Disparities in Infant Health in Winnipeg, Manitoba:

An Ecological Approach to Maternal Circumstances Affecting Infant Health

by

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Abstract

Infant health is an important comprehensive measure of the health in a society. Experiences during infancy can create durable and heritable patterns of social deprivation and illness ultimately producing health disparities in a population. This thesis sought to determine the relationship between maternal circumstances and infant mortality, morbidity and congenital anomaly rates in Winnipeg, Manitoba, Canada. Using logistic regression models the study explored provincial program screening data and administrative data held. The study found higher rates of congenital anomalies within two parent families and male infants. There was a relationship between hospital readmission rates and social and economic factors. Newborn hospital readmissions were associated with social support factors, while post-neonatal hospital readmissions were associated with contextual factors. Understanding the odds of infant mortality, morbidity and congenital anomaly in relation to different maternal socioeconomic factors may contribute to future health planning and the development of interventions that can improve health equity.

Dedications

This thesis was possible in part through the endless love and support provided by my family, Kevin, Taylor and Avery Kosowan and friends, Mary and John Godard. Your ability to assist me with reprioritizing and providing appropriate motivations has enabled me to explore and actualize greater potentials.

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Chapter 1: Introduction to Disparities in Infant Health

Unequal access to economic, social and health care resources can produce disproportionately higher rates of preventable mortality, morbidity and worse birth outcomes (Early Child Development Knowledge Network of the Commission on Social Determinants of Health [ECDKN], 2007; Smylie et al., 2010). An individual's lifestyle and life circumstances, the social determinants of health, produce unnecessary, avoidable and unfair differences in health within a population. Building on past work the present study explored the impact of low-income, low maternal education, maternal history of child abuse, maternal relationship status and poor social supports on infant morbidity, mortality and disability within the first 12 months of life. Exposures during early sensitive-periods of development can create durable and heritable patterns of social deprivation and illness. For example residing in a stressful environment within the first year of life has been linked to heart and circulatory system diseases in adulthood (Louis & Platt, 2011). It has been established that societies can improve infant outcomes and enduring health inequalities with investment in the social determinants of health (Denburg & Daneman, 2010; Dyck, 2009; HCC, 2011; Kettner, 2011; Mikkonen, & Raphael, 2010; Statistic Canada, 2010b). Canada needs to develop innovative approaches that attend to social, economic, and health disparities that can improve their global standing on measures of child and maternal health and wellbeing (Denburg & Daneman, 2010). Research documenting the impact of socio-economic factors on disparities in infant mortality, morbidity and congenital anomaly could provide a basis for the establishment and strengthening of maternal and family support to improve health outcomes (Dyck, 2009; Kettner, 2011; Mikkonen & Raphael, 2010; Statistic Canada, 2010b).

Background. The study focused its analysis on infants in Winnipeg, Manitoba. In Canada there were approximately 5 infant deaths per 1000 live births between 2005 and 2009 (PHAC 2008, Statistics Canada, 2013a). In 2007-2011 Manitoba had a higher pregnancy rate per 1000 women and higher infant mortality rate then the Canadian average (Statistics Canada, 2013a, Statistics Canada, 2013b). In 2010, Canada had a fertility rate of 1.63 per 1000 live women, while the Manitoba average was 1.92 per 1000 live women (Statistics Canada, 2013b). In 2011, the Canadian infant mortality rate was 4.8 compared to the Manitoban average of 7.7 (Statistics Canada, 2013a). In Manitoba low neighbourhood socioeconomic status (i.e., income, education, unemployment and lone parents) has been found to be associated with adverse birth outcomes and infant mortality (Luo et al., 2010).

Health disparities within a population are associated with a socioeconomic gradient between health and socioeconomic status (Commission on the Social Determinants of Health [CSDH], 2008). Populations with low socio-economic status tend to have a shorter life expectancy, higher illness levels and higher rates of infant mortality (Brownell et al., 2003; CSDH, 2008; Gage, Fang, O'Neill & Dirienzo, 2013; Halfon, Larson & Russ, 2010). Negative economic, social and health care experiences during critical and sensitive windows of human development can increase mortality, morbidity and disability risk (Louis & Platt, 2011). Obstetric and neonatal care as well as conditions originating in the perinatal period largely contribute to infant mortality in the first 27 days after birth and predict post-neonatal morbidity and long-term disability (Early Child Development Knowledge Network [ECDKN], 2007; Public Health Agency of Canada [PHAC], 2005; Public Health Agency of Canada [PHAC], 2008; Public Health Agency of Canada [PHAC], 2005; Smylie, Crengle, Freemantle & Taualii, 2010). Mortality, morbidity and disability during the post-neonatal period (28-365 days after birth) are often attributed to social and environmental factors. Congenital anomalies, sudden infant death syndrome and infection are the leading causes of post-neonatal infant mortality (ECDKN, 2007; Heaman, Elliott, Beudoin, Baker & Blanchard, 2002; PHAC, 2008; Smylie et al., 2010). Disparities in health between First Nation and non-Aboriginal children can be attributed to social, economic, demographic and community differences rather than biological determinants (Findlay & Janz, 2012; Heaman et al., 2010; Luo et al., 2010; Luo et al., 2010).

Geography/housing, poverty and education are related to infant health outcomes (Denburg & Daneman, 2010; Denny & Brownell, 2010; PHAC, 2005). Children born into low socioeconomic status are more likely to have low-birth weights and experience higher rates of injury, disability, disease, and behavioural and developmental problems (Denny & Brownell, 2010). Women with low socioeconomic status are more likely to experience higher levels of stress that can impact gestational weight gain as well as the physical and mental health of the mother, negatively impacting birth outcomes and child development (PHAC, 2005, Kettner, 2011; McFarlane, Symes, Binder, Maddoux & Paulson, 2014). Preterm births are the leading cause of infant mortality and morbidity, and are associated with social, economic, demographic, and prenatal care factors (Canadian Institute for Health Information, 2009).

Education. Globally, infant mortality and birth outcomes are strongly correlated with maternal education. Increased maternal education levels are shown to reduce infant mortality rates and improve birth outcomes (CSDH, 2008, Lou, et al., 2006; Dargent-Molina et al., 1994; Gage, Fang, O'neill & Dirienzo, 2013). The relationship between infant health and maternal education however, is not related to birth weight, maternal age, parity, marital status and infant sex (Gage, Fang, O'neill & Dirienzo, 2013; Chen et al., 1998). Currently in Canada the majority of statistics on maternal education are provided at a community level, therefore researchers are limited in assessing the impact of education on infant health (Luo et al., 2010). The present study analyzed individual level data on maternal education and its relationship with infant health, seeking to provide empirical evidence that may improve available supports and resources to improve infant health outcomes.

Poverty and geography. Parental income and employment status mediates a child's access and experiences with other factors, including housing and health care (Denburg & Daneman, 2010; Denny & Brownell, 2010; PHAC, 2005). Infants residing in low income areas are at an increased risk for low birth weight and prematurity, important indicators of early problems for newborns (Blenner, Hironaka, Vanderbilt, Frank, 2014; Kettner, 2011; Luo et al., 2010). Income and geography are associated with disparities in infant mortality rates which demonstrate higher risk among low income, northern and urban populations (Martens & Derksen, 2002; Szwarcwald, Borges de Souza, & Damacena, 2013; Gilbert, Auger, Wilkins and Kramer, 2013). Empirical support for the relationship between poverty and geography, and infant health to provide evidence for health policy and program development was investigated in the present study.

Social Variables. Maternal social supports and the mother’s emotional health impacts an infant’s health and wellbeing. Research investigating the impact of lone parents, maternal history of child abuse, parental relationship distress and isolation on infant mortality and morbidity is limited. Research that is available shows the impact of social experiences on maternal parental approaches and infant experiences. For instance, lone parents utilize health care programs less, which may affect infant health and wellbeing (Wallby, Modin & Hjern, 2013; Ballantyne, Stevens, Guttmann, Willan, & Rosenbaum, 2014). Research on parental relationship distress when assessed as intimate partner violence, has shown that there is a negative impact on infant health, and child's behaviour and development (Burke, Lee, O'Campo, 2008; McFarlane, Symes, Binder, Maddoux, & Paulson, 2014). Mothers who experienced child abuse are more likely to display authoritarian parenting style characterized by strict rules, harsh punishment and low warmth (Schwerdtfeger, Larzelere, Werner, Peters & Oliver, 2013). Child abuse research has shown that failing to provide experiences that would lead to feelings of being loved, wanted, secure and worthy can lead to failure to thrive, which is a condition whereby the child does not meet expected growth (Odhayani, Watson, & Watson, 2013). Further empirical evidence on the importance of a mother and infants' social context and its relation to health will add new knowledge to demonstrate additional considerations for the development and implementation of programs and services.

Although research suggests that socioeconomic environments have an impact on infant health, further research is required to assess the impact of individual-level factors so as to provide better information for the development and implementation of supports and resources that can attend to family needs. A broader social determinant approach to infant health and wellbeing is important to affect policy and programs (Luo et al., 2010). Current literature on the relationship between infant health disparities and socioeconomic factors will be examined in the next chapter. Empirical evidence suggests a relationship between income, geography, education, and social supports on infant health and wellbeing. Chapter three will expand on current empirical evidence to develop the research question and the philosophical perspective. Chapter four will describe the study methods including data utilized and research strengths, limitations, delimitations and assumptions. Chapter five will present the study findings. Chapter six will offer an interpretation of the relationship between disparities in infant mortality, morbidity and disability and socioeconomic factors of education, poverty, geography, maternal history of child abuse and social supports.

Chapter 2: Literature Review

The aim of the present study was to assess the relationship between maternal socioeconomic variables and infant mortality, morbidity and congenital anomaly. Understanding the current prevalence of infant mortality, morbidity and congenital anomaly in Manitoba will demonstrate the importance of attending to infant health. To understand the comprehensive impact of the social determinants of health on infant health outcomes, current literature will be profiled in relation to maternal education, economic, geographical and social variables. Within limitations, empirical evidence begins to demonstrate the impact of unequal access to economic, social and health care resources on preventable mortality, morbidity, worse birth outcomes, and durable and heritable patterns of health disparities (Early Child Development Knowledge Network of the Commission on Social Determinants of Health [ECDKN], 2007; Louis & Platt, 2011; Smylie et al., 2010).

Infant Mortality, Morbidity and Congenital Anomaly. Between 2005 and 2009 there were on average 365,000 births each year in Canada. During this same time period there was an annual average of 5 infant deaths per 1000 live births (Statistics Canada, 2013a). Canada monitors eight causes of infant mortality: congenital anomalies, asphyxia, immaturity, infection, sudden infant death syndrome, other unexplained infant death, external causes and other conditions. Mortality rates are commonly attributed to causes that originated in the perinatal period, 22 weeks gestation to 7 days after birth, such as low birth weights, prematurity and maternal complications (Kettner, 2011; PHAC, 2008).

In Canada 85% of child deaths occur during infancy with neonatal deaths (deaths between days 0-28 after birth) accounting for two-thirds of these deaths (PHAC, 2005). Mortality during the neonatal period is often attributed to obstetric and neonatal care, with the level and quality of hospital services dictating mortality and complication rates. Many of the morbid conditions in the neonatal period are related to preterm birth. Preterm births are the leading cause of infant mortality and contribute to short- and long-term morbidity and disability. Preterm births are associated with socioeconomic status, geography, maternal age, multiple births, maternal history and maternal medical conditions. Severe morbid conditions predict post-neonatal morbidity and long-term disability (Canadian Institute for Health Information, 2009; Early Child Development Knowledge Network [ECDKN], 2007; PHAC, 2005; PHAC, 2008; Smylie, Crengle, Freemantle & Taualii, 2010). Mortality during the post-neonatal period (28-365 days) is often attributed to social and environmental factors (ECDKN, 2007; PHAC, 2008; Heaman, Elliott, Beaudoin, Baker & Blanchard, 2002; Smylie et al., 2010). Within the post-neonatal period, mortalities were most commonly caused by congenital anomalies, sudden infant death syndrome and infection comprising 23%, 21% and 14% of deaths respectively (PHAC, 2008).

Congenital anomalies are described as structural or functional abnormalities that are present at birth. Most common are heart defects, neural tube defects and Downs syndrome. They are one of the leading causes of infant death. Globally, congenital anomalies affect an estimated 1 in 33 infants a year, resulting in approximately 3.2 million birth defects. Approximately, 270,000 newborns die neonatally from congenital anomalies globally every year and many more experience long-term disability with significant impacts on the individual, family, health care system and society. In 2007 the prevalence of congenital anomalies in Canada was 41 per 1000 live births a decline from 52 per 1000 live births in 2001 (PHAC, 2012; World Health Organization [WHO], 2014). Many congenital anomalies can be prevented. Known causes and risk factors for congenital anomalies are socioeconomic factors, genetic factors, infection, maternal nutritional status and environmental factors (WHO, 2014). Declines in infant mortality rates can partially be explained by an increase in the availability of prenatal diagnosis of congenital abnormalities and subsequent termination of affected pregnancies. The rate of pregnancy termination increased from .3 to .7 deaths per 1000 total births between 2000 and 2008 (PHAC, 2008; PHAC 2012).

Disparities in Infant Health. Within infancy (0-12 months) adverse life experiences negatively affect health and development contributing to disparities in morbidity and mortality (Brownell et al., 2003; CSDH, 2008; Kettner, 2011; Martens et al., 2010). From conception to the end of infancy, infant outcomes are associated with education, economic, and social circumstances of their mother (CSDH, 2008; ECDKN, 2007; Graham, 2007; Halfon, Larson & Russ, 2010; Kettner, 2011;, 2008; Public Health Agency of Canada [PHAC], 2008). Reviewing current literature in each of these areas will assist in understanding the complex interrelationship between the social determinants of health and infant health outcomes.

Maternal Education**.** Globally, infant mortality and morbidity are inversely correlated with maternal education. Infant mortality rates decrease with increases in maternal education levels (CSDH, 2008). As Dargent-Molina and colleagues (1994) indicate, “maternal education is one of the strongest determinants of infant survival in developing countries” (p. 343). The effect of maternal education has been found to be stronger than the effect of neighbourhood income (Lou, Wilkins, Kramer, 2006). In a large longitudinal interview-based study in the Philippines on infant health and nutrition Dargent-Molina and colleagues found an association between infant morbidity and maternal education level. They also found that an infant’s economic environment can protect an infant from negative health outcomes. Conclusively, Dargent-Molina and colleagues explain that the health outcomes of infants born in wealthier neighbourhoods and countries are less affected by maternal education (Dargent-Molina et al., 1994). Maternal education has an impact on post-neonatal risk, nutritional status and accessing health services for infants and young children (Bicego & Boerma, 1993). Increases in maternal education levels have been shown to improve infant birth outcomes, even within a publicly funded health care system (Grytten, Skau, Sorensen, 2014). In a population-based Canadian study, Chen Fair, Wilkins, and Cyr (1998) reported that “If all education groups [in Quebec] had been able to attain the low rates [of fetal and infant deaths among singleton births] of the higher education group, the number of fetal and infant deaths would have been reduced by approximately 20%” (p.55). Mothers with post-secondary education were less likely to have a preterm birth, small-for-gestational-age birth, stillbirth or infant mortality than mothers who had not completed high school (Lou, Wilkins, Kramer, 2006; Chen Fair, Wilkins & Cyr, 1998). In addition, Chen and colleagues (1998) found that the impact of maternal education is influential after adjusting for maternal age, parity, marital status and infant sex. However, when factors such as birth weight, and both gestational age and fetal growth were taken into account the effect on mortality diminished. Gage, Fang, O'Neill and Dirienzo (2013) explored 2001 US national population-based data on African American, Mexican American and European American finding that maternal education is inversely correlated with infant mortality rates independent of birth weight, after considering cultural differences.

Despite the empirical evidence showing the association between maternal education and infant health, more research would be necessary to better assess the many potential confounding risk factors including maternal smoking, breastfeeding, geography, income, occupation, pregnancy complications and prenatal care (Luo et al., 2010). Canadian studies have primarily assessed maternal education at an ecological level due to reliance on census data, limiting the ability to assess a direct link between education and infant health. Without individual level data on maternal education it is difficult to determine if education acts as an independent variable or is mitigated by geography and income (Luo et al., 2010).

***Low Income and Geography*.** Health disparities within a population are associated with a socioeconomic gradient between health and socioeconomic status (Brownell et al., 2003). Low socioeconomic status (low income, low education and underemployment) contributes to a shorter life expectancy, low-birth weights, and higher rates of infant mortality, morbidity and disability (Brownell et al., 2003; CSDH, 2008; Gage et al., 2013; Halfon, Larson & Russ, 2010; Kettner, 2011; Martens et al., 2010) Luo and colleagues (2010) demonstrated the relationship between low neighbourhood socioeconomic status (i.e., low income, low education, unemployment and being a lone parent), and adverse birth outcomes and higher infant mortality rates in Manitoba, Canada in a population-based geocoding-based birth cohort study.

Claeson, Bos, Mawji and Pathmanathan (2000) demonstrated the importance of household income as an upstream determinant of infant mortality. Income quintiles divide the population into five population equivalent income groups from lowest to highest income (MCHP, 2010). The rate of infant mortality doubles among low income quintile groups compared to the highest income quintile group (Martens & Derksen, 2002). Luo and collegues (2010) demonstrated in a Manitoba based study that First Nations women are at an increased risk of residing within a neighbourhood of low socioeconomic status and have a much higher risk for mortality, particularly post-neonatal infant mortality (Luo, et al., 2010). Despite declines in Canadian infant mortality rates between 1990 and 2000s disparities still persist between the lowest and highest income groups with low income groups experiencing higher rates of neonatal death, post-neonatal death and SIDS (Gilbert, Auger, Wilkins & Kramer, 2013). Changes in income distribution narrow income related health inequalities including infant mortality rates (Szwarcwald, Borges de Souza, & Damacena, 2013). Low income disproportionately produced higher rates of premature birth and its short and long term health consequences (Blenner, Hironaka, Vanderbilt, Frank, 2014).

Infant geographical residency impacts health. In a population-based Manitoba study, Martens and colleagues (2010) explain that “north-south place of residence does matter for adverse birth outcomes.” Infants residing in low income and urban areas are at an increased risk for low birth weight and prematurity, which are important indicators of early problems for newborns (Kettner, 2011; Luo et al., 2010). In a retrospective birth cohort study Simonet and colleagues (2010) found living in urban areas was not associated with improved birth and infant outcomes for Inuit and First Nations in Quebec despite universal access to health services, suggesting the need to improve socioeconomic conditions, and perinatal and infant care to improve birth and infant health outcomes (Simonet, et al., 2010).

A major weakness of these studies was their reliance on aggregate-area level data to assess the impact of income and geography on health outcomes, which limits the interpretation of findings at an individual level (Kettner, 2011; Luo et al., 2010). While income and geography are commonly linked due to their interrelationship, income and geography are related to a variety of confounding and mitigating variables that cannot always be accounted for within research, but could have a substantial impact on the findings (Denburg & Daneman, 2010; Denny & Brownell, 2010; PHAC, 2005). Income, for instance, is associated with a variety of structural and behavioural factors such as housing, food security, living conditions and access to health care that influence the risk of infant mortality, morbidity and disability. (Cleason, Bos, Mawji &

Pathmanathan, 2000; Denburg & Daneman, 2010; Denny & Brownell, 2010; Graham, 2007; PHAC, 2005).

Social Variables. Although limited, there is a body of research demonstrating the impact of maternal social and emotional health on an infant's health and wellbeing. Fecundity is increasingly used as a predictor of pregnancy outcomes contributing to higher rates of preterm births, low birth weights and birth defects. Fecundity includes hormonal profiles, pubertal onset and progression, sexual function, semen quality, time to pregnancy, and reproductive ageing that effect the pregnancy and the health of the infant. It is associated with level of social support available to the mother (Louis & Platt, 2011; Nugent & Balen, 2001). Advanced maternal age is and its impact on fecundity, has been linked to greater pregnancy complications which may impact the infant (Nugent & Balen, 2001).

The relationship between lone parents, maternal history of child abuse, parental relationship distress and isolation with infant health has been indirectly assessed in studies. Social experiences of the mother translate into differences in parenting approaches and infant experiences that can impact health and wellbeing. In a qualitative study of 105 mothers Schwerdtfeger and colleagues (2013) found that mothers who experienced abuse as children are more likely to display authoritarian parenting style, characterized by strict rules, harsh punishment and low warmth. Verbal hostility predicted child symptoms of affective, hyperactive and oppositional defiant disorders. Children of trauma survivors demonstrate greater vulnerability to stress and trauma and may experience higher rates of depression, anxiety, psychosomatic problems and aggression (Schwerdtfeger, Larzelere, Werner, Peters & Oliver, 2013). Failing to provide an environment for a child that would produce feelings of being loved, wanted, secure and worthy can inhibit the child's physical growth, a condition known as failure to thrive (Odhayani, Watson, & Watson, 2013).

Utilizing secondary data collected from 75 US hospitals in 20 cities Burke, Lee and O’Campo (2008) found that US infants born to mothers who experienced intimate partner violence had worse health and more difficult temperaments. Infants born to mothers who experience intimate partner violence are at increased risk for low-birth weight and prematurity (Burke, Lee, O’Campo, 2008; Sanchez et al., 2012). To examine intergenerational impact of violence McFarlane and collegues (2014) qualitatively studied 300 mothers and one child. Children witnessing intimate partner violence demonstrate behavioural changes and impaired functioning. Mothers who reported internalized problems (e.g., depression, anxiety) from intimate partner violence were seven times more likely to have children with similar problems. Mothers with externalized problems (e.g., aggression) from intimate partner violence were four and a half times more likely to have children with the same external problems (McFarlane, Symes, Binder, Maddoux, & Paulson, 2014). Examining longitudinal trends of 76 women Ogbonnaya and collegues (2013) found parental relationship distress, assessed through intimate partner violence, produces higher levels of maternal depression. Turney (2013) utilized results from the Fragile Families and Child Wellbeing study (N=4,048) in the US finding that maternal depression places children at risk of unfavorable health, after controlling for confounding demographic characteristics of the mother and child. Family instability, maternal health and socioeconomic status are mitigating factors in the relationship between maternal depression and children’s health (Turney, 2013). Black (2009) measured the growth of 221 infants aged 6 and 12 months finding that maternal depression is interrelated with a variety of factors that impact infant growth including, maternal education, infant nutrition, maternal perception of infant temperament, and caregiving observations (Black, Baqui, Zaman, Arifeen & Black, 2009).

Families with low-socioeconomic status are more likely to live within stressful environments characterized by factors such as family violence, low social support, hunger and overcrowded living conditions that can partially explain their poorer health outcomes (Denny & Brownell, 2010; Kettner, 2011). Birth outcomes are affected by environmental factors such as teen pregnancy, exposure to harmful substances, and maternal health conditions. Preventable risk factors, such as exposure to alcohol during pregnancy, can have lifelong implications on the child, family and society including congenital anomalies, morbidity and mortality (Kettner, 2011; PHAC, 2005; PHAC, 2008). Low income women, usually single parents and teen mothers, are more likely to experience more stressful events and chronic stressors associated with low gestational weight gain (PHAC, 2005). Poverty and its associated stressors disproportionately produce higher rates of prematurity and its short and long term consequences (Blenner, Hironaka, Vanderbilt, Frank, 2014). Lone parents utilize less health care programs which is likely to be detrimental to the health and wellbeing of the infant (Wallby, Modin & Hjern, 2013; Ballantyne, Stevens, Guttmann, Willan, & Rosenbaum, 2014).

Research assessing social relationships and maternal trauma primarily focus on its relationship with child development not infant health. The majority of studies assessing social variables rely on maternal self-reports, which could be influenced by unknown biases and recall. Future research would benefit from observational research methods and assessment of trauma and violence severity (Burke, Lee, & O'Campo, 2008; McFarlane, et al., 2014; Schwerdtfeger, et al., 2013).

Relevance of Knowledge. Education, income, geography and social context of the mother are all related to an infant's health beginning at conception. Ecologically, we study the dynamic interrelationships between the determinants of health and infant health outcomes. Some segments of the population adversely experience multiple determinants of health that impact the health of infants (PHAC, 2008). Geographically some areas within Canada are at heightened risk (Statistics Canada, 2013a). Disparities in birth outcomes are not completely understood due to social biological complexities that make it difficult to identify cause and effect. Previous research findings speculated that worse health outcomes are related to social, economic, demographic and community differences. Improving social determinants of health can reduce enduring patterns of health inequalities (Heaman et al., 2010; Luo et al., 2010; Louis, & Platt, 2011). Population-based data on socioeconomic status and birth outcomes is scarce (Heaman et al., 2010; Luo et al., 2010). There is limited data available on the relationship between social factors, and infant mortality and morbidity. Research that is currently available primarily uses self-reported data to examine violence within relationships as a demonstration of poor social support. There are a variety of limitations to this approach. The utilization of population-based data informed by individual level information, when linked to administrative health data, can provide a valuable overview of the health and wellbeing of infants in Winnipeg.

Globally, countries are rated on indicators of child wellbeing, including infant mortality, low birth weight and child poverty, for comparative purposes. Canada ranks sixth on maternal wellbeing, 13th on health and safety, second on educational well-being, 18th on relationships, 17th on behaviours and risks, and 15th on subjective wellbeing, of the 21 wealthiest countries in the world due to its social, economic and health discrepancies and disparities. Canada needs to develop innovative approaches to attend to social, economic and health inequalities that impact infant health and wellbeing (Denburg & Daneman, 2010). Populations that have a higher risk of infant mortality, morbidity and disability require programs that can attend to the social determinants of health (Luo et al., 2010). Social determinants are a major challenge for public health and an opportunity to improve infant health and health inequalities (Dyck, 2009; HCC, 2011; Kettner, 2011; Mikkonen, & Raphael, 2010; Statistic Canada, 2010b). Understanding the association between the social determinants of health and infant health may be translatable into knowledge to guide future initiatives by equipping us with information to design appropriate interventions that attend to inequalities. Prevention is the most promising method to improve the health of Manitobans, reduce inequalities and ensure sustainability of the publicly funded health care system. Research has demonstrated that unless we address the social determinants of health we will continue to spend a large amount of public money on the health care system (Dyck, 2009; Kettner, 2011; Mikkonen & Raphael, 2010; Statistic Canada, 2010b). A broader policy focus can develop policies that attend to more than economic growth which alone is insufficient in improving overall societal health. Non-health policies targeting the socioeconomic environment are as important as health policies when seeking to reduce infant morbidity, mortality and disability (Denburg & Daneman, 2010; Marmot, Wilkinson, & Brunner, 2006).

Chapter 3: Conceptual Framework

Population Health. A population health approach considers the personal, social, economic and environmental conditions and circumstances in which people live and work that impact the health and wellbeing of populations and are responsible for health inequities. The present study was framed with a population health approach leading to the assessment of the determinants of health such as income, residency, education, social support and gender (PHAC, 2011). The health and wellbeing of a child is strongly influenced by the health and wellbeing of their parents, family and community. As a social determinant of health, healthy child development examines developmental health from a holistic lens seeking to understand the impact of the environment in which a child develops on the child's current and future health and wellbeing (i.e., family relationships, socioeconomic status and geography). Health inequities begin prior to conception by affording different populations unequal opportunities to reach their full health potential due to disadvantages related to the social determinants of heath (Whitehead, 2007).

Bronfenbrenner's Bioecological Model. Bronfenbrenner's bioecological model describes the person-context interrelationship that influences health and wellbeing. By assessing processes, the person, context and time, the bioecological model assesses factors that impact the health and wellbeing of a developing person. Regularly occurring reciprocal interactions such as mother-infant interactions impact developmental outcomes. The form and impact of these proximal processes vary according to characteristics of the person, environmental context and time of occurrence. Understanding the impact of maternal socio-demographic factors on infant health outcomes requires the assessment of a variety of contextual influences. The influence of contextual factors on the health and well-being of a developing person arise within five socially organized subsystems: the microsystem, the mesosystem, the exosystem, the macrosystem and the chronosystem (Bronfenbrenner, 1994; Tudge, Mokrova, Hatfeild, & Karnik, 2009).

The microsystem is the immediate environment of the developing person. The microsystem is characterized by particular physical, social and symbolic features that determine the engagement of the developing person in activities and interactions. Within infancy the family is the main microsystem. Family characteristics, such as income, influence activities and interactions within the microsystem impacting infant health (Bronfenbrenner, 1994; Tudge et al., 2009). Lower family's income is associated with increased rates of infant disease and mortality (Heaman et al., 2002; Irwin, Siddiqi & Hertzman, 2007; Moffat & Herring, 1999). The mesosystem describes linkages and processes between two or more of the microsystems. Within infancy mesosystems may occur between the immediate and extended family or the family and their community (Bronfenbrenner, 1994; Tudge et al., 2009). Family interactions impact infant health outcomes with a lack of social support contributing to a child's failure to thrive (Slade, 2010; Halfon, Larson & Russ, 2010).

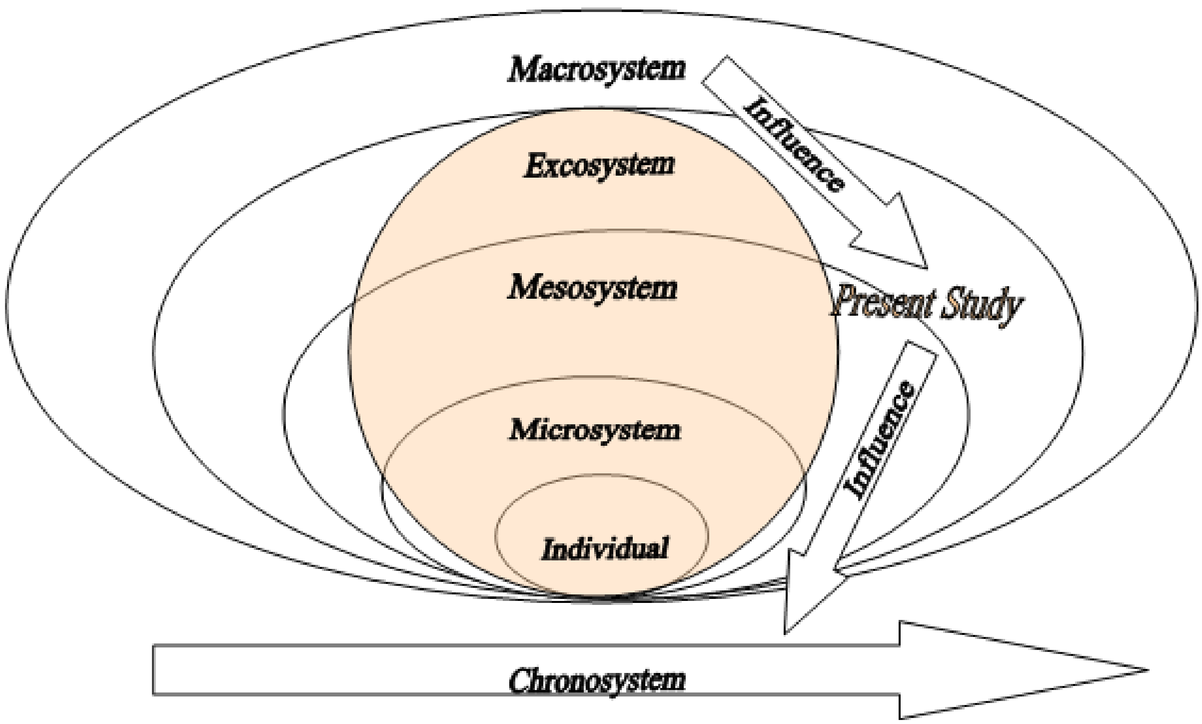
The exosystem relates to the linkages and processes between two or more settings where at least one does not include the developing person but where events will indirectly influence the immediate environment of the developing person. For instance, the level of maternal education influences infant health outcomes (Bronfenbrenner, 1994; CSDH, 2008; Irwin et al., 2007; Martens & Derksen, 2002; Tudge et al., 2009; World Health Organization & UNICEF, 2010). Parental income and employment influence a child's access to other determinants that impact their health and well-being (Denburg & Daneman, 2010).

The macrosystem representing the collective context includes shared values or beliefs, lifestyles and opportunities, and patterns of social interaction (Bronfenbrenner, 1994; Tudge et al., 2009). Cultural and behavioural aspects of the family translate into parental beliefs, values and norms that determine the child's environmental influences. Psychosocial determinants of health such as perceived status in society, stress and sense of control impact the infant's health. Distribution of societal resources is often dictated by middle socioeconomic status groups who have more political and societal power than low socioeconomic groups (Denburg & Daneman, 2010). The chronosystem refers to the variation in developmental processes according to the timing of historic events. Time refers not only to the chronological age of the developing person but is also an attribute of the surrounding environment (Bronfenbrenner, 1994; Tudge et al., 2009). Experiences with poverty, malnutrition and low maternal support over time reduce life expectancy and lead to higher rates of chronic disease and cognitive impairments (Brooks, 2012; Denburg & Daneman, 2010; Halfon et al., 2010; Slade, 2010). Although all are important subsystems, this thesis will not explore implications arising from the macrosystem and chronosystem directly.

Figure 1 provides a conceptual framework for the model describing its relationship to the present study. The present study assessed variables (i.e. income, education, geography, maternal history of child abuse and social support) at the individual level within the mircosystem, mesosystem and excosystem. Assessed variables are influenced by the macrosystem and study outcomes will be influenced by the chronosystem as the infant grows.

Figure 1

Bronfenbrenner's Bioecological Model



Research Question. What is the relationship between maternal socioeconomic variables and the health of an infant (0-12 months)? The impact of the social determinants of health is well documented but less is known about the implications of the social determinants of health on infant health outcomes. It was hypothesized that low-income, low maternal education, maternal history of child abuse, and poor social supports collectively will negatively impact the health of an infant within the first 12 months of life. To demonstrate the impact of maternal socioeconomic variables on infant health (mortality, morbidity and congenital anomaly) a logistic regression documented the following associations:

1. To describe the association between maternal variables of income, geography, education, history of child abuse, relationship status and level of social support on infant mortality in Winnipeg, Manitoba
2. To describe the association between maternal variables of income, geography, education, history of child abuse, relationship status and level of social support on infant morbidity in Winnipeg, Manitoba
3. To describe the association between maternal socioeconomic variables of income, geography, education, history of child abuse, relationship status and level of social support on the rate of diagnosed congenital anomaly among infants in Winnipeg, Manitoba

An independent analysis of the socioeconomic variables determined the strength of each factor in predicting infant mortality, morbidity and congenital anomaly. Logistic regressions assessed the interrelationships between maternal income, geography, education, history of child abuse, relationship status and level of social support from family and friends to determine the odds of each variable in contributing to differences in infant mortality, morbidity and congenital anomaly rates. The study controlled for multiple births and infant sex, which may mitigate differences in infant health outcomes.

Population of Interest. In 2003 Manitoba had a higher pregnancy rate than the national average at 64 births per 1000 women compared to 55 births per 1000 women. The number of births each year in Manitoba has been increasing from 14,582 in 2005 to 16,365 in 2009 (Kettner, 2011). In 2011 the Canadian infant mortality rate was 4.8 deaths per 1000 live births. This same year the infant mortality rate for Manitoba was 7.7 deaths per 1000 live births, higher then any other province in Canada. Between 2007 and 2011 the Manitoba infant mortality rate was consistently higher than the Canadian rate (Statistics Canada, 2013a). In 2006-2007 the estimated preterm birth rate in Manitoba was 8.1% contributing to the infant mortalities and morbidities within the province (Canadian Institute for Health Information, 2009).

Within Manitoba there are important differences between and within health regions, socioeconomic groups, and Aboriginal and non-Aboriginal people that translate into health inequalities in morbidity, injury, mortality and life expectancy (HCC, 2011; Janz et al., 2009; Kettner, 2011; Martens et al., 2010; Smylie et al., 2010; Statistics Canada, 2010a). In Manitoba the socioeconomic gradient of health describes the poorer health found in lower income neighbourhoods (Marni et al., 2012). The income gradient of infant mortality can be up to 2.5 times higher in low-income compared to high income populations around the province (Kettner, 2011).

Between 2005 and 2010 the infant mortality rate in Winnipeg, Manitoba was 6.3 per 1000 women, similar to the provincial average of 6.4 per 1000 women. The Winnipeg and Manitoba infant mortality rates are higher than the Canadian average of 5.1 per 1000 women (Manitoba Health, 2011; Statistics Canada, 2013a). Residents in low socioeconomic status communities in Winnipeg have significantly higher rates of preterm births and small-for-gestational age births related to social, economic, demographic and prenatal care factors. Women in neighbourhoods with low income, high unemployment, high immigrant, Aboriginal and single-parent families, and lower levels of education are associated with inadequate prenatal care (Kettner, 2011; Luo et al., 2010). Factors other than geography contribute to poor infant health outcomes among First Nation infants (Leo et al., 2010; Martens et al., 2010).

First Nation, Metis and Inuit populations comprise 10% of Winnipeg, Manitoba’s population, a larger proportion than any other urban centre in Canada. The Aboriginal population is younger than the non-Aboriginal population, with 25% of Manitobans under the age of 15 of Aboriginal descent (Kettner, 2011; Statistics Canada, 2006). Aboriginal groups experience higher rates of adverse infant health outcomes such as stillbirth, infant mortality, low-birth weight, high birth weight and prematurity (Heaman et al., 2010; Kettner, 2011; PHAC, 2005). There are large differences among the maternal and neighbourhood characteristics of Aboriginals and non-Aboriginals in Manitoba (Luo et al., 2010). In Manitoba, the First Nations population has an infant mortality rate of 10.7 deaths per 1000 live births compared to 5.73 deaths among all other Manitobans. The major causes of excess infant deaths among First Nations were congenital anomalies, conditions originating in the perinatal period, and SIDS (Elias, Hart & Martens, 2014). Aboriginal children experience poorer health than do non-Aboriginal children, which is associated with social rather than biological determinants including family and social conditions and community characteristics (Findlay & Janz, 2012). Low socioeconomic status is associated with an elevated risk of poor infant health outcomes, which may partly account for the higher rates experienced by Aboriginal populations in Manitoba (Heaman et al., 2010; Kettner, 2011; Luo et al., 2010).

The present study sought to comprehensively provide information on the health of infants in Winnipeg as well as future individual and societal implications arising from disparities. The infant's environment is largely impacted by maternal circumstances that may or may not be controllable. The social determinants of health impact conditions experienced by the mother, which translate into disparities in infant health outcomes (Findlay & Janz, 2012). Factors contributing to poor infant health outcomes need to be understood to enhance prevention initiatives that can attend to infant health disparities. Organizing health determinants utilizing an ecological model provides details on risk factors for adverse infant health outcomes that not only impact the health and wellbeing of infants but also their future health and well-being through implications on development and environmental modification of gene behaviour. The utilization of Bronfenbrenner’s bioecological model will assist in assessing the appropriateness of the subsystems for analyzing health concerns and provide a comprehensive picture of the determinants of infant health (Denburg & Daneman, 2010).

Chapter 4: Methods

Study Design. The study utilized population-based data to assess the social determinants of infant mortality, morbidity and congenital anomaly. Previous research found associations between service use, infant health and individual socioeconomic variables suggesting increased and decreased health risk related to geography, income, education, intimate partner violence, maternal history of child abuse and lone parents. This study expanded on current knowledge by verifying and broadening available information on the relationship between neighbourhood, income, education, lone parents, and social context and infant health outcomes.

Case-Control Study. Case-Control studies are observational studies assessing differences between individuals with a disease or condition to those without the disease or condition based on putative risk factors. This study assessed socioeconomic conditions of infants to determine differences between infants born with a congenital anomaly, were admitted to a hospital or have died, and healthy infants. Within a case control study subjects are selected based on the presence or absence of the disease or condition and using odds ratios associations between the disease/condition and risk factors are determined. Using scrambled Personal Health Information Numbers (PHIN) infants were grouped according to their health status. Infant health records were used to determine the number of infants who have experienced morbidity, congenital anomaly and mortality. Screening data was linked to infant health data using scrambled PHIN to show the presence of risk factors. Health records also provided information on infants without a morbidity, congenital anomaly or mortality, and the presence of risk factors for creation of the control group. Case-control studies are particularly suitable for the investigation of rare disease or conditions, such as infant mortality, with fewer subjects required to conduct this type of study (Silva, 1999; Mann 2003).

Repository Data. In Manitoba, the MCHP houses a comprehensive database holding de-identified administration records for Manitoba health and social service systems. Collectively these datasets are described as the Population Health Research Data Repository. The repository is population-based representing every person living in Manitoba who has a provincial health card. Health datasets provide information on mortality, birth, physician and hospital use, pharmaceutical use, and use of health services according to residency of the individual receiving the service. Social datasets held in the repository include the census, Healthy Child Manitoba records, and community and social service records. Through the Data Repository researcher are able to link socioeconomic data to health records (Brownell, et al. 2007 Brownell, et al., 2009; Martens, 2010; Roos, Menec & Currie, 2004; Roos et al., 2008).

Manitobans are all assigned a PHIN used to access Manitoba health services without an individual expense. The PHIN can be used to track an individual’s use of Manitoba's health and social services. Data held in the MCHP Repository is anonymized. Manitoba Health removes all personal identifiers prior to the transfer of the records to MCHP. As data is transferred PHINs are scrambled to ensure privacy as well as the ability to link records. The datasets are linkable because the PHIN was scrambled in the same way at Manitoba Health. Community level socioeconomic data from Statistics Canada is also available in the repository at the MCHP.

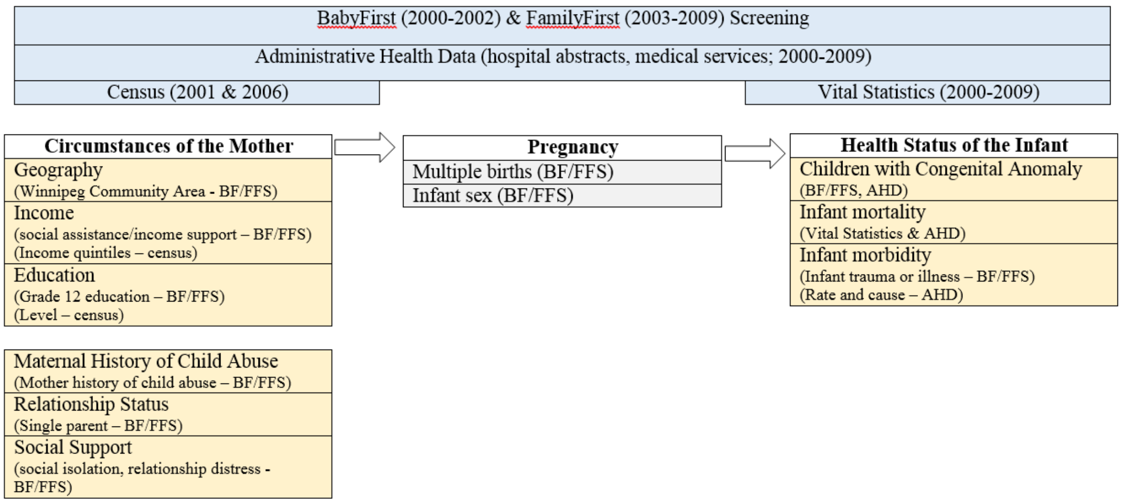
Data Access and Ethics. MCHP made available a secure computer lab to allow the researcher access to repository data. Secure computer labs at the University of Manitoba have many safe guards including firewalls, passwords, file encryption and restricted access to protect the privacy of the data and individual citizens. Researchers are granted access to requested datasets following permission from appropriate parties (Brownell, et al. 2007 Brownell, et al., 2009; Manitoba Centre for Health Policy [MCHP], 2014a; Martens, 2010; Roos, Menec &

Currie, 2004; Roos et al., 2008). The study obtained access permissions from the MCHP, Health Information Privacy Committee of the Government of Manitoba, Healthy Child Manitoba Office, and the Health Research Ethics Board of the University of Manitoba Approvals can be found in Appendix C – Appendix E (Brownell, et al. 2007 Brownell, et al., 2009; Manitoba Centre for Health Policy, 2014; Martens, 2010; Roos, Menec & Currie, 2004; Roos et al., 2008). Results were only removed from the MCHP lab after they had been aggregated to ensure that individuals are never identified. Some results were not able to leave the lab, such as some records on mortality due to small population sizes that affected the potential anonymity of the data.

Study Datasets. To assess the relationship between maternal circumstances and infant health, five datasets from the Population Health Research Data Repository were accessed, illustrated in figure 2. They are BabyFirst and FamilyFirst screening form data for newborn and family risk factors; the 2001 and 2006 census for socioeconomic information; hospital claims for a record of hospital admissions; medical claims data for visits to physicians outside of the hospital in-patient services, and vital statistics data which includes births, deaths and causes of death.

Figure 2:

Conceptual Outline



BabyFirst and FamilyFirst Screen's. The BabyFirst Screen (BFS) was implemented from 2000-2002 after which questionnaire changes were made and the survey became the FamilyFirst Screen (FFS) (2003-2009). Appendix F and Appendix G provide examples of the BFS and FFS. The BabyFirst and later the FamilyFirst screen was/is completed by public health nurses in Manitoba following patient consult to assess families with newborns within a week of discharge from the hospital related to biological, social and demographic risk factors. Families are asked questions regarding supports and challenges with three or more risk factors indicating that the family may require additional service supports. The BFS and FFS is the first of two screening stages for Manitoba's Families First home visiting program (MCHP, 2013a). The BFS and FFS have been accepted and embedded into Manitoba nursing practices, making it a universal tool for data collection. The BFS and FFS are gathering data on an increasing number of births in Manitoba. In 2007 the FFS represented approximately 87% of all births in Winnipeg.

In 2010 the FFS collected information from 95% of post-partum referrals in Manitoba. FamilyFirst data is limited for families residing on reserve, women giving birth outside of a hospital by a midwife and newborns apprehended at birth. The 2007 evaluation of the FFS reported rates of risk factors similar to other studies, high response rates, and continual improvement of data quality and predictability. FFS measures of maternal education show substantive agreement with data from Manitoba education (Brownell et al., 2007; Healthy Child Manitoba, 2010).

Both the BFS and FFS are based on a conversation between the public health nurse and the infant's mother, therefore the data may be biased to perceptions and social desirability. Nurses generally complete the screening form for the individual following their patient consultation, leaving open the potential for some recall or nurse perception bias in the results. Nurses who were uncomfortable discussing certain topics may have contributed to missing values in the data. Many items are highly sensitive and depend on skill level of the public health nurse to develop a positive rapport with the family. Patients may be unwilling to discuss topics due to social desirability or lack of a strong rapport with the nurse. Questions not answered on the screen can represent a negative or unknown response (Brownell et al., 2007; Morsback & Prinz, 2006).

2001 and 2006 Census. Since 1971 Statistics Canada conducts a Canadian Census every five years to develop a statistical portrait of Canada. The census utilizes a mandatory population-based survey that takes into account all persons living in Canada by dissemination areas to produce data on people and housing units by demographic, social and economic characteristics. A dissemination area is a small relatively stable geographical unit encompassing between 400 to 700 people. Dissemination area data can be aggregated to larger geographical areas. There are

2,152 Dissemination Areas in Manitoba. Approximately, 32.5 million people in Canada received a census questionnaire for the 2006 census. The short questionnaire is distributed to 80% of all households and, in 2006, included eight questions: name, sex, date of birth, marital status, common-law status, relationship to person, first language learned in childhood and release of personal data. The long form questionnaire distributed to 20% of all households contains the questions from the short questionnaire in addition to 53 questions on topic areas including: Aboriginal status, education, ethnicity, family and household, housing costs, income, employment and mobility. From one census year to another, there are some shifts in geographical boundaries. Area data suppression generally occurs when less than 40 people respond, with the exception of income (250 people) and postal code (100 people). These data are collected and therefore can only be linked at the community level (Statistics Canada, 2009).

Hospital and Medical claims. The Medical Service Database in the MCHP Data Repository contains physician service information including physician and hospital claims, identifying the provider, the type of service provided, date of service provision and service related fees. This database includes out-of-hospital and in-hospital services. Hospital claims include billing claims that are submitted to the provincial government for hospital services to receive reimbursement for costs. A hospital 'separation' is created each time a new hospital claim is generated. An 'episode' is contact with the system resulting in one or more separations. A discharge and readmission on the same day or within a short interval count as the same episode. Newborn claims are passed against the registration file and if the mother's demographic information corresponds with the registration information, a PHIN is assigned to the newborn and added to the claim. If demographic information does not match, manual investigation occurs until the problem is resolved and a PHIN is assigned and added to the newborn claim, which is then put on the hospital statistics file. All hospital claims should therefore contain a PHIN (MCHP, 2012).

Medical claims are provider claims for services submitted to the government for payment or as a record of the visit. Salary physician records may not be as consistently recoded within the database, as they are submitted for administrative purposes only (shadow billing), not for payment. Records for some areas of the province, particularly the north, are more affected by 'shadow billing' (MCHP, 2012).

Vital statistics. The Vital Statistics database is a longitudinal population-based registry that contains birth records, mortality records and the cause of mortality for all Manitobans. This database is maintained and updated by Manitoba Vital Statistics Agency the provincial member of the Vital Statistics Council for Canada (MCHP, 2013b).

Indicators. Data from Healthy Child Manitoba Office's BabyFirst and FamilyFirst screens and the census provided information on maternal socioeconomic factors and social supports. Data from Manitoba Health specifically hospital abstracts, physician claims and vital statistics were used to assess infant mortality, morbidity and congenital anomaly rates. Together these datasets provided descriptive statistics at a regional and community area level on maternal circumstances and their association with adverse infant health outcomes (Brownell, et al. 2007; Brownell, et al., 2009; Martens, 2010).

Table 1

Study Indicators

Indicator	Description
Outcome Variables	
Mortality	Death within the first 365 days of birth
Morbidity	Newborn readmission 1-28 days; Post-neonatal readmission 29-365 days; Hospital readmission in the first year

Congenital Anomaly	Diagnosed in-patient service or from family physician
Risk Factors	
Geography	Winnipeg Community Area code (BFS/FFS)
Income	Social Assistance and financial difficulty (BF/FFS); Income quintile (Census)
Low Education	Obtainment of grade 12 education (BFS/FFS)
Maternal History of Child Abuse	Maternal history of child abuse/neglect (BFS/FFS)
Lone Parent	Single parent (BFS/FFS)
Relationship Distress	Self-rated relationship distress (BFS/FFS)
Isolation	Availability of social supports through either self-reported spousal support or external supports (BFS/FFS)
Confounding Variables	
Multiple birth	Plurity at birth (BFS/FFS)
Sex	Sex of the child (BFS/FFS)

Infant health outcomes. The circumstances of the mother were hypothesized to translate into differences in infant mortality, morbidity and congenital anomaly rates. Infant mortality and causes of mortality were obtained from vital statistics records. The date of mortality was calculated by subtracting the infant's death date from their birth date. Infant mortality was only captured for infants whose parents completed the BabyFirst or FamilyFirst Screen therefore providing adequate socioeconomic data on the mother and infant. If the infant did not survive to the point that this screen was administered (usually within the first week of life) the infant was not captured within this study. There were 248 infants who had died but were not captured within the study due to death within the first week of life. 312 infants who died in the first seven days of life were captured within the study. Frequencies and proportional analysis demonstrated that the missing respondents and captured infants did not substantially differ on any of the key variables in the present study.

Morbidity outcomes were obtained from reported rates in the BabyFirst and FamilyFirst screen's and administrative health data on the rate and cause of morbidity, and rate and cause of hospital readmission. Within the morbidity sample each child has only been captured once, at the earliest point of hospital readmission, which was used to imply morbidity. Some infants may have been admitted to the hospital without an illness such as an infant accompanying a sick parent. Hospital admissions were then grouped into three categories: newborn (hospital readmission in the first 28 days following birth), post-neonatal (hospital readmission between days 29 and 365) and hospital readmission (hospital readmission within the first year of life). The hospital readmission date was recorded by calculating the first service date from the infant's date of birth. The number of readmissions and causes of readmission are different depending on the age of hospital readmission. According to MCHP a hospital readmission among an infant occurs more than one day after the discharge from the birth hospital stay (MCHP, 2010b). In the present study neonatal readmissions were largely attributed to conditions originating in the perinatal period, whereas post-neonatal hospital readmissions were largely related to communicable disease and infections.

The prevalence of congenital anomalies were obtained from BabyFirst and FamilyFirst screen data and administrative health data. Each infant was only represented once within the congenital anomaly rates as either having or not having a hospital or physician diagnoses of a congenital anomaly within the first year of life. A diagnosis of congenital anomaly was monitored among the first six diagnostic codes from hospital data or from a physician diagnosis of congenital anomaly. Hospital diagnosis codes located in 'Q' 'G901', 'P293' '74' and '75' and physician codes '74' and '75' were highlighted as a diagnosis of congenital anomaly. Diagnosis codes are used to identify a patient's illness or disease using a standardized classification system, ICD-9CM and ICD-10-CM. For each patient discharged from the hospital there can be several diagnoses reporting the most responsible diagnosis and any secondary diagnoses/conditions present (MCHP 2006; MCHP 2007). ICD-9-CM codes for congenital anomaly begin with the numbers 74 or 75 followed with additional specific congenital anomaly identification numbers. Infant mortality by congenital anomaly in ICD-10-CM codes are listed as G901, P293, or a Q followed by specific congenital anomaly identification numbers (MCHP, 2006; MCHP, 2007).

Independent Variables. Maternal socioeconomic and social factors were obtained from the BabyFirst and FamilyFirst screen, and the census. Socioeconomic factors recorded in the BabyFirst and FamilyFirst screens provided data for residency, obtainment of social assistance and maternal education. Residency was recorded through maternal postal code. Obtainment of social assistance was a dichotomized yes/no item on the screen. Maternal education demonstrated the response to two items: completed grade 12 and low educational obtainment. Registered nurses may ask these questions in a variety of ways before making their own judgment and recording on the screen a yes/no response. The census provided additional information on the income quintile group, geography and the education level of the neighbourhood in which the family resides. Maternal PHIN was linked to postal code data in the 2001 and 2006 census. Census data assess income and education within a dissemination area by attributing an income quintile and education level to a postal code.

In Winnipeg, there are 12 community areas that encompass 23 neighbourhoods (MCHP, 2005; MCHP, 2008). Maternal residency in one of the 12 community areas was captured in the BFS and FFS. For this study we collapsed the 12 areas into four community area clusters based on health status of the residing population. Community areas with the lowest premature mortality rate were considered the most healthy, whereas community areas with the highest premature mortality rate were considered the least healthy. The community area clusters are similar to groupings from other studies that use MCHP data including Profile of Metis Health Status and

Healthcare Utilization in Manitoba: A Population-Based Study (Martens et al., 2010) (See Table 5). The most healthy Winnipeg community area cluster was used as the dummy variable for the logistic regression with the other three community area clusters assessed against the most health areas.

Table 2

Winnipeg Community Clusters

Community Area Cluster	Winnipeg Community Area
Most Healthy	St. Vital
	Assiniboine South
	Fort Gary
Mid-most healthy	River Heights
	St. Boniface
	Transcona
Mid-least healthy	River East (including East St. Paul)
	Seven Oaks (including West St. Paul)
	St. James/Assiniboia
Least Healthy	Point Douglas
	Downtown
	Inkster

Income was recorded in five income quintiles according to statistics Canada data, with U1 representing the lowest income level and U5 representing the highest income level. Income quintiles were adjusted to consider inflation. Income quintile information is created by generating the population file for a selected year, removal of postal codes unable to be ranked, attachment of the average household income value from the Census files to the population file using the Postal Code Conversion File, ranking of the population by urban/rural geographical location and by average household income, and forming the 20% population income quintile groups based on the average household income values (MCHP, 2014). Table 6 presents the urban income quintiles used within the present study. Income quintile U5 was used as the dummy variable against the other income quintiles in the logistic regression.

Table 3

Urban Income Quintiles

Year	Income Quintile	Low Income Bracket	High Income Bracket
2000	U1	11,129	36,625
	U2	36,625	46,651
	U3	46,651	58,514
	U4	58,518	73,590
	U5	73,590	279,150
2009	U1	14,640	42,407
	U2	42,463	55,030
	U3	55,051	68,711
	U4	68,761	87,519
	U5	87,534	406,531
			MCHP, n.d.

Social indicators were obtained from the BabyFirst and FamilyFirst screen's capturing maternal history of child abuse, relationship status, social isolation and relationship distress. Information on the infant's social context was predicted to be associated with rates of hospital readmission through the health of the infant. For the purposes of this study maternal history of child abuse and relationship distress were coded as dichotomous answers without varying degrees of severity. Maternal history of child abuse was derived from the item "Mothers own history of child abuse/neglect" no versus yes. No maternal child abuse was assessed against a history of maternal child abuse in the dummy coding for the logistic regression. A yes/no response for "relationship distress" was recorded on the screen by the registered nurse following maternal consultation. No relationship distress was assessed against relationship distress in the dummy coding for the logistic regression. Isolation is the situation when the infant is born into a family with only one parent and no social support. A one parent family with social support and two parent family with no social support both represent non-isolation of the infant. No isolation was assessed against isolation in the dummy coding for the logistic regression. Lone parent describes the situation where either it is a one parent family with no social support or a one parent family with social support. Two parents with no social support represent two parent families. Not a lone parent was assessed against lone parent in the dummy coding for the logistic regression. Together these factors provided a comprehensive picture of maternal socioeconomic and social support factors that enabled the analysis of associations between the social determinants of health, and infant health and wellbeing.

Mitigating Factors. Pregnancy outcomes were controlled in the logistic regression model due to their correlation with infant health outcomes. BabyFirst and FamilyFirst included questions on multiple births and the sex of the child. Multiple births are known to impact gestational age and weight at birth which can impact health status (Kettner, 2011; PHAC 2008). Multiple births were captured on the BabyFirst and FamilyFirst screen. No multiple birth was assessed against multiple birth in the dummy coding for the logistic regression. Dichotomous coding was used for the multiple births indicator, 0 for only one infant and 1 for multiple birth. Male infants are known to experience higher rates of congenital anomalies (PHAC, 2011; World Health Organization [WHO], 2014). Sex of the child was recorded in both the BabyFirst and FamilyFirst screen and validated in administrative health data, providing a comprehensive dataset for infant sex. Male infant was assessed against female infant for the purposes of dummy coding in the logistic regression.

Variable Creation. The 10-year span of this study required data from both the BFS and FFS. To utilize data from both screens, variables were combined. The transition from BFS to FFS in 2003 adjusted and added new indicators on the screen preventing the assessment of some indicators such as alcohol use during pregnancy. Also there are reporting differences between the

BFS and FFS with BFS using a risk severity score and FFS obtaining a dichotomized yes/no answer. To use data from both screens we transformed the risk severity scores into dichotomized responses enabling the use of logistic regression techniques but preventing the analysis of details that were originally captured within the BFS (Brownell et al., 2007). Five variables with risk severity scores were transformed into dichotomous variables for study. They were maternal child abuse, isolation, relationship distress, lone parent and multiple births. The dichotomous variable was created to include any level of risk as having a condition, whereas the response of none continued to be represented as no condition.

Prior to merger, similar variables were assessed to determine similarities in frequency and question description. Frequency distributions of the data obtained from MCHP provided information on the number of individuals represented in the study. Distribution rates were calculated using SAS to determine the number of individuals in the sample, response rates and prevalence of risk factors and Aboriginal status. No statistically significant differences were found between samples or among responders and the missing item group. The merged questions were similar in description with the main difference related to the use of a risk severity score instead of a dichotomous question. Table 3 describes the variable mergers (McKnight, McKnight, Sidani, & Figueredo, 2007). Dichotomization presented an opportunity for researcher interpretation such as the definition of lone parent and isolation. Lone parent was represented as an individual identified on the BFS or FFS as a one parent family with or without social support. Isolation was represented by individuals identified on the screen with no social support and not a two parent family. Literature review was utilized to assist with dichotomization and merging of the data (Brownell et al., 2007; Morsback & Prinz, 2006).

Table 4

Variable Creation

<table>
<tr><th>Variable</th><th colspan="3">BabyFirst Screen(BFS)</th><th>FamilyFirst Screen (FFS)</th><th>Combined</th><th>Rational</th></tr>
<tr><td>Maternal History of Child Abuse</td><td colspan="3">0 = 221
1 = 314
2 = 20943</td><td>0 = 22276
1 = 2041
2 = 33081</td><td>0 = 22497
1 = 2355
2 = 46984</td><td>BFS risk severity score turned into Yes/No response (0 = 0 1-9 = 1) to combine with FFS child abuse question</td></tr>
<tr><td>Education</td><td colspan="3">0 = 8917
1 = 2371
2 = 10190</td><td>0 =32280
1 =6607
2 =18514</td><td>0 =41195
1 =8978
2 =21663</td><td>Used FFS low education question which captured all grade 12 responses and low education responses. Combined BFS low education questions (similar questions)</td></tr>
<tr><td>Income</td><td colspan="5">Income:
NF = 62
U1 = 22807
U2 = 13129
U3 = 11876
U4 = 12395
U5 = 11567</td><td>Used FFS and BFS social assistance question to move a couple individuals from NF to U1. If on social assistance rates classify the individual as U1 income level.</td></tr>
<tr><td>Isolation</td><td>One parent; social support
1=2251
2= 19227</td><td>One parent; no social support
1=137
2= 21341</td><td>Two parent; no social support
1=607
2= 20871</td><td>0 = 38257
1 = 1730
2 = 17414</td><td>0 = 41100
1 = 1866
2 = 28870</td><td>One parent, no social support was used to represent isolation (1); one parent, social support, and two parents, no social support represent no isolation (0)</td></tr>
<tr><td>Relationship distress</td><td colspan="3">0 =249
1 =985
2 = 20244</td><td>0 =32776
1 =1992
2 =22633</td><td>0 =33023
1 =2976
2 =35837</td><td>BFS risk severity score for relationship distress turned into Yes/No (0 = 0 1-9 = 1) to combine with FFS relationship distress</td></tr>
<tr><td>Lone Parent</td><td>One parent; social support
1=2251
2= 19227</td><td>One parent; no social support
1=137
2= 21341</td><td>Two parent; no social support
1=607
2= 20871</td><td>0 = 36826
1 =5970
2 =14605</td><td>0 =37423
1 =8354
2 =26059</td><td>one parent, social support, and one parent, no social support were used to represent lone parent (1); two parents, no social support represent no lone parent (0); combined with FFS lone parent question</td></tr>
<tr><td>Multiple Births</td><td colspan="3">0 = 324
1 = 444
2 =20710</td><td>0 =42336
1 =1137
2 =13928</td><td>0 =42657
1 =1581
2 =27598</td><td>BFS multiple birth risk severity score turned into Yes/No (0 = 0 1-9 = 1) to combine with FFS multiple births; BFS risk represented level of support required in multiple child birth</td></tr>
<tr><td>Aboriginal status</td><td colspan="3">0 = 10588
1 = 1770
2 = 9120</td><td>0 = 25963
1 = 5319
2 = 26119</td><td></td><td>Self reported aboriginal status completed with BFS and FFS reported aboriginal status (if aboriginal identity was coded then aboriginal status = 1)</td></tr>
</table>

Note. 0 = no; 1 = yes; 2 = missing response

Data Integrity. Approximately 87% of births are captured by the BFS and FFS, which by using scrambled PHIN can be linked to administrative health data. The thesis used a sample of 71,836 births in Winnipeg between 2000 and 2010. From this sample, 10,048 infants were hospitalized within their first year of life, 7,412 of these were within the first 28 days of life, and 2,636 from days 29-365 of life. Congenital anomalies were present in 3,008 infants and 425 of the infants did not survive through their first year of life. Infants not captured within this study were more likely to have died shortly following birth (267 children died within the first nine days following birth) or were more likely to have been involved with Child and Family Services shortly following birth. The 434 infants not captured in the study, especially those involved with Child and Family Services, could be different on some socioeconomic variables from those represented in the study. Differences between the study population and missing respondents have not been estimated for this study. This study can still be classified as a population-based study due to the low numbers of infants not captured (Brownell et al., 2007; Healthy Child Manitoba, 2010).

Missing Data. From the BFS and FFS key variables were measured to assess: education, maternal history of child abuse, relationship status, isolation, lone parent and multiple births. Response rates of these variables were assessed. In total there were 8,304 (11.6% of the sample) completed BFS and FFS screening forms. The FFS had a better uptake then the original BFS demonstrated through completion rates. Approximately 12.5% of FFS items and 39% of BFS items were not complete for any of the key BFS and FFS variables assessed in the study, impacting screen representativeness and ability to capture results for some indicators. Complete data was available for other indicators including geography, income and sex. Subsets of the study population experienced lower completion rates with no complete screens and at times limited response to key variables. This impacted the ability of the study to examine socioeconomic variables among infant mortality rates. Mothers of healthy infants were more likely to have complete BFS and FFS than mothers of infants who had a hospital readmission, congenital anomaly or mortality. Mothers of infants with a hospital readmission and/or diagnosed congenital anomaly had higher rates of complete BFS and FFS than mothers whose infant died. Approximately 15% of mothers who had an infant with a hospital readmission or congenital anomaly did not have any of the key indicators in the study on their screen. Failure to complete the screen can be related to nurse unwillingness to assess screen questions, difficulty contacting families, unwilling to answer questions due to social desirability, or lack of nurse recall (Brownell et al, 2007).

Table 5

Percentage of Missing Screens in the BFS and FFS

Dataset	Population with Missing Variables													
FFS (Out of 10 key Variables)	# missing	0/10	1/10	2/10	3/10	4/10	5/10	6/10	7/10	8/10	9/10	10/10		
	% missing	16.4%	33%	17.6%	8.9%	4.6%	2.5%	1.7%	1.4%	.9%	.5%	12.5%		
BFS (Out of 12 key Variables)	# missing	0/12	1/12	2/12	3/12	4/12	5/12	6/12	7/12	8/12	9/12	10/12	11/12	12/12
	% missing	.005%	.005%	.005%	.005%	.005%	.06%	.4%	1.3%	4%	6%	9.8%	39%	39.2%

To determine if the missing cases would impact study findings we looked at frequencies and proportional analysis for statistical significance. Frequencies and proportional analysis were recorded to assess any differences in the characteristics of sample groups, and between respondents and the missing item group on variables such as education, income, Aboriginal status and geography. Following analysis it did not appear that the missing records were from any one particular income, sex or community area. There were no large differences between sample groups and the sample of respondents and missing item group that may impact outcomes. A similar proportion of the BFS and FFS completed screens and incomplete screens came from each Winnipeg Community area with only slight differences from Seven Oaks with 10.5% of incomplete screens and 8.8% of complete screens residing in the area. No difference on income, sex, geography or Aboriginal status were found between no responses, yes responses and the missing item group. The FFS had a 9.3% Aboriginal population of whom 20.6% completed the screen and 9% did not complete any key variables on the screen. 22.6% of the non-Aboriginal population completed the FFS and 4% did not answer any key variables. The BFS had an Aboriginal population of 8% with 7% of the Aboriginal population not completing any key variables. 11% of the non-Aboriginal BFS responders did not answer any key variables.

Table 6:

Demographics of Completed Screens Compared to Incomplete Screens

Income Quintile	**Proportion of Complete Screens**	**Proportion of Incomplete Screens**
Not Found	.1%	.1%
U1	26.6%	27%
U2	20.8%	20.6%
U3	17.9%	17.8%
U4	18%	17.9%
U5	16%	16%
Sex	**Proportion of Completed Screens**	**Proportion of Incomplete Screens**
Male	51%	51.1%
Female	48.9%	48.8%
Winnipeg Community Area	**Proportion of Completed Screens**	**Proportion of Incomplete Screens**
W01	7.4%	5.9%
W02	3.9%	3.3%
W03	9%	7.7%
W04	8.8%	7.6%
W05	7.6%	6.7%
W06	4.9%	3.8%

W07	13%	10.5%
W08	8.8%	10.5%
W09	5.6%	4.4%
W10	9%	7.5%
W11	13.8%	12%
W12	7.6%	6%

Two analyses were completed in this study. The first analysis compared no and yes responses within the study samples, and the second analysis compared yes responses with a combined no and missing item group, increasing sample size for comparison purposes. The use of statistical techniques ensured that the reported results were not produced by anomalies in the data. Utilizing the two analyses the present study compared differences that may arise due to missing responses within the sample. Missing data impacts measurement, knowledge on variables relationships and a researcher's ability to draw scientific conclusions from the outcomes. Within this sample missing variables were not different on any of the key variables examined, and as such they were ignored due to its limited impact on randomization of the sample (McKnight, McKnight, Sidani, & Figueredo, 2007). Similar odds ratios were found between the two analyses when assessing congenital anomalies. Adding the missing item group produced similar although slightly stronger study findings, demonstrating congruence between samples.

Final Dataset. The population-based data utilized for the study created a large representative sample of 71,829 infants born between the years of 2000 and 2010. This represents 99.4% of the births recorded in Winnipeg between the years of 2000 and 2010 (denominator 72,270). Within this sample, infants were assessed for hospital readmissions, disabilities and mortalities, in addition to socioeconomic information. The sample of newborn readmissions (1-28 days) was 7,412 and the sample of post-neonatal hospital readmission (29-

365 days) was 2,636 creating a hospital readmission (1-365 days) sample of 10,048. The mean newborn readmissions occurred on day 10.81. Post-neonatal hospital readmissions usually occurred at 72.38 days. Together the mean day of hospital readmission was 26.97 days. The number of infants with a congenital anomaly was 3,008 infants. Of the infants that were assessed in this study through linkages with administrative health data, and BabyFirst and FamilyFirst screen data, only 425 infant mortalities were recorded.

Table 7

Study Sample

Sample	**N**	**% of population**
Study Population	71,829	-
Control Sample		
No diagnosis/condition	57,169	79.59%
Morbidity Sample		
Hospital readmission	10,048	13.99%
Newborn readmission	7,412	10.32%
Post-Neonatal readmission	2,636	3.67%
Congenital Anomaly Sample		
Congenital anomaly	3,008	4.18%
Mortality Sample		
Mortality	425	.59%

The study assessed infant administrative health records for the first year of life of 99% of the births that occurred in Winnipeg for the period of 2000 to 2010. Variables used in this analysis were geography, income, education, maternal history of child abuse, relationship distress and social support. Maternal factors were assessed to provide an understanding of the socioeconomic environment in which the infant was born. Mothers were of a variety of ages and represented the standard curve in birthing age. In Manitoba, most births occur to women aged 25 to 29, followed by women aged 30 to 34 and then women 20 to 24 (Milan, 2013). In the present study 2.1% of the infant population had an illness and 0.9% had a congenital anomaly shortly following birth. Approximately 2.2% of the births assessed in the study were multiples. Approximately 3.3% of mothers screened experienced child abuse as a child and 12.5% had less then a grade 12 education. The maternal and infant social context was fairly supportive with 4.1% experiencing relationship distress, 2.6% living in isolation and 11.6% single parents. Due to the study sample of new mothers averaging age 25 to 29, rates of single parents and education were slightly lower then reported in the Winnipeg census. According to the 2006 Winnipeg census capturing Winnipeg residents 15 and over 16.2% of females were single mothers and 23.1% did not have a certificate, diploma or degree. Maternal age, largely between 25 and 29, improves the rate of educational obtainment in the sample (City of Winnipeg & Statistics Canada, 2006).

The ten year span of the data produced a fairly even sample in relation to infant sex with 51% of infants being male and 49% female. The study's congenital anomaly subsample found higher rates of congenital anomaly among male infants. The Public Health Agency of Canada (2013) similarly reports higher rates of congenital anomaly among male infants compared to female infants (2.2% vs. 1.6%, respectively). Residency of the study sample is similar to Winnipeg census data with the largest populations found in River East and Downtown and the smallest populations found in Assiniboine South and Transcona (City of Winnipeg & Statistics Canada, 2006). Most children reside within the low-mid and low health status Winnipeg community clusters. Income distribution is fairly representative with approximately 20% of the population within each income quintile. Middle-income quintiles are narrower in range due to larger populations within these income quintiles. The broadest group is U5 representing incomes from between $87,534 and $406,531 in 2009. 7,089 of mothers in the study were screened as having Aboriginal status representing 9.86% of the sample. This is similar to rates reported in the 2006 census, which identified 10.2% of Winnipeg's population with an Aboriginal identity (City of Winnipeg & Statistics Canada, 2006). Rates of congenital anomaly were not significantly different in the sample between the Aboriginal and non-Aboriginal populations, with approximately 4.04% of each population experiencing a congenital anomaly. The present study sample with incomplete screens were slightly more likely to have a congenital anomaly (4.34% had a congenital anomaly) although not statistically significant.

Table 8

Independent Variable Representation in Study Population

Independent Variables	Sample Representation	
	N	%
Low Education	8,978	12.5%
Aboriginal Status	7,089	9.86%
Maternal History of Child Abuse	2,355	3.28%
Isolation	1,866	2.6%
Relationship Distress	2,976	4.14%
Lone Parent	8,354	11.63%
Multiple Birth	1,581	2.2%

Due to the small mortality sample size that was linkable to the BabyFirst and FamilyFirst screens a number of the indicators were suppressed. 62.82% of the infant mortalities within this sample occurred within the first nine days following delivery, similar to the population as a whole where approximately 60.65% of infant mortalities occur within the first nine days of life. Within the present study the top reasons for infant mortality were SIDS and extreme immaturity. Other leading causes were ill-defined, bacterial sepsis, newborn asphyxia, congenital anomaly and accidental suffocation. The sample population that experienced mortality did not significantly differ from the overall population on any of the independent variables. Further research using a larger sample can provide a representative depiction to demonstrate the similarities and unique experiences of these mothers and infants. 41.7% of the infant mortalities occurred in children with a diagnosed congenital anomaly. Infant mortalities were also more likely to occur if the infant did not have a hospital readmission, with 8.7% of infants with a mortality readmitted to the hospital.

Newborn readmissions are classified as hospital readmissions between days 1-28 following birth, which included a sample of 7,412 infants. Proportionally, a larger percentage of newborns with readmissions were diagnosed with a congenital anomaly than the overall sample (484 infants or 16.1%). Approximately, 0.2% of infant mortalities occurred to infants with a newborn readmission. The leading causes of infant newborn hospital readmission were development, conditions originating in the perinatal period, ill-defined, congenital anomaly and infection. Within the study sample, 209 infants were screened as having a congenital anomaly that were not captured in diagnostic data. Differences in the number of congenital anomalies in BFS and FFS data could be due to misunderstanding the term ‘congenital anomaly’ or that these children’s diagnosis was missing from the sample. Proportionally, the socioeconomic context of infants with a newborn readmission was similar to the context of the overall study sample. Proportional rates of geography and income levels were not different than the general study sample. BFS and FFS data provided information on the social context of infants who had a newborn readmission with 3.3% of mothers previously experiencing child abuse, 11.6% holding less than a grade 12 education (12.5% in general sample), 2.2% living in isolation, 4.2% experiencing relationship distress, 10.7% lone parents (11.6% in general) and 1.8% from multiple births (2.2% in general). The sample of newborn readmissions had slightly more male infants’ then female, 52% vs 48% respectively.

Post-neonatal hospital readmissions included any hospital readmission where the infant's first admission following birth was between days 29 and 365 of life. In total there were 2,636 post-neonatal hospital readmissions in the study sample. The top reason for post-neonatal hospital readmissions were communicable disease, respiratory infection, infection, and skin and subcutaneous tissue. Children with a post-neonatal mortality were not at an increased risk for mortality or congenital anomalies. Infant mortalities were more likely to occur among infants within the neonatal stage of life. Infants diagnosed with a congenital anomaly were likely to have been admitted to the hospital within the neonatal time period. Post-neonatal hospital readmissions are expected to differ from newborn hospital readmissions due to differences related to causes of hospital readmissions. Post-neonatal hospital readmissions and mortalities are often attributed to socioeconomic causes instead of perinatal origins. In the study sample the post-neonatal hospital readmissions were more likely to be attributed to households within the lowest income quintile and from communities with the poorest health status.

Table 9

Geography of Post-Neonatal Sample

N = 2,636

Sample	Winnipeg Community Cluster (proportional rates)			
	Poor health status	Poor-mid health status	Mid to high health status	High health status
Post-Neonatal	33%	26%	21.6%	19.1%
Study Population	28.4%	29.5%	20.1%	21.9%

Table 10

Income of Post-Neonatal Sample

N = 2,636

Sample	Income Quintile (proportional rates)				
	U1	U2	U3	U4	U5
Post-Neonatal	34%	19.4%	16.8%	14.9%	14.3%
Study Population	31.8%	18.3%	16.5%	17.3%	16.1%

Socioeconomic experiences of infants with a post-neonatal hospital readmission were different in relation to education level of parents (13.4% post-neonatal sample has low education vs. 12.5% general sample has low education) and rates of maternal history of child abuse (4.3% post-neonatal parents vs. 3.3% general sample). Infants with a post-neonatal hospital readmission experience similar levels of social support to the general sample (i.e., lone parents 11.8%, relationship distress 4.2%, and isolation 2.2%). There were lower rates of plurity at birth among the sample of infants with a post-neonatal hospital readmission (1.2% vs. 2.2%). Interestingly, there was a higher rate of female infants (51.1%) admitted to the hospital post-neonatally compared to males (48.9%) despite the higher rates of male infants in the sample and among the other subsample populations (newborn hospital readmission, hospital readmission and congenital anomaly).

Infant morbidity was recorded as a hospital readmission that occurred from day 1 to 365 of an infant’s life, creating a morbidity sample of 10,048 infants. 8.7% of infants who died had a hospital readmission, the majority of infant mortalities occurred in infants who were not readmitted to the hospital. Of those infants who were readmitted to the hospital 0.2% died. Infants with a hospital readmission were not proportionally different from the general sample in relation to geography or income. BFS and FFS data provided descriptive information of mothers who had an infant with a hospital readmission in the first year of life. Proportionally, there were some differences between infants hospitalized in the first year and the general study sample: 5.5% had a congenital anomaly compared to 4.1% in the general sample, and 2.9% had a reported illness shortly after birth compared to 2.1%. Maternal socioeconomic factors among infants with a hospitalization in the first year of life were similar to the general sample. Approximately, 3.6% of mothers experienced child abuse when they were children compared to 3.3% and 12.1% had less than a grade 12 education compared to 12.2%. Infants hospitalized in the first year of life had similar levels of lone parents (11% vs 11.6%), relationship distress (4.2% vs 4.1%) and isolation (2.2% vs. 2.6%) compared to the general study sample. Multiples were less likely to be hospitalized in their first year of life accounting for 1.6% of the hospital readmissions but approximately 2.2% of the general sample. The likelihood of hospitalization did not seem to be impacted by an infants' sex, given that there were similar rates of male infants admitted to the hospital within the first year of life (51.2%) compared to the general sample (51%).

For the purposes of the present study, disability was recorded through hospital and physician diagnosis of a congenital anomaly within the first year of life. There were 3,008 infants with a congenital anomaly in this study. Infants diagnosed with a congenital anomaly were significantly more likely to have maternal self-reported illness 9.1% vs 2.1%. Of the infants with a congenital anomaly 14.8% were diagnosed shortly after birth, according to maternal self-reported data. The mortality rate for infants with a congenital anomaly is significantly higher with 106 mortalities. Approximately 3.5% of infants with a congenital anomaly died compared to 0.35% of the general sample. 18.5% of infants with a congenital anomaly were readmitted to the hospital, the majority, 16.1%, had a newborn readmission. Infants with a congenital anomaly were proportionally similar to the general sample in terms of geography and income. Rates for maternal history of child abuse (3.7%), low education (11.8%), relationship distress (4.1%), isolation (2.5%) and multiple births (2.5%) were similar to the general sample. Infants with a congenital anomaly were less likely to live in a lone parent family compared to the general sample (9.9% vs. 11.6%, respectively). There was a larger representation of males in the congenital anomaly sample then females, 56.6% compared to 43.4% respectively. Whereas, in the general population the proportion of males to females was very similar 51.2% compared to 48.8%, respectively.

Analysis. The thesis examined three outcome variables with seven risk factors and two confounding variables to determine associations and risk. Table 4 provides information on each of the variables that were assessed. Statistical Analysis Software (SAS), a statistical software package, was used to build the datasets, and for analyzing data and determining variable relationships. Manitoba Centre for Health Policy provides a secure network that holds all data. SAS is used by MCHP to enable researchers to analyze data. SAS code was used to determine chi-square associations and logistic regressions. The SAS system provided the data results and information on model fit. Analyzing the socioeconomic risk factors in relation to the outcome variables, mortality, morbidity and disability within the SAS system ensured that anonymity was respected, provided important information on the relationships between each of the seven risk factors with each of the outcome variables, assessed the impact of risk factors in relation to other risk factors on each independent variable, and provided important data and result descriptives.

Bivariate Analysis. The Chi-square test was introduced by K. Pearson in 1900. The chi-square test is used to determine significant differences between categorical variables, as is done in this study. It was used to demonstrate variable relationships prior to the logistic regression analysis. This test operates under three assumptions, (1) random assignment; (2) large sample size; and (3) that no more than 20% of the expected values are smaller than five and no cells are equal to zero. A Chi-Square test applied to a small sample can produce type II errors - the acceptance of the null hypothesis when actually false. There is no acceptable sample size limit, with minimum sample sizes ranging from 20-50 participants (Bolboacă, Jäntschi, Sestraş, Sestraş & Pamfil, 2011).

The Fisher Exact Test modified from the chi-square test decreased the degree of freedom by one unit when applied to contingency tables and took into account the number of unknown parameters associated with the theoretical distribution. The Fisher Exact Test is applied when more than 20% of the expected values are smaller than five and/or at least one cell is equal to zero. Within this study the Fisher Exact Test was utilized to assess infant mortality, which had a sample of 425. The small mortality sample led to small numbers within some of the income and geography groups. Income group U5 was represented by only 49 infants. And some community clusters were represented by as few as 30 infants. The population-based nature of the study permitted the use of the Chi-Square test in the majority of the study (Bolboacă, Jäntschi, Sestraş, Sestraş & Pamfil, 2011). The Chi-square test only partially completes the data analysis, because it does not provide any indication of the degree or strength of association among variables in a contingency chart (Bohannon, 1986). Within the present study a database was created for each of the outcome measures representing their unique relationships with the risk factors. Statistical significance was assessed at an alpha of .05 with phi coefficient used to demonstrate relationship direction.

Logistic Regression Analysis. A logistic regression statistical modeling technique was utilized to predict infant health outcomes (i.e. mortality, morbidity and congenital anomaly) according to maternal circumstances. Logistic regression determines the likelihood of a yes/no outcome given certain individual or regional characteristics by generating adjusted odds ratios. As noted the outcomes were dichotomous, and the predictors were coded the same. A logistic regression model was used to assess the contribution of the socioeconomic factors on infant mortality, morbidity and disability outcomes, while accounting for other contributing factors (i.e., geography, multiple births and sex of the child). A simultaneous standard method of entry was used, with all independent variables entered into the equation at the same time. Each predictor was assessed as though it were entered after all the other independent variables, determining its ability to predict the dependent variable when considering all other inputted variables.

The odds ratio obtained from the logistic regression model indicates the likelihood of infant mortality, morbidity or disability. An odds ratio that does not contain 1 within its confidence limits and has an alpha of less than .05 signifies a greater (above 1) or lesser (below 1) odds of event occurrence. If the odds ratio or its confidence interval contains 1 than the characteristic being measured does not have a statistically significant effect on the outcome after controlling for the effect of other variables. Utilizing the logistic regression statistical modeling technique associations were assessed between maternal circumstances and infant health outcomes independent of other contributing factors enhancing our knowledge of associations between the social determinants and infant health (Debanne & Rowland, 2002; LaValley, 2008).

Chapter 5: Results

Bivariate Analysis. Many of the variables in the study were related in the chi-square analyses. Sex was unrelated to any other independent variable in the sample. Multiple birth was unrelated to the majority of the independent variables in the study, other than income and relationship distress.

Congenital anomaly was associated with hospital readmissions, newborn hospital readmissions and post-neonatal hospital readmissions. Infant mortality in the first year of life was also associated with congenital anomaly and hospital readmissions. Newborn hospital readmissions were related to mortality, although post-neonatal hospital readmission were not significantly associated with mortality rates.

Maternal socioeconomic factors were associated with infant morbidity and congenital anomaly. When assessing data, analyses compared ‘no’ responses to ‘yes’ responses in the BabyFirst and FamilyFirst screens. Morbidity was assessed as newborn hospital readmission, post-neonatal hospital readmission and hospital readmission, each had a different relationship with maternal socioeconomic factors. Newborn hospital readmission rates were associated with maternal history of child abuse, lone parent and relationship distress. Post-neonatal hospital readmissions were statistically significantly related to Winnipeg Community Cluster, low education and maternal history of child abuse. There was less than a 1% probability that post-neonatal hospital readmissions were not related to income and multiple birth. There was less than a 5% probability that post-neonatal hospital readmissions were not related to lone parent, relationship distress and sex. Among post-neonatal hospital readmissions there was a higher probability of female infant readmission. Hospital readmissions were significantly associated with a variety of independent variables, namely geography, low education, maternal history of child abuse, lone parents and relationship distress. Income was also a significant factor in hospital readmissions. Congenital anomalies were significantly more common among males and two parent families.

Table 11

Chi-Square Associations

N = 71,829

Outcome Measure	Variable	R	Pr
Newborn hospital readmission N=7,412	Geography	.0079	.2122
	Income	.0062	.6050
	Low education	.0003	.9446
	Maternal history of child abuse	.0268	<.0001
	Lone parent	.0244	<.0001
	Relationship distress	.0296	<.0001
	Isolation	.0069	.1521
	Multiple birth	.0049	.3067
	Sex	-.0065	.0805
Post-Neonatal hospital readmission N=2,636	Geography	.0244	<.0001
	Income	.0173	.0002
	Low education	.0228	<.0001
	Maternal history of child abuse	.0291	<.0001
	Lone parent	.0117	.0127
	Relationship distress	.0129	.0141
	Isolation	-.0000	.9929
	Multiple birth	-.0143	.0026
	Sex	.0087	.0195
Hospital Readmission N=10,048	Geography	.0159	.0004
	Income	.0124	.0271
	Low education	.0122	.0064
	Maternal history of child abuse	.0393	<.0001
	Lone parent	.0275	<.0001
	Relationship distress	.0327	<.0001
	Isolation	.0059	.2181
	Multiple birth	-.0040	.4025
	Sex	-.0010	.7902
Congenital Anomaly N=3,008	Geography	.0027	.9168
	Income	.0078	.3639

	Low education	.0003	.9483
	Maternal history of child abuse	.0111	.0791
	Lone parent	-.0100	.0316
	Relationship distress	.0028	.5984
	Isolation	.0020	.6826
	Multiple birth	.0062	.1890
	Sex	-.0229	<.0001
Note. Significant at the p<0.05 level.			

Logistic Regression. Following the analyses of independent relationships between independent variables and dependent variables, the logistic regression considered the interrelationship between independent variables against the dependent variable.

Newborn Hospital Readmission. In a logistic regression including geography, income and education none were found to be significant predictors of newborn hospital readmission. The -2 Log L for model fit was 31,691.027. The strongest logistic regression model completed for newborn hospital readmissions (- Log L = 12,293.284) included nine independent variables (all of the studies independent variables). According to the logistic regression two independent variables were related to increased rates of newborn readmission: low education and multiple birth. Newborn hospital readmission rates are 1.2 times higher among infants with a mother with an education level above grade 12 and 1.5 times higher if not from a multiple birth.

Table 12

Adjusted Odds Ratio of Newborn Hospital Readmissions
N=22,313

Risk Factor	Pr	B	95% CI	
Community 1 vs 4	.29	.917	.78	1.078
Community 2 vs 4	.31	.926	.798	1.075
Community 3 vs 4	.98	.998	.857	1.163
Income U1 vs U5	.24	1.112	9.31	1.328
Income U2 vs U5	.93	1.008	.843	1.204
Income U3 vs U5	.83	.980	.821	1.171
Income U4 vs U5	.68	.964	.811	1.145

Low education 0 vs 1	.03	1.201	1.023	1.411
Maternal Child Abuse 0 vs 1	.38	.914	.747	1.117
Lone Parent 0 vs 1	.31	1.096	.919	1.306
Relationship Distress 0 vs 1	.85	.976	.762	1.250
Isolation 0 vs 1	.95	1.008	.778	1.305
Multiple Birth 0 vs 1	.03	1.488	1.032	2.145
Sex 1 vs 2	.14	1.077	.977	1.187
Note. Significance at the $p<0.05$ level.				

Post-Neonatal Hospital Readmission. The post-neonatal hospital readmission logistic regression for geography, income and education found geography (Winnipeg Community Area 1 vs 4 and 3 vs 4) and low education to have less than a 1% probability that they were unrelated to readmissions. Winnipeg Community Cluster 1 was 1.3 times more likely and Winnipeg Community Cluster 3 was 1.4 times more likely to experience hospital readmission then Winnipeg Community Cluster 4. The -2 Log L for model fit was 13,787.835. These results changed with the addition of social variables into the model. The strongest logistic regression model completed for post-neonatal hospital readmissions included nine independent variables (all of the studies independent variables). The -2 Log L for model fit was 6,164.941. According to the logistic regression three independent variables were related to increased rates of post-neonatal hospital readmission: Winnipeg Community Area (cluster 3 vs. cluster 4), maternal history of child abuse and relationship distress. There was 95% probability that infants in Winnipeg Community Area 3 were 1.3 times more likely to have a post-neonatal hospital readmission. There was less than a 1% probability that families with maternal history of child abuse were more likely to have a post-neonatal hospital readmissions. There was a less than a 1% probability that relationship distress was unrelated to post-neonatal hospital readmissions.

Table 13

Adjusted Odds Ratio of Post-Neonatal Hospital Readmissions
N=22,313

Risk Factor	Pr	B	95% CI	
Community 1 vs 4	.79	1.036	.800	.1343
Community 2 vs 4	.81	1.031	.806	1.318
Community 3 vs 4	.02	1.329	1.040	1.698
Income U1 vs U5	.16	1.229	.925	1.633
Income U2 vs U5	.57	1.087	.815	1.449
Income U3 vs U5	.55	1.091	.818	1.455
Income U4 vs U5	.94	.989	.743	1.316
Low education 0 vs 1	.53	.929	.740	1.167
Maternal Child Abuse 0 vs 1	.01	.701	.539	.913
Lone Parent 0 vs 1	.70	.953	.744	1.221
Relationship Distress 0 vs 1	.02	.683	.498	.936
Isolation 0 vs 1	.15	1.361	.897	2.064
Multiple Birth 0 vs 1	.11	1.626	.890	2.969
Sex 1 vs 2	.07	.868	.746	1.010

Note. Significant at the p<0.05 level.

Hospital Readmissions. In the hospital readmission logistic regression including geography, income and education, geography (Winnipeg Community Area 3 vs 4) and low education were significant predictors of hospital readmission. The -2 Log L for model fit was 38,129.919. After considering all of the independent variables (geography, income, education, maternal history of child abuse, lone parent, relationship distress, isolation, multiple births and sex) the logistic regression of hospital readmission found maternal history of child abuse and multiple birth to be significantly related to hospital readmission rates. The -2 Log L for the model was 15,443.109 stronger than any of the other models. There was less than a 2% probability that maternal history of child abuse was not related to hospital readmissions. Mothers who experienced child abuse were more likely to have a hospital readmission. Singleton births were 1.5 times more likely to be admitted to the hospital.

Table 14

Adjusted Odds Ratio of Hospital Readmissions
N=22,313

Risk Factor	Pr	B	95% CI	
Community 1 vs 4	.42	.944	.820	1.086
Community 2 vs 4	.44	.950	.834	1.082
Community 3 vs 4	.22	1.087	.952	1.241
Income U1 vs U5	.08	1.150	.986	1.342
Income U2 vs U5	.71	1.030	.882	1.202
Income U3 vs U5	.90	1.010	.865	1.179
Income U4 vs U5	.69	.969	.834	1.127
Low education 0 vs 1	.13	1.111	.971	1.271
Maternal Child Abuse 0 vs 1	.02	.824	.698	.971
Lone Parent 0 vs 1	.52	1.050	.906	1.216
Relationship Distress 0 vs 1	.11	.849	.695	1.038
Isolation 0 vs 1	.38	1.107	.884	1.386
Multiple Birth 0 vs 1	.01	1.551	1.129	2.130
Sex 1 vs 2	.80	1.011	.929	1.099

Note. Significant at the $p<0.05$ level.

Congenital Anomaly. When assessing congenital anomalies two variables were significantly related in independent chi square analysis, lone parent and sex. In the logistic regression these same variables continued to be significant. Sex was the strongest factor. Males were 1.2 times more likely to have a congenital anomaly. Infants in two parent families were 1.3 times more likely to have a congenital anomaly. These results were obtained from the strongest logistic regression model containing variables: geography, income, low education, maternal history of child abuse, lone parents, relationship distress, isolation, multiple births and sex and with a model fit: -2 Log L = 7,412.043. A logistic regression model (-2 Log L = 16,729.307) for congenital anomaly was run with independent variables geography, income and education, none were found to be predictive of congenital anomaly.

The model was strengthened by adding the additional socioeconomic variables to conclude that two parent family status and sex are predictive of congenital anomaly.

Table 15

Adjusted Odds Ratio of Congenital Anomaly
N=22,313

Risk Factor	Pr	B	95% CI	
Community 1 vs 4	.55	.933	.744	1.171
Community 2 vs 4	.99	1.001	.814	1.233
Community 3 vs 4	.64	1.052	.850	1.303
Income U1 vs U5	.68	1.054	.824	1.348
Income U2 vs U5	.96	1.006	.787	1.286
Income U3 vs U5	.99	1.000	.784	1.276
Income U4 vs U5	.28	.874	.686	1.114
Low education	.32	.898	.726	1.111
Maternal Child Abuse	.54	.918	.699	1.205
Lone Parent	.01	1.385	1.079	1.776
Relationship Distress	.25	.823	.590	1.147
Isolation	.60	1.105	.765	1.597
Multiple Birth	.83	.954	.625	1.457
Sex	.00	1.257	1.098	1.440

Note. Significant at the $p<0.05$ level.

Secondary Analysis. Due to the low response rate on some variables of the BabyFirst and FamilyFirst screens, an additional analysis was performed to assess differences between ‘yes’ and a combined grouping of ‘no’ and missing items. Prior analysis was conducted to determine that the missing items group did not significantly differ on key variables such as geography, income, education, Aboriginal status or sex. The combined ‘no’ and missing items group was prepared for the independent variables low education, maternal history of child abuse, lone parent, relationship distress, isolation and multiple births. The independent variables geography, income and sex were complete variables as was the health administrative data utilized to capture the dependent variables: newborn readmission, post-neonatal hospital readmission, hospital readmission and congenital anomaly, therefore they did not require such a merger.

Bivariate Analysis. Similar to the original analysis the majority of the variables were found to be significantly related. The exception was for independent variables multiple birth and sex, which were unrelated to any of the independent variables. When assessing the study independent variables against the dependent variables (newborn readmission, post-neonatal hospital readmission, hospital readmission and congenital anomaly) a variety of relationships were found, some similar and some different from the original analysis.

In the original analysis newborn readmission rates were found to be associated with maternal history of child abuse, lone parent and relationship distress. In the secondary analysis lone parent continued to be significant but maternal history of child abuse and relationship distress were no longer significant. Low education, isolation and multiple births were also associated with newborn hospital readmission rates.

In the original analysis, the following variables were associated with post-neonatal hospital readmission: low education, lone parent, relationship distress, geography, income, sex, multiple birth and maternal history of child abuse. With the addition of the missing item group, we found the following. Low education, lone parent and relationship distress were no longer significantly associated with post-neonatal hospital readmissions. Geography and income maintained its strong significant relationships. Sex also maintained a 1% probability that it was not related to post-neonatal hospital readmissions. Multiple births was found to have a strengthened relationship with post-neonatal hospital readmissions. Maternal history of child abuse maintained a high significant relationship with post-neonatal hospital readmissions.

The original analysis of hospital readmission found six independent variables to be correlated with hospital admission rates: geography, income, low education, maternal history of child abuse, lone parent and relationship distress. The secondary analysis found that geography, income, isolation and multiple births predicted hospital readmission. In the secondary analysis a strong significant association was found between hospital readmission rates and multiple birth. The secondary analysis also found that there is less then a 5% probability that isolation is unrelated to hospital readmission rates.

Lone parent and sex were the leading predictors of congenital anomalies in both the original and secondary analyses. The addition of the missing items group did not impact the significant relationship between congenital anomaly and sex, and strengthened the relationship between lone parent families and congenital anomalies.

Table 16

Second Analysis of Chi-Square Association

Outcome Measure	Variable	First Analysis		Second Analysis (inclusion of missing items)	
		R	Pr	R	Pr
Newborn hospital readmission N=7412	Geography	.0079	.2122	.0079	.2122
	Income	.0062	.6050	.0062	.6050
	Low education	.0003	.9446	-.0088	.0188
	Maternal history of child abuse	.0268	<.0001	.0003	.9444
	Lone parent	.0244	<.0001	-.0096	.0104
	Relationship distress	.0296	<.0001	.0011	.7612
	Isolation	.0069	.1521	-.0076	.0408
	Multiple birth	.0049	.3067	-.0091	.0149
	Sex	-.0065	.0805	-.0065	.0805
Post-Neonatal hospital readmission N=2,636	Geography	.0244	<.0001	.0244	<.0001
	Income	.0173	.0002	.0173	.0002
	Low education	.0228	<.0001	.0055	.1406
	Maternal	.0291	<.0001	.0115	.0021

	history of child abuse				
	Lone parent	.0117	.0127	.0010	.7828
	Relationship distress	.0129	.0141	.0010	.7806
	Isolation	-.0000	.9929	-.0049	.1914
	Multiple birth	-.0143	.0026	-.0136	.0003
	Sex	.0087	.0195	.0087	.0195
Hospital Readmission N=10,048	Geography	.0159	.0004	.0159	.0004
	Income	.0124	.0271	.0124	.0271
	Low education	.0122	.0064	-.0047	.2070
	Maternal history of child abuse	.0393	<.0001	.0064	.0841
	Lone parent	.0275	<.0001	-.0078	.0360
	Relationship distress	.0327	<.0001	.0016	.6763
	Isolation	.0059	.2181	-.0093	.0123
	Multiple birth	-.0040	.4025	-.0154	<.0001
	Sex	-.0010	.7902	-.0010	.7902
Congenital Anomaly N=3,008	Geography	.0027	.9168	.0027	.9168
	Income	.0078	.3639	.0078	.3639
	Low education	.0003	.9483	-.0040	.2861
	Maternal history of child abuse	.0111	.0791	.0048	.1950
	Lone parent	-.0100	.0316	-.0110	.0032
	Relationship distress	.0028	.5984	-.0006	.8800
	Isolation	.0020	.6826	-.0009	.8025
	Multiple birth	.0062	.1890	.0037	.3221
	Sex	-.0229	<.0001	-.0229	<.0001
Note. Significant at the p<0.05 level.					

Logistic Regression. The addition of the missing item group strengthened some variables and impacted levels of significance.

Newborn Hospital Readmission. The overall model for the secondary analysis was not as strong as the original analysis with a -2 Log L of 47,621.228 compared to 12,293.284. The secondary newborn hospital readmission logistic regression continued to highlight the 1.2 times increased risk of readmission if the infant was not from a multiple birth. Low education was no longer a significant predictor of newborn hospital readmissions in the secondary analysis. Instead lone parent families and isolation became the highlighted factors. Both lone parent and isolation had less than a 5% probability of being unrelated to newborn hospital readmission rates with a 1.1 times heightened risk.

Table 17

Adjusted Odds Ratio for Newborn Hospital Readmissions
N=71,774

Risk Factor	Pr	B	95% CI	
Community 1 vs 4	.53	.975	.903	1.054
Community 2 vs 4	.55	.979	.912	1.050
Community 3 vs 4	.22	1.047	.972	1.128
Income U1 vs U5	.06	1.085	.995	1.183
Income U2 vs U5	.07	1.085	.995	1.183
Income U3 vs U5	.17	1.062	.974	1.158
Income U4 vs U5	.32	1.044	.959	1.136
Low Education	.12	1.071	.982	1.168
Maternal History of Child Abuse	.45	.947	.822	1.091
Lone Parent	.03	1.105	1.008	1.211
Relationship Distress	.17	.913	.802	1.040
Isolation	.05	1.178	1.000	1.387
Multiple Birth	.02	1.247	1.043	1.491
Sex	.08	1.044	.955	1.095

Note. Significant at the $p<0.05$ level.

Post-Neonatal Hospital Readmission. The -2 Log L in the secondary analysis for post-neonatal hospital readmissions was 22,492.584 suggesting strength in the original analysis which had a -2 Log L of 6,164.941. Post-neonatal hospital readmission rates in the original and secondary analysis both found geography and maternal history of child abuse to be significant predictors of readmission. Relationship distress was no longer a significant predictor of readmission in the secondary analysis instead multiple births and sex were significant. Infants in

Winnipeg Community Cluster 1 or 3 were 1.2 times more likely to experience a post-neonatal hospital readmission then those in Winnipeg Community Cluster 4. Maternal history of child abuse increased the rate of post-neonatal hospital readmission. Infants not from a multiple birth were 1.9 times more likely to have a readmission. Females were more likely to be admitted post-neonatal.

Table 18

Adjusted Odds Ratio for Post-Neonatal Hospital Readmissions
N=71,774

Risk Factor	Pr	B	95% CI	
Community 1 vs 4	.00	1.257	1.108	1.426
Community 2 vs 4	.82	.986	.874	1.113
Community 3 vs 4	.00	1.212	1.071	1.371
Income U1 vs U5	.09	1.132	.982	1.306
Income U2 vs U5	.08	1.138	.987	1.314
Income U3 vs U5	.10	1.129	.978	1.304
Income U4 vs U5	.72	.973	.842	1.125
Low education	.90	1.009	.882	1.154
Maternal History of Child Abuse	.01	.763	.622	.935
Lone Parent	.21	1.095	.949	1.263
Relationship Distress	.91	.988	.802	1.218
Isolation	.09	1.262	.965	1.650
Multiple Birth	.00	1.915	1.339	2.739
Sex	.02	.910	.842	.984

Note. Significant at the p<0.05 level.

Hospital Readmission. The logistic regression model for hospital readmission rates in the first year was not strengthened by the addition of the missing item group with a -2 Log L of 58,024.885 compared to the -2 Log L for the original analysis of 15,443.109. The original logistic regression reported maternal history of child abuse and multiple births as significant predictors of readmission rates. These two variables continued to be significant, in addition to geography, income, lone parent families and isolation. Multiple birth was the strongest predictor of hospital readmission, infants not from a multiple birth had a 1.4 times higher rate of readmission. Maternal history of child abuse increased the risk of hospital readmission among infants. Winnipeg Community Cluster 3 was at slight increased risk of hospital readmission compared to Winnipeg Community Cluster 4. Income quintiles U1, U2 and U3 were at a significantly higher risk of hospital readmission then U5. Social support variables lone parent and isolation were significant predictors of hospital readmission. Lone parents were 1.1 times more likely to have a hospital readmission. Isolated mothers were 1.2 times more likely to have an infant with a hospital readmission.

Table 19

Adjusted Odds Ratio for Hospital Readmissions
N=71,774

Risk Factor	Pr	B	95% CI	
Community 1 vs 4	.16	1.050	.981	1.124
Community 2 vs 4	.51	.979	.920	1.042
Community 3 vs 4	.01	1.095	1.025	1.169
Income U1 vs U5	.01	1.104	1.023	1.191
Income U2 vs U5	.01	1.105	1.024	1.193
Income U3 vs U5	.38	1.085	1.005	1.171
Income U4 vs U5	.49	1.027	.952	1.107
Low Education	.16	1.056	.979	1.138
Maternal History of Child Abuse	.03	.878	.778	.991
Lone Parent	.01	1.109	1.024	1.201
Relationship Distress	.21	.930	.830	1.042
Isolation	.01	1.214	1.052	1.401
Multiple Birth	<.0001	1.401	1.191	1.648
Sex	.81	1.005	.964	1.049

Note. Significant at the p<0.05 level.

Congenital Anomaly. The secondary analysis of diagnosed congenital anomalies continued to support original findings for the first logistic regression with lone parent and sex being the two factors related to diagnosis. The model fit was not as strong as the previously discussed model with a -2 Log L of 24,906.840 (original model 7,412.043). Male infants and infants from two parent families were both 1.2 times more likely to have a congenital anomaly.

Table 20

Adjusted Odds Ratio for Congenital Anomaly
N=71,774

Risk Factor	Pr	B	95% CI	
Community 1 vs 4	.70	.977	.869	1.099
Community 2 vs 4	.82	.988	.888	1.100
Community 3 vs 4	.67	1.025	.915	1.148
Income U1 vs U5	.11	1.114	.978	1.269
Income U2 vs U5	.21	1.087	.953	1.240
Income U3 vs U5	.29	1.074	.942	1.225
Income U4 vs U5	.53	.959	.842	1.093
Low Education	.57	1.038	.911	1.184
Maternal History of Child Abuse	.09	.838	.683	1.029
Lone Parent	.00	1.265	1.097	1.459
Relationship Distress	.53	.938	.769	1.146
Isolation	.78	1.034	.817	1.310
Multiple Birth	.30	.881	.696	1.117
Sex	<.0001	1.258	1.169	1.354

Note. Significant at the p<0.05 level.

Summary of Results. The population-based sample utilized for this study provided data on 71,829 infants born between 2000 and 2010. Within the collected sample five subsets were derived representing infants with a newborn readmission (N=7,412), infants with a post-neonatal hospital readmission (N=2,636), infants with a hospital readmission (N=10,048), infants with a diagnosed congenital anomaly (N=3,008) and infants with a mortality record (N=425). With the exception of the mortality dataset, study subsamples were proportionally equal in the representation of key variables, response rates and Aboriginal populations. Due to the limited socioeconomic data captured for infant mortalities we could not investigate this research question as any analysis would have breached security protocols and patient anonymity.

Newborn hospital readmission rates (1-28 days following birth) were independently associated with maternal history of child abuse, lone parent and relationship distress. Via logistic regression modeling, the first analysis provided the strongest model for discussion. Low education and multiple births were significantly associated with newborn hospital readmissions. The secondary analysis confirmed the impact of multiple births but suggested a stronger association with social contextual factors (lone parent and isolation) instead of education.

Post-neonatal hospital readmissions (29-265 days following birth) were predicted to be strongly related to socioeconomic variables. Associations were found with many of the independent variables: geography, income, low education, maternal history of child abuse, lone parent, relationship distress, multiple births and sex. The logistic regression modeling of the independent variables against post-neonatal readmission assisted in clarifying relationship strength. The strongest logistic regression model (original analysis) found geography, maternal history of child abuse and relationship distress to be leading variables in predicting post-neonatal hospital readmission. The secondary analysis continued to support the finding of geography and maternal history of child abuse but suggested that multiple births and sex instead of relationship distress were important contributing factors to readmission rates.

When assessing hospital readmissions in the first year of life, six variables were significantly independently associated to readmission rates: geography, income, low education, maternal history of child abuse, lone parent families and relationship distress. The logistic regression took into consideration all confounding and mitigating variables of the study to determine the variables with the strongest relationship to readmissions: maternal history of child abuse and multiple births. Low education and geography were significant factors in hospital readmissions when only considering education, income and geography. Upon adding the additional independent variables they were no longer predictors of readmission and instead multiple births and maternal history of child abuse were significant. In the secondary analysis, which included the missing item group geography, income, maternal history of child abuse, lone parent, isolation and multiple birth were found to be significant. Multiple births maintained the strongest relationship with hospital readmission rates throughout the analyses.

When assessing congenital anomalies two variables were significantly related in independent chi-square analysis: lone parent and sex. In the original and secondary logistic regression models these two variables continued to be significant. Males were 1.2 times more likely to have a congenital anomaly and two parent families are 1.2 times more likely to have an infant with a congenital anomaly.

Critical Analysis of Results. Sample response rates to some of the key variables may impact the interpretation of the findings. Grouping together the ‘no’ group and the missing item group’could sometimes imply a response when one was not provided. In addition some ‘yes’ codes may have been coded as ‘no’ impacting the results. The different findings from the original and secondary analysis in some of the logistic regressions demonstrated the impact of the sample on outcomes. The strongest model did not include the missing item group. Similarities in results between original and secondary analysis when assessing congenital anomalies strengthened study findings.

Chapter 6: Discussion

The infant mortality rate in Manitoba is higher than other Canadian province (Statistics Canada, 2012). Understanding the maternal infant circumstances surrounding birth and life in the first year can assist in understanding infant mortality, morbidity and congenital anomalies. Research on the social determinants of health suggests health inequalities begin prior to conception and are produced by environmental circumstances and conditions. An individual's personal, social, economic and environmental conditions and circumstances influence their health and wellbeing (PHAC, 2011; Whitehead, 2007). An infant's environment is shaped by its parents, family and community all of which impact the infant's current and future health and wellbeing (CSDH, 2008). Maternal socioeconomic factors are associated with infant health. An infant's social situation is related to rates of hospital readmission and congenital anomaly.

The study assessed 71,836 births in Winnipeg between 2000 and 2010, capturing a large population-based sample for analysis. Of the total sample, 10,048 infants (14%) were hospitalized within their first year of life and 3,008 infants (4%) were diagnosed with a congenital anomaly. The majority (73.7%) of the infants who were hospitalized within the first year of life had a newborn hospital readmission (within the first 28 days of life). Infant sex and multiple births were captured as confounding variables for this study due to their strong relationship with infant health outcomes (Canadian Institute for Health Information, 2009; PHAC, 2013). Approximately, 2.2% of the births between 2000 and 2010 in Winnipeg were multiples. The rate of multiple births has been increasing in developed countries, with recent Canadian rates estimating 3% of births are multiples (Canadian Institute for Health Information, 2009).

Summary of Findings.

Infant Health. Within this study many of the independent and dependent variables were interrelated. Relationships were found among the majority of the study variables. Infants with a congenital anomaly were more likely to also have a hospital readmission, newborn readmission or post-neonatal readmission than the general study sample. It is unclear if the diagnoses preceded the hospital readmissions or if the congenital anomaly was diagnosed due to increased medical assessment. Berry and colleges (2013) suggests that hospital readmission is associated with congenital anomaly, with variations related to hospital, condition, and the child's age. An infant death was more likely to occur to infants without a hospital readmission or newborn readmission. Wehby and colleges (2011) found that early pediatric care was associated with reduced neonatal hospitalization and birth defects. Improving access to early health care can improve infant health outcomes (Wehby, et al., 2011). In addition to the relationship between the dependent variables there were relationships between socioeconomic factors, and hospital readmission and congenital anomalies.

Morbidity. The present study aimed to describe the association between maternal socioeconomic variables of income, geography, education, maternal history of child abuse, relationship status and level of social support on infant morbidity in Winnipeg, Manitoba. Infant morbidity rates were assessed as hospital readmission, newborn readmission and post-neonatal readmission, with each producing different outcomes as described below. Findings were different with the inclusion of the missing item group within the second analysis. Conclusions are based on the strongest outcomes in the logistic regressions.

Hospital readmission. This study found that increases in hospital readmissions tend to be related to geography, income and social situation, all of which are related to health care access. Consistent with literature findings infants born to mothers with low income and/or residency in neighbourhoods of low socioeconomic status had higher rates of hospital readmissions (Martens & Derksen, 2002). Rates of infant morbidity and mortality are higher among the Aboriginal population who are more likely to be of low income and reside in low socioeconomic neighbourhoods (Janz, Seto, & Turner, 2009; Kettner, 2011; Luo, et al., 2010; Martens & Derksen, 2002; Smylie et al., 2010). The socioeconomic gradient of health describes the impact of low income on health (Brownell et al., 2003). The relationship between low income and geography, and health translates into the need for additional health services, as suggested by the study findings. Infants residing in low income urban areas are at an increased risk for low birth weight and prematurity, which are important indicators of early problems for newborn infants. Low income women are less likely to obtain prenatal care (Kettner, 2011; Luo et al., 2010). Low income single parents have higher rates of stress and lower gestational weight gain (PHAC, 2005). Poverty, stress and low gestational weight gain can lead to higher rates of prematurity and its short and long term consequences (Blenner, Hironaka, Vanderbilt, Frank, 2014).

This study found that infants from lone parents and/or isolated families were less likely to be admitted to the hospital within the first 28 days of life. Lone parents and isolated families experience difficulty in accessing health services; additional referrals and social support are required to increase program attendance (Ballantyne et al., 2014; Kettner, 2011; Luo et al., 2010; Wallby, Modin & Hjern, 2013;). Inequalities in access to resources among Aboriginal people have been related to increases in their higher rates of preventable mortality, morbidity and worse birth outcomes (ECDKN, 2007; Smylie et al., 2010). Hospital readmission rates were strongly related to multiple births. Singleton births were more likely to be admitted to the hospital. Infants from multiple births may be more likely to stay in the hospital following birth and therefore less likely to return to the hospital once they are released home (Escobar et al., 2005). Early pediatric care is associated with reduced neonatal hospitalization and birth defects (Wehby, et al., 2011).

The assessment of morbidity was further refined by examining differences in risk factors for hospital readmission associated with the age of the infant. Newborn hospital readmissions occur within the first 28 days of life. Newborn readmissions are often attributed to perinatal causes. Post-neonatal hospital readmission occurs between days 29 and 365 of life. Post-neonatal hospital readmissions are often attributed to the social determinants of health.

Newborn readmission. The study found a relationship between newborn readmission rates and independent socioeconomic variables demonstrating socioeconomic risk factors in addition to perinatal causes of infant morbidity. Social variables, as opposed to economic variables, have a significant relationship with newborn infant hospital readmission rates. As reported within the hospital readmission analysis infants from lone parent families were less likely to have a newborn hospital readmission. Similar to this study, other studies have demonstrated that lone parents experience increased barriers to accessing health services. Health supports and resources must be available to increase required access to health services (Wallby, Modin & Hjern, 2013; Ballantyne et al., 2014). Hospital readmission will improve health outcomes among newborn infants. The present study found that infant mortality was less likely to occur if the newborn infant had been admitted to the hospital. Resource access is linked to improved infant health outcomes (ECDKN, 2007; Smylie et al., 2010; Wehby, et al., 2011). Infants admitted to the hospital as a newborn are largely singleton births. Prolonged health care contact reduces the risk of newborn infant hospital readmission.

The study found that infants admitted within the first 28 days of life were more likely to be born to parents with at least a high school diploma. This appears in contrast to other global research on maternal education, which demonstrates increased rates of mortality and morbidity among low educated mothers (CSDH, 2008; Gage, Fang, O'neill & Dirienzo, 2013). Newborn readmissions in developed countries are commonly related to feeding difficulty and jaundice (Barber, 2013). Infants with a neonatal morbidity are more likely to be firstborn, breastfeed at discharge, and/or have labour and delivery complications (Shapiro-Mendoza, et al., 2006). Feedings practices, labour and delivery complications, and health knowledge may be confounding variables in the relationship between higher education and increased newborn hospital readmission. The protective effect of maternal education on infant health is related to the socio-economic environment, as such the effect of maternal education appears smaller in wealthier areas (Dargent-Molina et al., 1994).

Post-neonatal readmission. The present study suggested that an infant’s social environment is related to post-neonatal hospital readmission. Rates of low social support, relationship distress and lone parent captured in this study were around 3% to 12%. Mothers with a history of child abuse were more likely to have an infant with a post-neonatal hospital readmission. Maternal history of child abuse is associated with increased use of an authoritarian parenting style which can lead to behavioral and emotional problems in their children (Schwerdtfeger, Larzelere, Werner, Peters & Oliver, 2013). The present study also found an association between relationship distress and increases in post-neonatal hospital readmissions. Relationship distress, assessed as intimate partner violence in the literature, produces higher rates of maternal depression (Ogbonnaya, Macy, Kupper, Martin, Bledsoe-Mansori, 2013). Child and infant health is correlated with maternal depression rates (Black, Baqui, Zaman, Arifeen & Black, 2009; Turney, 2013).

Infants residing in low income and/or neighbourhoods characterized with low socioeconomic status are more likely to have a post-neonatal hospital readmission. Poverty and its associated stressors disproportionately produce higher rates of low birth weight and prematurity, both important indicators of infant health outcomes (Blenner, Hironaka, Vanderbilt, Frank, 2014; Kettner, 2011; Luo et al., 2010). Improved socioeconomic conditions and obtainment of perinatal and infant care are expected to improve health outcomes (Luo, et al., 2010; Simonet, et al., 2010).

Interpretation. Despite outcomes differences when the missing item group was included, the present study consistently found that social variables, maternal history of child abuse, lone parent, and isolation were associated with infant hospital readmissions. There appear to be barriers to health care access in relation to the hospital readmission subsample. Infants with a newborn readmission had mothers with a strong social support system and higher education as compared to infants with a post-neonatal hospital readmission. Limited social supports, education, geography and income all seemed to impact hospital access and/or the health of the post-neonatal infant (Luo et al., 2010; Smylie et al., 2010). Infants from a multiple birth have lower rates of hospital readmission. Infants from a multiple birth may have a decreased risk of readmission to the hospital due to their longer stay following delivery (Escobar et al., 2005).

Surprisingly, within the present study mothers with a higher education were more likely to have an infant with a hospital readmission. The higher rate of newborn readmission among infants born to mothers with at least a high school education may have been related to protective factor such as increased parental knowledge, or enhanced advocacy skills. Protective factors such as social support or income among mothers with at least a high school education can improve the ability to access services and/or improve knowledge related to newborn care (Barber, 2013).

Maternal education can increase health knowledge contributing to increased ability to notice symptoms that warrant a hospitalization and/or increased ability to advocate for health care services. Future research further analyzing this relationship by differentiatinge between level of education and infant health outcomes is needed.

***Congenital Anomaly*.** The present study aimed to describe the association between maternal socioeconomic variables of income, geography, education, history of child abuse, relationship status and level of social support on the rate of diagnosed congenital anomaly among infants in Winnipeg, Manitoba. Infants with a diagnosed congenital anomaly had proportionally higher rates of mortality, and BFS and FFS reported illnesses. Consistent between analyses lone parent status and infant sex were associated with congenital anomaly. The inclusion of the missing item group strengthened these findings. Infants with congenital anomalies were 1.2 times less likely to live in a lone parent family and 1.2 times more likely to be male. Rates of congenital anomaly may be related to the mitigating factor of parent age. Parental age increased the rate of congenital anomaly and decreases the risk of being a single parent (Materna-Kiryluk, et al., 2009).

Limitations. Case-control studies are relatively inexpensive but results are difficult to interpret due to the possibility of selection bias or that the risk factor did not precede the disease/condition. The major limitations of a case-control study are: the inability to determine absolute risk of the outcome, reliance on records to determine exposure status, confounders, difficult selection of control group, potential selection/recall bias and inability to calculate relative risk (Silva, 1999; Mann 2003). Logistic regression enabled the analysis of two or more variables of interest to predict scores on a dependent variable. Logistic regression was used to assess the odds of an outcome while controlling for other confounding variables, results not obtainable by other statistical methods. As opposed to experimental designs, logistic regression cannot determine causal effects, rather demonstrating an association between two or more variables. The odds ratio obtained should not be confused with relative risk, which can distort results. The inclusion of similar variables within the logistic regression may produce an overshadow effect, where a related variable is not shown to be associated despite its relationship to the dependent variable. The present study assessed individual variable relationships prior to input into the logistic regression. It is possible relationships between similar variables such as maternal history of child abuse, relationship distress and lone parent could have impacted results (Debanne & Rowland, 2002; LaValley, 2008; Roos et al., 2008).

Study variables were chosen based on literature review findings and availability of the data. Data availability was impacted by the utilization of a case-control study design and retrospective population-based data. The utilization of a case-control study design and retrospective population-based data did not allow for the assessment of time or proximal processes (Brownell et al., 2007; Kreiger,1992; Mustard, Derksen, Berthelot & Wolfson, 1999; Roos et al., 2008; Roos et al., 2004; Subramanian, Chen, Rehkopf, Waterman & Krieger, 2005). The recurrent nature of some infant health problems would have been more appropriately captured using longitudinal methods (Louis & Platt, 2011). Data on the presence of certain conditions prior to birth would have enhanced the analysis of the outcomes (Brownell et al., 2007). The utilization of retrospective population-based data obtained from the Manitoba Centre for Health Policy repository restricted data availability. Data unavailable in the repository prevented the model from assessing and/or controlling for some confounding variables such as Aboriginal status and alcohol consumption. Data collected in the BabyFirst and FamilyFirst screens presented gaps, biases and measurement error that impacted the indicators available for assessment (Brownell et al., 2007; Morsback & Prinz, 2006). The utilization of both the BabyFirst and FamilyFirst screen's produced a 10 year sample for analysis but also forced the selection and adjustment of indicators to ensure consistency between the two screens for research. Variables including alcohol use during pregnancy were not captured in both screens and therefore could not be utilized in this study. The screens did not collect data on some confounding variables such as income and household size (Brownell et al., 2007; Morsback & Prinz, 2006).

The removal of risk severity scores from the BabyFirst screen to the dichotomized method utilized in the FamilyFirst screen prevented a detailed analysis of some variables such as severity of relationship distress and presented an opportunity for researcher interpretation (Brownell et al., 2007). Combined variables were previously discussed in Table 3. To minimize variable impact a literature review was utilized to assist with dichotomization and merging of the data (Brownell et al., 2007; Morsback & Prinz, 2006). The matching of census, and BabyFirst and FamilyFirst screen data provided more complete data for income and education indicators in the study. The income and education measures collected in Statistics Canada data has been aggregated to the neighbourhood level preventing individual-level analysis. Studies demonstrate that census-based measures of socioeconomic status are closely related to individual-level socioeconomic status but there is always the potential of the ecological fallacy or the incorrect inference of aggregated data to individual level outcomes (Debanne & Rowland, 2002; LaValley, 2008; Roos et al., 2008).

There were 434 infants not captured in the study due to data limitations. BabyFirst and FamilyFirst data is limited regarding women giving birth outside of the hospital, newborn infants apprehended at birth and infants who died shortly following birth. Infants not captured in the study could be different on some socioeconomic variables than those represented. In total 11.6% of the sample had completed screens. Geography, income and sex were complete indicators. Uptake of the FamilyFirst screen was improved from the original BabyFirst screen, approximately 12.5% of the FamilyFirst screens and 39% of the BabyFirst screens did not provide information on any of the key socioeconomic variables assessed in the study, impacting screen representativeness and assessment of some study indicators such as social context of mortality rates. Subsets of the study sample experienced lower response rates with approximately 15% failing to complete any of the key indicators for the study. Low response rates prevented the analysis of the relationship between socioeconomic variables and mortality rates. Low response rates to some of the variables on the BabyFirst and FamilyFirst screens produced the need for a secondary analysis that included larger subsamples from the inclusion of the missing item group. Differences between the study population and missing respondents have not been estimated for this study. The missing items within this study were a significant limitation. To address this further analysis is planned that will account for the missing items as a third distinct group within the logistic regression. Comparing three groups based on no, yes and missing item responses will provide more specific information on potential relationships with infant health outcomes.

The BabyFirst and FamilyFirst screens are based on nurse patient consultation, which may be biased to perceptions and willingness to declare. The screens are completed following patient consultation suggesting there may be some nurse recall error or perception bias. Unmarked areas of the screen can represent a negative or unknown response. Low response rates can be in response to nurse unwillingness to assess screen questions, difficulty contacting families, unwillingness to discuss a topic, or lack of nurse recall. Certain indicators such as maternal history of child abuse are particularly vulnerable to reporting biases and nurse willingness to discuss the topic (Brownell et al., 2007; Morsback & Prinz, 2006).

Strengths. The BabyFirst and FamilyFirst screens provided independent socioeconomic variables for the study. The logistic regression enabled the research to determine which independent socioeconomic factor had the strongest relationship with infant morbidity and congenital anomaly, while controlling for confounding variables: multiple birth and infant sex (Debanne & Rowland, 2002; LaValley, 2008; Roos et al., 2008). The BabyFirst and FamilyFirst screens are accepted and embedded into Manitoba nursing practices to be administered by registered nurses within seven days following delivery. The surveys gather data on an increasing number of births in Manitoba. In 2010 the FamilyFirst screen collected information from 95% of post-partum referrals in Manitoba. This rate was higher in Winnipeg. The 2007 evaluation of the FamilyFirst screen reported rates of risk factors similar to other studies, high response rates, and continual improvement of data quality and predictability. FamilyFirst measures of maternal education show substantive agreement with data from Manitoba education (Brownell et al., 2007; Healthy Child Manitoba, 2010).

The thesis used a sample of 71,836 births in Winnipeg between 2000 and 2010. The large sample and congruence in Aboriginal status, geography, income and education rates between the study sample and Winnipeg Census rates created a representative population-based study (Brownell et al., 2007; Healthy Child Manitoba, 2010; City of Winnipeg & Statistics Canada, 2006). Similar proportional rates between the study participants with complete variable information and those with missing items on variables such as sex, education, income, Aboriginal status and geography demonstrate no large differences that would impact outcomes. The missing item group containing missing variables was utilized in a secondary analysis to determine if their inclusion affected results. Missing data did not impact the randomization of this sample and enabled further scientific conclusions to be drawn from outcomes (McKnight, McKnight, Sidani, & Figueredo, 2007).

Conclusions. Infant health is an important comprehensive measure of the health of a society reflecting experiences with the social determinants of health that impact not only the current health of an infant but also their future health and wellbeing. Maternal circumstances are associated with infant mortality, morbidity and congenital anomalies. Understanding the relationship between maternal socioeconomic factors and adverse infant health outcomes provides knowledge to attend to mortality, morbidity and congenital anomaly risk factors (Denburg & Daneman, 2010; Dyck, 2009; Kettner, 2011; Mikkonen & Raphael, 2010; Statistics Canada, 2010b).

The study found an interrelationship between infant mortality, morbidity and congenital anomalies, all of which were independently related to the social determinants of health. The study assessed the implications of maternal socioeconomic variables on the health of an infant (0-12 months) through the investigation of nine social determinants of infant health. The findings support current knowledge regarding the relationship between low-income, low maternal education, maternal history of child abuse and poor social supports on infant mortality, morbidity and disability rates. Leading contributing factors depended on the infant outcome and infant age. Hospital service readmission is impacted by social and economic factors. The impact of social factors on infant hospital readmission rates depended on the age of the infant. Newborn hospital readmissions were more likely to occur among infants with more social support, whereas post-neonatal hospital readmissions were more likely to occur among infants with less social support, demonstrating that the availability of supports and resources impacts service access and infant health. Congenital anomalies were more likely to occur in two parent families with male infants. The socioeconomic factors assessed in this study had less of an impact on congenital anomaly rates then multiple births and infant sex. Mitigating factors, such as maternal age are expected to partially account for this relationship.

Research implications. Further research can enhance the findings of this study. Infant mortality was not captured in this study due to limited sample size. Although it appears that the mortality sample did not differ from the study sample on any of the independent variables, further research utilizing a larger sample or improved tool to gather socioeconomic data is required to provide a representative depiction and to demonstrate the similarities and unique experiences of these mothers and infants. To further attend to infant mortality, other research avenues should be pursued such as a survey or other MCHP datasets. The BabyFirst and FamilyFirst screens are implemented for program process as opposed to a standardized approach that can provide data for future research as well as program enhancement, development and evaluation. Screening methods should be applied more consistently to assist with program improvement as well as the development of other resources and tools to support these women and infants. Future research on the relationship between the social determinants of health and infant mortality rates can enhance this study's findings, and its policy and program recommendations.

Some confounding factors were not captured in the study due to availability of the measures and targeting of the study. The researcher decided to focus primarily on geography, income, education and social experiences, while controlling for mitigating factors, multiple births and infant sex. Research assessing further confounding factors such as education level, Aboriginal status, alcohol use and maternal age could be relevant to these outcomes.

The study did not support a strong inverse relationship between education and infant morbidity, as suggested in other studies (CSDH, 2008; Gage, Fang, O'neill & Dirienzo, 2013). Other socioeconomic factors appear to impact this relationship. The study found that newborn hospital readmission rates increased with high parental education. Future research should assess education using more confined education increments. This study assessed low education compared to completion of high school and was unable to assess post-secondary education. Assessing education in smaller increments may provide a different relationship between education and morbidity. A large proportion of maternal education research has been conducted in developing countries. There could be protective factors involved among developed countries such as social supports that impact the relationship between maternal education and infant morbidity. Further research assessing confounding variables would be necessary.

The study found that congenital anomalies are more likely to occur among two parent families with male infants. Further research assessing parental age may provide further detail into this relationship.

Program and Policy Implications. The study found an interrelationship between infant mortality, morbidity and congenital anomaly all of which were independently related to the social determinants of health. Adverse experiences with the social determinants of health account for some of the disparities in infant health outcomes. Understanding the relationship between maternal socioeconomic environment and infant health outcomes can provide important policy and programming implications. This study found social supports, maternal history of child abuse and multiple birth were significantly associated with infant health outcomes, in addition to geography, income and sex reported in this and other studies. Understanding the strength of the relationship between maternal socioeconomic variables, and infant morbidity and congenital anomaly highlight the importance of targeting a number of factors related to the development or expansion of programs, services and supports. Infant health outcomes have a lasting impact into adulthood and have large societal implications. Knowledge of contributing factors to poor infant health outcomes can guide future health planning, assisting in the development of interventions that can improve health equity (Denburg & Daneman, 2010; Dyck, 2009; Kettner, 2011; Mikkonen & Raphael, 2010; Statistics Canada, 2010b). Understanding ways to enhance prevention initiatives to attend to infant health disparities can help improve the health and wellbeing of Winnipeg's future generation

Morbidity rates were impacted by maternal social support. Infants of mothers with a strong social support system were more likely to be admitted to the hospital as a newborn. Infants in families lacking social support may experience difficulty in accessing health services, demonstrating a need for supports and resources to increase required access to health services. Infants of mothers without social supports, low income and residency in a low socioeconomic area were more likely to be admitted to the hospital post-neonatally, which could be attributed to their inability to access health services earlier. Lone parents and isolated families can experience difficulty in accessing health services. Additional referrals and social supports, including program and service supports, are required to increase health service access. Parents may require additional knowledge of available services, additional support services and/or further information regarding appropriate instances to obtain hospital service, ultimately improving infant health, and health system efficiency and effectiveness (Ballantyne et al., 2014; Kettner, 2011; Luo et al., 2010; Wallby, Modin & Hjern, 2013;).

Two parent families with male infants are more likely to have children with a congenital anomaly. The majority of congenital anomalies are preventable prenatally. Increasing knowledge and access to prevention services are important for these families and can contribute to lower congenital anomaly rates in Winnipeg (PHAC, 2013).

Taking into consideration health determinants utilizing an ecological model helps to identify risk factors for adverse infant health outcomes that are related to the current and future health and wellbeing of infants. Both health and non-health policies targeting the socioeconomic environment are important for infant health outcomes, given the effect of human behaviour, structural factors, culture and context on intervention uptake and health (Marmot, Wilkinson, & Brunner, 2006). The social determinants are a major challenge for public health and an opportunity to improve infant health and health inequalities (Dyck, 2009; HCC, 2011; Kettner, 2011; Mikkonen, & Raphael, 2010; Statistic Canada, 2010b).

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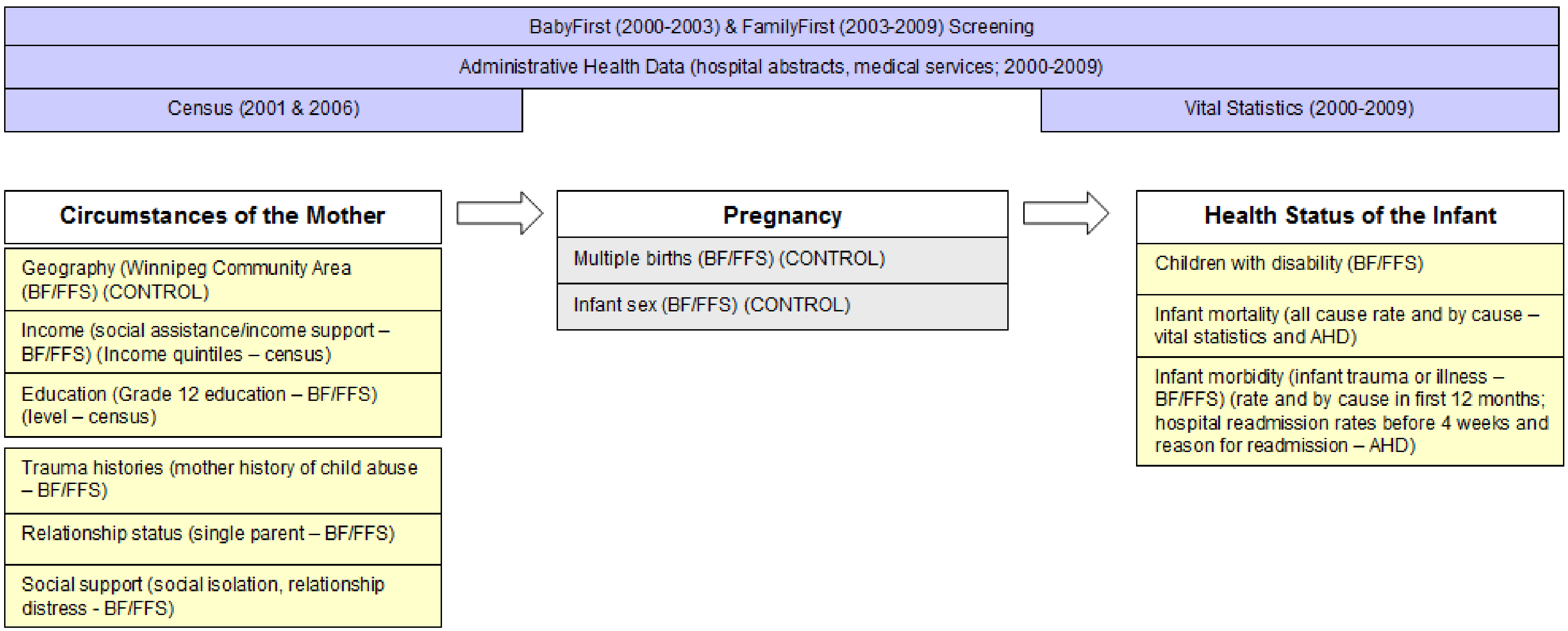
Appendix A

Conceptual Outline



Appendix B
Thesis Timeline

Year	**Fall**				**Winter**				**Summer**			
	Sept	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**March**	**April**	**May**	**June**	**July**	**August**
Year 1 (2011-2012)	Narrowing Thesis Scope, Choose Topic and Confirm with Thesis Advisor								Thesis preparation, proposal development			
Year 2 (2012 – 2013)	Thesis proposal development and defense	Ethics and approvals		Research					Thesis development		Leave	
Year 3 (2013 - 2014)	Leave											
Year 3 (2014-2015)	Thesis development and defense				Revisions and submission of thesis to graduate studies							

Appendix C

Ethics acceptance

UNIVERSITY OF MANITOBA | BANNATYNE CAMPUS
Research Ethics Boards

P126 - 770 Bannatyne Avenue
Winnipeg, Manitoba
Canada R3E 0W3
Tel: (204) 789-3255
Fax: (204) 789-3414

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

PRINCIPAL INVESTIGATOR:	INSTITUTION/DEPARTMENT:	ETHICS #:
[redacted]	UofM / Family Social Sciences	HS15910 (H2012:374)

APPROVAL DATE:	EXPIRY DATE:
December 7, 2012	December 7, 2013

STUDENT PRINICIPAL INVESTIGATOR SUPERVISOR (If applicable):
[redacted]

PROTOCOL NUMBER:	PROJECT OR PROTOCOL TITLE;
NA	Disparities in Infant Health in Winnipeg, Manitoba: An Ecological Approach to Maternal Circumstances Affecting Infant Health

SPONSORING AGENCIES AND/OR COORDINATING GROUPS:
NA

Submission Date of Investigator Documents:	HREB Receipt Date of Documents:
November 7 and December 5, 2012	November 9 and December 5, 2012

THE FOLLOWING ARE APPROVED FOR USE:

Document Name	Version(If applicable)	Date

Protocol:

Proposal received November 9, 2012 with clarification outlined in letter dated December 5, 2012

Consent and Assent Form(s):

Other:

Data Fields received November 9, 2012

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

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

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

CONDITIONS OF APPROVAL:

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

Sincerely,

[redacted]

Chair, Health Research Ethics Board
Bannatyne Campus

Please quote the above Human Ethics Number on all correspondence.
Inquiries should be directed to the REB Secretary **Telephone:** (204) 789-3255/ **Fax:** (204) 789-3414

Appendix D

Health Information and Privacy Committee Approval

Manitoba

Health
Health Information Privacy Committee
4043 – 300 Carlton Street
Winnipeg, MB R3B 3M9
T 204-786-7204 F 204-944-1911
www.manitoba.ca

January 4, 2013

[redacted]

File No. 2012/2013 – 39

Re: Disparities in Infant Health in Winnipeg, MB: An Ecological Approach to Maternal Circumstances Affecting Infant Health

Thank you for submitting the requested documentation and providing clarification for the above named project. The Health Information Privacy Committee has now ***approved*** your request for data for this project.

Any significant changes to the proposed study design should be reported to the Chair/HIPC for consideration in advance of their implementation. Also, please be reminded that *all manuscripts and presentation materials resulting from this study must be submitted for review at least 30 days prior to being submitted for publication or presentation.*

Please note that a Researcher Agreement will need to be completed before work on this project can commence. This will be initiated by MCHP. If you have any questions or concerns, please do not hesitate to contact Lisa LaBine, Committee Coordinator at 204-786-7204.

Yours truly,

Fo[redacted]

Chair, Health Information Privacy Committee

Please quote the file number on all correspondence

[redacted]

Manitoba
spirited energy

Appendix E

Researcher Agreement

An Agreement Respecting Access to Manitoba Health Information at the Manitoba Centre for Health Policy (University of Manitoba) for Research Being Conducted by University Researchers Within The Secure Data Environment of MCHP.

THIS AGREEMENT dated as of the 17 day of December, 2012 (the "Effective Date").

BETWEEN:

THE GOVERNMENT OF MANITOBA,
represented by the Minister of Health

(hereinafter referred to as "Manitoba")

- and -

THE UNIVERSITY OF MANITOBA,
MANITOBA CENTRE FOR HEALTH POLICY

(hereinafter referred to as the "University")

WHEREAS:

A. This constitutes an agreement of the conditions under which anonymized electronic data from Manitoba will be disclosed to the University in accordance with the provisions stated in *The Personal Health Information Act* (Manitoba), *The Freedom of Information and Protection of Privacy Act* (Manitoba) and all other applicable Federal and Provincial legislative acts governing the use of this data;

B. This constitutes a research agreement pursuant to the Information Sharing and Protection of Privacy Agreement between the University and Manitoba which became effective January 1, 2007;

C. Javier Mignone, an academic staff member of the University in the Faculty of Human Ecoloy (hereinafter referred to as the "Principal Investigator") has certain expertise in Family Social Sciences;

D. The Principal Investigator has requested access to information owned by Manitoba and held by the University in the Manitoba Population Health Research Data Repository housed at the Manitoba Centre for Health Policy. The Principal Investigator needs to access this information to conduct a proposed Research Project;

E. This Agreement shall apply to access for the Principal Investigator or University researcher to conduct research within the Centre;

F. The Principal Investigator has obtained ethical approval for the Research Project from the University's Health Research Ethics Committee or Research Ethics Committee;

G. The Health Information Privacy Committee has approved the Principal Investigator's access to the information for the Research Project described in subsection 2.01 of this Agreement, in accordance with the provisions of section 24 of *The Personal Health Information Act* (the "Act"), subject to the University entering into this Agreement;

MANITOBA AND THE UNIVERSITY AGREE AS FOLLOWS:

SECTION 1.00 – DEFINITIONS AND INTERPRETATION

1.01 In this Agreement:

(a) "Aggregate Level Data" means information not at the level of an individual person. It may include summary statistics or categorical descriptors. Aggregate information does not include identifying information or potentially identifying information;

(b) "Centre" means the Manitoba Centre for Health Policy, a research unit established by the University in the Department of Community Health Sciences at the University of Manitoba;

(c) "Data Repository" means the Population Health Research Data Repository, a comprehensive population-wide health research database of De-identified Individual Level Information developed by the Centre over the last twenty-five (25) years, primarily from De-identified Individual Level Information provided by Manitoba Health;

(d) "De-identified Individual Level Information" means information about an individual that has been modified or from which identifying or potentially identifying information has been removed in a way that minimizes the likelihood that an individual's identity can be determined by any reasonably foreseeable method. Methods of de-identifying information can include scrambling or encrypting identifying or potentially identifying information;

(e) "Health Information Privacy Committee" or "HIPC" means the Health Information Privacy Committee established under section 59(1) of the Act;

(f) "Information" means the project specific individual level data including any information which may inadvertently be identifying or potentially identifying, as detailed in Schedules "A" or "B";

(g) "Personal Health Information" has the meaning given to this term in the Act and includes any information about an individual's health or health care history, provision of health care to the individual or payment for health care provided to the individual which, alone or in combination with other information, could potentially identify an individual;

(h) "Personal Information" has the meaning given to this term in *The Freedom of Information and Protection of Privacy Act*, and includes any information about an identifiable individual which, alone or in combination with other information, could potentially identify an individual. Personal Information includes Personal Health Information;

(i) "Research Project" means "Disparities in Infant Health in Winnipeg, Manitoba: An Ecological Approach to Maternal Circumstances Affecting Infant Health".

1.02 The requirements and obligations in this Agreement respecting protection of Information by the University apply to all Information received by the University from Manitoba in whatever manner, form or medium and apply whether the Information was provided or received before or after the signing of this Agreement.

SECTION 2.00 - RESEARCH PROJECT

2.01 The University has requested access to Information for the Research Project described in the HIPC submission. The HIPC Submission is attached hereto as Schedule "A" and the Final Approval Letter(s) are attached as Schedule "B".

2.02 The University acknowledges that much of the information in the Data Repository is information about the health of individuals and would, if it were not De-Identified, constitute Personal Health Information. The University acknowledges the sensitivity of Personal Health Information and the necessity for this Agreement and the approval of HIPC in order to conduct the Research Project.

2.03 The University acknowledges that the Research Project described in Schedule "A" complies with all current policies and guidelines of the Centre, including the Centre's Private Sector Guidelines, as applicable.

SECTION 3.00 - ACCESS TO INFORMATION BY THE UNIVERSITY

3.01 The University will give access only to the minimum amount of Information (herein termed "Approved Information") necessary to conduct the Research Project. The Approved Information is limited to only that information which has been described in Schedule "A" and approved by the Health Information Privacy Committee in Schedule "B".

3.02 Subject to the terms and conditions of this Agreement, the University may have access to the Approved Information in the following form and manner:

(a) access the Approved Information through a computer terminal on the premises of the Centre in the Centre's secure data environment; and

(b) access with a user ID and a password provided by the Centre that will permit access to the Approved Information.

3.03 The University agrees and acknowledges that Manitoba owns all title to, and rights and interest in, any Information that the Principal Investigator accesses including copyright, intellectual property and other proprietary rights.

SECTION 4.00 - USE OF INFORMATION BY THE UNIVERSITY

4.01 The University may analyze and manipulate the Approved Information described in subsection 3.01 for the purpose of carrying out the Research Project and may produce Aggregate Level Data that may be printed, placed on a disc or otherwise transmitted outside the Centre's secure data environment.

SECTION 5.00 - OBLIGATIONS OF THE UNIVERSITY RESPECTING USE AND DISCLOSURE OF INFORMATION

5.01 The University represents and warrants that:

(a) the University shall keep the Information secure and in strict confidence;

(b) only Approved Information shall be accessed in accordance with subsections 3.01 and 3.02;

(c) the Approved Information shall be accessed and used only by the Principal Investigator's project specific team within the Centre;

(d) Approved Information will be accessed and used solely for the research purpose as described in subsection 2.01 of this Agreement and for no other purpose; and

(e) the University shall not permit the Information to be accessed or used for any purpose other than the research purpose as described in subsection 2.01 of this Agreement.

5.02 The University shall ensure that no Information will be used, disclosed, published or made available in any manner, form or medium (including, without limitation, in any research results, research paper or publication respecting the research and in any related presentation).

5.03 The University shall not:

(a) make copies or reproductions of the Information, in whole or in part, in any manner, form or medium, except in accordance with the terms and conditions of the Data Sharing Agreement;

(b) use the Information received from Manitoba, or any part of it, to develop, establish, expand, modify or maintain a database or other collection of information in machine-readable form or any other form, except as may be required for the research purpose described in subsection 2.01;

(c) sell or disclose the Information, or any part of the Information, for consideration or exchange the Information for any goods, services or benefit; or

(d) give the Information to any individual, corporation, business, agency, organization or entity for any purpose, including (but not limited to) for solicitation for charitable or other purposes;

and shall not permit any of these activities to take place.

SECTION 6.00 - REPORTS, MONITORING AND ENFORCEMENT

6.01 The University shall, via the Centre, immediately upon becoming aware of any of the following, notify Manitoba in writing of:

(a) any use of, access to or disclosure of the Information which is not authorized by this Agreement; and

(b) any breach of any term or condition of this Agreement;

with full details of the unauthorized use, access or disclosure or of the breach. The University shall immediately take all reasonable steps to prevent the recurrence of any unauthorized use, access or disclosure of the Information, or to remedy the breach, and shall notify Manitoba and the Centre in writing of the steps taken.

6.02 Manitoba and its representatives may carry out such inspections or investigations respecting the use and handling of the Information by the University as Manitoba considers necessary to ensure that the University is complying with the terms and conditions of this Agreement and that the Information is adequately protected. The University shall cooperate fully in any such inspection or investigation. If any inspection or investigation identifies deficiencies in the information practices of the University, the University shall take steps to correct the deficiencies immediately to the satisfaction of Manitoba.

6.03 Where Manitoba is reasonably of the opinion that the University:

(a) has used, permitted access to or disclosed the Information in a manner which is not authorized under this Agreement, or is about to do so;

(b) has not adequately protected the Information from risks such as unauthorized use, access or disclosure; or

(c) has failed to comply with, or is about to fail to comply with, any of its obligations or undertakings under this Agreement;

Manitoba may terminate this Agreement at any time by providing notice in writing, effective immediately or as of the date set out in the notice.

6.04 On termination of this Agreement for any reason, the University shall immediately refrain from any further use of, access to, disclosure of and activities and transactions involving the Information.

6.05 In addition to its rights under subsection 6.03 of this Agreement or any other rights Manitoba may have under this Agreement, or the Information Sharing and Protection of Privacy Agreement, or under any enactment, or otherwise, where Manitoba is of the opinion that the University has used, permitted access to or disclosed the Information in a manner which is not authorized under this Agreement, or is about to do so, Manitoba may report these activities to any one or more of the following for appropriate action:

(a) the Centre;

(b) the University;

(c) the Health Information Privacy Committee;

(d) the institutional research review committee which approved the research;

(e) any professional association or disciplinary or other body with jurisdiction to discipline, supervise or regulate the University; and

(f) the institution from which funds were provided to conduct the research study.

6.06 Nothing in this Agreement shall prevent the following uses of any information, data (including data in tabular form), analyses and research acquired, developed or discovered by the University upon the completion of an approved project:

(a) publication in learned journals or other printed media;

(b) oral presentation or the distribution of printed materials at educational or professional conferences or seminars; or

(c) publication of a thesis by a graduate student;

provided that:

(d) such publication or use shall not disclose any Confidential Information;

(e) such publication or use shall not disclose any Personal Information or Personal Health Information (as these terms are defined in *The Freedom of Information and Protection of Privacy Act*), respecting a third party in a way that could reasonably be expected to identify the third party, without the consent of that third party.

6.07 As used herein "Confidential Information" means any and all information disclosed by Manitoba to the University which is identified in writing as confidential by Manitoba. Confidential Information shall not include information that is:

(a) already known to the University prior to receipt from Manitoba as evidenced by written records; or

(b) generally available to the public or becomes publicly known through no fault of the University; or

(c) received by the University from a third party who had a legal right to disclose without restriction; or

(d) developed by the University independently of and without reference to the Confidential Information as evidenced by written records.

Notwithstanding any other provision of this Agreement, disclosure of Confidential Information shall not be precluded if such disclosure is in response to a valid court order of any governmental agency, court or other quasi-judicial or regulatory body of competent jurisdiction, provided however that the University, as promptly as reasonably possible, gives notice to Manitoba of the requirement to disclose.

6.08 The University and any employees of the University or persons involved with research shall treat as confidential, and shall not disclose or permit to be disclosed to any person, corporation or organization, any Confidential Information provided by Manitoba under this Agreement without prior consent of Manitoba, whose consent shall not be unreasonably withheld.

6.09 Regarding the use of this project specific Approved Information, the University shall provide to Manitoba:

(a) at least thirty (30) calendar days prior notice of every intended publication in learned journals or thesis presentation;

(b) at least ten (10) calendar days prior notice of every poster or oral presentation where such presentation material will be physically released or distributed, or posted on a website.

6.10 In the case of publications in learned journals or thesis presentations, Manitoba will review same for confidentiality and proper representation of Manitoba and Information and advise the Principal Investigator of any required changes within two (2) weeks of receipt. Manitoba has no right of censorship of the research content including any research findings or recommendations.

6.11 In the case of poster or oral presentations as described in clause 6.09(b), Manitoba will review same for confidentiality and proper representation of Manitoba and Information and advise the Principal Investigator of any required changes within three (3) working days of receipt. Manitoba has no right of censorship of the research content including any research findings or recommendations.

6.12 The University will acknowledge Manitoba in any report or paper that is based upon the Information and it shall be stated in such publication that the results and conclusions are those of the authors and no official endorsement by Manitoba is intended or should be inferred.

SECTION 7.00 - GENERAL

7.01 While this Agreement is in effect, and at all times thereafter, the University shall be solely responsible for and shall save harmless and indemnify Manitoba, and its ministers, officers, employees and agents, from and against all claims, liabilities and demands of any kind with respect to any injury to persons (including, without limitation, death), damage to or loss of property, economic loss or incidental or consequential damages or infringement of rights (including, without limitation, privacy rights) caused by, or arising directly or indirectly from:

(a) the provision of any Information by Manitoba to the University;

(b) the breach of any term or condition of this Agreement by the University or an employee or agent of the University; and

(c) any omission or wrongful or negligent act of the University or of an employee or agent of the University.

7.02 This Agreement is subject to any restrictions or limitation in, or provisions of, any statute, regulation or other legislation enacted or amended by the Province of Manitoba or the Government of Canada and in effect from time to time which may affect any term or provision of this Agreement.

7.03 The obligations and undertakings of the University under this Agreement shall survive the completion or termination of the Research Project.

7.04 The University shall not assign or transfer this Agreement or any of the rights or obligations under this Agreement.

7.05 The University shall not enter into any contract, sub-contract or arrangement with a third party involving use of or access to, or disclosure of, the Information for any purpose.

7.06 This Agreement shall be interpreted, performed and enforced in accordance with the laws of the Province of Manitoba.

7.07 Any notice or other communication given or required under this Agreement shall be in writing and shall be delivered personally or sent by registered mail, postage prepaid, or by way of facsimile transmission, as follows:

To Manitoba:

Manitoba Health, Health Information Management
Room 4036 – 300 Carlton Street
Winnipeg, MB R3B 3M9
Attention: Executive Director

To the University:

Manitoba Centre for Health Policy
4th Floor Brodie Centre
Winnipeg, MB R3E 3P5
Attention: Director

With a copy to:

The University of Manitoba
Room 260 Brodie Centre, 727 McDermot Avenue
Winnipeg, MB R3E 3P5
Attention: Dean, Faculty of Medicine

7.08 Any notice given in accordance with subsection 7.07 of this Agreement shall be deemed to have been received by the addressee:

(a) on the day delivered, if delivered personally;

(b) on the third business day after the date of mailing, if sent by prepaid registered mail; or

(c) on the date of the transmission shown on the sender's confirmation of transmission notice, if sent by facsimile transmission.

If mail service is disrupted by labour controversy, notice shall be delivered personally or by facsimile transmission.

This Agreement has been executed on behalf of Manitoba and by the University on the dates noted below.

SIGNED IN THE PRESENCE OF:

[redacted]
Witness

FOR THE GOVERNMENT OF MANITOBA

Per: [redacted]
Executive Director, Health Information Management

DATE: Jan 21/13

[redacted]
Witness

FOR THE UNIVERSITY OF MANITOBA

Per: [redacted]
Dean, Faculty of Medicine

DATE:

[redacted]
Witness

READ AND UNDERSTOOD

PRINCIPAL INVESTIGATOR - SUPERVISOR

Name: [redacted]

DATE: Jan/9/13

[redacted]
Witness

READ AND UNDERSTOOD

PRINCIPAL INVESTIGATOR - STUDENT

Name: [redacted]

DATE: Jan 9/2013

H:\Legal\LEGAL OFFICE\Precedents Website Documents\Signing Policy\MCHP Access To Manitoba Health Information Agmt For Student Researchers - April 2010.doc

Appendix F

Baby First Screening Form Example

C. Family Interaction Risk Factors

7. Social situation

a) One parent family with social support…………………………….. ○ 2

b) One parent family – no social support…………………………….. ○ 7

c) Two parent family – no social support……………………………. ○ 4

13. Low education status (i.e. did not complete grade 12 or equivalent……○ 3

D. Other Factors

14. Relationship distress…………………………... ○ 0○ 1○ 2○ 3 ○4○ 5○6○7○8○9

15. Multiple births………………………………… ○0 ○1 ○ 2○3 ○ 4 ○5 ○ 6 ○7○8○9

Appendix G

Family First Screening Form Example

C. Family Risk Factors

14. Mother's highest level of education completed is less than grade 12……○ yes ○ no

15. On social assistance/income support or financial difficulties……………○ yes ○ no

16. Single parent family……………………………………………………○ yes ○ no

31. Assessed lack of bonding (e.g., minimal eye contact, touching)…………○ yes ○ no

32. Social isolation (lack of social support and/or isolation related to culture, language or geography)………………………………………………………………○ yes ○ no

33. Relationship distress…………………………………………………○ yes ○ no