E929, E989), accidents caused by foreign bodies (ICD-9-CM codes E914, E915 or ICD-10-CA codes W44-W47), struck by objects, caught between objects (ICD-9-CM codes E916-E918 or ICD-10-CA codes W20, W22.08-W22.09, W23, W51, W52), accidents caused by machinery, explosions, electricity (ICD-9-CM codes E919-E926 or ICD-10-CA codes W24-W42, W85-W91), overexertion, strenuous movements (ICD-9-CM code E927 or ICD-10-CA codes X50-X57), injuries undetermined as accidental or purposely inflicted (ICD-9-CM codes E983-E988 or ICD-10-CA codes Y10-Y34), and other unspecified accidents (ICD-9-CM codes E887, E928, E928.8, E928.9 or ICD-10-CA codes X58, X59). This definition excludes intentionally inflicted injuries as indicated by ICD-9-CM E-Codes E950-E959 or ICD-10-CA codes X60-X86 (suicide and self-inflicted injury) and ICD-9-CM E-Codes E960-E968, E928.3 or ICD-10-	

	CA codes X85-Y09 (homicide and injuries inflicted by others) as well as injuries due to legal interventions (ICD-9-CM codes E970-E978 or ICD-10-CA code Y35), injuries due to war operations (ICD-9-CM codes E990-E999 or ICD-10-CA code Y36), injuries due to misadventures during surgical or medical care (ICD-9-CM codes E870-E876; ICD-10-CA codes Y60-Y69, Y88.1), reactions or complications due to medical care (ICD-9-CM codes E878-E879; ICD-10-CA codes Y70-Y84, Y88.2, Y88.3), and adverse reactions due to drugs (ICD-9-CM codes E930-E949; ICD-10-CA codes Y40-Y59, Y88.0).	
Child Health Outcomes		
Autism spectrum disorder (ASD)	Child autism spectrum disorder diagnosed from birth to 5 years post-delivery (dichotomous): Autism spectrum disorder (yes/no). Consistent with Brownell et al. (2008),[17] children will be defined as having an ASD if from birth to 5 years post-delivery, any of the following criteria are met: (1) one or more hospitalizations with any one of the recorded ICD-9-CM diagnostic codes as 299.0, 299.1, 299.8, or 299.9, or any one of the recorded ICD-10-CA diagnostic codes as F84.0-F84.5, F84.8, or F84.9; OR (2) one or more physician claims with the diagnosis code 299.[17] **Note:** Brownell et al. (2008)[17] also used Manitoba Special Needs data file to identify cases of ASD. This data source was not be used in this study due to the younger age range examined (birth to age 5).	Hospital Abstracts, Medical Services (physician claims)
Attention deficit-hyperactivity disorder (ADHD)	Child attention deficit-hyperactivity disorder diagnosed from birth to 5 years post-delivery (dichotomous): Attention- deficit-hyperactivity disorder (yes/no). Consistent with several Manitoba Centre for Health Policy deliverables,[3,5,7,8,18] children were defined as having an ADHD if from birth to 5 years post-delivery, any of the following criteria were met: (1) one or more hospitalizations with a diagnosis of hyperkinetic syndrome of childhood (ICD-9-CM code 314 or ICD-10-CA code F90); **OR** (2) one or more physician visits	Hospital Abstracts, Medical Services (physician claims), Drug Program Information Network

	with a diagnosis of hyperkinetic syndrome of childhood (ICD-9-CM code 314); **OR** (3) two or more prescriptions for a psychostimulant medication without a corresponding diagnosis of conduct disorder (ICD-9-CM code 312 or ICD-10-CA codes F63, F91, F92), disturbance of emotions (ICD-9-CM code 313 or ICD-10-CA codes F93, F94), or cataplexy/narcolepsy (ICD-9-CM code 347 or ICD-10-CA code G47.4).[3,5,7,8,18] Note: Brownell et al. (2008)[17] also included the additional criteria of one prescription for a psychostimulant in the fiscal year and a diagnosis of hyperkinetic syndrome of childhood in the previous three years. Due to differences in age groups assessed (5 to 19 year olds vs. birth to age 5), this criteria was excluded in the current study. **Note:** A full list of medications (based on currently available ATC codes and Drug Identification Numbers used to treat the aforementioned conditions) used to compute the ADHD variable is available at:[3] http://mchp-appserv.cpe.umanitoba.ca/concept/MB_Kids_2012_ADHD_DIN_List_DPIN.pdf	
Congenital anomalies	Child congenital anomalies diagnosed from birth to 5 years post-delivery (dichotomous): Congenital anomaly (yes/no). Consistent with Brownell et al. (2008),[17] the presence of a congenital anomaly was determined based on the presence of any of the following conditions on the hospital discharge form, hospital abstracts post-delivery, of physician visits: Down Syndrome (ICD-9-CM code 7580; ICD-10-CA codes Q900-Q902, Q909); neural tube defects (ICD-9-CM codes 7400-7402, 7420, 74101-74103, 74100, 74191-74193, 74190, 74100; ICD-10-CA codes Q000-Q002, Q010-Q012, Q018, Q019, Q050-Q059, Q070); anencephaly and similar anomalies (ICD-9-CM codes 7400-7402; ICD-10-CA codes Q000-Q002), spina bifida (ICD-9-CM codes 74101-74103, 74100, 74191-74193, 74190, 74100; ICD-10-CA codes Q050-Q059, Q070), congenital heart defects (ICD-9-CM codes 7450, 74511, 74519, 74510, 74512, 74519, 7453, 74512, 74519, 74689, 7454, 7455,	Hospital Abstracts, Medical Services (physician claims)

	74569, 7452, 7450, 7459, 74601, 74602, 74609, 7461, 7462, 7469, 7463-7467, 74689, 74687, 74682, 74683, 74681, 74685, 74686, 74689, 7473, 7457; ICD-10-CA codes Q200-Q203, Q2030-Q2032, Q2038, Q204, Q2050, Q208-Q214, Q219-Q225, Q228-Q234, Q238-Q246, Q248, Q249, Q255), hypoplastic left heart syndrome (ICD-9-CM code 7467; ICD-10-CA code Q234), cleft palate or cleft lip with or without cleft palate (ICD-9-CM codes 74900, 74902, 74910; ICD-10-CA codes Q351, Q353, Q355, Q357, Q359, Q36, Q37), limb reductions (ICD-9-CM codes 75521, 75526, 75527, 75520, 75531, 75534, 75536, 75537, 75530, 7554; ICD-10-CA codes Q712-Q715, Q718-Q731, Q738), hydrocephalus (ICD-9-CM code 7423; ICD-10-CA codes Q030, Q031, Q038, Q039), oesophageal atresia/stenosis (ICD-9-CM code 7503; ICD-10-CA codes Q390-Q394), anorectal and large intestine atresia/stenosis (ICD-9-CM cod 7512; ICD-10-CA codes Q420-Q422, Q428, Q429), hypospadias and epispadia (ICD-9-CM codes 75261, 75263, 75269, 75262; ICD-10-CA codes Q540-Q544, Q548, Q549, Q5560, Q5568, Q640), gastrischisis (ICD-9-CM code 75679; ICD-10-CA codes (Q792, Q793, Q795), and renal agenesis/hypoplasia (ICD-9-CM code 7530; ICD-10-CA codes Q600-Q606).[17] **Note:** Brownell et al. (2008) included any hospital or physician visit indicating aforementioned codes from birth to child's first birthday. This study includes any identified congenital anomaly from birth to the child's 5th birthday.[17]	
Lower respiratory tract infection	Child lower respiratory tract infection from birth to 5 years post-delivery (dichotomous): Lower respiratory tract infection (yes/no). Consistent with Brownell et al. (2001/2008),[17,19] a child was defined as having a lower respiratory tract infection from birth to 5 years post-delivery if any of the following diagnoses appeared on a hospital abstract or physician claims form: Pulmonary tuberculosis (ICD-9-CM code 011: ICD-10-CA codes A15.0-A15.3, A16.0-A16.3) respiratory tuberculosis (ICD-9-CM code 012; ICD-10-CA codes A15.4-A15.9, A16.4-A16.9), acute	Hospital Abstracts, Medical Services (physician claims)

	bronchitis and bronchiolitis (ICD-9-CM code 466; ICD-10-CA codes J20, J21), viral pneumonia (ICD-9-CM code 480; ICD-10-CA code J12), pneumococcal pneumonia/streptococcus pneumoniae pneumonia ((ICD-9-CM code 481; ICD-10-CA code J13), other bacterial pneumonia (ICD-9-CM code 482; ICD-10-CA codes J14, J15), pneumonia due to other specified organism (ICD-9-CM code 483; ICD-10-CA code J16), pneumonia in infectious diseases classified elsewhere ICD-9-CM code 484; ICD-10-CA code J17), bronchopneumonia, organism unspecified (ICD-9-CM code 485; ICD-10-CA code J18.0), pneumonia, organism unspecified (ICD-9-CM code 486; ICD-10-CA codes J18.1-J18.9), influenza (ICD-9-CM code 487; ICD-10-CA codes J10, J11) , bronchitis, not specified as acute or chronic (ICD-9-CM code 490; ICD-10-CA codes J22, J40), chronic bronchitis (ICD-9-CM code 491; ICD-10-CA codes J41, J42), and asthma (ICD-9-CM code 493; ICD-10-CA code J45)[17,19] **Note:** Diagnoses of asthma are also used to identify lower respiratory tract infections in children less than 5 years of age.[11,14]	
Child intentional injury hospitalizations	Child hospitalizations for intentional injuries (i.e., injuries inflicted by others) from birth to 5 years post-delivery (dichotomous): Hospitalization for intentional injury (yes/no). Hospitalizations for intentional injuries was based on hospitalizations lasting one day or longer that resulted in an injury as indicated by the presence of one of the ICD-9-CM E-Codes (E-Code = external cause of injury code) or ICD-10-CA V, W, X, Y-Codes listed in the hospital discharge abstract. The ICD-9-CM E-Codes E950-E959 or ICD-10-CA codes X60-X84 (suicide and self-inflicted injury) and ICD-9-CM E-Codes E960-E968, E928.3 or ICD-10-CA codes X85-Y09, W50 (homicide and injuries inflicted by others) were used to determine whether intentional injury hospitalizations. This definition excludes injuries due to legal interventions (ICD-9-CM E-Codes E970-E978 or ICD-10-CA code Y35) or war operations (ICD-9-CM E-Codes E990-E999 or ICD-10-CA code Y36).	Hospital Abstracts

	Note: In this study, child intentional injury hospitalizations were combined with non-intentional injury hospitalizations (see below) to protect confidentiality/anonymity. An "any injury hospitalization" variable was computed that combined both intentional and non-intentional injury hospitalizations into a single variable.	
Child non-intentional injury hospitalizations	Child hospitalizations for non-intentional injuries from birth to 5 years post-delivery (dichotomous): Hospitalization for non-intentional injury (yes/no). Hospitalizations for non-intentional injuries was based on hospitalizations lasting one day or longer that resulted in an injury as indicated by the presence of any of the ICD-9-CM E-Codes (E-Code = external cause of injury code) or ICD-10-CA V, W, X, Y-Codes listed in the hospital discharge abstract. Included are hospitalizations due to motor vehicle accidents (ICD-9-CM codes E810-E819, E822-E825 or ICD-10-CA codes V03-V04, V13-V14, V20-V29, V33-V34, V40-V79, V80.4, V81.0-V81.1, V82.0-V82.1, V87.2-V87.5, V88.2-V88.5, V89), other vehicle accidents (ICD-9-CM codes E800-E807, E820-E821, E826-E829, E831, E833-E838, E840-E848 or ICD-10-CA codes V01-V02, V05, V09, V10-V12, V15-V19, V30-V32, V35-V39, V80.0-V80.3, V80.5-V80.9, V81.2-V81.9, V82.2-V82.9, V86, V87.0-V87.1, V88.6-V88.9, V91, V94, V96, V97, V98-V99), poisoning (ICD-9-CM codes E850-E858. E860-E869, E980-E982 or ICD-10-CA codes X20-X29, X40-X49), accidental falls (ICD-9-CM codes E880-E885, E886.9, E888 or ICD-10-CA codes W00-W19), accidents caused by fire and flames/hot substances (ICD-9-CM codes E890-E899 or ICD-10-CA codes X00-X19), accidents due to natural and environmental factors (E900-E909, E928.0-E928.2, E928.6 or ICD-10-CA codes W42, W43, W92-W99, X30-X39), choking, suffocation and constriction (ICD-9-CM codes E911-E913, E928.4, E928.5 or ICD-10-CA codes W75-W84), sports injuries (ICD-9-CM codes E886.0, E917.0, E917.5), late effects of injury (ICD-9-CM codes E929, E989), accidents caused by foreign bodies (ICD-9-CM codes E914, E915 or ICD-	Hospital Abstracts

	10-CA codes W44-W47), struck by objects, caught between objects (ICD-9-CM codes E916-E918 or ICD-10-CA codes W20, W22.08-W22.09, W23, W51, W52), accidents caused by machinery, explosions, electricity (ICD-9-CM codes E919-E926 or ICD-10-CA codes W24-W42, W85-W91), overexertion, strenuous movements (ICD-9-CM code E927 or ICD-10-CA codes X50-X57), injuries undetermined as accidental or purposely inflicted (ICD-9-CM codes E983-E988 or ICD-10-CA codes Y10-Y34), and other unspecified accidents (ICD-9-CM codes E887, E928, E928.8, E928.9 or ICD-10-CA codes X58, X59). This definition excludes intentionally inflicted injuries as indicated by ICD-9-CM E-Codes E950-E959 or ICD-10-CA codes X60-X86 (suicide and self-inflicted injury) and ICD-9-CM E-Codes E960-E968, E928.3 or ICD-10-CA codes X85-Y09 (homicide and injuries inflicted by others) as well as injuries due to legal interventions (ICD-9-CM codes E970-E978 or ICD-10-CA code Y35), injuries due to war operations (ICD-9-CM codes E990-E999 or ICD-10-CA code Y36), injuries due to misadventures during surgical or medical care (ICD-9-CM codes E870-E876; ICD-10-CA codes Y60-Y69, Y88.1), reactions or complications due to medical care (ICD-9-CM codes E878-E879; ICD-10-CA codes Y70-Y84, Y88.2, Y88.3), and adverse reactions due to drugs (ICD-9-CM codes E930-E949; ICD-10-CA codes Y40-Y59, Y88.0).**Note:** In this study, child non-intentional injury hospitalizations were combined with intentional injury hospitalizations (see above) to protect confidentiality/anonymity. An "any injury hospitalization" variable was computed that combined both intentional and non-intentional injury hospitalizations into a single variable.	
Maternal and Child Mortality		
Maternal death	Maternal death from birth to 5 years post-delivery (dichotomous): maternal death (yes/no). **Note:** This variable was not included in final thesis due to low cell count sizes when stratified by intimate	Vital Statistics

	partner violence screen response status.	
Neonatal death (0 to 27 days)	A neonatal death is indicated by the death of the live newborn weighing more than 500 grams at birth within 0 to 27 days of life (dichotomous): neonatal death (yes/no). **Note:** This variable was not included in final thesis due to low cell count sizes when stratified by intimate partner violence screen response status.	Vital Statistics
Postneonatal death (28 to 364 days)	A postneonatal death is indicated by the death of a live newborn weighing more than 500 grams at birth between 28 days and 364 days of life (dichotomous): postneonatal death (yes/no). **Note:** This variable was not included in final thesis due to low cell count sizes when stratified by intimate partner violence screen response status.	Vital Statistics
Child mortality (age 1 to age 5)	Infant/child death is indicated by the death of the infant/child between 365 days of life to their 5th birthday (dichotomous); Infant/child death (yes/no). **Note:** This variable was not included in final thesis due to low cell count sizes when stratified by intimate partner violence screen response status.	Vital Statistics
Social Outcomes: Child Protective Organization		
Family Receiving Services from Child and Family Services	Children in families receiving services from Child and Family Services from birth to age 5 (dichotomous): Family receiving services (yes/no). Data from the Child and Family Services Information System (CFSIS) was used to identify children in families who are receiving services from Child and Family Services. This included only children who remained in the family and excluded children that had been taken into care (see below). In this study, children in families who are receiving Child and Family Services were calculated as the percentage of children 0 to 5 years who are reported in the CFSIS databases as having received any services/care at any time over the study	Child and Family Services Information System

	period.[15,16] **Note:** This measure likely underestimates the number of children in families receiving services because prior to April 1, 2010, it was not required that on-reserve children in care (usually federally funded cases) be entered into the CFSIS system.[16] In 2000, the CFSIS captured only approximately 60% of Indigenous cases (vs. 100% of non-Indigenous cases).[16] Because women living in Indigenous communities (i.e., on reserve) were excluded from analyses in this thesis, this might help to reduce this bias.	
Children in Care	Children placed in the care of Child and Family Services from birth to age 5 (dichotomous): Child in care (yes/no). Data from the Child and Family Services Information System (CFSIS) was used to identify children who had been taken into care of Child and Family Services via voluntary placement, voluntary surrender of guardianship, apprehension, or order of guardianship. In this study, children in care were calculated as the percentage of children 0 to 5 years who were reported in the CFSIS databases as being taken into care at any time over the study period.[20,21] **Note:** This measure likely underestimates the number of children in care because prior to April 1, 2010, it was not required that on-reserve children in care (usually federally funded cases) be entered into the CFSIS system.[21] In 2000, the CFSIS captured only approximately 60% of Indigenous cases (vs. 100% of non-Indigenous cases).[21] Because women living in Indigenous communities (i.e., on reserve) were excluded from analyses in this thesis, this might help to reduce this bias.	Child and Family Services Information System
Social Outcomes: School Readiness at Kindergarten		
Assessment of school readiness	The assessment of school readiness was based on the child's Early Development Instrument (EDI) assessment at kindergarten entry.[22] The EDI is a population-based measure of school readiness filled out by kindergarten	Early Development Instrument

	teachers when the child is approximately 5 years old. The EDI assesses a child's readiness across 5 domains (physical health and well-being, social competence, emotional maturity, language and cognitive development, and communication skills and general knowledge). Dichotomous assessments (ready vs. not ready) can be determined for each separate domain (children scoring in the 10th percentile or lower as deemed to be 'not ready'). An overall assessment of school readiness (ready vs. not ready) is based on whether the child scores in the 10th percentile or lower in at least one domain (i.e., not ready) as well as a multiple challenge index (the child scores at the 10th percentile or below in at least three different domains). This study examined school readiness across the five domains, the overall assessment of school readiness, and the multiple challenge index as indicators of school readiness at kindergarten entry.[22]	

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APPENDIX C: ETHICS APPROVAL CERTIFICATE

P176 - 770 Bannatyne Avenue
Winnipeg, Manitoba
Canada R3E 0W3
Telephone 204-789-3255
Fax 204-789-3414

UNIVERSITY OF MANITOBA | BANNATYNE CAMPUS Research Ethics Board

HEALTH RESEARCH ETHICS BOARD (HREB)
CERTIFICATE OF FINAL APPROVAL FOR NEW STUDIES
Delegated Review

PRINCIPAL INVESTIGATOR:	INSTITUTION/DEPARTMENT:	ETHICS #:
Tamara Taillieu	U of M and MCHP/ Family Social Services in Community Health Sciences	H2015:355 (HS 18922)

APPROVAL DATE:	EXPIRY DATE:
September 14, 2015	**September 14, 2016**

STUDENT PRINCIPAL INVESTIGATOR SUPERVISOR (if applicable):
Dr. Douglas A. Brownridge

PROTOCOL NUMBER:	PROJECT OR PROTOCOL TITLE:
	Violence and Pregnancy: Pregnancy, Maternal, and Child Outcomes from Birth to 5-Years Post-Delivery

SPONSORING AGENCIES AND/OR COORDINATING GROUPS:
Evelyn Shapiro Award for Health Sciences Research - Pending

Submission Date of Investigator Documents:	HREB Receipt Date of Documents:
September 1, 2015	September 8, 2015

THE FOLLOWING ARE APPROVED FOR USE:

Document Name	Version(if applicable)	Date
Protocol: Proposal		September 1, 2015
Consent and Assent Form(s):		
Other: List of Data Fields/Data Capture Sheet		submitted September 1, 2015

CERTIFICATION
The above named research study/project has been reviewed in a ***delegated manner*** by the University of Manitoba (UM) Health Research Board (HREB) and was found to be acceptable on ethical grounds for research involving human participants. The study/project and documents listed above was granted final approval by the Chair or Acting Chair, UM HREB.

HREB ATTESTATION
The University of Manitoba (UM) Research Board (UMREB) is organized and operates according to Health Canada/ICH Good Clinical Practices, Tri-Council Policy Statement 2, and the applicable laws and regulations of Manitoba. In respect to clinical trials, the HREB complies with the membership requirements for Research Ethics Boards defined in Division 5 of the Food and Drug Regulations of Canada and carries out its functions in a manner consistent with Good Clinical Practices.

QUALITY ASSURANCE

The University of Manitoba Research Quality Management Office may request to review research documentation from this research study/project to demonstrate compliance with this approved protocol and the University of Manitoba Policy on the Ethics of Research Involving Humans.

CONDITIONS OF APPROVAL:

1. The study is acceptable on scientific and ethical grounds for the ethics of human use only. ***For logistics of performing the study, approval must be sought from the relevant institution(s).***
2. This research study/project is to be conducted by the local principal investigator listed on this certificate of approval.
3. The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to the research study/project, and for ensuring that the authorized research is carried out according to governing law.
4. **This approval is valid until the expiry date noted on this certificate of approval. A Bannatyne Campus Annual Study Status Report** must be submitted to the HREB within 15-30 days of this expiry date.
5. Any changes of the protocol (including recruitment procedures, etc.), informed consent form(s) or documents must be reported to the HREB for consideration in advance of implementation of such changes on the **Bannatyne Campus Research Amendment Form.**
6. Adverse events and unanticipated problems must be reported to the HREB as per Bannatyne Campus Research Boards Standard Operating procedures.
7. The UM HREB must be notified regarding discontinuation or study/project closure on the **Bannatyne Campus Final Study Status Report.**

Please quote the above Human Ethics Number on all correspondence.
Inquiries should be directed to the REB Secretary Telephone: (204) 789-3209 Fax: (204) 789 3414