INDICATORS FOR PRENATAL SUPPORT AND NEONATAL OUTCOMES IN NORTHERN CANADA

by

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ABSTRACT

Background: The current practice in northern Canada is to transfer pregnant women residing in communities without hospital facilities to larger centres at 37 weeks gestation. Little research has been conducted on how the practice of transferring women for childbirth affects available prenatal care continuity and prenatal care options, and whether or not this in turn affects health outcomes.

Objectives: The aim of this study is to examine whether differences exist in prenatal care, risk factor distribution, and neonatal morbidity, between women who are transferred for childbirth, and women who are able to remain in their home community to give birth.

Methods: Secondary analysis of the Canadian Maternity Experiences Survey 2006-2007 data was conducted in order to examine the relationship between transfer for childbirth, prenatal care, maternal risk factors, and neonatal morbidity. The study population consisted of 229 women who had given birth to a live singleton infant between eleven and fourteen months before the study was conducted. Crude odds ratios and adjusted odds ratios were calculated to assess the relationships between variables using multiple logistic regression, with bootstrap weights applied.

Results: Women who were transferred for childbirth were less likely to receive ten or more prenatal care visits (OR=0.5, 95% CIs 0.4-0.7) and were more likely to initiate care after 14 weeks gestational age (OR=2.2, 95% CIs 1.2-3.9). Women who were transferred for childbirth were more likely to smoke during pregnancy (OR=2.9, 95% CIs 2.0-4.0, more likely to not have finished high school (OR=2.0, 95% CIs 1.4-3.0, less likely to have an income higher than $30,000 (OR=3.9, 95% 1.4-

11.4], more likely to be aboriginal (OR=5.6, 95% CIs 3.3-9.3), and more likely to be multiparous (OR=1.8, 95% CIs 1.2-2.5). Women who were transferred for childbirth were more likely to experience a negative neonatal morbidity outcome (OR=1.9, 95% CIs 1.3-2.8), though this relationship disappeared when the relationship was adjusted for potential confounders. When these results were adjusted for potential confounding, smoking during pregnancy was the only risk factor shown to be significantly associated with neonatal morbidity in this study (OR=1.8, 95% CIs 1.0-3.0).

Conclusion: More detailed and widespread data collection is needed to be able to properly assess prenatal care, maternal risk factors and neonatal morbidity in northern Canada. A perinatal database, constructed for surveillance purposes, would assist in further exploring the effect of transfer policy on prenatal care practices and maternal risk factor distribution, and the effect this has on neonatal health outcomes.

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CHAPTER 1: GENERAL INTRODUCTION

1.0 Introduction

In the three northern Canadian territories, health care options vary widely by community. Due to differences in both the population base and geographical distance, health services vary, and there are disparities in available health care between smaller communities, regional population centres, and territorial capital cities. As a result, the availability of prenatal care and birthing services will differ greatly depending on a pregnant woman's place of residence.

In the north, only women who have birthing services, located in a level 2 health centre in their community, can choose to stay in that community to give birth (dependent on their level of risk). At present, only women residing in Yellowknife and Whitehorse, low-risk women residing in Inuvik and Iqaluit, and low-risk women who have a midwifery clinic in their community, have the option to give birth in their home community. All other pregnant women are required to leave their communities at 37 weeks gestation to give birth in a larger population centre.

The policy of transferring women out of their communities at 37 weeks is based on a perceived need for secondary or tertiary hospital services for all births. However, proponents of community-based midwifery are increasingly challenging this perception. The difficulties caused by transfer for childbirth are evident - for many women, transfer for childbirth means spending a month or more hundreds of kilometers from their homes and families, and giving birth without their spouse, friends or family present. While the cultural and social implications of this practice

have been explored in qualitative studies, there has been little research to date on how this practice directly or indirectly influences other risk factors, which in turn influence birth outcomes.

Neonatal outcomes have been linked in the literature to prenatal care, socioeconomic indicators, and risk behaviours, though the mechanism through which this relationship operates and these factors interact is still unclear. In the north, transfer for childbirth is yet another factor that impacts both availability and continuity of care, and in turn, may exaggerate poor outcomes. This study seeks to examine the prenatal care experiences of mothers who received their prenatal care in northern Canada, using data from the Maternity Experiences Survey 2006-2007. It will examine whether women who reside in a community where transfer for childbirth is mandatory experience different levels of neonatal morbidity, different prenatal care experiences, and have a different profile of socioeconomic determinants and risk behaviours than women who are able to receive prenatal care and give birth in their home communities.

Chapter 2 presents a review of the literature relevant to this topic. Chapter 3 describes the data source and outlines the methods employed in this study. The results of the data analysis are presented in Chapter 4. Finally, Chapter 5 discusses the results and makes suggestions about how they may be interpreted and applied to future research.

CHAPTER 2: LITERATURE REVIEW

2.0 Outline

The first section of this literature review outlines the setting of the study: the population distribution and geography of northern Canada, Canadian childbirth practices throughout history, as well as current practice surrounding childbirth throughout the circumpolar region. The second section looks at prenatal care, beginning with a review of studies regarding the effects of different types of prenatal care provision on birth outcomes, and ending with an overview of prenatal care available throughout the Northwest Territories and comparison groups. The third section outlines the neonatal outcomes of interest that will be examined in this study, and the final section explores the ways in which the risk factors for neonatal morbidity in the comparison groups may differ, due to demographic differences that exist between communities in northern Canada.

2.1 Setting

2.1.1 Geography and population distribution

The region referred to in this study as "northern Canada" stretches across the Yukon, the Northwest Territories, and Nunavut, and is often extended to include Nunavik (northern Quebec) and Nunatsiavut (northern Labrador). The three territories combined cover 3,547,801 square kilometers, or 39.3% of Canadian territory, and the combined population of this region is approximately 101,310 (1).The Yukon has a population of 30,372 and covers 474,711.02 square kilometers

(2). The Northwest Territories has a population of 41,464, spread over a region of 1,140,834.90 square kilometers(3). The population of Nunavut is 29,474, and the territory encompasses 1,932,254.97 square kilometers, making it the most sparsely populated territory of the three (4).

The three northern territories are commonly grouped together for analysis, despite key demographic differences. The percentage of the population that identifies as aboriginal increases drastically from west to east, from a minority in the Yukon (33.5%), to roughly equal in the Northwest Territories (50.3%) to a clear majority in Nunavut (85.0%) (2-4). The degree of isolation varies across the territories as well, with most communities in the Yukon accessible by road, and having highway links to British Columbia and Alaska, while all communities in Nunavut are accessible by air only for all or part of the year; the Northwest Territories has a combination of the two (5, 6). Finally, the population distribution is different across the territories, with the majority of the population of the Yukon centralized in Whitehorse, half the population of the Northwest Territories located in Yellowknife, and a more even distribution of smaller communities spread out across Nunavut (2-4).

2.1.2 Childbirth practices in northern Canada

Childbirth in the north has changed significantly over the past 50 years. Throughout the north of Canada, the transfer of birth from the home into hospitals began in the 1950s. At this time, the increased availability of Western-style health care, and attempts to extend political and administrative control over the Inuit and

First Nations populations, led to the relocation of communities to permanent settlements, and women were encouraged to give birth in community nursing stations rather than at home or on the land (7). In the 1970s, it was common practice for women to be evacuated to a hospital in the south if they were judged to be high-risk; British nurse-midwives handled all other births in the nursing station (8). Due to a surplus of Canadian nursing graduates during the 1980s, restrictions were placed on the immigration of foreign-trained nurse-midwives (9). As midwifery was not legal in Canada in regions where physician care was available, Canadian nurses received only limited obstetrical training (10). As a result, nursing stations in Northern Canada were increasingly staffed with nurses who were uncomfortable managing births (11).

The reduction in the number of nurses willing to supervise births within small communities occurred in concert with the emergence of recommendations that births only be permitted in medical care facilities that met specific volume and capacity criteria. In the 1960s, risk scoring was introduced to help identify women likely to have an adverse pregnancy outcome, so that nurses could refer high-risk women to a larger hospital to give birth (12). During the late 1970s and early 1980s, a number of publications questioned the validity of risk scoring, and it was recommended that obstetric units without the ability to do cesarean sections, give blood transfusions, or administer anesthetics should not handle births (13). Despite later research conducted by Black and Fyfe (14) suggesting that the obstetrical care provided by smaller hospitals without these capabilities was "as safe as that provided in larger centres" (13), professional recommendations, combined with the

lack of trained nurse-midwives in rural communities, led to a policy of transferring women south at 37 weeks gestation being implemented across the North by the 1990s (7).

2.1.3 Social implications of transfer for childbirth

The risk-oriented approach to childbirth, as described in the previous section, is the product of a biomedical approach to health care; thus, it seems misplaced to many aboriginal women to whom it applies (8). Prenatal assessments tend to search for potential problems. This has fostered a perception in western medicine under which pregnancy is perceived by both women and practitioners as a "state of risk, and consequently a state of illness" (12). Risk is perceived as being unique to the individual, and is judged solely on the chances of mortality or the extent of potential morbidity in a given situation. This perception is distinct from how risk is perceived by aboriginal communities. Risk is acknowledged as a part of life in the north, and while the loss of a newborn is always tragic, it is perceived as another hardship connected with living in a rural and remote environment; thus, aboriginal women have difficulty understanding why childbirth is centered out from the other risks they face on a day-to-day basis, as requiring invasive intervention (15). As well, the health of the individual is seen as being closely tied to the emotional and spiritual health of the family unit, and the health of the community (16). Therefore, medical risk to the mother, from an aboriginal perspective, is just one aspect of health risk, and this measure of risk needs to be weighed against the risk to the family and community that the woman's absence from her community

represents (17). In order to effectively assess risk among pregnant women in northern communities, the definition of "risk" needs to be broadened, so that instead of referring only to morbidity and mortality, risk to culture and community are considered as part of the risk equation.

Many qualitative studies have shown that the community and familial risk caused by the policy of transferring women for childbirth is considerable. Within northern communities, rich traditions surrounding childbirth have quickly been lost (18). Prior to the implementations of transfer policy, birth was treated as a community, social, and spiritual event (19). Life-long social relationships were formed around the birth process.. For instance, newborns in many Inuit communities were given names of people in the community, either those of living elders, or those of the recently deceased, with the expectation that they would take on characteristics of that individual. In this way, grieving families coped with loss, and intergenerational bonds were formed within the community, beyond the biological family unit (20). This tradition, along with many other traditions surrounding birth, has suffered as a result of the removal of childbirth from the communities.

Family instability is another risk presented by maternal transfer for childbirth. Women worry that their husbands will resent their absence, causing animosity and exacerbating family violence problems (17). Children left behind are cared for either by fathers, who may be unfamiliar with childcare and housekeeping, or relatives, who have their own financial challenges and child care responsibilities (21). This increases the risk of child neglect and imposes stress on young children,

who often have problems with bed-wetting or violent behaviour that begin while the mother is away (21). All members of the family are exposed to the stress brought on by transfer for childbirth. As stated by O'Neil, Kaufert and Brown in and article outlining Inuit concerns about childbirth policy, "families now endure childbirth instead of enjoying it" (22).

Adding to the stress experienced by families is financial strain due to transfer policy. While the travel and boarding for the pregnant women are covered by the health care system, telephone calls, either from homesick women calling home or from children who miss their mother, can be a considerable cost, as is childcare, if required (11). If the father or another relative has to take time off work or hunting in order to look after dependent children, this may create long-term problems. Job security in northern communities is negligible due to high unemployment rates, and missing work to care for children puts an individual's job at risk (21). Hunting requires flexibility, in that a man needs to be able to respond to changes in weather or information about migration patterns. The loss of either of these sources of sustenance can have a significant long-term effect on the wellbeing of the entire family. Fathers may be forced to take children out on the land in prohibitive conditions, or bring them into unsafe workplaces (22), increasing the risk of child injury.

Both the community and familial impacts of transfer policy add to the psychological stress already placed on women by this practice. Women are usually unable to bring their partner or another support person with them due to the prohibitive cost of travel, and thus give birth feeling alone and isolated (17, 21, 23).

Women with children worry about leaving them behind when they leave their community to give birth, and may be separated from children who are still nursing at the time (21). In order to circumvent transfer policy, some women lie about the date of their last menstrual period during their pregnancy, and then hide their labour until it is too late to transfer them (8). Women who choose to circumvent transfer policy risk being judged by the healthcare provider in their community as noncompliant, potentially establishing a negative relationship that may affect her in the future, as that provider may be her family's sole source of healthcare (24). In addition, since birthing in the community is not a regular practice, these women give birth without the presence of trained midwives or appropriate medical facilities. Effectively, women in the north are forced to "choose between their culture and their safety" when they give birth (25).

2.1.4 Circumpolar childbirth practice

Obstetrical practices in Northern nations vary dramatically. Until recently, Russian childbirth was highly regimented and not particularly woman-friendly – women laboured together in one large room, with physician examinations taking place in full view of all present, and fathers were not permitted to attend the birth. As recently as 2002, one article identified that shaving, enemas and episiotomy are still the norm in Russian hospitals, and labouring women have little say on these practices, or the use of drugs in augmenting their labour. A growing movement is encourages couples to consider midwife-assisted homebirth; nonetheless the

midwifery practice in Russia is not yet regulated and most women still give birth in hospital (26).

At the other end of the spectrum, midwives are the primary caregivers in Iceland, Sweden and Finland (27-29). Over the course of a normal pregnancy, women in Sweden may only see an obstetrician or general practitioner once during the course of their pregnancy, if at all (28). Midwives in Greenland are also primarily responsible for prenatal care, with the Chief Midwife making decisions about provision of care for childbirth alongside the Chief Obstetrician. Women are transferred to Nuuk, Greenland, for childbirth only if they appear to be high-risk (30).

The remaining circumpolar nations, Norway, Denmark and the United States, offer varied combinations of midwifery and obstetrical care. In Alaska, under 6% of women listed a midwife or birthing centre as their primary source of prenatal care in 2003 (31). However, the Midwife Association of Alaska is an established and growing organization, and midwifery care is now available in ten cities and towns, with midwives available to travel to other regions if requested (32). In Norway and Denmark, shared-care models are used in that women consult with general practitioners, obstetricians, and midwives throughout the course of their pregnancies (27, 33).

There is a clear trend among the circumpolar nations, including Canada, to an increasing reliance on midwifery care for prenatal consultations and childbirth, wherever this is not already the norm. The growing demand for midwifery services has been observed throughout Canada, both in the southern provinces and the

northern territories, and an increasing number of women are attempting to decrease the degree of medical intervention that takes place during their labour and delivery.

2.2 Prenatal care

2.2.1 Prenatal care in northern Canada

In the Yukon, the population is concentrated in Whitehorse, and most women residing in Whitehorse receive prenatal care and give birth within this city. Women in the surrounding communities receive prenatal care in the health centres in their communities, which may vary depending on the level of care available, and the proximity to Whitehorse, and all women travel to Whitehorse to give birth. Unlike in the other two territories, however, traveling for birth is not necessarily as isolating an experience, because road accessibility allows fathers and other family and friends easier and more affordable means to visit pregnant women in Whitehorse and possibly attend the birth.

In the Northwest Territories, women experience wide variations in the availability and type of prenatal care. This includes variation in the levels of care and the practitioners available. Depending on the region where the woman lives, a general practitioner, a nurse practitioner, a public health nurse or a midwife could be the main provider of primary care, with secondary and tertiary care available only in Yellowknife or Edmonton. Options for place of birth in the Northwest Territories are also limited. Outside of the capital, there is a hospital in Inuvik that allows both natural births and caesarean births for both the town of Inuvik and the

surrounding Beaufort-Delta region. The community of Fort Smith contains the only midwifery clinic in the Northwest Territories, housed in the regional health centre, where women who are assessed to be at low risk of requiring intervention can choose to give birth. Otherwise, all women in the territory are flown to Yellowknife at approximately 37 weeks gestation, and are housed in boarding homes while they wait to deliver (34, 35).

In Nunavut, women can deliver at the Baffin Regional Hospital in Iqaluit, or under the care of midwives at the birthing centre in Rankin Inlet, provided they are judged to be low-risk; otherwise, women are flown to either Yellowknife or Ottawa, depending on their place of residence and perceived level of risk. As all communities can only be accessed by air, women outside of Iqaluit and Rankin Inlet are unlikely to be accompanied by family or friends when they give birth, due to the distance and high costs of travel and lodging. As well, aboriginal languages are more commonly spoken in Nunavut than in the other two territories, with more than two-thirds of the population listing a mother tongue other than English or French, and more than half listing a language other than English or French as the language commonly spoken at home (4). In the rest of the territories, a mother tongue other than English or French is far less common (NWT – 20.7%; Yukon – 11.0%), and even fewer individuals identify a language other than English or French as being the language commonly used at home (NWT – 8.7%; Yukon 3.1%) (2, 3). This suggests that women from Nunavut are more likely to rely on their traditional language for communication, making the transition to a southern hospital more difficult if they are not used to communicating solely in English.

As outlined earlier, northern Canada has a small total population, spread over an incredibly vast region. Due to the high number of rural and remote communities with small populations, most communities in the north do not have resident physicians, and instead rely on nurse practitioners, nurses or community health workers for day-to-day care, with occasional fly-in visits from physicians. Medical staff recruitment and retention is an on-going issue in the north, resulting in chronic under-staffing throughout the region (36). Therefore, the availability of medical staff varies from community to community, and in individual communities over time.

Another factor in the variability of care is access to other communities; this causes variations in care availability and options across the three territories. For instance, communities in the Yukon are largely connected by highway, meaning that it would be possible for women to travel to a neighbouring community to receive care if they chose to do so. This is possible among a few communities in Yellowknife, but not feasible in Nunavut, except in rare cases where communities are linked by road or winter road. In addition, as outlined in the next section, the north, like the rest of Canada, is witnessing a re-emergence of midwifery practice. This means that women living in similar communities, of similar size and remoteness, may have access to very different forms of prenatal care and very different birthing options, depending on whether there is an established midwifery clinic within her community.

2.2.2 The re-emergence of midwifery practice in northern Canada

There are successful midwifery practices currently operating in the north. In Nunavik, Quebec, the midwifery model of maternity care has been in operation for over 20 years. As a result of community activism for self-government and cultural revitalization among the Inuit in Povungnituk, Nunavik, the Inuulitsivik Health Centre Maternity was created in 1986. The success of this Maternity led to the opening of another birth centre in Inukjuak in 1998, and one in Salluit in 2004 (16). The Inuulitsivik Health Centre Maternity is governed by a board made up of Inuit community members, and provides women with the opportunity to give birth in their own community and culture, as well as training local women to supervise births (37). Decisions about the level of risk and place of birth of each individual woman take place in a collective manner, with midwives, medical staff and community members meeting throughout each pregnancy to decide on the place of birth (38). This allows for a more comprehensive evaluation of the needs of the pregnant woman, as medical staff tend to focus on clinical tests and examinations, while midwives and community representatives focus more on the interests of the woman and her family, when making their recommendations (39). Women who are deemed high risk are still required to travel south to Montreal to give birth; however, they have access to culturally appropriate prenatal care throughout their pregnancy leading up to transfer, and are provided with postnatal care when they return (20).

The 2005 Midwifery Profession Act legitimized the practice of midwifery in the Northwest Territories, though midwives had been supervising births in Fort

Smith for several years before this act (40). Since their official opening in 2005, the Fort Smith midwives have supervised over fifty births within the community, and by 2007-2008 they were providing prenatal and postnatal care to 100% of the women in the community, whether or not they were transferred to give birth in Yellowknife due to their risk status (34).

The Rankin Inlet Birthing Centre has been in operation in Nunavut since it was introduced as a three-year pilot project in 1993. This project allowed women in Rankin Inlet who were identified as low-risk to give birth without leaving their community. Incorporated into the health care system in 1996, the Ranking Inlet Birthing Centre has struggled with some staffing issues over the past decade, however, since 2005 stable staffing has been in place and the Rankin Inlet midwifery training program should increase the number of trained midwives available to staff at both this centre and other community birthing centres throughout Nunavut (41).

The first midwife trained exclusively in Nunavut, through the Rankin Inlet Nunavut Arctic College program, graduated in December 2008. The number of Nunavut-trained midwives is expected to grow, with five new trainees having begun the program in the fall of 2007 (42). In addition to the traditional midwifery courses offered in Nunavik and Nunavut, a midwifery degree program has been offered as a collaborative program at Laurentian University, McMaster University, and Ryerson University in Ontario since 1993. As well, a degree program in midwifery opened at Université du Québec à Trois Rivières in 2000, and at the University of British Columbia in 2002. Povungnituk and Inukjuak, Nunavik, also have training programs to educate community midwives, without forcing them to leave their community for

an extended period of time (43). This suggests two things. The first is that there are an increasing number of well-trained, qualified, Canadian midwives available to fill positions. The second is that training midwives within aboriginal communities in the north is a viable option for increasing the number of midwives in the Northwest Territories. Midwives who are originally from the north are seen as more likely to stay in northern Canada than midwives who come up from the south, as they have family, community, and cultural ties to the region.

2.2.3 Prenatal care and birth outcomes

A number of studies suggest that adequate prenatal care can mitigate maternal risk factors and improve outcomes for both mothers and newborns (44). There are a number of different ways, however, that "adequate" prenatal care can be defined. Three predominantly used indices, the Kessner/Institute of Medicine (IOM) Adequacy of Prenatal Care Index, the Kotelchuck Adequacy of Prenatal Care Utilization (APNCU) Index, and the GINDEX, focus on the gestational age at the first prenatal care visit and the number of prenatal care visits during the rest of the pregnancy, using the recommendations put forward by the American College of Obstetricians and Gynecologists in 1985 (45-47). In a study conducted in Winnipeg, Manitoba, in the late 1980s, Mustard and Roos, using a combination of gestational age at initiation of care, and number of prenatal visits, found that the newborns of women with "adequate" prenatal care had birth weights that were, on average, 73 grams higher than those of women with "intermediate" or "inadequate" care ($p=0.0001$, 95% CIs 47-99 grams) (48). Heaman, using the Kessner Adequacy of

Prenatal Care Index, analyzed risk factors for preterm birth in Aboriginal women and non-Aboriginal women, again based in Winnipeg. This case-control study found that "inadequate" prenatal care was a risk factor for preterm birth (OR=2.4, 95% CIs 1.41-3.96). While "inadequate" care was one of a number of risk factors for preterm birth identified by the study, it was one of the few that was potentially modifiable from within the health care system, and also holds the potential to influence and supervise other risk factors, such as maternal smoking or low weight gain (49,50).. Another study conducted in 2008 by the same author, comparing the APNCU and R-GINDEX (modified GINDEX), found that "inadequate" prenatal care was related to preterm birth (adjusted OR 1.2, 95% CIs 1.1-1.3), low birth weight (adjusted OR 1.3, 95% CIs 1.2-1.5) and small for gestational age newborns (adjusted OR 1.4, 95% CIs 1.3-1.5). The author speculated that the relationship between these factors was a result of potentially modifiable risk factors, and could be prevented or mitigated if the mother had access to quality prenatal care (51).

Although useful, the three indices mentioned above (IOM, APNCU, and GINDEX), have a number of elements that can lead to inaccurate interpretation of the link between prenatal care and neonatal outcome. For instance, it is assumed that prenatal care results in tests and interventions that reduce risk and lead to better neonatal outcomes; however, care-seeking may be part of a package of health-promoting maternal behaviours. Thus, "adequate" or "adequate-plus" levels of prenatal care, as measured by these indices, may be just one of a number of risk-reducing, health-conscious maternal behaviours; any one of these behaviours could, in turn, be responsible for the observed improvement in neonatal outcome (52). A

British cohort study found an inverse association between the number of prenatal care visits and low birth weight and perinatal mortality for between four and fourteen visits in primiparous women (OR 1.034 per unit visit increase, 95% CIs 1.003-1.067); however, this relationship does not exist for fewer than four visits, or for more than fourteen (53). Unlike the IOM or APNCU indices, the GINDEX attempts to account for the fact that a high number of prenatal visits may be indicative of a pre-existing condition that prenatal care may not be able to prevent, such as diabetes, that will lead to a negative pregnancy outcome (45). However, these indices do not take into consideration any more information than the number and timing of prenatal care visits, and therefore the purpose and the content of each visit are unknown.

The variation in the measurement of prenatal care adequacy has led to conflicting evidence about the effectiveness of prenatal care. For instance, a systematic review conducted by Villar et al. reviewed seven trials evaluating the number of prenatal care visits for women with low-risk pregnancies. The results showed that, while maternal satisfaction was related to high levels of prenatal care, there was no quantitative relationship between number of prenatal visits and pregnancy outcomes (54). The conflicting results regarding this relationship suggest that more maternal factors, such as risk level and health behaviours, need to be taken into account alongside the number of prenatal care visits when the quality of prenatal care is under review. In addition, later work by the original developers of the GINDEX and the APNCU suggests that the assessment of prenatal care should be expanded to include, alongside the gestational age at initiation of care and the

number and spacing of visits, the content of medical care (including screening and diagnostic tests, medical treatment of diseases, referral to any necessary services, and health education), the level of training and type of care provider, and the content of available ancillary services (educational services, psychosocial services, substance abuse counseling, and social support services) (52).

As mentioned above, the indices used to assess prenatal care do not take into account elements of prenatal care, outside gestational age at initiation of care and number of prenatal care visits, which could potentially affect neonatal outcome. Therefore, the studies that have been conducted evaluating the relationship between quality of prenatal care and neonatal outcome also do not include detail regarding the content of prenatal care visits. As well, these studies are conducted using either chart extraction or maternal interviews, so response bias or clinician error could bias the results. Finally, it is not possible to randomize women to receiving adequate or inadequate prenatal care, so differences between pregnant women who receive adequate care and those that do not, such as care-seeking behaviour, may influence the size of the effect of the relationship between prenatal care and neonatal morbidity.

2.2.4 Continuity of care and birth outcomes

A link has been demonstrated in the literature between continuity of caregiver and pregnancy outcome. In a systematic review of continuity of care, women who had continuous care by a small team of midwives had a lower likelihood of giving birth to newborns who required resuscitation at birth, compared to women

who received care from a variety of physicians and midwives during their pregnancy (OR=0.66, 95% CIs 0.52-0.83)(55). Another study comparing family practices, with a high level of continuity of care, and obstetric clinics, with a low level of continuity of care, found that women who were cared for by family practitioners gave birth to newborns with birth weights that were, on average, 220 grams higher than women who received care from obstetrical clinics ($p<0.05$) (56). Finally, a study conducted in the United States in the early 1990s looked at two models of prenatal care. In one group, the recommended number of prenatal care visits, according to the indices explored in the previous section, was provided to each woman by a number of different caregivers. In the other group, a reduced number of prenatal care visits were provided (10 for nulliparous women, 8 for parous women), such that the provision of care would have been judged to be "inadequate" according to the prenatal care indices; however, all of these visits were designed to deliver focused content, and the women in this group saw the same care provider at each visit. While there was no statistically significant difference in outcome (not surprising given the small sample size and low-risk status of the women in the study), women in the study group, with fewer, concentrated visits, and continuity of care, were more satisfied by their care regimen than women in the group receiving the recommended number of care visits from different providers (57).

On the other hand, an historical prospective study conducted in the United States evaluated a continuity of care group against a regular care group, finding improved outcomes in the continuity of care group; however, the researchers found that this relationship disappeared when they controlled for the number of prenatal

visits and the gestational age at first visit. These results suggest that the number of prenatal visits and the gestational age at first visit – the variables measured by the indices discussed in the previous section – are responsible for the relationship observed between continuity of prenatal care and pregnancy outcome (58).

These findings serve to reiterate that the relationship between prenatal care and obstetrical outcome is reliant on a variety of factors, rather than a single measure. As well, the above-mentioned studies, as well as those in the previous section, demonstrate that there is no commonly accepted standard or index used to evaluate prenatal care. As a result, these studies used a variety of definitions of "continuity of care", with some studies looking at team models of care, while others focused on women who had the same individual practitioner for the duration of their care. Also, studies each compared only two of a variety of types of potential prenatal caregivers, making it difficult to compare studies regarding continuity of care to one another. Finally, like quality of prenatal care, it is not possible to randomize continuity of care, and women who may seek out certain types of care provider, and have a single stable care provider, may differ from women who do not in ways that may affect the neonatal outcomes that they experience.

2.2.5 Effectiveness of social programs for improving birth outcomes

A systematic review assessing the effect of programs that offered social support on the pregnancy outcomes of women considered to be at risk of having preterm or small-for-gestational-age (SGA) babies defined "social support" as some form of emotional support, with or without additional information or advice, that

took place in the home, during a medical visit, or by telephone, during the pregnancy (61). Eighteen studies, from Australia, Great Britain, France, Latin America, the Netherlands, South Africa, and the United States, were included, and the evaluation found that there was no association between social support programs and the number of preterm births, SGA births, or stillbirths and neonatal deaths. A similar review published in 1985 looked at a variety of types of prenatal social intervention studies, beyond the typical standard of clinical care, including nonrandomized studies, randomized controlled trials of general nonclinical interventions, and randomized controlled trials of dietary interventions. In the observational studies category, four out of six studies supported the hypothesis of increased social support and reduced instances of low birth weight births. For randomized controlled trials, in those related to general interventions, only two of nine studies found a statistically significant relationship between social support and low birth weight, and of the nutritional intervention trials, only nine of twenty-three demonstrated a statistically significant increase in birth weight (62). Thus, it is not known conclusively whether improved or expanded access to ongoing interventions, such as the Canadian Prenatal Nutrition Program or the Northern Women's Health Program, will conclusively affect pregnancy outcomes. However, it was speculated that it is overly optimistic to suggest that for women in situations of social deprivation, sporadic social interventions beginning during pregnancy could be powerful enough to counteract the conditions in which women spend their lives (62).

The effectiveness of social programs for improving pregnancy outcomes is difficult to measure, due to the varying definitions of what constitutes "social programming", the widely varying means of measuring the provision of these programs, and the complicated interrelation between social support, pregnancy, socioeconomic status, maternal attitudes, and risk behaviours such as smoking and alcohol use. For instance, one study defined social support based on whether the pregnant woman had received more than, or less than, psychosocial services during the course of their prenatal care (59), while another measured social programming based on the admittance of women to a health centre designed to provide a myriad of social services, including nutrition counseling, social and financial services, childcare, and transportation (60); clearly, the results of these interventions are difficult to compare to one another. Again, it is impossible to randomize social conditions, such as socioeconomic status, or behavioural patterns, or to randomize certain types of support, such as assistance from friends and family; therefore, it is difficult to draw strong scientific conclusions about the relationship between social support and pregnancy outcome.

2.3 Neonatal outcomes

2.3.1 Perinatal outcomes in northern Canada

A study regarding maternal and neonatal outcomes in the north collected perinatal data on all 288 deliveries that took place in the Ungava Bay region of Nunavik, Quebec, between 1979 and 1982. Deliveries in nursing stations accounted for 6% of all births, 79% occurred at the hospital in Kuujjuaq, and 15% occurred in

southern hospitals. This study recorded a high number of interventions, with 40% having their membranes artificially ruptured, 10.8% receiving an analgesic during labour, 12% being given oxytocin and 3.1% being born by Caesarean section. The percentage of low birth weight infants was 6.6%, close to the Canadian average of 6.0%; however a considerably higher proportion of northern infants were premature (less than 37 weeks). The perinatal mortality rate was especially high, at 27.7 per 1000 births compared to the Canadian average of 10.7 per 1000 births. Of the four stillbirths and four neonatal deaths recorded, three-quarters were low birth weight infants. The researcher attributed the high rate of interventions to the high turnover in physicians, and nurses with different competences in obstetrical services. As well, the researcher recommended that better community and cultural involvement in the health care delivery system as a mechanism to prevent the high prevalence of low birth weight, suggesting that midwives should be the primary care provider, due to their social, non-interventionist approach (63).

Obstetrical data on Inuit women was collected at Stanton Territorial Hospital in Yellowknife between January 1981 and December 1985, recording data regarding a total of 512 women. The stillbirth rate for this population was 9.7 per 1000 deliveries, and 6.3% of infants were classified as low birth weight (<2500g). The caesarian section rate was 8%, low compared to the Canadian average (64). The author suggests that understaffing among medical personnel in remote communities reduces the ability for nurses to provide preventive and health promotion activities, and that adequate staffing could allow for these activities to take place, potentially reducing perinatal losses and negative outcomes (64).

A review of 205 births that took place at the Innulitsivik Maternity in Povungnituk between September 1986 and September 1988, which represented 69% of births on the coast in the first year the maternity was open, and 84% of births on the coast for the second year (38). During this study, no deaths occurred at the Maternity, though one death occurred in a Nursing Station, due to prematurity, and one death occurred in Montreal after transfer, due to congenital malformations. There was a low percentage of low birth weight infants (2.5% compared to 6.3%), indicating that screening and referral south were effective, and first prenatal visits occurred earlier in the pregnancy than before the Maternity was established (38). A study reviewing birth outcomes in northern Quebec found that the perinatal mortality rate, given the decreasing number of women being transferred south for childbirth, was not increased by this change. This study concluded that the service run by the Povungnituk midwives was a safe means of permitting women to give birth within the community, as long as their pregnancy was not considered high-risk (65).

Another study conducted on birth outcomes in Povungnituk examined data on 418 women who were pregnant, and lived in the community, between 1989 and 1991 (12). Of these women, 17 gave birth in nursing stations, 44 were transferred south, one gave birth in Kuujjuac, and the other 349 (84.9%) in the Inuulitsivik Maternity. The perinatal mortality rate was higher, at 19.5 per 1000 births, and the overall rate for stillbirth was 1.0%, while 4.6% of infants were low birth weight (<2,500 grams) (12).

The midwives in Inukjuak conducted a study of the birth outcomes in their midwifery clinic, from 1998 to 2002 (66). During this time period, 72% of pregnant women in the community gave birth at the Inukjuak maternity, for a total of 132 births. Of all births in the community during this period, there was one perinatal death, which was the result of an unexpected premature birth. The premature birth rate for women in Inukjuak was especially low (3.3%) and the intervention rate for all women in the community was low as well, with zero episiotomies, one caesarian section, and one vacuum extraction in all women from the community, both those transferred and those who birthed in the Maternity (66).

While the small number of births occurring in northern facilities make conclusive statistical analysis difficult (20, 67), past studies have demonstrated evidence that the perinatal outcomes observed at these maternity centres are similar to those that have been observed in southern obstetric wards (12) and the rates of complications and interventions actually decreased as most births began occurring within the community rather than in the south (7). This lends legitimacy to a hybrid solution for rural health care and birthing practices, in which Inuit and First Nations peoples can "use the tools of biomedicine, but within a framework of the traditional and communal authority that lies at the core of their culture" (7).

2.3.2 Common indicators of neonatal morbidity

Common indicators of neonatal morbidity include gestational age, birth weight, admission to an intensive care or special care unit, and readmission to hospital within the first five months of life.

Low birth weight

Low birth weight infants can be divided into two categories – infants who are small for gestational age (SGA) and preterm infants. The two are not necessarily mutually exclusive – an infant that is small for its gestational age may also be born prematurely, exacerbating the mortality and morbidity associated with both outcomes.

Pre-term birth

An infant delivered before 37 completed weeks of gestation is commonly defined as having been born pre-term. However, the degree to which mortality and morbidity are linked to pre-term birth is not the same for all babies born pre-term, and the risks are much higher for "very pre-term" (less than 32 weeks) and "extremely pre-term" (less than 28 weeks) infants (68). According to Statistics Canada data, in 2006, the percentage of live births in Canada with a gestational age of less than 37 weeks was 7.9%; 0.7% of births were in the "very pre-term" (28 to 31 weeks) category, and 0.4% of births were in the "extremely pre-term" (20 to 27 weeks) category (69).

In 2006, the pre-term birth rate in Nunavut was 13.4%, and had been increasing steadily since 2000, when this figure was only 10.2%. The pre-term birth rate for 2006 in the Northwest Territories was 8.0%, slightly higher than the Canadian average (69).

Small for gestational age

An infant is generally classified as being small for gestational age (SGA) if their birth weight falls within the lowest 10th percentile of birth weight

corresponding to the gestational age of the infant at birth. As a result, the cut-off for infants considered to be small for gestational age can vary between countries and populations (70).

Small for gestational age infants are of reduced size due to either genetic factors (smaller than average parents) or due to intrauterine growth restriction (IUGR), in which the fetus does not receive sufficient oxygen and nutrients to develop normally. IUGR can be caused by genetic disorders, placental insufficiency, maternal disease or infection, or environmental factors such as substance abuse, poor nutrition, and low socioeconomic status (71).

Clearly, given the method in which they are defined, the smallest 10% of infants born at any particular gestational age will be classified as small for gestational age, and thus there is no meaningful "rate" that can be compared between populations. However, the morbidity associated with low birth weight will apply to this category, and will increase as the rate of low birth weight births within a particular population increases.

Definition and prevalence of low birth weight

According to the World Health Organization, low birth weight is defined as any infant weighing less than 2500g at birth, while very low birth weight is defined as less than 1500g, and extremely low birth weight is defined as less than 1000g (72). In Canada in 2006, 5.1% of births fell into the low birth weight (1,500-2,499) category, while 0.5% infants were classified as very low birth weight (1,000-1,499) and another 0.5% were classified as having an extremely low birth weight (less than 1,000) (73). The rates of low birth weight throughout the circumpolar region,

tabulated for the 2000-2004 period, range from 3.5 to 7.8%, with one of the highest rates (7.5%) in Nunavut (74). The rate of low birth weight in the Northwest Territories for 2006 was 3.7%, lower than the Canadian average, while the rate for Nunavut in 2006 was 8.4%, suggesting that the incidence of low birth weight births may be higher in Inuit populations (73).

Health effects

Low birth weight babies have been repeatedly shown to have poorer health and developmental outcomes than children born at a normal weight (72, 75). Low birth weight infants have a higher risk of mortality than normal weight infants (76); the likelihood of death increases as birth weight decreases (72). Also, low birth weight has been shown to be associated with lower cognitive achievement (77), respiratory issues (36), neuro-developmental problems (36) and motor skill and social development (78).

Maternal risk factors

Low birth weight due to either, or both, pre-term birth and intrauterine growth restriction, has been linked to low socioeconomic status (36), physical and emotional stress (79, 80), smoking, alcohol intake, caffeine intake, and drug use, (81-86), inadequate weight gain (36), poor maternal nutrition (72), young maternal age (87), advanced maternal age (88), hypertension, pre-eclampsia, and congenital anomalies (83). Clearly, many of these factors can be interrelated and more than one factor will commonly be present. For instance, maternal stress is considered a causal factor for low birth weight; this may be due to stress-related immune suppression, resulting in maternal illness or infection; poor nutrition due to a low

household income, which also causes stress about how to make ends meet; or substance abuse or other poor health practices used to cope with family violence or other stressful situations (79).

High birth weight

Definition and prevalence

High birth weight, or macrosomia, is often recorded as the number of infants with a birth weight equal to or greater than 4,000 grams (74). In Canada in 2006, 11.6% of infants were recorded as having birth weights of 4,000 grams or higher, while 1.8% had a birth weight of 4,500 grams or higher (73)(78). The Northwest Territories has the highest rate of macrosomia in Canada; in 2006, 17.7% of infants had birth weights of 4,000 grams or above, and 3.3% of all infants born to mothers in the Northwest Territories had birth weights of 4,500 grams or higher (73). As high birth weight is common within the Northwest Territories, it has been suggested that using a cut-off of 4,000 grams to define macrosomia over-estimates morbidity in both mothers and infants; instead, a cut-off of 4,500 grams should be used to define which children should be classified as macrosomic (35).

Health effects

High birth weight babies have a higher risk of shoulder dystocia, fetal death, and birth injury than normal weight babies (77), and high birth weight has been associated with lower five-minute Apgar scores (88). A study conducted using data from across the United States found that the risk of fetal and infant mortality, birth injury, neonatal asphyxia, and meconium aspiration were significantly higher in infants with birth weights of 4,500 grams or higher (89). In the long term, high birth

weight infants have a higher likelihood of obesity as children (77, 90) and high birth weight is strongly associated with the development of type II diabetes mellitus later in life (91, 92).

Maternal risk factors

While macrosomia, especially in infants with birth weights close to 4,000g, can be related to genetics and maternal height (83), it is also associated with maternal risk factors. In particular, fetal macrosomia is strongly associated with high maternal pre-pregnancy BMI (83, 93-95), inappropriate nutrition during pregnancy, and gestational diabetes (88, 96).

Admission to neonatal intensive care or special care unit at birth

Definition and prevalence

Admission to intensive care or special care units at birth is an indicator of morbidity, as admission to intensive care signifies that the neonate was assessed at birth as needing immediate intervention and/or enhanced supervision in order to avoid death or severe disability. This degree of morbidity can be associated with small-for-gestational-age births and pre-term births, however this outcome may also be associated with congenital anomalies and malformations, early elective caesarean section or multiple births (97).

Health effects

Infants admitted to the intensive or special care due to low birth weight or pre-term birth will be at risk for the associated health outcomes discussed in the previous section. In addition, neonates admitted to intensive care due to congenital anomalies are subject to the risk of morbidity associated with corrective surgery.

Admission to an intensive care unit also increases the risk that neonates will contract a bacterial infection while in care; this risk increases with the amount of time spent in the intensive care unit (98).

Maternal risk factors

A UK study demonstrated that, much like pre-term birth and SGA, maternal deprivation contributes to higher neonatal special care admission rates (97). An Australian study published in 2009 found that pre-pregnancy obesity was linked to a twofold increase in the odds of giving birth to an infant with congenital anomalies (99), and maternal obesity was found in a recent meta-analysis to be linked to an increased risk of structural anomalies (100). Pregnancy risk factors associated with other negative neonatal outcomes, such as gestational diabetes, pregnancy-induced hypertension, and pre-term labour, are also associated with admission to a neonatal intensive care unit due to their association with SGA and pre-term birth as well as other potential fetal risks (101).

Readmission to hospital

Definition and prevalence

Readmission to hospital within the first five months of life can be interpreted as an indirect indicator of neonatal morbidity (102). In Canada overall, the rate of neonatal readmission to hospital during the first 28 days of life was 3.4 per 100 in 2004, as reported in the 2008 Canadian Perinatal Health Report (103). The rate of readmission to hospital during the first five months was 6.7 per 100 for all of Canada, in the sample of 6,421 women collected by the Maternity Experiences Survey 2006-2007 (102).

Readmission to hospital is more common in pre-term infants (104, 105) and infants with congenital anomalies (106). In term infants without identified structural abnormalities, readmission to hospital is commonly associated with infection, hyperbilirubinemia, and feeding or gastrointestinal problems (106).

Health effects

Readmission to hospital is associated with the potential long-term morbidities seen in pre-term and small for gestational age infants, as discussed in previous sections. Infants born with congenital anomalies may be readmitted due to complications or a need for corrective surgeries; both of these carry the associated risk of infection that exist within intensive care units (98).

Maternal risk factors

As readmission to hospital is more common in pre-term infants (104, 105) and infants with congenital anomalies (106), the maternal risk factors linked to both pre-term birth and congenital anomalies also increase the risk of readmission to hospital.

A Swedish study published in 2008 found that mothers receiving active follow-up care after giving birth had lower rates of infant readmission to hospital (107). In addition, a study conducted in Manitoba found that health care practitioners in northern remote regions were more likely to err on the side of caution and readmit infants, particularly if admission to hospital required being flown to a larger population centre (108). If these associations were generalizable to the Canadian population, the availability of follow-up care and the remote

location of many communities may contribute to differences in infant readmission rates related to place of residence, within northern Canada.

2.4 Differences in demographic, socio-economic and risk factor distributions across Canada

There are a number of demographic differences between the three territories, as well as between major centres such as Yellowknife and Whitehorse, and smaller communities throughout the territories. Some of these factors have been identified in the previous section as having the potential to affect neonatal outcomes, independent of the conditions surrounding transfer policy. These factors are difficult to measure, due either to lack of individualized data, as in the case of substance abuse prevalence, or the unreliability of measures and indices in the context of the north, as in the case of socioeconomic status. The potential demographic factors that could influence the analysis include socioeconomic status, including income and education; age; ethnicity; marital status; pre-pregnancy BMI; and substance abuse prevalence.

2.4.1 Socio-economic status

Frequently used indicators of socio-economic status, such as income and education, are not necessarily meaningful in a Northern context. For instance, a measure such as income does not take into account subsistence activities, such as hunting and fishing, and measures of level of education achieved do not take into account the learning of traditional knowledge that would assist in these activities.

Subsistence activities are combined with wage labour and government transfers within these communities, so income alone does not indicate the prosperity of a household. As well, indicators of socio-economic status tend to treat the household as a unit, which does not take into account cooperative production and distribution among neighbours and extended families more commonly found in smaller northern communities (109).

Statistics Canada 2006 census data can be used to draw superficial comparisons between territories and regions. There are considerable differences in income between territories, with a median household income of $35,006 in the Northwest Territories, $31,352 in the Yukon, and $20,982 in Nunavut. The median household income within the capital city of each territory does not reflect this distribution, however; the highest median household income was found in Iqaluit, Nunavut, at $44,885, followed by $44,567 in Yellowknife, Northwest Territories and $34,201 in Whitehorse, Yukon. This indicates that the distribution of income between rural and urban areas is very different in the three territories, with residents of Iqaluit making over twice the average household income for the rest of Nunavut, and the residents of Whitehorse making only slightly more than rural Yukon residents (2-4). The differences between rural and urban income is complicated by the variations in the cost of food within the territories (5, 110), suggesting that relative costs of living in smaller, more remote communities is higher; clearly, this will vary depending on aspects of the community, such as whether there is road access for any part of the year, and whether hunting is a major source of food within the community.

2.4.2 Maternal age

The average age of the population also varies considerably across the territories. The average age of the population of the Yukon is 38.4 years, while the average age of the population of the Northwest Territories is 31.2 years, and the average age of the population of Nunavut is only 23.1 years. Also, while the average age of the population of Whitehorse, 37.6 years, is slightly lower than the average age of the population of the Yukon overall, the population of Yellowknife is slightly older (32.2 years), on average, than the population of the Northwest Territories as a whole, and the population of Iqaluit, Nunavut, at 28.8 years, is nearly six years older than the average for the territory as a whole (2-4). This suggests that the populations of rural and remote communities, who have less access to health care options, are younger, on average, than the population of capital cities in the Northwest Territories and Nunavut, where more care choices exist.

While there is currently no published data regarding average maternal age by town or community in northern Canada, the average maternal age for births in the northern Canada between 2000 and 2004 was considerably lower than the Canadian average, with over 15% of births to mothers less than 20 years of age in northern Canada compared to less than 5% in Canada overall, and with over 42% of births to mothers less than 25 years of age, compared to 21% of births in all of Canada (74). While it is difficult to assess whether average maternal age is higher in any particular region just because the average age is higher in general, a study conducted in Quebec in 2008 found that mothers living in rural areas were more likely to be under 20 years of age (111). Given this finding, combined with the

younger average age in smaller communities in the Northwest Territories and Nunavut, and the high proportion of births to young mothers in northern Canada, it is possible that the average maternal age of women in the larger population centres may be significantly higher than the average maternal age of women who reside in smaller communities, and are subject to mandatory transfer policy (3).

2.4.3 Maternal ethnicity

As mentioned previously, the three territories have very different demographic characteristics. A minority of the residents of the Yukon (33.5%) is Aboriginal (2); these individuals are predominantly First Nations (86.3%) (112). Half of the population of the Northwest Territories identifies as Aboriginal (3), and in the 2006 census, approximately 61.3% identified as First Nations, 17.4% as Metis, and 20.2% as Inuit (113). In Nunavut, the majority of the population identifies as being aboriginal (85%)(4), and of these individuals, the majority (98.9%) self-identify as Inuit, while only 0.4% identify as First Nations and 0.5% identify as Metis (114).

There are also clear demographic differences between the larger population centres and the smaller and more remote communities. Despite the fact that 85% of the population of Nunavut identifies as Aboriginal, only 60.0% of the residents of Iqaluit identify as Aboriginal (115). In the Northwest Territories, 50.3% of the population is Aboriginal, however, Aboriginal peoples make up only 22.2% of the population of Yellowknife (116). The population distribution of the Yukon follows a similar pattern, with 25.1% of the population identifying as Aboriginal, but only

18.7% of the city of Whitehorse identifying as Aboriginal (117). This suggests that the populations of smaller communities in all three of these territories, to which transfer policy is more likely to apply, have a larger percentage of Aboriginal inhabitants than the three capital cities.

2.4.4 Pre-pregnancy Body Mass Index

The 2002-2003 First Nations Regional Longitudinal Health Survey indicated that 73% of First Nations individuals are overweight or obese across Canada (118); this figure is 20% higher than the Canadian national average (119). While there is no data on the actual regional obesity rates in the northern Canada, it is possible that the demographic differences between the territories would result in different average body mass index (BMI), both between the territories and when comparing the territories and Canada.

It is important to note that BMI may not be an accurate measure of obesity among the First Nations and Inuit populations. BMI is a measure developed based upon studies of European populations. While obesity is still a health risk for Inuit populations, a study conducted in circumpolar Inuit populations showed that high BMI did not have the same impact on some metabolic indicators among Inuit as it does among white populations (120). Given this genetic factor, BMI may not have the same effect on fetal development in women with different ethnic backgrounds.

2.4.5 Maternal education

Highest level of education and rates of completion of secondary school education are commonly used as socio-economic status indicators (121). The three territories in Northern Canada have different rates of high school graduation, with 77.3% of Yukon residents, 67.0% of Northwest Territories residents, and 42.7% of Nunavut residents having obtained a high school diploma or higher (122-124). Again, these numbers are different in the larger centres than in the territories overall, with 79.7% of Whitehorse residents, 81% of Yellowknife residents, and 64.4% of Iqaluit residents having completed a high school diploma or higher (122-124). This suggests that there are differences in educational attainment between the three territories themselves, as well as between the larger population centres and smaller rural and remote communities.

2.4.6 Marital status

Maternal marital status is also commonly used as a potential indicator of low maternal SES (48). The proportion of lone parent families is not remarkably different between territories, with 21.7% of families in the Yukon, 21.4% of families in the Northwest Territories, and 27.6% of families in Nunavut being classified as lone parent families. These numbers are all slightly lower in the capital cities (20.7% in Whitehorse, 15.7% in Yellowknife, and 23.1% in Iqaluit), but these differences are not as extreme as those observed in income and education level between the territories, and between capital and rural regions (122-124).

2.4.7 Substance use

Alcohol use varies widely throughout the north, with some communities having established themselves as dry communities and others carrying alcohol restrictions. In the Yukon, Old Crow was confirmed by word of mouth to officially be a dry community, the lack of documented reports of this ban, or of media coverage regarding breaches or alcohol related criminal charges, suggests that the ban on alcohol is not widely observed, and no reliable documentation could be found to either confirm or deny this statement. In the Northwest Territories, fifteen communities are considered unrestricted, restrictions to the amount of alcohol that can be in an individual's possession are in effect in eleven communities, and six communities prohibit the possession or consumption of alcohol entirely (125). Nunavut has similar variation, with five unrestricted communities, twelve restricted communities, and eight dry communities. It is not possible to purchase alcohol in person outside of a restaurant, club or bar, however, so individual alcohol purchases must be made by mail order and paid for in advance (126).

Smoking rates in northern Canada are higher than those seen in the rest of the country, and vary across the territories. According to the Canadian Community Health Survey Cycle 3.1 (2005) the rate of smoking was 30% in the Yukon, 36% in the Northwest Territories, and 53% in Nunavut (127). The smoking rates for individual communities within northern Canada were not available.

2.5 Rationale

A number of qualitative studies have been conducted regarding the detrimental effects of transfer policy on maternal satisfaction and psychological wellbeing; however, there has been no quantitative examination to date on the effect that the policy of transfer for childbirth, and the associated prenatal care differences and risk factors, has on the health of the newborn (39). There is debate about how much comprehensive and continuous prenatal care can influence birth outcomes; a systematic review regarding the relationship between birth weight and prenatal support for "at-risk" pregnant women reviewed a number of different prenatal intervention studies, concluding that prenatal support is not likely to be sufficient to overcome a lifetime of low socioeconomic status (61), and another author suggested that a few months of prenatal intervention may not be sufficient to overcome substance use or nutritional habits that have been established for a decade or more (36). On the other hand, a retrospective study conducted in the US found continuity of prenatal care to be associated with higher mean birth weight; there was a two-fold excess in weights less than 2,500 grams in the group lacking continuity of care (56). This study will examine whether continuous and comprehensive prenatal care, such as that made possible by funded midwifery care, greater availability of social programming, or caregiver continuity, leads to better neonatal outcomes, within the context of northern Canada.

CHAPTER 3: METHODS

3.0 Objectives

The purpose of this study is to determine whether there are differences in prenatal care and services available to pregnant women who are transferred from their communities in order to give birth and women who are not, and whether these differences lead to disparities in neonatal morbidity, with consideration given to other individual and environmental factors. This purpose may be divided into three separate objectives:

1) Determine whether there are differences in prenatal care available to women who live in communities where they are required to travel more than 100 km from home to give birth, and those that do not have to travel more than 100 km.
2) Determine whether the prevalence of socio-economic status and maternal risk behaviours are different in women who have to travel more than 100 km to give birth, and women who do not have to travel more than 100 km.
3) Determine whether there are differences in neonatal morbidity between newborns whose mothers who have to travel more than 100 km from home to give birth, and newborns whose mothers did not have to travel more than 100 km.

3.1 Conceptual Model

Place of residence is a key determinant of three sets of variables used in this study: prenatal care variables, maternal risk factors, and transfer for childbirth. In

addition, prenatal care variables, and maternal risk factors, may influence whether a woman is transferred for childbirth, if she lives in a community where birth facilities exist. Finally, all three groups of variables associated with place of residence may have an impact on neonatal morbidity.

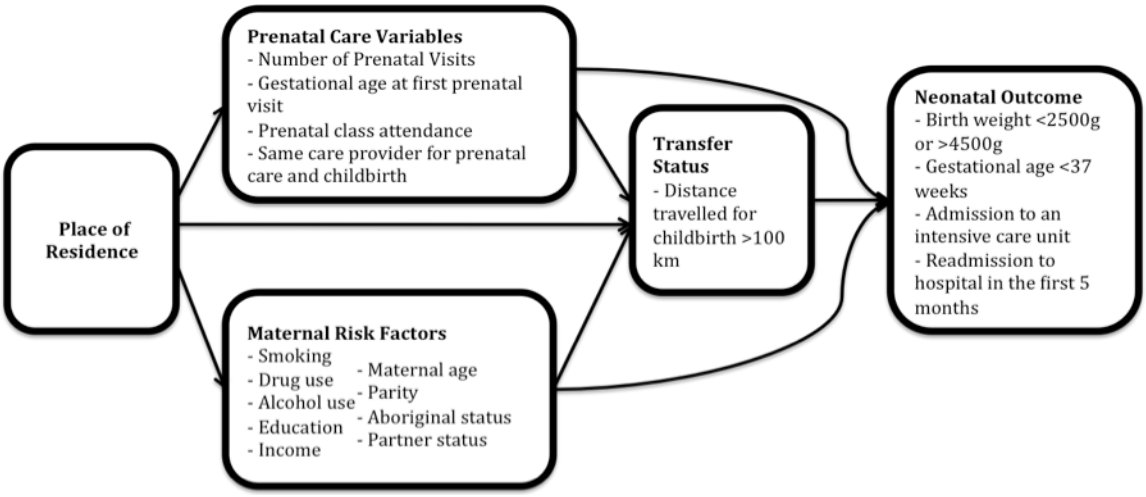

Figure 1: Conceptual Model

3.2 Study design

This study was a secondary analysis of the Maternity Experiences Survey 2006-2007, conducted by the Public Health Agency of Canada, in collaboration with Statistics Canada (102).

3.3 Data source

Data was obtained from the Public Health Agency of Canada. Details of the survey, conducted in partnership with Statistics Canada, can be found on the website of the Maternity Experiences Group, a task group created by the steering committee

of the Public Health Agency of Canada's Canadian Perinatal Surveillance System. The Maternity Experiences Group conducted the MES in order to gain insight into the perceptions of women surrounding pregnancy and birth.

The Maternity Experiences Survey included women who were birth mothers, 15 years and older, who had experienced a singleton live birth during the three months preceding the 2006 Canadian Census, and who lived with the infant referred to in the survey at the time of data collection. This survey excluded First Nations women living on-reserve and institutionalized women (102).

The original study included a sample of 6,421 women from across Canada, out of an estimated total of 8,244 potentially eligible respondents, for a total response rate of 77.9%. This sample includes 61 respondents from the Yukon, 89 respondents from the Northwest Territories, and 83 respondents from Nunavut. The response rates were lower throughout the territories compared to the rest of Canada, at 77.5%, 76.0%, and 64.0%, respectively (102). A Census-based sampling frame was used to identify women with births immediately preceding the 2006 Canadian Census of Population. A stratified random sample of 8,542 women was drawn from this sampling frame, with 6,421 of the 8,244 determined eligible participating. Each participant was assigned a sampling weight using generalized regression estimation, based on strata such as province or territory, maternal age at the time of birth, first language, and Aboriginal status, such that the original sample of 6,421 was weighted to represent the total number of eligible women included in the 2006 Census (76,508) (102).

The Maternity Experiences Survey was administered by female interviewers and took place primarily by telephone. The study included over 300 questions and took approximately 45 minutes to complete. Women identified as eligible for the MES were mailed an introductory letter and survey pamphlet in 2006, and then were contacted by telephone between October 23rd, 2006, and January 31st, 2007, between five and fourteen months after the birth of their baby (102).

The Canadian Maternity Experience Survey 2006-2007 was tested for validity in a number of ways. The questionnaire was piloted in 2005, interviewing a sample of 210 women in all provinces and territories. The results of this pilot were used to make revisions to the instrument before the main survey was conducted. As well, quality assurance measures, including training of interviewers, observation of nterviewers, and data quality checks, were conducted throughout the interview process. Finally, the survey estimates were validated by specialists in pregnancy, birth and postpartum fields using existing data sources (102).

3.4 Study population

For the purpose of this study a subset of women who had received their prenatal care in northern Canada (the Yukon, the Northwest Territories, and Nunavut) was extracted from the original study population. This subset included 229 birth mothers, aged 15 and over. As there are no First Nations reserves in the three territories, no women were excluded from this study due to place of residence.

The selection of the subset was based upon the answer to the question "Where did you receive the majority of the prenatal care?" Women who responded

that they had received the majority of their prenatal care in the Yukon, the Northwest Territories, or Nunavut were selected for inclusion in this study. This question was used to discriminate between women from the territories and the rest of the study participants, rather than the response to the question "what is your province of residence?" This decision was made in order to avoid inappropriately including or excluding women who were working or studying outside of their province or territory of residence at the time of their pregnancy, or women who had moved to a new province or territory after the birth of their child, as the responses of these women may not be representative of someone receiving prenatal care in northern Canada.

3.5 Description of main measures

The variables examined in this study can be grouped into four, broader, main measures. These four measures include transfer status, neonatal morbidity, prenatal care variables, and maternal risk factors.

3.5.1 Transfer status

Women were divided into two groups based on whether or not they were transferred for childbirth. Transfer status was determined using the response to the question "How far did you travel to give birth?" If the distance travelled was greater than 100 kilometers, or if the woman chose "I don't know" as her response, then the respondent was grouped in the transfer group, provided that her response to the question "How many nights did you stay in this city, town or community before you

gave birth?" was greater than or equal to three. The rationale for the use of these responses are to identify women who were transferred by air, which is likely in the territories for a distance greater than 100 km, and therefore were not likely to be able to travel back and forth to receive prenatal care in a larger city, or to visit their family while waiting to give birth. The definition based on the number of nights spent waiting to give birth in another community was set at greater than three in order to distinguish women who were medevaced to a larger centre due to early labour or other complications from those who were transferred as part of routine prenatal care practice.

The respondents who answered "I don't know" to the question regarding the distance travelled for childbirth were included in the transfer group based on a statement in the Maternity Experiences Survey report. This report stated that in the territories, when women stated that they did not know how far they had travelled for birth, this was most often because they were flown long distances to their destination, which made it difficult for them to tell exactly how far they had had to travel (102).

Women who answered that they travelled more than 100 km, or did not know how far they had travelled, and answered that they had spent more than three nights away from home before the birth of their baby, made up the transfer group, and all other women were placed in the non-transfer group.

3.5.2 Neonatal morbidity

Neonatal morbidity variables included all variables in the Maternity Experiences Survey that indicated a potentially negative outcome. These variables include low or high birth weight, gestational age, admission to a special care or intensive care unit, and readmission to hospital within the first five months of life.

Several neonatal morbidity variables were recoded for analysis. Gestational age was originally recorded as a continuous variable. In order to distinguish the number of pre-term births from the number of births at term, it was recoded into a grouped gestational age variable, and recorded as pre-term if the gestational age was less than 37 weeks, and term if the gestational age was equal to or greater than 37 weeks. Birth weight was initially divided into groups based on the risk of morbidity. Low birth weight is an indicator of increased risk of mortality and morbidity, and this risk increases as birth weight decreases. Therefore, birth weight was recoded into 5 groups [extremely low (less than 1,500 grams), very low (1,500 grams up to less than 2,000 grams), low (2,000 grams up to less than 2,500 grams), normal (birth weights from 2,500 grams up to less than 4,500 grams), and high (birth weights of 4,500 grams or higher)]. Due to small numbers within the sample of extremely low, very low and low birth weight infants, this category was collapsed such that birth weight is recoded into three groups [low (birth weights less than 2,500 grams), normal (birth weights from 2,500 grams to less than 4,500 grams), and high (birth weights of 4,500 grams or higher)].

A neonatal outcome index was used to assess differences in neonatal morbidity between the transfer and non-transfer groups, due to the small sample

size available for this analysis, and the low frequency of the neonatal outcomes recorded. To create this index, each outcome representing neonatal morbidity was assigned a value of one. The outcomes representing neonatal morbidity were as follows: yes to admission to an intensive care or special care unit at birth; yes to readmission to hospital in the first five months, a birth weight of less than 2,500 grams, a birth weight of greater than 4,500 grams, or a gestational age of less than 37 weeks. All other responses to the above five questions were assigned a value of zero. Missing responses and "I don't know" responses were both recorded as zero, since negative health outcomes in newborns would be likely to register prominently in the minds of the mother if they had actually occurred.

The sum of the value of the neonatal morbidity index responses was calculated for each respondent. The total number of responses indicating neonatal morbidity became the neonatal morbidity index value for that individual, ranging from zero to a maximum value of four. Based on the distribution of the newly created neonatal morbidity index variable, it was decided that the neonatal morbidity index would be made into a dichotomous variable, based on whether the index for the individual was zero, or if the index for the individual was one or higher. This variable was used to analyze whether or not neonatal morbidity differed between the transfer and non-transfer groups.

3.5.3 Prenatal care variables

Prenatal care was assessed using the answers to the questions: "How many weeks pregnant were you when you had your first visit for prenatal care?"; "Did you

receive prenatal care as early as you wanted?"; "How many prenatal care visits did you have?"; "From which type of healthcare provider did you receive most of your care?"; During your pregnancy, did you attend prenatal or childbirth education classes?"; and "Did the healthcare provider who cared for you during your pregnancy also care for you during labour and birth?". These questions were included based on their relevance with regards to maternal access to and use of prenatal care, the timing and number of prenatal care visits, the type of care provider from whom women received care, and continuity of care in pregnancy and childbirth.

The number of weeks pregnant at first prenatal care visit was originally recorded as a continuous variable. Based on the literature, a grouped early initiation of care variable was created, for which a response of less than 14 weeks was recorded as yes and a response equal to or greater than 14 weeks was recorded as no.

The number of prenatal care visits was also recoded into a categorical variable based on the literature. This variable was divided into three categories: low if the number of prenatal care visits was less than ten, medium if the number of prenatal care visits was equal to or greater than ten but less than fifteen, and high if the number of visits was equal to or greater than fifteen.

3.5.4 Maternal risk factors

Maternal risk factors selected for analysis were responses to questions regarding smoking during pregnancy, alcohol consumption during pregnancy, drug

use, pre-pregnancy BMI, aboriginal status, age, stress level, education, income and marital status. This group of variables attempts to describe the differences that exist in maternal risk factors and behaviours between transfer and non-transfer groups. These variables may have a potentially confounding effect on any relationship we see between neonatal morbidity and maternal transfer status.

Maternal BMI was calculated by the initial data analysts based on the pre-pregnancy height and weight reported by respondents, and included in the database as a continuous variable, rounded to two decimal points. Since the use of BMI as a measure of adiposity in aboriginal populations is currently under debate, BMI was used to evaluate obesity in the study population, but not overweight or underweight. This decision was made based on the assumption that, in order to be classified as obese, the ratio of weight to height would have to be large enough that it would be unlikely to misrepresent someone who was at a normal weight as obese, regardless of ethnic background. Obesity was calculated as a dichotomous variable coded as no if the BMI of the respondent was less than 30.0 and as yes if the BMI of the respondent was equal to or greater than 30.0.

The survey also recorded a number of variables related to smoking. In order to assess smoking during pregnancy, the answer to the question "during the last 3 months of your pregnancy, did you smoke daily, occasionally, or not at all?" was considered. This variable was recoded as ever or never smoking by combining the daily and occasionally responses to create a variable including all women who smoked at any time during the last three months of their pregnancy.

For the purposes of this study, alcohol consumption was assessed using the responses to the question "after you realized you were pregnant, how often did you drink alcoholic beverages?" The responses to this question were divided into eight categories, ranging from not drinking at all to drinking every day during pregnancy. In order to condense this variable for analysis, alcohol consumption was reduced to an ever or never dichotomous variable, where a response was coded as never if the respondent reported not drinking at all during pregnancy, and any other response was coded as an ever response.

Maternal education was condensed into three categories by grouping the original ten categories into three categories: no high school diploma, encompassing anyone who indicated their highest level of education as less than a high school diploma; high school diploma, encompassing respondents that indicated they had graduated from high school and those that indicated attending some post-secondary education, without obtaining a diploma or degree, and post-secondary education, including respondents who indicated they had achieved a post-secondary certificate, diploma, degree, or graduate degree of any kind. These criteria were selected due to the lower rates of high school completion and post secondary education throughout the territories, since the distinction between not completing high school, completing high school, and obtaining a post-secondary certificate, diploma or degree is more relevant in this region than the distinction between, for instance, obtaining a college diploma or a graduate degree.

The variable marital status was condensed into a dichotomous variable, where respondents were classified in the category of partner if the respondent

stated that she was either married or in a common law relationship, or no partner if the respondent stated that she was separated, divorced, widowed or single.

3.6 Data Management

This thesis was completed using data from the Maternal Experiences Survey, which is maintained by the Public Health Agency of Canada (PHAC) and is accessible at Research Data Centres across Canada. Permission to use this data was granted by PHAC without requiring an application process, due to the researcher's position as a PHAC employee through the research affiliate program.

Statistical analysis programs were tested using a dummy dataset, consisting of 600 records, provided by the Health Surveillance and Epidemiology Division of the Public Health Agency of Canada. These records were created for the purposes of testing programs and were not representative of the response pattern of any of the survey respondents. The analysis took place by email correspondence with the data manager in the PHAC offices in Ottawa, due to the remote location of the researcher and the lack of a Research Data Centre in Yellowknife. Data analysis programs were created using SAS version 9.1.3 (SAS Institute, Cary, NC), and programs submitted to the data manager were generally returned within one or two days.

To obtain a more accurate estimate of variance, bootstrapping was used in all analyses of the Maternity Experiences Survey dataset. Using a program created by the data analysts at PHAC, the results of relative risk, adjusted relative risk and logistic regression calculations were calculated using the "Bootvare" program and

were all run through 1000 iterations in order to evaluate variability in the study subsample.

Except when otherwise stated, missing, refusal and "I don't know" responses were all coded as missing and excluded from the analysis. "I don't know" variables were included in the analysis if it was reported in the Maternity Experiences Survey Report that these responses were likely to be indicative of a specific outcome.

3.7 Data Analysis

Data analysis was conducted in three parts. Univariate analysis was conducted to describe the data set. Bivariate analysis was then used to explore the differences between the women who were transferred for childbirth and the women who gave birth in their home community. Finally, multivariate analysis was used to compare meaningful variables, as identified in the previous analyses, while controlling for the effect of other variables in the model.

3.7.1 Univariate analysis

All of the variables analyzed in the study were examined for the distribution of each of the possible responses, as well as for missing responses, refusals, and "I don't know" responses, within the subsample of the MES study population used in this analysis.

3.7.2 Bivariate analysis

The relationships between transfer status and each of the variables outlined in section 3.4 were examined using logistic regression to calculate crude odds ratios. These odds ratios were used to determine which variables would be included in multivariate analyses, in order to produce adjusted odds ratios. Bootstrapping methods were used to evaluate the data and to calculate variance estimates for the odds ratios included in the analysis. Differences were considered significant if the parameter estimates were statistically significant (95% confidence intervals not including 1.00) and if the coefficient of variation was less than 33.3%.

3.7.3 Multivariate analysis

To assess confounding, and to calculate adjusted odds ratios for the relationship between neonatal morbidity and transfer status, multiple logistic regression was used. The first model included all the potential confounders described in the previous sections. The second, reduced model, included only the potential confounding variables that had statistically significant odds ratios in the first round of analysis. Differences were considered significant if the parameter estimates were statistically significant (95% confidence intervals not including 1.00) and if the coefficient of variation was less than 33.3%.

3.8 Ethics Review

The Queen's University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board granted ethics approval for this study in December of 2008.

Due to the fact that this study was a secondary analysis of data already collected by the Public Health Agency of Canada, a research license from the Aurora Research Institute, the body responsible for reviewing and coordinating the approval of research projects conducted in the Northwest Territories, was not required.

CHAPTER 4: RESULTS

4.1 Characteristics of the study population

Table 4.1 summarizes the demographic characteristics of the study population. The study population included 229 individuals. Within this sample, 61 women (27%) were from the Yukon, 87 women (38%) were from the Northwest Territories, and 81 women (35%) were from Nunavut.

There were differences in population demographics between the three territories. In the Yukon, the proportion of respondents who had less than a high school education was approximately 8%, while 21% of respondents in the Northwest Territories and 55% of respondents in Nunavut had less than a high school education. As well, while only 10% of respondents in the Yukon reported a household income lower than the low-income cut-off established in the survey, 26% of respondents in the Northwest Territories and 32% of respondents in Nunavut had household incomes below the established low-income threshold used in this survey.

Overall, 24% of the women interviewed had less than a high school education, while 22% had a high school diploma, and 47% had a post-secondary certificate, diploma or degree. The majority of women (53%) were in their twenties at the time of the birth of their infant, while 11% of women were in their teens, 34% were between 30 and 39 and 2% were 40 or older. Single, widowed, divorced or separated women made up 16% of the study population, while 82% were either married or in a common law relationship. Approximately half of the respondents

(52%) self-identified as being Aboriginal, while slightly less than half (43%) self-identified as being non-aboriginal.

Table 4.1. Demographic characteristics of the study population, Canadian Maternity Experiences Survey, 2006-2007.

	N	%
Total	229	100
Territory		
Yukon	61	22.6
Northwest Territories	87	38.0
Nunavut	81	35.4
Education Level		
Less than High School	65	28.4
High School	51	22.3
Post-Secondary Degree or Diploma	108	42.7
Not Stated	5	2.2
Marital Status		
Married or Common Law	188	82.1
Single/Widowed/Divorced	36	15.7
Don't Know/Refusal	5	2.2
Aboriginal Status		
Aboriginal	132	57.6
Non-Aboriginal	82	35.8
Valid Skip (not born in Canada/US/Greenland)/Not Stated	15	6.6
Household Income		
<$30,000	55	24.0
$30,000 to <$60,000	43	18.8
$60,000 to <$100,000	59	25.8
>$100,000	36	15.7
Don't Know/Refusal	36	15.7
Maternal age at birth		
15 to 19 years	24	10.5
20 to 24 years	48	21.0
25 to 29 years	73	31.9
30 to 34 years	52	22.7
35 to 39 years	26	11.4
40 years and above	5	2.1

4.1.1 Transfer status

Table 4.2 summarizes transfer status and birth hospital level in the study group. Approximately 47% of the women in the study had to travel to another community, and 38% had to travel more than 100 kilometers and spend over three nights in another community before they gave birth. The majority of women (59%) gave birth in a regional hospital (Level 2), while 27% gave birth in a community hospital (Level 1) and 11% gave birth in a hospital located in a larger centre such as Edmonton or Ottawa (Level 3).

The proportion of women transferred to another community to give birth varied greatly by territory. While only 16% of women in the Yukon were transferred for childbirth, 37% of women in the Northwest Territories and 57% of women in Nunavut were transferred to a community over 100 km from home to give birth.

Table 4.2. Place of birth of infants born to women in the study population, Canadian Maternity Experiences Survey, 2006-2007.

	N	%
Level of Hospital where delivery took place		
Community Hospital	61	26.6
Level 2 Hospital	135	59.0
Level 3 Hospital	25	10.9
Missing	8	3.5
Travel to another community to give birth		
Yes	108	47.2
No	120	52.4
Total	229	100

4.1.2 Prenatal care

Table 4.3 summarizes the prenatal care received by the women in the sample. Slightly less than half (46%) of the respondents had the same provider that they had had for prenatal care attending the birth, while 52% had a different care provider. The most common prenatal care provider within the study population was a family doctor (43%) followed by a nurse or nurse practitioner (33%). Midwives cared for 6 % of the women in the study population, and 6 % of the women were cared for by an obstetrician. Prenatal care was initiated before 10 weeks gestation for 92% of respondents, and most women surveyed received prenatal care as early as they wanted (83%). Within the study population, 32% of women attended less than 10 prenatal care appointments, while 56% attended from 10 to 14 visits and 12% had more than 14 prenatal care visits. The majority of women (62%) did not attend any prenatal classes.

The results for prenatal care were different across the territories. The average gestational age at first prenatal care visit was 6.6 weeks for mothers in the Yukon, 7.8 weeks for mothers in the Northwest Territories, and 8.5 weeks for mothers in Nunavut. The average numbers of prenatal care visits differed as well; women in the Yukon attended an average of 12.1 visits, women in the Northwest Territories attended an average of 11.3 visits, and women in Nunavut attended an average of 10.6 visits. In the Yukon, the majority of women received their prenatal care from a family physician (83%), while in Nunavut, more than half of the respondents received their prenatal care from a nurse or nurse practitioner (59%). Finally, the percentage of women who had the same care provider for both prenatal

care and birth was higher in the Yukon (77%), while in the Northwest Territories and Nunavut, the percentages were only 34% and 38%, respectively.

Table 4.3. Prenatal care received by the women in the study population, Canadian Maternity Experiences Survey, 2006-2007.

	N	%
Type of Health Care Provider		
Obstetrician	13	5.7
OBGYN	3	1.3
Family Doctor	98	42.8
General Practitioner	13	5.7
Doctor	11	4.8
Midwife	13	5.7
Nurse or Nurse Practitioner	76	33.2
Same provider for prenatal care and birth		
Yes	106	46.3
No	120	52.4
Prenatal Care received as early as wanted		
Yes	190	83.0
No	34	14.8
Attended Prenatal Classes		
Yes	84	36.7
No	141	61.6
Number of Prenatal Visits		
<10	74	32.3
10-14	128	55.9
>14	27	11.8
Gestational age at start of prenatal visits		
Before 10 weeks	210	91.7
10 weeks or later	19	8.3
Total	229	100

4.1.3 Maternal risk factors

Table 4.4 summarizes the maternal risk factors present in the study population. Within the study sample, 44% of respondents reported that most days were "somewhat stressful" and 9% of women reported that most days were "very stressful". 35% of respondents smoked either daily or occasionally during the last

three months of their pregnancy. Only 8% of women drank alcohol at any time during the last three months of their pregnancy, and 4% of women reported that they used street drugs during pregnancy. Abusive incidents during the pregnancy were reported by 7% of women interviewed. Maternal pre-pregnancy obesity, as measured by BMI, was reported by 16% of the women in the territories. 25% of women were primiparous (first birth), 64.6% were multiparous (1-4 previous births) and 10.5% were grand multiparae (5 or more previous births).

Table 4.4. Behavioural risk factors experienced by women in the study population, Canadian Maternity Experiences Survey, 2006-2007.

	N	%
Maternal Stress – in the past year, most days were…		
Not stressful	106	46.3
Somewhat stressful	101	44.1
Very stressful	21	9.2
Maternal Smoking		
Ever	79	34.5
Never	150	65.5
Frequency of alcohol consumption during pregnancy		
Ever	18	7.9
Never	206	90.0
Use of street drugs while pregnant		
Ever	9	3.9
Never	218	95.2
Abusive incidents during pregnancy		
Yes	16	7.0
No	212	92.6
Maternal Parity		
Primiparous	57	24.9
Multiparous	172	75.1
Maternal Obesity		
Obese	36	15.7
Not obese	193	84.3
Total	229	100

4.1.4 Neonatal morbidity

Table 4.5 describes neonatal morbidity in the study sample. Of the infants born to the women who received the majority of their prenatal care in the north, 4% had a birth weight of less than 2,500 grams, 4% had a birth weight of greater than 4,500 grams, and 14% were born prematurely. The proportion of infants admitted to an intensive care unit at birth was 8%, and 14% of infants were readmitted to hospital within the first five months of life. No women in the sample rated the health

of their infant as poor within the three territories. Overall, 27% of infants born to the study population experienced at least one outcome indicative of neonatal morbidity.

Table 4.5. Neonatal morbidity experienced by infants born to women in the study population, Canadian Maternity Experiences Survey, 2006-2007.

	N	%
Admission to a special care unit		
Yes	18	7.9
No	206	90.0
Readmission to hospital (first five months)		
Yes	31	13.5
No	198	86.5
How would you rate your child's health		
Excellent	140	61.1
Very good	59	25.8
Good	29	12.7
Fair	--	--
Poor	--	--
Gestational age		
<37 weeks	31	13.5
37 weeks or more	198	86.5
Birth weight		
<2500g	9	3.9
2500g to <4500g	212	92.6
4500g or higher	8	3.5
Neonatal Morbidity		
One or more negative outcomes	61	26.6
No negative outcome	168	73.4
Total	229	100

-- Data suppressed due to cell number <5

4.1.5 Descriptive analysis of the transfer and non-transfer groups

Table 4.6 summarizes the distribution of demographic characteristics, prenatal care variables and risk factors, by transfer status and neonatal morbidity

status. Within the non-transfer group, the most common prenatal care provider was a family doctor (60%), while in the transfer group, the most common prenatal care provider was a nurse or nurse practitioner (61%). In the transfer group, 10% received the majority of their care from a midwife, while only 3% of women in the non-transfer group received their care from a midwife. In the transfer group, it was more common for women to give birth in a level 2 hospital (70%), located mainly in the territorial capitals, while there were more women in the transfer group who were transported to a level 3 facility, located in the southern provinces (22% vs. 4%).

The women in the transfer group were younger than the women in the non-transfer group, with 13% of the transfer group and 9% of the non-transfer group reporting they were less than 20 years old at the time of the birth of their child. A higher proportion of women in the transfer group had less than a high school education (38%) than in the non-transfer group (23%). The majority of women in the non-transfer group (54%) had a post-secondary certificate, degree, or diploma, while only 36% of women in the transfer group had a post-secondary education. The majority of women in the transfer group self-identified as belonging to at least one Aboriginal group (76%) while the majority of women in the transfer group self-identified as being non-Aboriginal (58%). A higher proportion of women in the transfer group identified as having a household income of less than $30,000 per year (27% compared to 22% for non-transfer). The question regarding income had the highest rate of non-response in the study population, with 24% of transfer participants and 11% of non-transfer participants not providing a response.

Table 4.6. Distribution of demographic characteristics, prenatal care variables and risk factors by transfer status and neonatal morbidity status, n and column percentages, Canadian Maternity Experiences Survey 2006-2007.

	Transfer Status				Neonatal Morbidity			
	Transfer		Non-Transfer		Morbidity		No Morbidity	
	n	%	n	%	n	%	n	%
Territory								
Northwest Territories	32	36.4	55	39.0	20	32.8	67	39.9
Nunavut	46	52.3	35	24.8	31	50.8	50	29.8
Yukon	10	11.4	51	36.2	10	16.4	51	30.4
Maternal age at birth								
15 to 19 years	11	12.5	13	9.2	7	11.5	17	10.1
20 to 24 years	27	30.7	21	14.9	18	29.5	30	17.9
25 to 29 years	28	31.8	45	31.9	20	32.8	53	31.5
30 to 34 years	12	13.6	40	28.4	8	13.1	44	26.2
35 to 39 years	6	6.8	20	14.2	5	8.2	21	12.5
40 to 44 years	--	--	--	--	--	--	--	--
45 to 49 years	--	--	--	--	--	--	--	--
Missing	--	--	--	--	--	--	--	--
Education level								
Less than high school	33	37.5	32	22.7	25	41.0	40	23.8
High school	20	22.7	31	22.0	15	24.6	36	21.4
Post-secondary degree or diploma	32	36.4	76	53.9	20	32.8	88	52.4
Partner status								
Partner	70	79.5	118	83.7	49	80.3	139	82.7
No partner	16	18.2	20	14.2	10	16.4	26	15.5
Household Income								
<$30,000	24	27.3	31	22.0	19	31.1	36	21.4
$30,000 to <$60,000	19	21.6	24	17.0	10	16.4	33	19.6
$60,000 to <$100,000	20	22.7	39	27.7	12	19.7	47	28.0
>$100,000	--	--	32	22.7	--	--	33	19.6
Aboriginal Status								
At least one Aboriginal identity	67	76.1	53	37.6	44	72.1	88	52.4
No Aborignial identity	16	18.2	82	58.2	16	26.2	66	39.3
Type of Health Care Provider								
Obstetrician	--	--	12	8.5	--	--	12	7.1
Family Doctor	14	15.9	84	59.6	20	32.8	78	46.4
General Practitioner	--	--	9	6.4	5	8.2	8	4.8
Doctor	--	--	8	5.7	--	--	10	6.0
Midwife	9	10.2	4	2.8	--	--	10	6.0
Nurse or Nurse Practitioner	54	61.4	22	15.6	26	42.6	50	29.8
Level of Hospital where delivery took place								
Community Hospital	30	34.1	31	22.0	20	32.8	41	24.4
Level 2 Hospital	37	42.0	98	69.5	28	45.9	107	63.7
Level 3 Hospital	20	22.7	5	3.5	11	18.0	14	8.3
Travel to another community to give birth								
Yes	88	100.0	20	14.2	41	67.2	67	39.9
No	0	0.0	120	85.1	20	32.8	100	59.5
Same care provider for pregnancy and birth								
Yes	22	25.0	84	59.6	26	42.6	80	47.6
No	65	73.9	55	39.0	35	57.4	85	50.6

	Transfer Status				Neonatal Morbidity			
	Transfer		Non-Transfer		Morbidity		No Morbidity	
	n	%	n	%	n	%	n	%
Prenatal Care received as early as wanted								
Yes	70	79.5	120	85.1	48	78.7	142	84.5
No	14	15.9	20	14.2	11	18.0	23	13.7
Attended Prenatal Classes								
Yes	31	35.2	53	37.6	18	29.5	66	39.3
No	55	62.5	86	61.0	42	68.9	99	58.9
Number of Prenatal Visits								
10 or more	51	57.5	104	73.8	36	59.0	119	70.8
<10	37	42.0	37	26.2	25	41.0	49	29.2
Gestational age at start of prenatal visits								
10 weeks or later	11	12.5	8	5.7	55	90.2	155	92.3
Before 10 weeks	77	87.5	133	94.3	6	9.8	13	7.7
Maternal Stress – in the past year, most days were…								
Very Stressful	11	12.5	10	7.1	7	11.5	14	8.3
Not stressful/somewhat stressful	40	45.4	67	47.5	54	88.5	153	91.1
Maternal Smoking								
Ever	45	51.1	34	24.1	31	50.8	48	28.6
Never	43	48.9	107	75.9	30	49.2	120	71.4
Frequency of alcohol consumption during pregnancy								
Ever	5	5.7	13	9.2	--	--	--	--
Never	80	91.0	126	89.4	57	93.4	149	88.7
Use of street drugs while pregnant								
Ever	--	--	--	--	--	--	--	--
Never	80	90.9	138	97.9	57	93.4	161	95.8
Abusive incidents during pregnancy								
Yes	8	9.1	8	5.7	5	8.2	11	6.5
No	80	90.9	132	93.6	55	90.2	157	93.5
Maternal Parity								
Multiparous	61	69.3	87	61.7	43	70.5	105	62.0
Primiparous	18	20.5	39	27.7	18	29.5	63	37.5
Maternal Obesity								
Obese	11	12.5	25	17.7	10	16.4	26	15.5
Not obese	77	87.5	116	82.3	51	83.6	142	84.5

-- Data suppressed due to cell number <5

Reported stress levels were similar in the transfer and non-transfer groups, though a higher proportion of women in the transfer group reported that most days were “very stressful” (13%) than in the non-transfer group (7%). A higher proportion of women in the transfer group smoked during the last three months of their pregnancy (51%) than in the non-transfer group (24%). Alcohol consumption

during the last three months of pregnancy was slightly higher in the non-transfer group (9%) than in the non-transfer group (6%), while the use of street drugs was more common in the transfer group (7%) compared to the non-transfer group (2%). Abusive incidents during pregnancy were also higher in the transfer than the non-transfer group (9% and 6%, respectively. A higher proportion of transfer group respondents were multiparous (69% vs. 62%) and a higher percentage of non-transfer group respondents were primiparous (28% vs. 20%). Finally, a higher percentage of women in the non-transfer group reported a high pre-pregnancy BMI that would have put them in the "obese" category (18%) compared to women in the transfer group (12%).

A higher proportion of women in the transfer group had infants who were admitted to a special care unit after birth (14%) compared to the non-transfer group (4%). As well, a greater proportion of infants born to women in the transfer group were readmitted to hospital (16%), than in the non-transfer group (12%). Fewer women in the transfer group gave birth prematurely (12%, compared to 14% in the non-transfer group), however a slightly higher proportion of infants born to women in the transfer group had a low birth weight (5%) compared to the non-transfer group (4%). The proportion of high birth weight is the same. The combined neonatal morbidity variable shows a higher proportion of negative outcomes in the transfer group (34%) and a lower proportion of negative neonatal outcomes in the non-transfer group (22%).

4.1.6 Descriptive analysis of the neonatal outcome groups

Women from Nunavut experienced half (51%) of all neonatal morbidity outcomes. Mothers with infants who had negative outcomes were less educated, with 41% of women in the morbidity group having less than a high school education, compared to 24% of the no morbidity group. The distribution of partnered and lone-parent mothers was roughly equal between the two groups, however women whose infants experienced a negative outcome were more often in the lowest income strata (31% compared to 21%), while mothers of infants who did not experience negative outcomes were more frequently in the highest income strata (20% vs. 3%). Women who self-identified as aboriginal made up 72% of the neonatal morbidity group, but represented only 52.4% of the no morbidity group.

Women who traveled to another community to give birth made up 67% of the morbidity group, while they represented only 40% of the no morbidity group. In addition, 41% of the morbidity group attended fewer than 10 prenatal visits, while only 29% of the no morbidity group had fewer than 10 visits. There were no significant differences in having the same care provider for pregnancy and birth, receiving prenatal care as early as desired, attending prenatal classes, or gestational age at the start of visits.

Stress levels, abuse and obesity rates were similar in the morbidity and no-morbidity groups. Smoking was more common in the morbidity group (51%) than in the no-morbidity group (29%), and there was a higher percentage of multiparous women in the morbidity group than in the no-morbidity group (71% vs. 62%).

4.2 Bivariate analysis

Table 4.6 summarizes the distribution of demographic characteristics, prenatal care variables and risk factors, by transfer status and neonatal morbidity status. Table 4.7 summarizes the relationships between both transfer status and neonatal morbidity, and demographic characteristics, risk factor status and prenatal care.

4.2.1 Relationship between prenatal care and transfer status

Within the non-transfer group, the most common prenatal care provider was a family doctor (60%), while in the transfer group, the most common prenatal care provider was a nurse or nurse practitioner (61%). In the transfer group, 10% received the majority of their care from a midwife, while only 3% of women in the non-transfer group received their care from a midwife. In the transfer group, it was more common for women to give birth in a level 2 hospital (70%), located mainly in the territorial capitals, while there were more women in the transfer group who were transported to a level 3 facility, located in the southern provinces (22% vs. 4%). Women in the transfer group were less likely to have the same provider for both prenatal care and delivery (OR=0.2, 95% CIs 0.2-0.3). There was also a difference in the number of prenatal care visits women received, with 42% of women in the transfer group attending less than 10 prenatal care visits, compared to 26% of the non-transfer group (OR=0.5, 95% CIs 0.4-0.7). More women in the non-transfer group began prenatal care visits before 14 weeks gestation (94%) than in the transfer group (88%); women in the transfer group were twice as likely to begin

care later than the recommended 14 weeks gestation mark (OR=2.2, 95% CIs 1.2-3.9). Prenatal class attendance was similar between the non-transfer and transfer groups, with 38% of the non-transfer and 35% of the transfer groups attending prenatal classes.

Table 4.7. Crude odds ratios, demographic characteristics, prenatal care and risk factors, based on transfer status and neonatal morbidity, odds ratios, 95% confidence intervals and coefficients of variation, bootstrap estimates, Canadian Maternity Experiences Survey 2006-2007.

	Transfer			Neonatal Morbidity		
	OR	95% CI	CV	OR	95% CI	CV
Neonatal Morbidity	**1.92**	1.29-2.84	30.9			
Territory						
Northwest Territories	**2.97**	1.99-4.44	10.8	**1.54**[F]	1.01-2.34	49.3
Nunavut	**6.60**	4.13-10.55	12.7	**3.32**	2.12-5.19	19.0
Yukon	1.00			1.00		
Maternal age at birth						
15 to 19 years	1.17[F]	0.64-2.11	198.0	0.99[F]	0.49-2.01	368.0
20 to 24 years	**1.96**[F]	1.22-3.13	35.8	1.50[F]	0.89-2.53	66.1
25 to 29 years	1.00			1.00		
30 to 34 years	**0.51**[F]	0.31-0.86	39.6	**0.46**[F]	0.25-0.85	40.2
35 to 39 years	**0.46**[F]	0.24-0.89	43.1	**0.52**[F]	0.28-0.97	48.5
40 to 44 years	**4.29**[F]	1.17-15.75	45.5	0.86[F]	0.73-7.60	69.7
45 to 49 years	**--**			**--**		
Education						
Less than high school	**2.02**	1.35-3.01	29.3	**2.26**	1.41-3.62	29.5
High school	1.36[F]	0.88-2.11	72.2	1.65[F]	0.99-2.76	52.2
Post secondary	1.00			1.00		
Income						
1st quartile	**3.92**[F]	1.35-11.37	37.8	3.17[F]	0.87-11.51	57.0
2nd quartile	**4.33**[F]	1.49-12.58	37.2	1.96[F]	0.54-7.20	98.3
3rd quartile	2.82[F]	0.98-8.10	52.1	1.57[F]	0.42-5.94	149.8
4th quartile	1.00			1.00		
Aboriginal Status						
Aboriginal	**5.55**	3.31-9.32	15.4	**1.74**	1.07-2.84	18.2
Non-Aboriginal	1.00			1.00		
Same care provider for pregnancy and birth						
Yes	**0.23**	0.16-0.33	12.9	0.78[F]	0.53-1.15	79.4
No	1.00			1.00		
Number of Prenatal Care Visits						
10 or more	**0.51**	0.35-0.73	27.0	**0.57**[F]	0.37-0.87	38.5
Less than 10	1.00			1.00		
Number of Weeks Gestation at First Prenatal Visit						
14 or more	**2.17**[F]	1.20-3.93	38.8	1.20[F]	0.62-2.31	182.5
Less than 14	1.00			1.00		
Maternal Smoking						
Ever	**1.29**	1.00-1.66	16.3	**2.32**	1.55-3.47	24.5
Never	1.00			1.00		
Use of street drugs while pregnant						
Ever	**2.71**[F]	1.02-7.24	50.2	1.97[F]	0.79-4.92	68.6
Never	1.00			1.00		
Maternal Parity						
Multiparous	**1.76**	1.22-2.53	21.7	1.49[F]	0.99-2.22	51.8
Primiparous	1.00			1.00		

[F] Unreliable estimate due to coefficient of variation > 33.3%

4.2.2 Relationship between maternal risk factors and transfer status

Women were more likely to be in the transfer group if their community of residence was in Nunavut (OR=6.6, 95% CIs 4.1-10.6) or the Northwest Territories (OR=3.0, 95% CIs 2.0-4.4) than the Yukon. Women were significantly more likely to be in the transfer group if they were in the 20-24 year age group at the time of the birth (OR=2.0, 95% CIs 1.2-3.1)

Women were twice as likely to be in the transfer group if they reported not having finished high school (OR=2.0, 95% CIs 1.4-3.0). As well, they were far more likely to be in the transfer group if they reported belonging to at least one Aboriginal group (76%; OR=5.6, 95% CIs 3.3-9.3). Women were also more likely to be in the transfer group if they reported having a household income of less than $30,000 per year (OR=3.9, 95% 1.4-11.4).

Women were more likely to be in the transfer group if they reported smoking during the last three months of their pregnancy their pregnancy (OR=2.9, 95% CIs 2.0-4.0). Finally, women were more likely to be in the transfer group if they were multiparous (OR=1.8, 95% CIs 1.2-2.5).

4.2.3 Relationship between neonatal morbidity and prenatal care, risk factors and transfer status

The only relationship between a neonatal morbidity outcome and transfer status was admission to a special care unit, which was over three times more likely in the transfer group than in the non-transfer group (OR=3.4, 95% CIs 2.0-6.64). When all the indicators of neonatal morbidity were grouped together to form a

dichotomous neonatal morbidity variable, the women in the transfer group were statistically significantly more likely to experience an outcome indicating neonatal morbidity than women who were not transferred for birth (OR=1.9, 95% CIs 1.3-2.8).

There were no significant differences in having the same care provider for pregnancy and birth, receiving prenatal care as early as desired, attending prenatal classes, or gestational age at the start of visits. A statistically significant protective effect was observed for having more than 10 prenatal visits against the risk of neonatal morbidity (OR=0.57, 95% CIs 0.4-0.9).

Women who gave birth to infants with a neonatal morbidity indicator were twice as likely to have less than a high school education (OR=2.3, 95% CIs 1.4-3.6). Mothers of infants with neonatal morbidity were statistically significantly more likely to self-identify as aboriginal (OR=1.7, 95% CIs 1.1-2.8).

4.3 Multivariate analysis

Table 4.8 lists the adjusted odds ratios, calculated for the risk factor variables that were significant in the initial analysis for both transfer policy and neonatal outcome. Almost all the significant relationships identified by crude odds ratios were eliminated when the model was adjusted, and the high coefficients of variation show that even the remaining significant relationships may be statistically unreliable. When all variables were included in the logistic regression model, only the lowest income quartile was significant (OR=3.4, 95% CIs 1.1-11.3). When only the variables that were statistically significant in bivariate analysis for both the

transfer group and the neonatal morbidity index, the only variable that was statistically significant was smoking during pregnancy (OR=1.8, 95% CIs 1.0-3.0). Both of the adjusted odds ratios presented had coefficients of variation of 49% or higher. In the multiple logistic regression, the relationship between transfer and neonatal morbidity was no longer significant (full model, OR=1.9, 95% CIs 1.3-2.8; reduced model, OR=1.7, 95% CIs 0.9-3.2).

Table 4.8. Adjusted odds ratios, variables significantly associated with both transfer status and neonatal morbidity, bootstrap estimates, Canadian Maternity Experiences Survey, 2006-2007.

	Neonatal Morbidity		
	OR	95% CI	CV
Transfer for Childbirth	1.65[F]	0.86-3.17	66.7
Education			
Less than high school	1.25[F]	0.62-2.56	163.9
High school	1.18[F]	0.70-1.99	161.5
Post secondary	1.00		
Income			
1st quartile	2.21[F]	0.69-7.11	75.1
2nd quartile	1.77[F]	0.54-5.88	106.7
3rd quartile	1.42[F]	0.42-4.78	178.8
4th quartile	1.00		
Aboriginal Status			
Aboriginal	0.68[F]	0.36-1.30	86.3
Non-Aboriginal	1.00		
Number of Prenatal Care Visits			
10 or more	0.76[F]	0.40-1.43	116.6
Less than 10	1.00		
Maternal Smoking			
Ever	**1.77**[F]	1.03-3.02	48.0
Never	1.00		

[F] Unreliable estimate due to coefficient of variation > 33.3%.

CHAPTER 5: DISCUSSION

5.1 Summary of main findings

The main findings address the three relationships outlined in the objectives (section 3.0): differences in prenatal care between women who are transferred and women who are not; differences in demographic and behavioural risk factors between women who are transferred and women who are not; and differences in neonatal morbidity outcomes between the transfer for childbirth and non-transfer for childbirth groups.

5.1.1 Prenatal care in the transfer and non-transfer groups

This study has shown that the prenatal care received by women who were transferred more than 100 km to give birth was different from that received by women who were able to remain in their home community to give birth. Based on the indicators of quality of prenatal care used in this study, women who were transferred for childbirth tended to have a lower quality of prenatal care. They had fewer prenatal visits, they began receiving prenatal care later in the pregnancy, and were less likely to have the same care provider that provided them with their prenatal care present when they gave birth.

5.1.2 Demographic and behavioural risk factors in the transfer and non-transfer groups

Women who were transferred to give birth were more likely to have smoked during their pregnancy, were less likely to have graduated from high school, were more likely to have a low income and were younger. Women who remained in their home communities to give birth, on the other hand, were more likely to consume alcohol during their pregnancy, and were more likely to be obese, than women who were transferred to another community to give birth.

5.1.3 Neonatal morbidity in the transfer and non-transfer groups

This study did not find that women who were transferred more than 100km to give birth experienced higher neonatal morbidity. The only factor that appeared to influence neonatal morbidity in this study was whether or not a mother had smoked during the last three months of her pregnancy.

5.2 Limitations

Before any conclusions may be drawn, it is important to recognize the limitations of this study. These include: 1) those associated with survey methods; 2) the small sample size of the study; and 3) those related to the formulation and use of questions for the study that may not be culturally relevant for the First Nations and Inuit respondents in the study.

5.2.1 Limitations of the survey methods

The Maternity Experiences Survey 2006-2007 was a cross-sectional survey, conducted between five and fourteen months after the birth of the baby. In the three territories, this span was between eleven and fourteen months, so the potential for error in the responses given by women may be slightly higher in the women surveyed in northern Canada than in the rest of the country. The ability of women to remember their behaviours, prenatal care aspects, stress level and other factors may have been compromised by the long period of time before experiencing these aspects and responding to the interview questions.

Since a significant amount of time had passed since the birth of their child when the survey was conducted, it is possible that recall bias may have effected the results, in which women who experienced a negative neonatal outcome may inflate their exposure to known risk factors. For instance, smoking is highly publicized as a risk factor for pregnant women, so women who have a newborn baby that is low birth weight, premature or has other health issues may exaggerate their smoking, or recall smoking occasionally, whereas women who did not experience this kind of an outcome may underestimate their smoking or not report it at all. On the other hand, it is well publicized that smoking during pregnancy is harmful to the fetus, and alcohol consumption has been highly publicized as being related to fetal alcohol spectrum disorder, so social desirability may be a factor in women's responses to questions about alcohol, drug use and smoking.

The study sample may underestimate neonatal morbidity in the region. Women were excluded from the study if they were under 15 years of age or if they

no longer lived with their baby, thereby potentially excluding women with a high risk of morbidity. As well, women were excluded if they experienced a stillbirth or an infant death, so any morbidity associated with these outcomes was not captured by this study. As well, there was a small group of eligible women who did not respond to the survey questions; response bias could have been introduced in this study if those women are significantly different from the women who did respond to the survey questions.

Detailed information on the content of prenatal care visits was not available. Questions were asked about the number of visits each woman had, and the type of care provider she saw for the majority of her visits, but questions were not asked about the content of these visits, which was discussed in the literature as a significant factor in assessing the quality of prenatal care (52). Therefore, while we can see that women in the transfer group may have had fewer prenatal visits, it is unknown if this can be considered indicative of the quality of care they received.

In-depth analysis of indications for transfer to a level three hospital (outside of the territories) could not be evaluated, as this information was not available in the data set. Therefore, women who were transferred due to longer-term risk factors, such as pre-eclampsia or pre-term labour, and who would not have otherwise been transferred for childbirth, would likely have been included in the transfer group. This has the potential to falsely exaggerate the relationship between transfer and morbidity, since the women transferred due to longer-term risk factors may be more likely to experience negative neonatal outcomes.

As this thesis project is a secondary analysis of the data, the data available was restricted to the information collected by the MES research team. In the original survey, information about maternal place of residence was collected by recording the first three letters of the respondent's postal code. In northern Canada, everyone living in a territory shares the same first three characters of their postal code. As a result, province of residence could be used to stratify the data, but since more detailed information about community of residence was not available for each individual, and cluster analysis could not be conducted to evaluate whether women in different communities or regions had similar neonatal outcomes or risk factor profiles.

This study may underestimate the amount of neonatal morbidity experienced in the three territories, due to the exclusion criteria of the Maternity Experiences Survey 2006-2007. This study excluded women who experienced a stillbirth or neonatal death. As well, women under 15 years of age, and women who no longer lived with their child, were excluded from the survey; these women may have been at higher risk for neonatal morbidity.

Finally, this study was restricted to the original data collected in the Maternity Experiences Survey 2006-2007. Therefore, though nutrition has been identified as having a potential influence on neonatal morbidity, it was not possible to address maternal diet as a risk factor in this study.

5.2.2 Limitations of the sample size

The sample size, as it was restricted to northern Canada, was relatively small, with only 229 women included in the analysis. Because of this, the degree to which data could be stratified for analysis was limited. The three territories have very different demographic and infrastructural characteristics; however, we were forced to combine them for comparison due to the small numbers available. As well, there are a variety of differences between communities in the transfer group, such as differences in provider availability, cost of living, the availability of alcohol and other substances, and other economic and educational factors. Unfortunately, due to the limited size of the sample, it is not possible to analyze prenatal care and maternal risk factors on a community-by-community level.

There were a number of "don't know" or "refusal" responses, which affected the number of women who could be included in the adjusted odds ratios calculated for the sample. For most of the variables in the study, there were only a few non-responses; however, income had the highest level of non-response, with 36 missing responses. This reduced the sample available to calculate the adjusted odds ratios by nearly 16%.

As a result of the small sample size, and the further reduction in the sample due to non-response, the lack of statistically significant relationships in the adjusted model may be due to a lack of statistical power, rather than a lack of a significant relationship. Power calculations were not conducted at the outset of this study based on the fact that the sample size of the data available was not modifiable by the researcher, and the data available in the Maternity Experiences Survey is the only

data available regarding prenatal care practices and perinatal experiences and risk factors in northern Canada. A post-hoc power calculation was conducted [Appendix D] and identifies 171 as the number of participants that would be required to find a statistically significant odds ratio effect size of the relationship found between transfer for childbirth and neonatal outcome. While we had an adequate sample size according to this calculation, when the confounding variables are added in to the analysis, this sample size is no longer adequate to detect a significant effect. This may be improved by increasing the sample size, in order to significantly detect a smaller effect size; for instance, an effect size of 1.5 could be significantly detected with a sample size of 415 women, and an effect size of 1.1 could be significantly detected with a sample size of 17,951 women.

5.2.3 Limitations due to cultural differences

The Maternity Experiences Survey questionnaire was not tested for cultural relevance within northern populations (102). Therefore, some of the measures used in this study may not have the same meaning in northern Canada as they do in southern Canada. For instance, in communities where hunting is a common means of acquiring food, a low monetary household income may not be an indicator of poverty in the same way as it would be in southern Canada. As well, due to the demographic differences within the Yukon, Northwest Territories and Nunavut, there may be measures that have differing effects and meanings in data collected in each of the three territories, and between the populations centres and smaller communities. For instance, the higher prices of food, shelter and consumer goods in

remote, air only communities suggest that a low household income could suggest a greater degree of deprivation in remote, fly-in communities than in urban centres connected to the south by road, where goods and services are less expensive and more support systems, such as food banks, may be in place. As elements such as hunting practices, prices, social supports and community collaboration may vary drastically between communities, in northern regions it is difficult to assign a uniform meaning to measures of socio-economic status.

5.3 Interpretation of Findings

5.3.1 Prenatal care in the transfer and non-transfer groups

Women who were transferred for childbirth were likely to receive less than optimal prenatal care, based on the common definition of adequate prenatal care, determined by the number of visits to a care provider, and the gestational age of the fetus at the first prenatal visit (45-48). These measures do not take into account the content of prenatal care visits, which may influence the relationship between the number and initiation of visits and outcome (52). Until more data can be collected on the content of prenatal care visits in northern Canada, however, the number of visits, and gestational age at initiation of visits, remain the most comparable indicators of the adequacy of prenatal care.

The differences in prenatal care observed between the transfer group and the non-transfer group may be due to the fact that women who are transferred for childbirth generally reside in small, remote communities. These communities are more likely to have difficulties in recruiting and retaining health care practitioners,

and understaffing remains an ongoing issue in northern communities throughout the region (36). As a result, there may be fewer opportunities for women in the transfer group to book appointments with their health care practitioners. As women in the study were more likely to report not receiving prenatal care as soon as they would have liked if they were part of the transfer group, it may indicate that staff shortages are an ongoing barrier to accessing health care in northern communities.

In communities with small populations, personal relationships with health care practitioners may also influence health-seeking behaviours, and the difficulties in maintaining confidentiality in small communities may influence prenatal care patterns. For instance, if the nurse practitioner in the community is a relative or close family friend, women may be reluctant to seek care or to disclose risk factors such as stress, spousal abuse, or substance abuse. The lack of disclosure may render the practitioner unable to properly advise the pregnant women on a proper course of action, which compounds the effect of these factors and the under-availability of staff. On the other hand, the proximity of individuals in smaller communities may assist the care practitioner in delivery appropriate care, since the individual, and any risk factors she is dealing with, may be known to the practitioner due to non-clinical interactions that take place within the community(Add Candice, Julie as anecdotal citations?).

5.3.2 Demographic and behavioural risk factors in the transfer and non-transfer groups

There are a number of possible explanations for the finding that demographic and behavioural risk factors were different in the transfer group than in the non-transfer groups, both in socioeconomic profile and risk behaviours.

Although mothers in the transfer group were more likely to be in the lowest income strata, this may not have the same significance to socio-economic status as it does in urban regions, as hunting and internal economies of exchange may enhance the economic status of a community overall without increasing monetary household income (128). It is uncertain whether low income, in the northern context, can be used as an indicator of deprivation, in the same manner that it is used in southern regions.

Mothers in the transfer group were less likely to have completed high school. The territories overall have lower rates of high school graduation than in the rest of Canada(2-4), and the urban areas of each territory have higher graduation rates than the rural and remote regions(122-124); these disparities are evident within the mothers in our study population. This may be due to the fact that, in some small communities, the school system does not offer classes through to grade 12, and students in these regions will have to either take distance-learning classes or leave their home communities if they want to graduate high school. As well, the socio-economic factors related to education in southern Canada may not be the same in northern Canada, since standards of high school education do not take into account hunting, mechanical or traditional craft skills that may be as significant to economic

well-being in remote northern communities as high school education is in the south (109).

It is well known that there is a higher prevalence of smoking throughout the territories than the rest of Canada (127), and a number of programs have been initiated to encourage smoking reduction, as well as second-hand smoke reduction measures such as smoke-free workplaces and smoking outside the home. Though the number of smokers lessened between the 2003 and 2005 cycles of the CCHS (127), the prevalence of smoking was higher, and while we cannot establish whether women in the transfer or non-transfer groups smoke more cigarettes overall, there are more women who smoke either daily or occasionally smokers in the transfer than in the non-transfer group.

Women in the non-transfer group were more likely to report having consumed alcohol during their pregnancy. This may be due to the unavailability of alcohol, given that many communities in northern Canada have restrictions on the amount of alcohol that can be purchased, if it can be purchased at all (125, 126). Also, there may be stigma related to alcohol consumption that may lead to underreporting in the communities, either because possession or consumption is illegal, or because of the recent publicity surrounding fetal alcohol spectrum disorder that has been occurring recently in northern Canada.

Reporting of drug use during pregnancy was very low in both groups, but slightly higher in the non-transfer group. Again, this may be due to availability of illegal drugs in larger centres as opposed to smaller communities; however, the numbers are too small to be able to make any suggestions based on this finding.

5.3.3 Neonatal morbidity in the transfer and non-transfer groups

There were clear demographic differences between the transfer and non-transfer groups; rates of smoking, household income level, and level of educational achievement. These differences were also present when the group of women who gave birth to infants with one of the indicators of neonatal morbidity was compared with the group of women who gave birth to infants without any of the indicators of neonatal morbidity evaluated in this study. All of these factors have been associated in the literature with morbidity indicators such as admission to intensive care at birth, low birth weight and pre-term birth, and it is possible that any of these three variables, or combinations thereof, may be responsible for the relationship observed between neonatal morbidity and transfer status.

The main relationship of interest of this study was between transfer for childbirth, the associated prenatal care and risk factor profile, and the prevalence of neonatal morbidity indicators. Initially, the crude odds ratio indicated nearly twice the likelihood of experiencing a neonatal morbidity outcome in the transfer group, when compared to women in the non-transfer group. When the model was adjusted to include variables that were significantly different, both between the non-transfer and transfer groups, and between the morbidity and no-morbidity groups, in the relationship between morbidity and transfer, the relationship was no longer statistically significant. Therefore, we cannot reliably say that these factors did not play a significant role in the increased risk of neonatal morbidity observed in the transfer group. However, since a higher prevalence of demographic and behavioural risk factors, and a higher risk of less than adequate prenatal care, both are more

prevalent in the transfer group, it is possible that these two groups of variables interact in smaller communities to increase the risk of morbidity. If this is the case, then it may be possible to argue that more comprehensive prenatal care in smaller communities may change the relationship between these variables, and negative neonatal morbidity outcomes. More detailed data regarding prenatal care and risk factor exposures, as well as a larger and more comprehensive population sample, is needed to more accurately assess any potential relationships that exist.

Smoking during pregnancy was identified as being significantly associated with neonatal morbidity. If this is the case, it reinforces the argument for expanded prenatal care services and midwifery practice in the north, since smoking cessation is often difficult to accomplish, and harm reduction measures, such as encouraging women to reduce the amount they smoke, if they cannot quit altogether, or monitoring proper weight gain, diet and other risk factors in order to mitigate some of the negative effects of smoking, are commonly applied by the midwives currently practicing in northern Canada (34, 129).

5.4 Implications of findings

5.4.1 Implications for future research

The Maternity Experiences Survey 2006-2007 was constructed using interview that included many more questions than those considered in this study. As well, a lot of the data captured in this survey is not captured in other data sources. This means that this survey may potentially be used to examine other

potential relationships relevant to perinatal care practices, such as relationships between care provision and maternal morbidity or breastfeeding practices.

Due to the small population in northern Canada, making statistically relevant determinations using cross-sectional data is very difficult. There is a need to develop a perinatal database to capture prenatal care and neonatal and maternal morbidity information, in order to gather a larger reservoir of data with which statistically significant comparisons can be made. This type of information would allow for meaningful conclusions to be drawn regarding type of care practitioner, number of prenatal visits, and other considerations related to place of residence and transfer for childbirth, in order to better evaluate this practice.

More advanced perinatal surveillance, in the form of a perinatal database, would also allow us to follow the growth of midwifery practice in the north, and detect whether there are significant changes in neonatal or maternal morbidity, and in maternal satisfaction with care, for women living in regions where midwifery care is available. Midwifery care within the community would provide women with low-risk pregnancies with the option to give birth in their home community. Qualitative studies suggest that the availability of midwifery care in small communities, in order to provide this choice, would be a more culturally appropriate model of care. In addition, quantitative studies conducted by midwives in Nunavik, Quebec, suggest that the midwifery model is a viable option in remote northern regions. However, it is difficult to make a quantitative case for the expansion of midwifery practice in the three territories without collecting longitudinal data on perinatal outcomes, in order

to construct meaningful comparisons based on a larger study population in the Yukon, Northwest Territories, and Nunavut.

5.4.2 Implications for practice and policy

This study has a number of implications for practice and policy. It is clear that there are key demographic and care provision gaps between women living in different regions of northern Canada. In order to address these gaps, there is a need for increased staffing and funding for health services and health promotion throughout the territories. As well, more funding should be directed to developing culturally appropriate care services, rather than uniformly imposing a model across northern regions that may not meet community-specific needs. The expansion in midwifery care in the north indicates a push for woman-centred care practices and a push for more choice in prenatal care, and training women in or near their own communities provides a retention advantage over attempting to recruit health care practitioners from the south. The results of this study suggest that improvements in care need to be made in regions where transfer for childbirth is the norm, and increases in both funding and capacity are needed in order to make these changes.

5.5 Conclusion

Transferring women for childbirth has clear society and cultural implications in northern Canada; this study has provided evidence that there are differences in prenatal care and risk factor distribution also associated with this practice. While this study did not find that that women who were transferred more than 100 km to

give birth experienced more cases of neonatal morbidity than women who were not transferred for childbirth, it does identify a number of areas for improvement in health care delivery and promotion in remote northern regions, and signals a higher prevalence of risk factors within the group of women who are transferred for childbirth.

The disruptive effects of transfer for childbirth are further compounded by a reduced availability of prenatal care and services, and a higher prevalence of pregnancy risk factors. In communities without birthing services, additional attention needs to be given to issues of continuity of care and prenatal services, in order to improve the quality of prenatal care and perinatal risk management. Perinatal care should be tailored to fit the needs, available infrastructure, and demographic profile of each community, due to the wide variation in each of these aspects that exists in northern Canada.

Detailed data collection, involving more extensive breakdown of risk factor variables, and longitudinal data collection in order to produce a broader population base, is needed in order to gain a clearer picture of perinatal health in northern Canada. This data may be used to further analyze the risk profile and prenatal care provision in northern Canada, and the effect that these factors have not only on neonatal morbidity, but also on maternal morbidity and satisfaction with care, and longer term child health outcomes.

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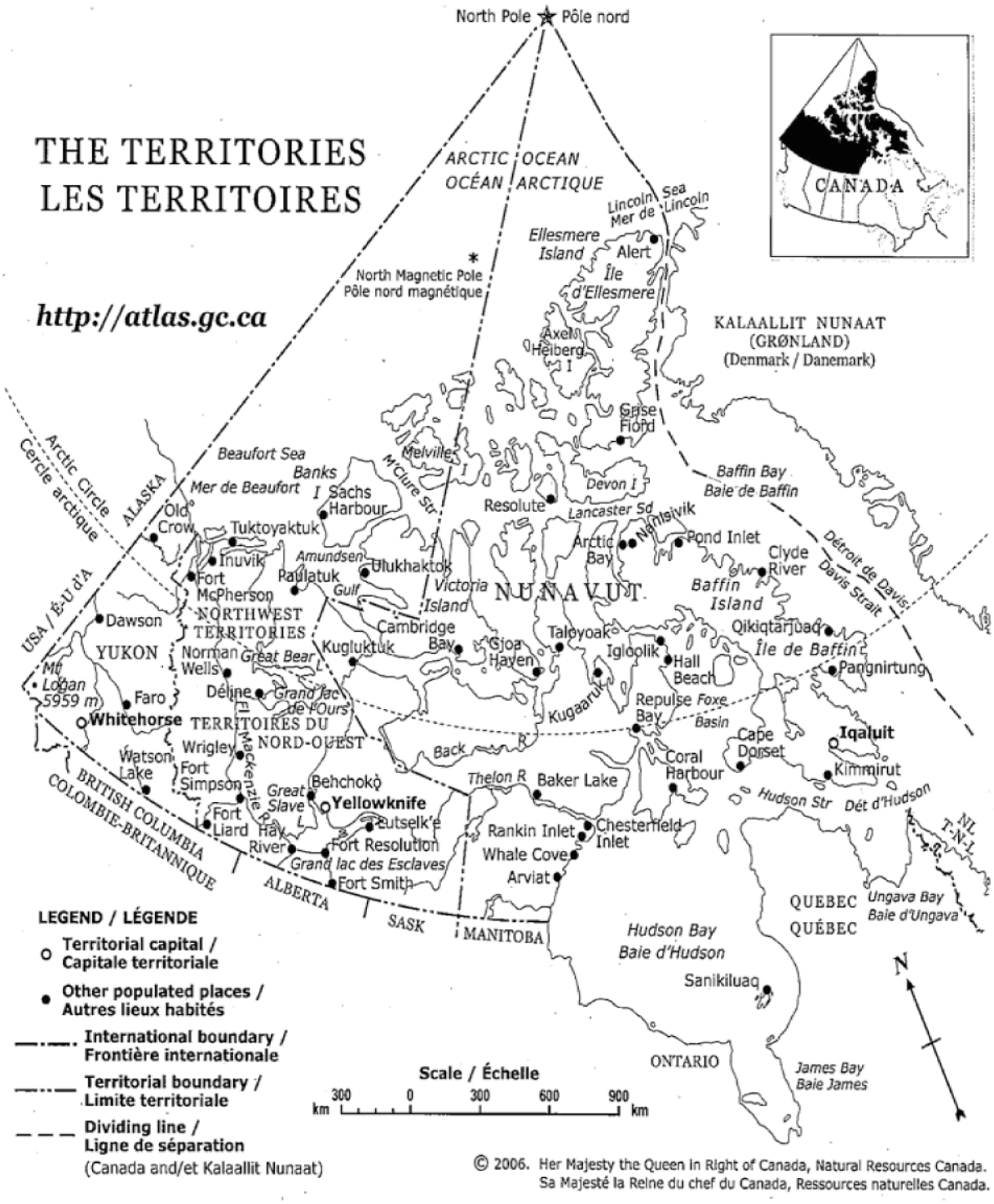
Appendix A: Map of the three northern territories



Appendix B: Excerpts from the Maternity Experiences Survey 2006-2007 Questionnaire (Source: http://www.phac-aspc.gc.ca/rhs-ssg/pdf/question07_e.pdf)

PC_Q01 How many weeks pregnant with ^baby's name were you when you had your first visit for prenatal care? This includes the first time your pregnancy was confirmed by a healthcare provider.

INTERVIEWER: If response given in months, probe for an answer in weeks. If response is given in weeks and a decimal or fraction is given, round down to the nearest week. For example 3 and ¾ weeks become 3 weeks.

Enter 94 if respondent did not have prenatal care visits.

____(2 spaces) [Min: 1 Max: 94]
DK, RF

Coverage: All respondents

PC_C02 If PC_Q01 = 94….....(Go to PC_Q07A)
Else….....(Go to PC_Q02)

PC_Q02 Did you receive prenatal care as early as you wanted?

INTERVIEWER: We are referring to the prenatal care the respondent received while pregnant with her baby.

1 Yes….....(Go to PC_Q04)
2 No
DK, RF….....(Go to PC_Q04)

Coverage: Respondents who had prenatal care visits

PC_Q04 How many prenatal care visits did you have?

INTERVIEWER: If respondent is having difficulty remembering, ask for best estimate. We are referring to the prenatal care the respondent received while pregnant with her baby.

____(2 spaces) [Min: 1 Max: 42]
DK, RF

Coverage: Respondents who had prenatal care visits

PC_Q05A From which type of healthcare provider, such as an obstetrician, family doctor or midwife, did you receive most of this care?

01 Obstetrician
02 Gynaecologist
03 OBGYN
04 Family doctor
05 General practitioner / GP
06 Doctor….....(Go to PC_Q05B)
07 Midwife
08 Nurse or nurse practitioner
09 Other
DK, RF

Default: (Go to PC_Q06)

Coverage: Respondents who had prenatal care visits

PC_Q06 In which province or territory did you receive most of your prenatal care?

INTERVIEWER: We are referring to the prenatal care the respondent received while pregnant with her baby.

10 Newfoundland and Labrador
11 Prince Edward Island
12 Nova Scotia
13 New Brunswick
24 Quebec
35 Ontario
46 Manitoba
47 Saskatchewan
48 Alberta
59 British Columbia
60 Yukon
61 Northwest Territories
62 Nunavut
76 United States
77 Other country (Outside Canada and the United States)
DK, RF

Coverage: Respondents who had prenatal care visits

PC_Q07A During your pregnancy with ^baby's name, did you attend prenatal or childbirth education classes?

INTERVIEWER: Only classes attended during the pregnancy with her baby will be included for this question.

1 Yes
2 No….....(Go to PC_Q08)

DK, RF….....(Go to PC_Q08)

Coverage: All respondents

PC_Q08 What was the expected or due date for the birth of ^baby's name?

INTERVIEWER: If respondent is having difficulty remembering, please probe for an approximate date. Probe by asking if the baby was born before, on or after the due date.
DK, RF

Note: Call date block.

Coverage: All respondents

PC_C08 If PC_Q08.DATY = RF, DK….....(Go to PC_C09)

PC_C09 If PC_Q01 = 94….....(Go to PC_END)
Else….....(Go to PC_Q09)

HW_Q01A How tall are you without shoes on?

INTERVIEWER: Was that in feet and inches or in centimetres?

1 Centimetres….....(Go to HW_Q01B)
2 Feet and inches….....(Go to HW_Q01C)
DK, RF….....(Go to HW_Q02A)

Coverage: All respondents

HW_Q02A Just before your pregnancy with ^baby's name, how much did you weigh?

INTERVIEWER: Enter amount only: Weight

____(3 spaces) [Min: 0 Max: 575]

DK, RF….....(Go to HW_Q03A)

Coverage: All respondents

HW_Q02B INTERVIEWER: Was that in pounds or kilograms?

1 Pounds
2 Kilograms
DK, RF

Coverage: All respondents

SE_Q01 Thinking about the amount of stress in your life during the 12 months before ^baby's name was born, would you say that most days were…?

INTERVIEWER: Read categories to respondent.

1 Not stressful
2 Somewhat stressful
3 Very stressful
DK, RF

Coverage: All respondents

LB_Q04 Did you travel to another city, town or community, to give birth to ^baby's name?

1 Yes….....(Go to LB_Q05A)
2 No
DK, RF

Default: (Go to LB_C08)

Coverage: All respondents

LB_Q05A In kilometres or miles, how far did you travel to give birth?

INTERVIEWER: Enter distance only.

____(4 spaces) [Min: 1 Max: 995]

DK, RF….....(Go to LB_Q06)

Coverage: Respondents who 107raveled to another city, town or community, to give birth to their baby

LB_Q05B Was that in kilometres or miles?

1 Kilometres
2 Miles
DK, RF

Coverage: Respondents who 107raveled to another city, town or community, to give birth

to their baby

LB_Q06 How many nights did you stay in this city, town or community before you gave birth?

INTERVIEWER: If less than 1 night, enter 0.

____(2 spaces) [Min: 0 Max: 90]
DK, RF

Coverage: Respondents who 108raveled to another city, town or community, to give birth to their baby

LB_Q08 Did the healthcare provider who cared for you during your pregnancy also care for you during the labour and birth?

1 Yes
2 No….....(Go to LB_Q10)
DK, RF….....(Go to LB_Q10)

Coverage: Respondents who had prenatal care visits

PP_Q01A How much did ^he/she weigh at birth, in grams, or pounds and ounces?

INTERVIEWER: Choose grams or pounds/ounces below and enter number in the next question.

1 Grams….....(Go to PP_Q01B)
2 Pounds and ounces….....(Go to PP_Q01C)
DK, RF….....(Go to PP_Q02)

Coverage: All respondents

PP_Q01B Enter birth weight in grams. 1 kilogram =1000 grams.

____(4 spaces) [Min: 1000 Max: 8000]
DK, RF

Default: (Go to PP_Q02)

Coverage: Respondents who entered the birth weight of their baby in grams

PP_Q01C Enter birth weight in pounds in this screen, and ounces in the next.

____(2 spaces) [Min: 1 Max: 15]

DK, RF….....(Go to PP_Q02)

Default: (Go to PP_Q01D)

Coverage: Respondents who entered the birth weight of their baby in pounds and ounces

PP_Q01D Enter ounces.

____(2 spaces) [Min: 0 Max: 15]
DK, RF

Coverage: Respondents who entered the birth weight of their baby in pounds and ounces

PP_Q02 Immediately after birth, was ^baby's name admitted to an intensive care or special care unit?

1 Yes
2 No….....(Go to PP_Q04)
DK, RF….....(Go to PP_Q04)

Coverage: All respondents

BH_Q04 Not counting the birth, has ^baby's name stayed in a hospital overnight since he was born?

1 Yes
2 No….....(Go to BH_Q06)
DK, RF….....(Go to BH_Q06)

SM_Q07 During the last 3 months of your pregnancy, did you smoke daily, occasionally, or not at all?

INTERVIEWER: We are referring to the last 3 months of the respondent's pregnancy with the selected baby.

1 Daily
2 Occasionally….....(Go to SM_Q09)
3 Not at all….....(Go to SM_Q10)
DK, RF….....(Go to SM_Q10)

Coverage: All respondents

AL_Q03 After you realized you were pregnant, how often did you drink alcoholic beverages?

INTERVIEWER: We are referring to the respondent's pregnancy with the selected baby.

01 Was not drinking at the time/stopped drinking….....(Go to AL_END)
02 Less than once a month
03 Once a month
04 2 to 3 times a month
05 Once a week
06 2 to 3 times a week
07 4 to 6 times a week
08 Everyday
DK, RF….....(Go to AL_END)

Coverage: All respondents

DR_Q03 After you realized you were pregnant, did you use street drugs?

INTERVIEWER: We are referring to the respondent's pregnancy with the selected baby.

1 Yes
2 No….....(Go to DR_Q05)
DK, RF….....(Go to DR_Q05)

Coverage: All respondents

AV_Q13 Did any of these incidents happen during your pregnancy with ^baby's name?

1 Yes
2 No….....(Go to AV_Q15)
DK, RF….....(Go to AV_Q15)

Coverage: Respondents who have experienced abuse or violence in the last 2 years

SD_Q06 Are you an Aboriginal person, that is, First Nations, Métis or Inuit?

1 Yes
2 No….....(Go to SD_R08)
DK, RF….....(Go to SD_R08)

Coverage: Respondents who were born in Canada, United States or Greenland

SD_Q11 What is the highest grade of elementary or high school you ever completed?

1 Grade 8 or lower (Quebec: Secondary ll or lower)….....(Go to SD_Q13)
2 Grade 9 – 10 (Quebec: Secondary III or IV, Newfoundland and Labrador: 1st year of secondary)….....(Go to SD_Q13)
3 Grade 11 – 13 (Quebec: Secondary V, Newfoundland and Labrador: 2nd to 4th

year of secondary)
DK, RF….....(Go to SD_Q13)

Coverage: All respondents

SD_Q12 Did you graduate from high school (secondary school)?

1 Yes
2 No
DK, RF

Coverage: Respondents whose highest grade of elementary or high school that they ever completed was the
equivalent of grade 11 to grade 13

SD_Q13 Have you received any other education that could be counted towards a degree, certificate or diploma from an educational institution?

1 Yes
2 No….....(Go to SD_Q15)
DK, RF….....(Go to SD_Q15)

Coverage: All respondents

SD_Q14 What is the highest degree, certificate or diploma you have obtained?

01 No post-secondary degree, certificate or diploma
02 Trade certificate or diploma from a vocational school or apprenticeship training
03 Non-university certificate or diploma from a community college, CEGEP, school of nursing, etc.
04 University certificate below bachelor's level
05 Bachelor's degree
06 University degree or certificate above bachelor's degree
DK, RF

Coverage: Respondents who have received other education that could be counted towards a degree, certificate
or diploma from an educational institution

SD_Q16 What is your marital status? Are you…?

INTERVIEWER: Please read categories to respondent. The categories widowed, separated, divorced, and single, apply only to respondents who are not in a common law relationship.

01 Married
02 Living common law

03 Widowed….....(Go to SD_END)
04 Separated….....(Go to SD_END)
05 Divorced….....(Go to SD_END)
06 Single, never married….....(Go to SD_END)
DK, RF….....(Go to SD_END)

Coverage: All respondents

WA_Q09 What is your best estimate of the total income, before taxes and deductions, of all household members from all sources in the past 12 months?

01 Less than $10,000
02 $10,000 to less than $15,000
03 $15,000 to less than $20,000
04 $20,000 to less than $30,000
05 $30,000 to less than $40,000
06 $40,000 to less than $50,000
07 $50,000 to less than $60,000
08 $60,000 to less than $80,000
09 $80,000 to less than $100,000
10 $100,000 to less than $150,000
11 $150,000 to less than $200,000
12 $200,000 or more
DK, RF

Coverage: All respondents

Appendix C: Queen's Health Sciences and Affiliated Teaching Hospitals Research Ethics Board approval

QUEEN'S UNIVERSITY HEALTH SCIENCES & AFFILIATED TEACHING HOSPITALS RESEARCH ETHICS BOARD

November 28, 2008

This Ethics Application was subject to:

☐ Full Board Review
Meeting Date:
☒ Expedited Review

Mr. Bryany Denning
Department of Community Health and Epidemiology
Queen's University

Dear Mr. Denning,

Study Title: **Place of Residence, Prenatal Support and Neonatal Outcome in the Northwest Territories**
Co-Investigators: **Dr. Duncan Hunter, S. Chatwood**

I am writing to acknowledge receipt of your recent ethics submission. We have examined the protocol for your project (as stated above) and consider it to be ethically acceptable. This approval is valid for one year from the date of the Chair's signature below. This approval will be reported to the Research Ethics Board. Please attend carefully to the following list of ethics requirements you must fulfill over the course of your study:

- **Reporting of Amendments**: If there are any changes to your study (e.g. consent, protocol, study procedures, etc.), you must submit an amendment to the Research Ethics Board for approval. (see http://www.queensu.ca/vpr/reb.htm).

- **Reporting of Serious Adverse Events**: Any unexpected serious adverse event occurring locally must be reported within 2 working days or earlier if required by the study sponsor. All other serious adverse events must be reported within 15 days after becoming aware of the information.

- **Reporting of Complaints**: Any complaints made by participants or persons acting on behalf of participants must be reported to the Research Ethics Board within 7 days of becoming aware of the complaint. Note: All documents supplied to participants must have the contact information for the Research Ethics Board.

- **Annual Renewal**: Prior to the expiration of your approval (which is one year from the date of the Chair's signature below), you will be reminded to submit your renewal form along with any new changes or amendments you wish to make to your study. If there have been no major changes to your protocol, your approval may be renewed for another year.

Yours sincerely,

Albert Clark
Chair, Research Ethics Board

Dec 2, 2008
Date

ORIGINAL TO INVESTIGATOR - COPY TO DEPARTMENT HEAD- COPY TO HOSPITAL(S) /P&T (If appropriate) - FILE COPY

Study Code: EPID-282-08

- **Investigators please note that if your trial is registered by the sponsor, you must take responsibility to ensure that the registration information is accurate and complete**

QUEEN'S UNIVERSITY HEALTH SCIENCES & AFFILIATED TEACHING HOSPITALS RESEARCH ETHICS BOARD

The membership of this Research Ethics Board complies with the membership requirements for Research Ethics Boards as defined by the Tri-Council Policy Statement; Part C Division 5 of the Food and Drug Regulations, OHRP, and U.S DHHS Code of Federal Regulations Title 45, Part 46 and carries out its functions in a manner consistent with Good Clinical Practices.

Federalwide Assurance Number : #FWA00004184
#IRB00001173

Current 2008 membership of the Queen's University Health Sciences & Affiliated Teaching Hospitals Research Ethics Board

Dr. A.F. Clark	**Emeritus Professor, Department of Biochemistry, Faculty of Health Sciences, Queen's University (Chair)**
Dr. H. Abdollah	**Professor, Department of Medicine, Queen's University**
Dr. C. Cline	**Assistant Professor, Department of Medicine Director, Office of Bioethics, Queen's University Clinical Ethicist, Kingston General Hospital**
Rev. T. Deline	**Community Member**
Dr. M. Evans	**Community Member**
Dr. S. Irving	**Psychologist, Providence Care, St. Mary's of the Lake Hospital Site**
Prof. L. Keeping-Burke	**Assistant Professor, School of Nursing, Queen's University**
Dr. J. Low	**Emeritus Professor, Department of Obstetrics and Gynaecology, Queen's University and Kingston General Hospital**
Dr. W. Racz	**Emeritus Professor, Department of Pharmacology & Toxicology, Queen's**
Dr. B. Simchison	**Assistant Professor, Department of Anesthesiology, Queen's University**
Dr. A.N. Singh	**WHO Professor in Psychosomatic Medicine and Psychopharmacology Professor of Psychiatry and Pharmacology Chair and Head, Division of Psychopharmacology, Queen's University Director & Chief of Psychiatry, Academic Unit, Quinte Health Care, Belleville General Hospital**
Dr. E. Tsai	**Associate Professor, Department of Paediatrics and Office of Bioethics, Queen's University**
Rev. J. Warren	**Community Member**
Ms. K. Weisbaum	**LL.B. and Adjunct Instructor, Department of Family Medicine (Bioethics)**
Dr. S. Wood	**Director, Office of Research Services (Ex-Officio)**

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May 11, 2009

Ms. Bryany Denning
Research Affiliate
Public Health Agency of Canada
Arctic Health Research Network
P.O. Box 11050
Yellowknife, NT X1A 3X7

Re: "Place of Residence, Prenatal Support and Neonatal Outcome in the Northwest Territories" EPID-282-08

Dear Ms. Denning,

I am writing to acknowledge receipt of your email dated Friday, May 08, 2009 which requested approval for an amendment to your study:

- Due to problems extracting data from medical records, now plan to analyze a secondary data source (the Maternity Experiences Survey 2006-2007) from the Public Health Agency of Canada

I have reviewed this amendment and hereby give my approval. Receipt of this amendment will be reported to the Health Sciences Research Ethics Board.

Yours sincerely,

Albert Clark

Albert Clark, Ph.D.
Chair
Research Ethics Board

AFC/kr

c.c.: Dr. Duncan Hunter, Community Health and Epidemiology
Ms. Susan Chatwood, Executive Director, Arctic Health Research Network

APPENDIX D: Sample Size Calculation

Prevalence of neonatal morbidity in general population $p_1 = 0.1$
Size of non-transfer group in sample n_1
Size of transfer group in sample (approximate) $2/3\, n_1$

Effect size 2.0

$$n_1 = \left[\sqrt{\bar{p}\bar{q}\left(1+\frac{1}{k}\right)Z_{1-\alpha/2}} + \sqrt{p_1q_1 + \frac{p_2q_2}{2}Z_{1-\beta}}\right]^2 \Big/ \Delta^2$$

$$= \left[\sqrt{0.084(0.916)(2.5)(1.96)} + \sqrt{0.1(0.9) + 0.08(0.84)}\right]^2 \Big/ 0.1^2$$

$$= \left[0.614 + 0.396\right]^2 / 0.01$$

$$= 102.01$$

$$n_2 = 2/3\,(102.01)$$

$$= 68.01$$

Total sample size needed – 102.01+68.01=170.02; 171 women

Effect size 1.5

$$n_1 = \left[\sqrt{\bar{p}\bar{q}\left(1+\frac{1}{k}\right)Z_{1-\alpha/2}} + \sqrt{p_1q_1 + \frac{p_2q_2}{2}Z_{1-\beta}}\right]^2 \Big/ \Delta^2$$

$$= \left[\sqrt{0.12(0.88)(2.5)(1.96)} + \sqrt{0.1(0.9) + 0.06375(0.84)}\right]^2 \Big/ 0.05^2$$

$$= \left[0.7193 + 0.0694\right]^2 / 0.0025$$

$$= 248.81$$

$$n_2 = 2/3\,(248.81)$$

$$= 165.87$$

Total sample size needed = 248.81+165.87=414.68; 415 women

Effect size 1.1

$$n_1 = \left[\sqrt{\bar{p}\bar{q}\left(1+\frac{1}{k}\right)Z_{1-\alpha/2}} + \sqrt{p_1q_1 + \frac{p_2q_2}{2}Z_{1-\beta}}\right]^2 \Big/ \Delta^2$$

$$= \left[\sqrt{0.104(0.896)(2.5)(1.96)} + \sqrt{0.1(0.9) + 0.04895(0.84)}\right]^2 \Big/ 0.01^2$$

$$= \left[0.6757 + 0.3621\right]^2 / 0.0001$$

$$= 10770.29$$

$$n_2 = {}^{2}\!/_{3}(10770.29)$$

$$= 7180.19$$

Total sample size needed = 10770.29+7180.19=17950.48; 17951 women