Manitoba's Francophone Children:

What Determines EDI Scores?

by

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Abstract

The years prior to entering school are considered a critical period of a child's development. Little research exists on early childhood development in Manitoba's Francophone community and the factors that affect this linguistic minority. The objective of this study was to investigate whether children in the *Division scolaire franco-manitobaine* (DSFM) are different from other children in Manitoba on five Early Development Instrument (EDI) outcomes, when controlling for neighbourhood, family and individual factors. With population data housed at the Manitoba Centre for Health Policy, multilevel modelling was used to compare 944 DSFM children in Kindergarten to 25,950 Kindergarten children from other schools in Manitoba. DSFM children scored 0.451 points higher ($p < .001$) on physical health and well-being, 0.238 points lower ($p < .001$) on language and cognitive development, and 0.314 points lower ($p < .001$) on communication and general knowledge compared to other children in Manitoba. DSFM children who live in communities with a high proportion of Francophones scored higher on all EDI domains with the exception of physical health and well-being, compared to other DSFM children. DSFM children whose first language was not French had significantly lower scores on each of the five domains. Results demonstrate the importance of both developing the French language in the home, as well as the need for the Francophone community to provide a supportive network for child development, especially opportunities for the development of the French language.

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Table of Contents

List of Tables

Chapter 1: Introduction

In Canada, early childhood development research has gained much ground over the past two decades and affected public policy as a result (McCain, Mustard, & Shanker, 2007). Research has demonstrated that child development influences health, well-being, and competence over the life course (Hertzman & Power, 2005; Hertzman, Power, Matthews, & Manor, 2001; McCain & Mustard, 1999). Child development is not merely determined by genetic and biological factors, but is also heavily influenced by one's environment (Irwin, Siddiqi, & Hertzman, 2007; Public Health Agency of Canada, 2001; World Health Organisation, 2007). Family-level variables such as income, parents' education, adolescent parenthood, as well as neighbourhood-level variables, such as average household income, proportion of unemployed adults, social cohesion and safety are all related to childhood development (Kohen, Brooks-Gunn, Leventhal, & Hertzman, 2002; Lapointe, Ford, & Zumbo, 2007; Leventhal & Brooks-Gunn, 2000; Roos et al., 2013).

Despite our knowledge of the social determinants on childhood development, research focusing on family and neighbourhood effects is often limited to small samples of children, high-risk populations and focuses on specific developmental outcomes (Kershaw, Forer, Irwin, Hertzman, & Lapointe, 2007). Recently, Canadian researchers have pioneered a holistic assessment tool, known as the Early Development Instrument (EDI), that can be used to evaluate early child development at a population-level (Janus & Offord, 2007). Linkages to other population databases allow researchers to include family and community factors in their analyses (Guhn, Janus, & Hertzman, 2007; Janus & Offord; Keating, 2007). Furthermore, since the EDI is meant to be reported at the

population level (e.g., school or community) and can be reported by sub-population (e.g., by sex or by linguistic group), researchers can use this tool to investigate and inform areas of concern or interest (Keating, 2007).

A population of interest for decision makers and researchers is the Francophone population, particularly when Francophones are living as a linguistic minority, which is true for all provinces in Canada with the exception of Quebec. Few empirical studies exist on the health of populations living in linguistic minority settings in Canada (Forgues, Noël, Nkolo, & Boudreau, 2009; Office of the Commissioner of Official Languages, 2004), and there has been little work on how living in a linguistic minority community affects early childhood development (Chartier, Dumaine, & Sabourin, 2011). As decision makers currently rely on theories, anecdotal evidence and assumptions to guide their policies, researchers in this field attempt to address the many questions that remain unanswered. In Manitoba, a province with the largest percentage of Francophones in Western Canada, questions remain as to why Francophone children are not doing as well on the EDI as other children in the province. This will be the focus of the present study.

Early Development Instrument

The Early Development Instrument (EDI), developed by Offord and Janus of McMaster University, is an evaluation tool that can be used both retrospectively, as a reflection of the first five years of life (early childhood outcomes), and prospectively, as a forecast of future outcomes in school and over the life course (school readiness) (Janus & Offord, 2000). Although each child is assessed individually, this instrument is designed and utilised for measuring group-level outcomes. Results are thus reported at the

aggregate level, such as the school or community level. Although this instrument is not used for diagnostic purposes, it can be linked at an individual level and has been shown to be predictive of children's subsequent performance (Chartier, Mayer, Morga, & Dumaine, 2009; Lloyd and Hertzman, 2009). The purpose of the EDI is to "examine populations of children in different communities in order to help them assess how well they are doing in supporting young children and their families" (Hertzman, McLean, Kohen, Dunn, & Evans, 2002, p. 5). The EDI measures five different developmental domains: 1) physical health and well-being, 2) social competence, 3) emotional maturity, 4) language and cognitive development, and 5) communication skills and general knowledge (discussed in detail in Chapter 2). Children who fall below the 10th percentile of the standardized Canadian average in any of the five domains are considered "not ready" for school. The EDI can be administered in either English or French (known as the *Instrument de mesure du développement de la petite enfance* – IMDPE).

EDI Research in Manitoba

In Manitoba, the EDI has been administered province-wide since the 2005-06 school year. The EDI was initially administered annually (i.e., 2005-06 and 2006-07) however, due to the high costs of administering such an assessment, it was scaled back to every two years (i.e., 2008-09, 2010-11, etc.). Recently, a research team at the Manitoba Centre for Health Policy (MCHP) focused on the link between socioeconomic status, health status at birth, and the Early Development Instrument (Santos, Brownell, Ekuma, Mayer, & Soodeen, 2012). Not surprisingly, a socioeconomic gradient was observed when looking at the percentage of children who were "not ready" for school. It was found that children living in neighbourhoods with the lowest income quintile were almost one

and a half times more likely to be assessed as "not ready" in at least one or more domains compared to children in the highest income quintile. Furthermore, children born at low or very low birth weight were more likely to be vulnerable on the EDI. Three at-risk groups of children were also studied in this particular study. Children who were either of teen mothers, in a family receiving income assistance (IA) or involved with Child and Family Services (CFS) were also reported to be disproportionately more likely to be "not ready" for school compared to children with no risk factors (54% vs 23%). Among children with only one of the above mentioned risk factors, children in families receiving income assistance had the highest rate of vulnerability. Children with two risks factors were at most risk if they were involved with CFS and also from a family receiving IA.

A study on the health and social determinants of health of Manitoba's children (Brownell, Chartier, Santos, et al., 2012) followed up on Santos and colleagues (2012) research with a greater focus on what factors appear to have an impact on EDI outcomes of children born in 2001. Using structural equation modelling (SEM), researchers found relationships between EDI scores and the following latent constructs: prenatal health, health at birth, emotional health, and Grade 3 literacy and numeracy assessments. Across all five domains, poor prenatal health had a significant and negative association on EDI outcomes in the base models. However, when controlling for material deprivation (estimated by "on income assistance", "labour force participation", "no high school education", and "living in a poor neighbourhood"), poor prenatal health was no longer significant. Poor health at birth was directly correlated with poorer EDI scores on all domains in the base models as well with "language and cognitive development", "communication skills and general knowledge" and "physical health and well-being" in

the full models. Furthermore, when adding material deprivation, this variable had a direct significant and negative association with EDI scores. Younger children, boys, children of families with four or more children, children involved with Child and Family Services, children whose mother was a teen at her first birth, children who were not initiated to breastfeeding during hospitalization and children with intellectual disabilities were also found to have statistically lower EDI scores. These results are consistent with the literature on what impacts early childhood development. However, questions still remain as to whether or not these same variables affect sub-populations of children in Manitoba in the same manner.

Manitoba's Francophone Children

All 37 public school divisions in Manitoba currently administer the EDI in their schools (Brownell, Chartier, Santos et al., 2012). One of the first school divisions to adopt the Early Development Instrument in 2002-03 was Manitoba's only French school division, the *Division scolaire franco-manitobaine* (DSFM). With data from the 1997 Manitoba Birth Cohort Study linked to the EDI, Chartier and her colleagues (2011) examined children in Kindergarten (N = 217) attending DSFM schools in 2002-03. When comparing this sample of children to the Canadian average, DSFM children scored statistically lower on both "language and cognitive development" and "communication skills and general knowledge". Furthermore, they found that among these children, those who were raised in a French environment (e.g., home, daycare) during their early childhood had higher scores in "communication skills and general knowledge" as compared to children raised in a bilingual or English setting. However, differences between these groups on "language and cognitive development" did not appear to be

statistically significant, suggesting that there are factors other than the child's linguistic environment that have an influence on EDI scores. Nevertheless, children of French-speaking families who engaged in French at home and in their community through various activities had statistically higher scores for "emotional maturity" compared to children brought up in English speaking or bilingual environment.

Results from the Understanding the Early Years (UEY) initiative, a national multi-site effort to evaluate, understand and equip communities with knowledge about the development of children in their community, showed that children of the DSFM (N = 367) scored significantly less on "language and cognitive development" than the Canadian average (Willms, 2010). It was also found that this cohort (2005-06) had statistically higher scores on "physical health and well-being". A recent study released by the MCHP (Chartier et al., 2012) concluded that Francophone children (primarily but not limited to children in the DSFM) had statistically higher rates of "not ready for school" in at least one of the five EDI domains compared to a matched cohort of other children in Manitoba. Specifically, Francophone children had statistically lower scores on "emotional maturity", "language and cognitive development" and "communication skills and general knowledge".

Results from the three above mentioned studies suggest that DSFM children are different from their Kindergarten counterparts living in Manitoba. Though better on "physical health and well-being" in one study and not as ready on "emotional maturity" in another when compared to the Canadian average, the two domains of concern for this sub-population are "communication skills and general knowledge" and "language and cognitive development" as they appear to be consistently lower. As we will see in the

following chapter, these particular domains are composed of questions that require age-appropriate mastery of the language of assessment (to various degrees). Nonetheless, since the language utilised in early childhood did not appear to influence "language and cognitive development" scores (Chartier, Dumaine, & Sabourin, 2011), this warrants further investigation into the factors which would influence this particular domain of the EDI. Reasons as to why these differences exist remain and are the object of this study.

Gaps in EDI Research

Although Lapointe, Ford, and Zumbo (2007) demonstrated that EDI scores for English Second Language (ESL) students in British Columbia are lower than those who knew one of Canada's two official languages, they did not consider assessing Anglophones and Francophones separately. Even though many Francophones across Canada are assessed in their mother tongue if they attend a French first language school, most researchers have not studied the impact of living in a linguistic minority setting on EDI scores. Unlike Anglophones living in a dominant linguistic setting, who in many cases do not learn two languages at once, Francophones living in a minority setting (i.e., all provinces outside Quebec) require interactions across different milieus to maintain or develop a mastery of both official languages. This process has been termed additive bilingualism and is defined as the addition of a second language that is not to the detriment of the first language, in this case French (Landry & Allard, 1990). According to the *counterbalance model of bilingual development*, additive bilingualism requires the promotion of the French language in both the family milieu and school milieu (i.e., French first language school) to counterbalance the anglo-dominant socio-institutional milieu. Depending on the vitality of the community, the socio-institutional milieu can

play an important role in providing an environment that is rich in French-speaking health, educational and social programming. Hence, given that Manitoba is an anglo-dominant province, it provides an opportunity to examine EDI scores by distinguishing linguistic groups.

Though the Understanding the Early Years (UEY) study has demonstrated that children in the DSFM are statistically different from the Canadian average on two out of the five domains, it is impossible to draw any conclusions without controlling for other factors such as socio-economic status, child health and at-risk families. Furthermore, Chartier et al. (2012) compared Francophone children to a matched cohort (1 Francophone to 3 Other Manitobans for the 2005-06 and 2006-07 academic years), matched by age, sex and geographical area (by closest postal code). Nevertheless, we were unable to identity a study in which an entire cohort (or multiple cohorts) of Francophone children in Manitoba were compared to all other children in Manitoba. Additionally, given that Chartier et al. (2012) did not control for other possible covariates or risk factors in their analysis, this study will include multiple factors that are known to affect early childhood development, as well as identify the factors that are different for the Francophone community compared to other children in Manitoba.

Purpose of the Study

The purpose of this study is to investigate whether DSFM children are different on early childhood development outcomes, when controlling for neighbourhood, family and individual factors. This research will consist of a multi-level model study comparing Franco-Manitoban children to other children in Manitoba. Specifically, the analysis will compare children attending French first language elementary schools to children

attending other schools in Manitoba on the Early Development Instrument scores.

This study is unique in that it will be among the first studies examining whether or not Francophone children living in an anglo-dominant setting have different EDI scores than their non-Francophone counterparts while controlling for individual, family and neighbourhood factors.

Research Questions

The three research questions that will be investigated in this study are as follows:

1) After controlling for possible contributing factors, are Kindergarten children in the *Division scolaire franco-manitobaine* (DSFM) statistically different from other children on the five EDI domains?
2) a. What are the individual, family and neighbourhood factors that influence EDI scores among children in the DSFM?

   b. Are these factors different from those affecting other children in Manitoba?

Hypotheses

Given that previous research has shown that DSFM children have lower scores on "language and cognitive development" and "communication skills and general knowledge" compared to other children, it is hypothesised that Kindergarten children of the DSFM will have lower EDI scores on the "language and cognitive development" and "communication skills and general knowledge" domains. It is also hypothesised that DFSM children will not differ on the other three domains, that is, "physical health and well-being", "social competence" and "emotional maturity".

Given the research by Santos and his colleagues (2012) as well as that of Brownell and her colleagues (2012), it is hypothesised that factors that influence EDI

scores for the general population will also affect the children in the DSFM. These factors include SES, children at-risk (i.e., children of teen mothers, families on IA or with CFS), and children with lower health status at birth.

Considering Landry and Allard's theory of the *counterbalance model of bilingual development* (1990), and given recent research concluding that the linguistic environment where a child is raised, both in the home and in the community, appears to have an impact on EDI scores (Chartier, Dumaine, & Sabourin, 2011), it is hypothesised that both the percentage of Francophones in a community and the language in the home will have an influence on EDI scores for DSFM children. As such, children living in communities with higher proportion of Francophones will have higher scores on the "language and cognitive development" and "communication skills and general knowledge" domains. Additionally, DSFM children whose first language is not French will have lower scores on the EDI, especially on the "language and cognitive development" and "communication skills and general knowledge" domains.

Chapter 2: Literature Review

The early years of a person's life, especially prior to entering school, are considered a critical period of development (Irwin, Siddiqi, & Hertzman, 2007; McCain & Mustard, 1999; McCain & Mustard, 2002; McCain, Mustard, & Shanker, 2007). Research has shown that the child is not only affected by genetic predisposition or individual characteristics but by social factors, from family to public policy, that also have an influence on the development of a child.

Firstly, the Early Development Instrument (EDI), an instrument that assesses early childhood development at the population level, will be presented with a particular attention given to its five developmental domains. Secondly, we will present four theories that have guided the current study, as well as report on contributors to early childhood development at the child, family and community levels. Furthermore, the Francophone population of Manitoba will be discussed, with a focus on Franco-Manitoban children, the efforts in the community to support these children and the areas in child development that should concern the community. Finally, we will establish what the present study intends on adding to the body of knowledge in early childhood development, as it pertains to Franco-Manitoban children.

Early Development Instrument

The Early Development Instrument (EDI) was developed by researchers Magdalena Janus and Dan Offord of the Offord Centre of Child Studies, at McMaster University. In Spring 1999, the final version was released after an extensive review of the literature, identification of items on large-scale studies of early childhood development, consultation with experts in the field of child development and focus groups with parents and teachers (Guhn, Zumbo, Janus, & Hertzman, 2011).

The EDI is a teacher-administered 104-item questionnaire, which requires 20 minutes per child to fill out. Its purpose is to evaluate Kindergarten children's readiness for school (i.e., entry to Grade 1). In Canada, the EDI can be administered in either English or French (known as the *Instrument de mesure du développement de la petite enfance – IMDPE*) and is being administered in most provinces on a bi-annual or tri-annual basis.

The EDI was not designed as a diagnostic tool for individual children. Rather, it was designed as a holistic monitoring tool to assess populations of children in terms of early childhood outcomes. Though each child is evaluated individually, results are reported at the aggregate level (Guhn, Gaderman, & Zumbo, 2007) and comparisons can be made across different communities or groups.

There are many advantages to using the EDI, such as the ability to link it with other population databases. Such a feature provides "opportunities for analyses of multiple contributions or barriers to school readiness" (Keating, 2007, p. 565). Secondly, it can be used both retrospectively, as a reflection of the first five years of life (early childhood outcomes), and prospectively, as a forecast of future outcomes in school and life (school readiness) (Janus & Offord, 2000). Research has shown that EDI scores are predictive of individual children's subsequent performance (Chartier, Mayer, Morga, & Dumaine, 2009; Lloyd and Hertzman, 2009). Thirdly, "the outputs from EDI reporting can be organized in such a way that they are potentially useful for local and community planning to address targeted areas of concern, a goal that has been identified for some time but has proven difficult to realize" (Keating & Mustard, 1996, as cited in Keating, 2007, p. 565).

Domains. The EDI is composed of five different developmental domains: 1) physical health and well-being, 2) social competence, 3) emotional maturity, 4) language and cognitive development, and 5) communication skills and general knowledge. The questions that compose the EDI can be found in Appendix A and are divided by domain.

Physical health and well-being. This domain is a set of 13 items used to evaluate a child's readiness for school in terms of their physical readiness for the school day, physical independence, and gross and fine motor skills. It includes questions on their energy levels, clumsiness, and proficiency at holding a pencil (Santos et al., 2012; Willms, 2010).

Social competence. This domain is a set of 26 items used to assess a child's level of overall social competence with peers, responsibility and respect for others, approaches to learning and readiness to explore new things. This includes questions on self-confidence, ability to get along with other children, accepting responsibility for their own actions, and eagerness to play with a new game/toy (Santos et al., 2012; Willms, 2010).

Emotional maturity. This domain is a set of 30 items used to measure a child's readiness for school in terms of their pro-social and helping behaviours, and lack of anxious, fearful, aggressive, hyperactive and inattentive behaviours. This includes questions on offering help to other children, restlessness, distractibility, and inattentiveness (Santos et al., 2012; Willms, 2010).

Language and cognitive development. This domain is a set of 26 items used to assess a child's level of basic literacy and numeracy skills, interest in literacy/numeracy and memory, and advanced literacy skills. Questions include those pertaining to interest in reading and books, recognition of numbers and shapes and awareness of time concepts

(Santos et al., 2012; Willms, 2010).

Communication skills and general knowledge. This domain is a set of 8 items used to evaluate a child's readiness in terms of their ability to understand and communicate in English or French (depending on the language of assessment), to clearly communicate one's own needs and understand others, as well as interest in general knowledge about the world (Santos et al., 2012; Willms, 2010).

For this particular study, it is necessary to understand the difference between two particular domains: "language and cognitive development" and "communication skills and general knowledge". Language and cognitive development focuses more on literacy and numeracy skills, such as appreciating books and counting, whereas communication skills and general knowledge focus on an age-appropriate mastery of the language of assessment. For example, a child who is evaluated in French but primarily speaks English would be negatively affected on roughly 9 out of the 26 items on language and cognitive development, whereas this child would be affected on roughly 6 out of the 8 items on communication skills and general knowledge. As previously stated, these two domains are areas of concern for Francophones living in a linguistic minority, especially that of communication skills and general knowledge.

School readiness. Children who fall below the 10th percentile in any of the five domains are considered "not ready" for school. Roughly 1 in 4 children are not ready on one or more domains (Offord Centre, n. d.). In Manitoba, 28 percent of children are not ready for school in one or more developmental domains (Healthy Child Manitoba, 2011).

Theoretical Framework

Based on the extant literature, four different theories on development will be presented. Specifically, three models that explain child development in general terms are

presented, whereas the fourth theory considers the development of language in a linguistic minority environment.

Bioecological model. The bioecological model of human development, developed by Urie Bronfenbrenner, is based on the notion that "each person is significantly affected by interactions among a number of overlapping systems" (Berger, 2006, p. 27). Bronfenbrenner proposed that the individual is influenced by *proximal processes*. These are direct enduring interactions with the environment, such as mother-child interactions. Such interactions happen within a hierarchical system, i.e., levels nested within one another often compared to a Russian doll. The *individual*, who has a biological and genetic predisposition, as well as personal characteristics that he or she brings with them into any social interaction, is nested within *microsystems*, where family, peer groups, schools, communities and the religious setting have an influence on that individual. The *mesosystem* is a level in the model that explains the interactions between the different microsystems. The *exosystem*, the next level of the model, refers to community structures as well as the educational, medical, employment and media systems, which have an indirect influence on the child. The most outer ring of the model is the *macrosystem* that explains the influence of cultural values, political philosophies, economic patterns and social conditions (Bronfenbrenner, 1994). Finally, the *chronosystem* refers to the development of the individual as well as the development of the systems over time. In Bronfenbrenner's later iterations of the bioecological theory, he proposed the Process-Person-Context-Time (PPCT) model; four components that he believes should always be simultaneously investigated in research that studies human development (Bronfenbrenner, 1994). Given that this theoretical model is in a continual state of

development (Bronfenbrenner & Morris, 2006), Tudge, Mokrova, Hatfield, and Karnik, (2009) argue that researchers should be clear on which version of the bioecological theory is guiding their study, and if at all possible, "all four elements of the [PPTC] model should be present" (p. 5).

This model is among the many models used by scholars to explain child development, and is commonly used in the fields of developmental and community psychology (Bronfenbrenner & Evans, 2000; Berger, 2006; Nelson & Prilleltensky, 2010). The present study has been influenced by this ecological framework, in that children, who are born with certain characteristics (i.e., the *person*), develop and are reciprocally influenced (i.e., *process*) by different family and community factors (i.e., the *context*) over early childhood (i.e, *time*). Furthermore, the current study will make use of multilevel modelling to consider this nesting or hierarchical influence of family and community factors on early childhood development.

Life course approach. Hertzman and Power (2005) have stated that it is essential to look at early life events since they can have a major impact on outcomes in adult life. The social determinants of health, such as neighbourhood factors or parental education, are examples of early life 'events'. Such events can affect the life course in three different ways, through latency, cumulative, or pathway effects. A *latency* effect refers to a one-time exposure that expresses or manifests itself years or decades later. A *cumulative* effect refers to multiple exposures that have a combined effect on the outcome, whereas a *pathway* effect refers to a sequence of events or exposures that influences the probability of other exposures or outcomes. As will be discussed later in this chapter, the inclusion of social factors that influence early childhood development and that occur between birth

and the EDI assessment will be integral to our study.

Total Environment Assessment Model for Early Child Development (TEAM-ECD). Developed by the World Health Organization's Commission on Social Determinants of Health's Knowledge Network on Early Child Development (Siddiqi, Irwin, & Hertzman, 2007), this model incorporates Bronfenbrenner's bioecological model of human development and the life course approach, among other components, with a clear focus on early child development. Unlike the bioecological model, Siddiqi and his colleagues separate the family and community into different influential environments. The closest level to the child is the family. Next, the family is in turn influenced by the neighbourhood in which it resides as well as other surrounding communities. Two additional components that are not seen in Bronfenbrenner's ecological model are "relational communities" and "early childhood education centres, programs and services". Though Bronfenbrenner does include "religious setting" among the various microsystems, TEAM-ECD differentiates the relational community from the geographical community. Relational communities are socially bonded. These include groups based on ethnicity, religious, or other characteristics, such as language, and may not necessarily match the geographical boundaries of a neighbourhood. Finally, all of the environments where the child lives and develops are influenced by regional, national, and global socio-economic and political factors.

One particular component of this model that is of interest to the current study is the notion of relational communities. As will be discussed later in this chapter, belonging to a cultural or linguistic community appears to have a distinct influence on child

development. Furthermore, this model supports the use of multilevel modelling to demonstrate the influence of individual, family and community factors on EDI scores.

Theory of language development in a linguistic minority. According to Landry and Allard's (1990) *counterbalance model of bilingual development*, bilingualism can either be additive or subtractive. Subtractive bilingualism is not optimal because in this situation learning the second language hinders the first, fostering a gradual loss of the first language. However, in additive bilingualism, the second language is learned without affecting the first language. To achieve additive bilingualism when the first language is a minority language, as is the case for Francophone children in Manitoba, three elements must be present: 1) the household is a French environment (as much as possible), 2) the school is a French first language school, and 3) contact with community programs offered in the minority language must be optimised. The current study intends to add to the body of research that support this theory.

Factors that Influence Early Childhood Development

Individual factors. Studies have consistently shown that being a girl positively affects EDI outcomes (Carpiano, Lloyd, & Hertzman, 2009; Guhn, Gaderman, Hertzman, & Zumbo, 2010; Santos, Brownell, Ekuma, Mayer, & Soodeen, 2012). Additionally, being older at the time of the evaluation has also been shown to affect EDI scores positively (Chartier, Mayer, Morga, & Dumaine, 2009; Healthy Child Manitoba, 2011; Puchala, Vu, & Muhajarine, 2010). Gender and age are two factors that are positively associated with other educational outcomes, such as child academic, behavioural and cognitive outcomes (Conley, Pfeiffer, & Velez, 2007; Levine, Pollack, & Confort, 2001) and high school achievement (Roos et al., 2013).

A child's health at birth, using measures such as birth weight, 5-minute Apgar score and gestational age, has been shown to have long-term effects on future outcomes (Oreopoulous, Stabile, Walld, & Roos, 2008). Specifically with early childhood outcomes, researchers have shown that poor health at birth was directly correlated with poorer EDI scores (Brownell et al., 2012). Children born with low or very low birth weight have proportionately lower scores on the EDI (Santos, Brownell, Ekuma, Mayer, & Soodeen, 2012).

"Children in care" are children who have physically been removed from their family and placed in another person's custody. "Children receiving protective and support services" are children who are receiving services from Child and Family Services because their families are experiencing parenting challenges and/or the children's lives or emotional well-being are endangered. Whether 'in care' or 'receiving protective and support services', this group of children have been shown to have poorer health, educational and social outcomes (Brownell et al., 2010; Brownell et al., 2007; Santos, Brownell, Ekuma, Mayer, & Soodeen, 2012).

Though these above mentioned child-level factors are significantly associated with childhood outcomes, Roos et al. (2013) demonstrated that their influence is negligible in terms of explaining the variance between children when family and community covariates are accounted for in a multilevel model. According to Jutte, Brownell, Roos, and colleagues (2010), social factors are important predictors of later health and educational outcomes. When using C statistics to explain the power of biological and social predictors in their regression models, the combined social covariates had a higher explanatory power than the combined biological covariates. It is therefore

vital to include in the current study several social factors known to affect childhood outcomes.

Family factors. Research has shown that children are influenced by the family via two pathways: family background and composition, and interactions in the home environment (Doherty, 2007). In many population-based studies, parental or family data, such as household income or parental education level, are not available or are not linkable at the child level, and are therefore missing from multilevel model studies (Kershaw, Forer, Irwin, Hertzman, & Lapointe, 2007). With access to linkable population data at the Manitoba Centre for Health Policy, family background factors, such as maternal education and receipt of income assistance, shown to influence early childhood outcomes, will be added to the current study's multilevel analyses.

Based on Roos and colleagues' (2013) study on achievement in early adulthood, family-level variables that have long term effects over the life course of a child are the mother's age at the birth of her first child, the mother's marital status, residential mobility and family size. In this study, family size was statistically significant but became of little importance in the full multilevel model (with all the covariates) to explain high school outcomes, as it only explained 0.11% of the total variation. Nonetheless, family size does appear to have an influence on EDI scores. Also using a multilevel model approach, Santos and his colleagues (2012) found that children who come from a family of four or more children are 1.62 times more likely to be considered 'not ready' on one or more of the EDI domains.

According to Jutte, Roos, Brownell, and colleagues (2010), children with mothers who had their first child at 19 years of age or younger (either current or prior teen

mothers) had worse health, educational and social outcomes than those with older mothers. In fact, children of teen mothers were 1.35 times more likely to be considered 'not ready' on one or more of the EDI domains, compared to other children in Manitoba (Santos, Brownell, Ekuma, Mayer, & Soodeen, 2012).

Family disruption, whether through separation or divorce, has been shown to have a negative impact on childhood and adolescent educational outcomes. Specifically, children of unmarried mothers are more likely to have lower achievement scores (Jutte, Brownell, Roos, et al., 2010; Roos et al., 2013), and this seems to affect boys more than girls (Kerr, 2004). Timing of the parental separation also seems to have an effect on children. Separation during early childhood (0 to 6 years old) appears to have a significantly negative effect on educational outcomes (i.e., grades and dropout rates) compared to other childhood life periods (Adam & Chase-Lansdale, 2002). In fact, for children of families whose parents have declared marriage or common-law status (by the time the child is four year old) there is a 22% decrease in odds of not being ready on one more domains of the EDI (OR = 0.78) than other children in Manitoba (Santos, Brownell, Ekuma, Mayer, & Soodeen, 2012).

Another form of family disruption is residential mobility, a disruptive occurrence that is associated with lower educational achievement (Adam & Chase-Lansdale, 2002). As such, Santos et al. (2008) predicted that three or more moves would be associated with children not being ready for school in any of the five EDI domains, yet after accounting for biological and socioeconomic factors, family residential mobility became insignificant. Conversely, residential mobility has also been shown to have a positive influence over the long run (Hango, 2006), especially when moving to a more advantaged

neighbourhood (Leventhal & Brooks-Gunn, 2003). Given the inconsistent findings of residential mobility on childhood outcomes, this factor will be tested.

An influential factor of great importance is parental level of education, especially maternal education. A mother's low education status (i.e., less than high school) has been shown to affect childhood outcomes (Brownell et al., 2007). Maternal education is significantly correlated with child development (Willms, 2002, as cited in Kershaw, Forer, Irwin, Hertzman, & Lapointe, 2007). Specifically, research has shown that lower parent education level is associated with lower scores on the following early childhood development outcomes: receptive vocabulary, communication skill, number knowledge, and copying and symbol uses (Thomas, 2006). Studies have often used the percentage of the population without a high school certificate as an alternative to not having parental education. One such study used this variable to assess neighbourhood-level contributors to EDI outcomes (Oliver, Dunn, Kohen, & Hertzman, 2007) and found that it negatively influenced communication skills and general knowledge scores on the EDI.

Receiving income assistance (IA) is a measure of family-level socioeconomic status that is important to consider, as it strongly relates to educational outcomes (Santos, Brownell, Ekuma, Mayer, & Soodeen, 2012; Roos et al., 2013). Furthermore, it specifically identifies those who are at the bottom of the income gradient, rather than estimating socioeconomic status through community-level measures, such as average household income or SEFI (Socio-Economic Factor Index) score. Being in a family that receives income assistance is a predictor of many negative outcomes, such as a higher risk of ending up in care (Brownell et al., 2007) or a greater chance of failing Grade 12 exams (Jutte, Brownell, Roos et al., 2010; Roos et al., 2013). In Manitoba, researchers

have demonstrated that there is a strong relationship between children from families who have received or are receiving income assistance and poorer EDI outcomes. There are greater odds (OR = 1.7) of not being ready for school (i.e., not ready on one or more EDI domains) for children in families receiving IA than for those who do not (Santos, Brownell, Ekuma, Mayer, & Soodeen, 2012).

Neighbourhood factors. Guhn, Janus and Hertzman (2007) believe that a child's development is not only influenced by family characteristics, such as parenting style or family socio-economic status but that it is also a reflection of "the broader social dynamics and institutions through which the entire citizenry organises itself economically, culturally, socially and so on" (p. 537). Though Oliver, Dunn, Kohen, and Hertzman (2007) have found that family-level characteristics, in this case family income, explained more of the variance in a multilevel model, neighbourhood-level characteristics were "independently associated with early development outcomes, particularly physical health and well-being, language and cognitive development, and communication skills and general knowledge" (p. 848).

The literature on neighbourhood influence shows that it has an independent influence on developmental outcome. Using a multilevel model approach, Roos, et al. (2013) demonstrated that neighbourhood average household income over the life course was of greatest importance in predicting high school achievement. Studies in British Columbia (Carpiano, Lloyd, & Hertzman, 2009; Lapointe, Ford & Zumbo, 2007) have also shown that the percentage of immigrants in the neighbourhood, unemployment rate, neighbourhood level of education, percentage reporting Aboriginal identity, percentage that moved in the last year were all important predictors of EDI outcomes.

Relational community factors. As suggested by the Total Environment Assessment Model for Early Child Development (TEAM-ECD) (Siddiqi, Irwin, & Hertzman, 2007), immigrant and Aboriginal status, as well as linguistic community can also be considered relational community factors. These inherent factors go beyond the family and the natural boundaries of a geographic neighbourhood, and have a particular effect on early childhood outcomes. Canadian researchers have found that children with Aboriginal status have significantly lower scores on the EDI, after controlling for age, sex, English as a second language (ESL) status, special needs status, neighbourhood ethnic diversity, neighbourhood percentage of movers during the previous year and percentage employed (Puchala, Vu, & Muhajarine, 2010).

Oliver, Dunn, Kohen and Hertzman (2007) demonstrated that the percentage of the neighbourhood population whose mother tongue was non-English was a strong predictor of negative outcomes on communication skills and general knowledge (a domain on the EDI that is affected by age-appropriate mastery of the language of assessment). Kershaw and his colleagues (2007) found that the percentage of households using a foreign language at home (i.e., not English or French) was by far the most important predictor of lower scores on communication skills and general knowledge, as it explained 55.8% of the model. As well, the percentage of the population reporting Aboriginal status accounted for another 10% of this model. Kershaw et al. postulate that these children may be exposed to foreign or Indigenous languages rather than English during early childhood, which would explain the lower score on this domain. Exposure to another language prior to entering school other than the language of evaluation may provide insight into why Francophone children are different on EDI domains related to

language.

A study in Saskatchewan demonstrated that children with English as a second language (ESL) had significantly lower scores on all five EDI domains compared with non-ESL children. Nevertheless, ethnically diverse communities had a protective effect on ESL children for emotional maturity and especially communication and general knowledge (Puchala, Vu, & Muhajarine, 2010). Puchala and her colleagues postulated that ESL children in diverse communities have higher scores on emotional maturity because minority families have to maintain their cultural and linguistic identity by fostering interdependence and community. They also speculated that children (both ESL and non-ESL) who live in ethnically diverse communities have higher scores on communication and general knowledge because they are exposed to a variety of languages and would have greater skills at understanding and communicating in other languages. However, this study did not assess the linguistic composition of neighbourhoods, and will be an important factor to consider in the current study. Puchala's study does nevertheless provide some insight regarding how relational community factors may provide a supportive network for child development. In the current study, the proportion of Francophones in the neighbourhood where the child lives will be important to include.

Francophone Children in Manitoba

In Manitoba, 4.2% of the population reported French (or French and another language) as their mother tongue (Statistics Canada, 2006a) whereas 3.8% reported French as their first official language spoken (Statistics Canada, 2006b). The official language minority includes individuals who reported that French was their first official

language spoken and half of those who reported both French and English (for provinces outside of Québec). After English and German respectively, French is the third most common mother tongue in Manitoba (Statistics Canada, 2011). As such, the Francophone community is a linguistic minority.

The Francophone community in Manitoba is a thriving community with many organisations that represent it and provide French services (FCFA, 2009). Among those organisations is the *Division scolaire franco-manitobaine* (DSFM), Manitoba's only French school division (which functions entirely in French). Created in 1994, there are presently 24 schools in the division, with over 5,000 students from Kindergarten to Grade 12. Twenty-one schools have early elementary programs (i.e., Kindergarten to Grade 4), six of which are in Winnipeg. Unlike French Immersion schools, children who are registered in these schools can only come from Francophone families, who are duly recognised as such. Based on Section 23 of the Canadian Charter of Rights and Freedoms, these families are "ayant droit" (Landry & Rousselle, 2003). In Manitoba, an "ayant droit" or "rights holder" is a parent or guardian whose first language learned and still spoken is French, or who received four years of education in a French-language program in Canada, or is the parent (guardian) of a child who is receiving his or her education in a French-language school or has received such an education for at least four years.

In the DSFM, English Language Arts is only offered starting in Grade 3. Yet, with the exception of newcomers, Francophone children have already been exposed to English prior to entering school. "Communities in minority situations differ from other communities in regards to the transmittal of the language, the culture, the accessibility

and availability of French services and programs, and assimilation. (Willms, 2010, p. I-10)" In some families, French is the only language spoken at home, whereas in other families, French and English, or another language is spoken at home (Ewart & de Rocquigny, 2011). According to the Understanding the Early Years study (Willms, 2010), 57% of DSFM parents reported speaking to their children only in French, whereas 29% used both official languages. Nevertheless, 12% spoke only in English. The remaining 2% used another language or French and another language. As such, many children arrive in Kindergarten in the DSFM with weak French linguistic skills (Willms, 2010).

To counter the effect of assimilation, the Francophone community has recognised that investing in early childhood education is essential, not only to the health and well-being of children, but also for the survival of the French language (i.e., transmission from one generation to another) and the vitality of the community (Coalition francophone de la petite enfance, 2004). In fall 2000, the DSFM and the *Fédération des parents du Manitoba* (FPM)[1] partnered to develop a plan on early childhood development. Part of the initiative was to develop early childhood centres (*Centre de la petite enfance et de la famille* or CPEF) in Francophone communities across the province. This project was inspired by McCain and Mustard (1999) who stated that early childhood development required quality programs integrated into the community. As a result of this partnership, 17 preschools were officially included in the DSFM in September 2003. The following month, the *Coalition francophone de la petite enfance du Manitoba* (i.e., the "Coalition"), a partnership between the DSFM, the FPM, the *Société franco-manitobaine* (SFM) and Healthy Child Manitoba – *Enfants en santé Manitoba* (HCM-ESM), was

created to continue efforts in early childhood development. In 2006, four communities had access to a CPEF: École Précieux-Sang in Saint-Boniface, Winnipeg, École / Collège régional Gabrielle-Roy in Île-des-Chênes, École communautaire Réal-Bérard in St-Pierre, and École régionale Saint-Jean-Baptiste in St-Jean-Baptiste. Currently, there are 14 CPEFs, the majority of which are integrated within DSFM schools, whereas a few are satellite sites (i.e., not attached to the school) within Francophone communities.

Despite these efforts and even though DSFM families have a relatively high socioeconomic status (Willms, 2010), children in the DSFM appear to have statistically significant lower scores on several early childhood indicators. Results from the Understanding the Early Years (UEY) study conducted in the DSFM (Willms, 2010) indicate that scores on receptive vocabulary (using the Peabody Picture Vocabulary Test – Revised (PPVT-R) of the Parent Interviews and Direct Assessments of Children Survey (PIDACS)) were 20 points lower than the Canadian average (79.5 versus 100). Scores on number knowledge and pre-literacy skills were also statistically lower than the Canadian average (100), with scores of 93.8 and 93.4, respectively. Furthermore, 63% of the DSFM's Kindergarten children that were tested fell below 85 points (the low-score threshold) on the assessment for receptive vocabulary. Twenty-five percent and 22% of children in the DSFM had low scores on number knowledge and pre-literacy skills, respectively. Though all three assessments show statistically lower scores for DSFM children compared to the Canadian average, the lower scores for receptive vocabulary are cause for concern. Willms argues that "this reflects the nature of the number knowledge and pre-literacy skills assessments, which do not depend as strongly on children's knowledge of French as does the assessment of receptive vocabulary. (p. II-8)"

As presented in the Introduction, the Understanding the Early Years (UEY) study (Willms, 2010) demonstrated that Kindergarten children in the DSFM (2005-2006) had significantly lower scores on 'language and cognitive development' and higher scores on 'physical health and well-being' compared to the national average scores. In addition to what was previously stated, compared to the Canadian average, only 8% of DSFM children were considered vulnerable on 'physical health and well-being', while 22% were considered vulnerable on 'communication skills and general knowledge'. Willms and his team considered the lowest 15% of the Canadian sample as the vulnerability threshold.

DSFM children scored statistically lower on both 'language and cognitive development' and 'communication skills and general knowledge' on the EDI in 2002-2003 (Chartier, Dumaine & Sabourin, 2011). Similarly, Chartier, Finlayson and their colleagues (2012) concluded that Francophone children had statistically lower scores on 'emotional maturity', 'language and cognitive development' and 'communication skills and general knowledge'. Additionally, these children had statistically higher rates of 'not ready for school' in one or more of the five EDI domains compared to other children in Manitoba. Specifically, Francophone children had statistically higher rates of not being ready on 'emotional maturity' and 'communication and general knowledge'.

Research suggests that DSFM children have statistically different scores from their Kindergarten counterparts. Based on the theory of the *counterbalance model of bilingual development* (Landry & Allard, 1990), it was hypothesised by Chartier, Dumaine and Sabourin (2011) that the linguistic environment would have an influence on the development of Francophone children in the DSFM. In fact, children who were raised in a French environment (e.g., home, daycare) during their early childhood had higher

scores in 'communication skills and general knowledge' and 'emotional maturity' as compared to children raised in a bilingual or English setting. This difference, however, did not appear to be statistically significant on 'language and cognitive development'.

Study's Expected Contributions

The current study hopes to make contributions to the body of knowledge in four ways:

1) by comparing EDI scores of Francophone children living in an anglo-dominant setting to non-Francophone children;

2) by adding multiple covariates to the analysis to explain the differences between Francophone and non-Francophone children;

3) by adding the proportion of Francophones in the community among these covariates to see if community linguistic influence has an effect on EDI scores for Francophone children;

4) and by using a multilevel modelling approach to consider the dependence of the covariates and the inherent hierarchical influence on early childhood development.

Specifically, given that studies comparing Francophone children to other children, such as that of Chartier et al. (2012), did not control for other possible covariates or risk factors in their analysis, we cannot explain why these children are different. By including multiple factors that are known to affect early childhood development, we are trying to understand what factors could explain the difference between Francophone children and other children in Manitoba.

Among the covariates, the proportion of Francophones living in the child's neighbourhood will be added. By adding this relational community factor, we are trying to understand whether living in a community with a higher proportion of Francophones is

associated with higher scores on the EDI scores, particularly on 'communication skills and general knowledge' and 'language and cognitive development'.

Finally, much of the research on family and community effects on childhood outcomes do not use multilevel modelling as their statistical method of analysis (Kershaw, Forer, Irwin, Hertzman, & Lapointe, 2007; Oliver, Dunn, Kohen, & Hertzman, 2007). Yet disregarding the nested nature of child development within its various environments, researchers are unable to disentangle the variation that happens at the individual level versus other levels. Furthermore, family level data is most often absent in multilevel modelling studies on the EDI (Kershaw et al., 2007). By using population data housed at the Manitoba Centre for Health Policy, the present study will be among the first to add parent or family data to an entire cohort of Kindergarten children evaluated on the EDI. Additionally, by using multilevel modelling, this study will disentangle and estimate the variation between children by explaining part of the variation due to the differences between communities.

Chapter 3: Methods

Overview

Data collected by the Healthy Child Manitoba Office (HCMO) along with other data collected by Manitoba ministries were used to study the research questions. The study relied on results from the Early Development Instrument (EDI) to assess early childhood outcomes measures. The EDI is an evaluation instrument, developed by researchers Offord and Janus, used to evaluate populations of Kindergarten children as to their readiness for school and to assess how well communities are supporting families and the development of their children prior to entering school (Janus & Offord, 2007). Child, family and community level variables used to answer the research questions originated from data collected for administrative purposes and will be described further. Multilevel modelling was used to examine the effect of individual, family and community factors on early childhood development outcomes of Francophone children and non- Francophone children.

Study Design

This study made use of the administrative databases available at the Manitoba Centre for Health Policy (MCHP). The Population Health Research Data Repository ("the Repository") housed at MCHP contains just under 70 different linkable datasets, some dating back to 1970. These datasets come from a number of ministries and university based research files in Manitoba, but mainly from Manitoba Health. The Research Registry, which includes every person who registered for the Manitoba Health Services Insurance Plan since 1970, contains an encrypted Personal Health Identification Number (PHIN), residential postal code, and family composition for each registrant. It is

with this encrypted PHIN that all datasets can be linked. Anonymity is protected because the encryption is completed at Manitoba Health.

Advantages. Researchers have argued that it is necessary to study early childhood development through population-based research to monitor child outcomes and their long-term development (Lloyd & Hertzman, 2009; McCain, Mustard, & Shanker, 2007). This requires information-rich environments, such as the Manitoba Centre for Health Policy, which has access to population-based longitudinal administrative data for the province of Manitoba (Roos et al., 2008; Roos, Roos, Brownell, & Fuller, 2010). Using administrative data does not require contact with participants (Roos et al., 2008), thus preserving a person's privacy and confidentiality and also maintaining total anonymity by reason of encrypted PHINs. Additionally, it reduces loss to follow-up and volunteer bias that occurs often with survey data collection (Lloyd & Hertzman, 2009).

The biggest advantage to using the Repository is that the datasets are linkable at the individual level (Roos & Nicol, 1999; Roos, et al., 2008). Having access to a significant number of linkable databases allows researchers to study a relatively large number of measures and to incorporate many covariates (e.g., Brownell, et al., 2008). Furthermore, such a feature allows more complex studies to be conducted, such as sibling, family or neighbourhood effects (Roos, et al., 2013). Due to this linking ability, MCHP has recently been innovative in identifying sub-populations, such as the Métis population or the Francophone population of Manitoba (Chartier, et al., 2012; Martens, et al., 2010).

Disadvantages. When using administrative data, researchers must use the variables that are available in the databases (Roos, et al., 2008). Since this information

was not originally collected for research purposes, a few disadvantages present themselves. Depending on the database, the quality of information can be an issue. Some reasons for lack of quality include administrative forms not being properly filled out or information incorrectly entered in the database (e.g., inversing day and month in time/date variables). Consequently, data cleaning is required prior to any analysis.

Another disadvantage to using administrative databases is that the variables have been predetermined by the collecting agency/ministry (e.g., physician claims to enable Manitoba Health to pay physicians). Consequently, studying Francophones living in a minority setting, such as in this study, is challenging because of the lack of available data specifically identifying this population (Schofield & Gauthier, 2007). Three of the six major challenges identified in a *Consortium national de formation en santé* (CNFS) report (Gaboury, Guignard, Noël, Forgues, & Bouchard, 2009) were encountered to varying degrees at the Manitoba Centre for Health Policy while examining the health and health utilisation of Francophones in Manitoba (Chartier, et al., 2012).. They were: 1) the lack of reliable language variables in administrative databases, 2) the lack of harmonisation of language variables which leads to researchers creating algorithms to identify Francophones of minority communities (FMCs), 3) a variable on language of communication with health professionals does not exist in any database across Canada. This has led some researchers to avoid secondary data analysis and focus on other research methods, such as paper-based surveys (e.g., de Moissac, et al., 2006; Griffith, et al., 2009; Pelletier, et al., 2007). Nevertheless, the Francophone Health Deliverable research team was innovative in overcoming these issues. With the Repository's ability to link administrative health data to other data, such as the education, child care and survey

data, MCHP is now capable of identifying a fair number of Francophones in Manitoba. In fact, the sub-population that is the most feasible and reliable to identify are the *children* attending a school in the *Division scolaire franco-manitobaine* (DSFM) because of the linkable Education database that identifies the school attended by each child.

Population

The population in the current study consisted of Kindergarten children who completed the EDI in 2006, 2007 or 2009. It was originally proposed to compare children attending French first language schools (i.e., students in the DSFM) to children attending French Immersion schools and to children attending English schools in Manitoba, with the rationale that children in French Immersion might be evaluated in French, even though their primary language is usually English. However, it was confirmed by the Healthy Child Manitoba Office (HCMO) that the EDI is administered in English for all schools with the exception of DSFM schools (T. Mayer, personal communication, July 10, 2013). For ease of analysis and interpretation, it was therefore decided that children of the DSFM would be compared to all other children in Manitoba. According to the DSFM, a total of 1018 children attended Kindergarten in DSFM schools during these three years (DSFM, 2009).

Children of these three cohorts were first identified through the Research Registry. Typically, children start Kindergarten in September of the year they turn 5 years old. However, some children may start one year earlier (usually children born earlier in the year) and others may start one year later (usually children born later in the year). As such, in order to capture all eligible children, only those born between January 1, 1999 and December 31, 2004 were initially included. Subsequently, these children

were identified through both the enrolment and EDI databases. Only children attending Kindergarten in 2005-2006, 2006-2007 or 2008-2009, and assessed on the EDI in 2006, 2007 or 2009 respectively, were included. These years were selected because 1) province-wide EDI assessments started in 2006 and 2) the last DSFM school to be added to the division was added in 2004 (ensuring that all DSFM students throughout the three cohorts are captured). Finally, with information available in the EDI dataset, and in keeping with the approach used by Santos and his colleagues (2012), children needed to be between the ages of 5 and 7. Based on the difference between the birthdate in the Research Registry file and the EDI assessment date, all children that were evaluated prior to age 5 or after age 7 were eliminated (specific method of calculating this variable is available further in the section "Independent variables").

Children were then categorised by language group by identifying children attending DSFM schools and those attending all other schools. Each school has a four digit number assigned to them by Manitoba Education that is publicly available (Government of Manitoba, 2010). The Enrollment database, which contains a separate record for each child enrolled in school, identifies the school in which the child is enrolled (i.e., "School ID"). School IDs were categorised into four groups: "DSFM", "Immersion", "English" and "Other". "Other" includes some French first language schools and 50/50 schools that are not in the DSFM. Since we were unable to confirm in which language the EDI was administered in these "Other" schools and because the children from these schools appear considerably different from DSFM children (see the Descriptive results), these children were not included among the Francophone children. For the purpose of the study, we reported descriptive statistics across the four school

groups. Subsequently, for the purpose of answering our research questions, "Immersion", "English" and "Other" school categories were merged for the multilevel model analyses, by using a dichotomous variable (i.e., "DSFM = 1" or "Not DSFM = 0") A list of the DSFM, Immersion, and Other schools is available in Appendix B.

It is to be noted that in some cases, children were registered in two schools at the beginning of the school year and therefore had two separate records. For the purpose of this study, it was necessary to identify the school in which they were enrolled at the time they were assessed on the EDI. Additional information in the EDI dataset was required to identify the school in which the child was assessed. Each school has been assigned another number for the purposes of the EDI data collection. This is a 5 to 6 digit number (i.e., "EDI School ID"). Each child with a valid EDI assessment is linked to an "EDI School ID". A conversion table was used to convert "EDI School IDs" to "School IDs" so as to allow for categorisation of children via school category.

Considerations. This approach to identifying the Francophone children population (through the enrolment and EDI databases) is not without problems. Children of DSFM schools must have at least one parent whose mother tongue is French, known in French as an "ayant droit". However, it is not required that both parents are Francophone. With the current data, it is impossible to distinguish children of two Francophone parents from children of an exogamous couple (i.e., one parent speaks French, the other (usually) English). Since studies have shown a difference in early development outcomes between children who were raised in a French environment compared to children raised in a bilingual or English environment and that DSFM children are evaluated in French (reflecting the ability of children to respond / be assessed in French), it would be

important to know the language utilised at home in the early childhood period, prior to entering school. Children of exogamous families who have learned English in the household but whose parents' chose to register them in a French school may negatively influence EDI scores for the Francophone cohort (Chartier, Dumaine, & Sabourin, 2012). Therefore, for DSFM children, one variable on the EDI assessment will be utilised to distinguish children whose first language is French and those whose first language is not French. i.e., an indicator of the language used in the home. However, this variable will be used with caution because the Kindergarten teacher, who administers the evaluation, may not be aware of the child's first language.

Databases

In this study, nine databases housed at the Manitoba Centre for Health Policy were used to analyse neighbourhood, family and individual level variables. Out of these databases, twelve data files were created with the variables needed for the research (see Appendix C for specific information on databases, files, years and variables). The following is a brief overview of the databases that were used in this study.

Research Registry. The Research Registry was used to link all identified children to all other databases required for this study. The Registry includes every person who has registered for the Manitoba Health Services Insurance Plan since 1970, as previously stated. It contains an encrypted Personal Health Identification Number (PHIN), residential postal code, and family composition (i.e., number of children, marital status) for each registrant. It is with this PHIN that all datasets were linked.

Early Development Instrument. The Early Development Instrument (EDI) data collected by the Healthy Child Manitoba Office (HCMO) was linked to the Research

Registry. This database contains individual results of all Kindergarten children who were evaluated. The dataset includes scores on the five developmental domains: physical health and well-being, social competence, emotional maturity, language and cognitive development, and communication skills and general knowledge. For each of the five domains, a binary variable is included to indicate if a child is considered vulnerable or not.

Manitoba Schools: Enrollment. Data collected by Manitoba Education was also included in the analysis. The Enrolment and courses database includes all children that have attended a Manitoba school from Kindergarten to Grade 12, including home schooling, since 1995 (Manitoba Centre for Health Policy, 2012). The education data provided allowed us to identify the year and the school in which a child was registered. Along with information provided in the EDI database, this database was used to identify the children from French first language schools, as well as French Immersion, English and other schools. See the previous section for an explanation of the target population and groupings by school language.

Census. Census data allowed us to include variables that were collected and aggregated by Statistics Canada in the 2006 census. This census year was selected because all children in the study were born by that time. This data does not include individual-level variables but rather neighbourhood-based variables, such as average household income, unemployment rate, percentage of single parent households, and percentage of high school graduates. A composite variable (i.e., an index) called SEFI-2 (Socioeconomic Factor Index – Version 2) was used as the neighbourhood variable to estimate socio-economic status. This score is calculated for every Dissemination Area

(DA) using unemployment rate, average household income, proportion of single parent households and proportion without high school graduation. A Dissemination Area is a "small, relatively stable geographic unit composed of one or more blocks, with a population of 400 to 700 persons. It is the smallest standard geographic area for which all census data are disseminated" (Statistics Canada, 2010). More details about SEFI-2 can be found in the "Variables" section under "Independent variables".

The proportion of Francophones living in the neighbourhood was extracted through the "Beyond 20/20" database, where all Census data can be found. Researchers studying francophone minorities across Canada have noted different ways of defining a Francophone (Forgues & Landry, 2006). Many researchers have questioned the way the number and percentage of Francophones resident in an area are calculated in Canada (Forgues, Landry, & Boudreau, 2009). In the current study, the proportion of Francophones was calculated using the official language minority percentage and transforming it into a proportion (i.e., out of 100). Outside of Québec, the definition of the official language minority is based on the individuals who reported French as their first official language spoken and half of those who reported both French and English. In 2006, the official language minority percentage in Manitoba was 3.8%, representing 43,120 Manitobans (Statistics Canada, 2006b).

Hospital Abstracts. A hospital abstract is a form or computerized record filled out at the time a patient is discharged from hospital. It contains information from the patient's medical record based on their stay in hospital. Information required for the current study included the health of the child at birth, such as their 5-minute APGAR score, gestational age and birth weight, and identification of the child's mother. Details

on the above mentioned variables are available in the section covering "Independent variables."

Child and Family Services Information System. This database tracks all children and families that have contact with Child and Family Services (CFS). This includes all children in care as well as families receiving protective or support services. For the purpose of this study, any child who has been taken into care was identified. Details about the CFS variable are discussed further.

Income/Employment Assistance Program. This dataset includes all individuals and families who receive financial assistance from the Employment and Income Assistance (EIA) Program, a provincial program available for people who need help to meet basic personal and family needs (Manitoba Centre for Health Policy, 2013). This database registers each client (person or family) for each month they receive income assistance.

Baby First and Families First Screening Databases. The Baby First screening, now known as the Families First Screening Program, is a universal screening program administered by public health nurses with the purpose of evaluating the biological and social factors that influence child outcomes. The Baby First Screening captures families with children born between January 1, 2000 and December 31, 2002. Information such as maternal depression, maternal and paternal levels of education, and parental health factors were collected. The Families First Screening captures all families with children born after January 1, 2003. It should be noted that babies of on-reserve First Nation families are not screened, given this is federal jurisdiction (Brownell, Santos, Chartier, Girard, & Roos, 2011).

The Baby First screening form has different variable names and some different content compared to the Families First screening form. A question about Francophone and Newcomer families was added to the form, but was not available for the cohorts in this particular study. For the purpose of this study, only maternal level of education was utilised. However, this information was treated with caution. Two variables exist for maternal education: one for "Grade 12 completion", the other indicating "low education". The Baby First form was filled out differently than the Families First form. Though the question on Grade 12 completion was a yes/no answer, only mothers that were thought to have a low education level were assigned a numeric value of '3' for that particular itemized question. Conversely, both questions in the Families First form for maternal education (i.e., "Grade 12 completion" and "low education") are formulated as yes/no responses and typically answered. Thus, maternal education will be defined as "Grade 12 completion". Paternal education was also available; however, given the amount of missing responses for this variable, it was decided not to use this variable in the models. Since we were not able to include maternal education for all children, a post-hoc analysis was done with only the children who could be linked to their mother's education level.

Variables

Independent variables. The primary independent variable is the basis by which the groups are defined. It is based on the language of communication in the schools. It is assumed for this study that virtually all children who attend French first language schools are Francophones and the majority of children attending English or Immersion schools, with the exception of those from "Other schools", are English-speaking. Nonetheless, one study suggests that only half of all Francophones attend French first language schools

(Landry, 2010); meaning that some Francophones are attending other schools. This is, however, not expected to affect the results of the Anglophone/Immersion/Other population, since Francophones represent less than 5% of the population.

Basic definitions of the variables that are used in the final multilevel models are included in Table 1. Variables fall under three types of levels: individual-level, family-level and community-level variables.

The following are detailed explanations and definitions of specifics variables used in this study. These definitions also include variables that are not included in the full models.

Individual-level variables.

EDI assessment date. This is the date that the child was evaluated on the EDI. Though it is extremely unusual that children would be assessed any time after March 31st of the school year, the end of the school year (i.e., June 30th) was selected as the last possible cut-off date. Any dates falling in the months of July to December were converted to March 15th of the assessment year. Additionally, it is possible that when entering the data, month and day were inverted. Evaluation dates that fell on the 1st, 2nd or 3rd of outlier months (i.e., July to December) were converted as following: month switched to day and day switched to month. The reasoning behind this decision is that higher number of cases fell on these dates compared to other dates in the July-December range.

Research Registry coverage dates. For the purpose of this study, it was required that children registered as being born in the province, meaning immigrants were not included. They needed to be born in Manitoba to allow us to include information about

the child's health at birth. As well, only children who were registered as being in the province on the day they were evaluated on the EDI were included. The EDI evaluation date need to fall between the beginning of the coverage to the end of their coverage (or the last date of coverage we had in the dataset: November 30, 2011).

Age (continuous). The mean age of children who get assessed is 5.7 years of age. After calculating each child's age at EDI assessment date, using the correct birth date (based on the Research Registry), children who were younger than 5 years old and older than 7 year were eliminated.

Age (in months). Age was also calculated in months, as some researchers have found it to be more meaningful (Fransoo, 2007).

Child's 5th birthday. This variable was calculated by adding 5 years to the child's birth date which is available through the Research Registry. (Note: The birth date available through the EDI database was deemed unreliable and therefore ignored.)

Sex: This is the biological sex of the child, based on the information provided in the Research Registry. Females were categorised as "0" (i.e., the reference category) and males as "1".

Birth order. Calculated with data from the Research Registry, this variable indicates the order in which the child was born in his or her family. Multiples (i.e., twins, triplets, etc.) were assigned the same birth order number. Birth order was categorised as "1st born", "2nd born", "3rd born" and "4th or later born". Simply for descriptive statistics, the percentage was reported by oldest child (1) or not (0).

Child and Family Services (CFS). This variable includes all children in care. For the purpose of this study, a dichotomous variable was created which indicated whether or

not a child was ever taken into care (i.e., had ever been involved with CFS up to their 5th birthday (1) or not (0).

Low Birth Weight (LBW). This variable is based on the weight of the child at birth, available in the Hospital Abstract data. Birth weight is a continuous variable in grams. Based on the approach used by Santos and his colleagues (2012), this variable was transformed into a dichotomous variable of "low birth weight = 1" (i.e., babies weighing less than 2,500 grams) or "not = 0".

Preterm birth. This variable is based on the gestational age of the child at birth, available in the Hospital Abstract data. It gestational age is calculated in weeks and approximated from the first day of the woman's last menstrual period to birth. The average gestational age of a newborn is 37 weeks (Santos et al., 2012). The gestational age variable was transformed into a dichotomous variable indicating "preterm birth = 1" (i.e., before 37 weeks) or "not = 0".

5-minute Apgar score: This is an assessment of the physiological well-being of virtually all babies born in hospital. Five vital signs are measured (appearance, pulse, reflex, muscle tone, breathing pattern) and given a score of 0, 1 or 2. Total Apgar score is on 10. This variable was transformed into a dichotomous variable of either normal Apgar (0) or low Apgar (1). Low Apgar score is a score ranging from 0-7. Normal is a score from 8-10.

French not the first language. This variable was available for all DSFM kids in the EDI assessment data. It is based on whether the child's first language is French (0) or not (1). Since this variable is based on the teacher's assessment, it was used with caution in a post-hoc analysis.

Family-level variables.

Mother's age at first birth. This variable was calculated using information from the Research Registry and Hospital Abstracts. This is the age of the child's mother at the birth of her first biological child.

Number of children. This variable was calculated using the Research Registry. It is the number of children in the family by same mother at the child's fifth birthday.

Four or more children. The number of children was subsequently changed to a dichotomous variable of "4 or more children = 1" in the family or "not = 0".

Number of residences: This was calculated with information provided in the Research Registry. It is the number of family residences up to the child's fifth birthday based on the postal code.

Three or more moves. The number of moves was calculated based on the number of changes in the postal code. This was subsequently defined as a dichotomous variable of "3 or more moves = 1" or "Not = 0".

Family income assistance (IA) usage. IA is reported monthly. However, given the irregularities in the monthly reporting (e.g., a family is not on IA for a random month out of the full year of coverage), a dichotomous variable was created. Research has shown that any amount of time with this service is an indicator of vulnerability (Fransoo et al., 2008; Santos et al., 2012). Therefore, children were simply categorised as being in a family receiving income assistance (1) or not (0).

Mother's marital status. Available through the Research Registry, this variable considers if the child's mother is registered with Manitoba Health as being married or in a common-law relationship (1) or not (0). Since Manitoba Health does not require a

person to declare marital status, this variable must be interpreted with caution. Married or common-law status most likely means the mother is in a stable relationship. However, not declaring being married or in a common-law relationship does not necessarily mean that the mother is not in a stable relationship. Two variables were created: "at the child's birth" and "at the child's fifth birthday" and were reported for descriptive purposes. For the models, we only considered mother's marital status at the child's fifth birthday.

Mother's education. This variable is available through the BabyFirst / FamilyFirst Screening. This is the mother's education level, specifically, whether the mother has obtained her high school diploma (i.e., completed Grade 12). It is to be noted that, in some cases, children had multiple screenings of the BabyFirst / FamilyFirst Screening (i.e., multiple observations in this dataset). In most cases, it appeared that the first observation for each case had more complete data. There were 20 cases where manual imputation was needed. Selection of the most complete observations was as follows:

a) if the first observation had missing data but the following observation had data, the more complete observation was selected;

b) if there were two observations for one case and there was differing data, the first observation was selected;

c) if there were three or more observations, the observation with the most commonly reported answer was selected.

Community-level variables.

Dissemination Area (DA). We used the child's area of residence at age 5 based on a 6-digit postal code to determine the dissemination area in which they live. In certain cases, some postal codes were missing an associated DA. These postal codes were

verified and the appropriate DA was assigned. As previously stated, a dissemination area is a "small, relatively stable geographic unit composed of one or more blocks, with a population of 400 to 700 persons. It is the smallest standard geographic area for which all census data are disseminated (Statistics Canada, 2010)." At the neighbourhood level (level 2) in the multilevel models, children are grouped by DA. This is consistent with the literature that reports EDI results at the neighbourhood level, rather than at the school catchment area level, since the EDI is not a reflection of the school but rather of the neighbourhood a child lived in prior to entering Kindergarten (Hertzman, Kershaw, Irwin, Trafford, & Wiens, 2008, as cited in Lloyd & Hertzman, 2009).

Average household income. Available through the Census data, the average household income is the mean income of households in each dissemination area. "A household refers to all persons who live within the same dwelling, regardless of their relationship to each other. Household income is the sum of incomes of all persons in the household" (Manitoba Centre for Health Policy, 2010). This variable was only used for the descriptive results. SEFI-2 score is a more reliable and stable variable as a proxy for socio-economic status.

SEFI-2 score. This is an index created using four variables from the Census data that characterise the dissemination area (DA) where each individual child lived at age 5. They are: unemployment rate (age 15+), average household income (age 15+), proportion of single parent households (derived variable) and proportion without high school graduation (derived variable). This variable is used as another way to estimate socio-economic status, rather than simply using average neighbourhood household income. "Scores less than zero indicate more favourable socioeconomic conditions, while scores

greater than zero indicate less ideal socioeconomic conditions." (Manitoba Centre for Health Policy, 2009)

Proportion of Francophones. In the current study, the official language minority percentage for each dissemination area (DA) where each individual child lived at age 5 was extracted. The proportion of Francophones was calculated by transforming the percentage into a proportion (i.e., out of 1). Outside of Québec, the definition of the official language minority is based on a count of the individuals who reported French as their first official language spoken and half of those who reported both French and English.

Dependent variables. The outcome of interest (i.e., early childhood development) was calculated by using the Early Development Instrument (EDI) scores for all individuals for whom EDI scores were collected during three complete evaluation years (i.e., 2005/06, 2006/07, and 2008/09). Early childhood outcomes were analysed according to the five domains of the EDI: physical health and well-being, social competence, emotional maturity, language and cognitive development, and communication skills and general knowledge. Scores for each domain are on a 10-point scale. Total EDI score was available for the 2006 and 2007 assessment years. This allowed us to calculate any missing domain scores for children in these particular years.

It is to be noted that, some children had multiple evaluations of the EDI (i.e., multiple observations in this dataset). In most cases, the first observation for children with multiple observations was taken. The decision to take a particular observation was based on the following:

1) if the child was assessed the same year, the first observation was taken unless

there were discrepancies in the information, such as an incorrect birthday;

2) if the child was assessed the same year and there were discrepancies in the information, the observation with the most correct information was taken (e.g., correct birthday information compared to the Research Registry information);

3) and, if the child was assessed in different years, the EDI results from the year where the child was closest to age 6 was taken.

The sixth outcome of interest was "not ready in one or more domains". This is a relative measure that ranks children into percentiles for each domain. Children who fall in the bottom tenth percentile of the Canadian average on any of the five domains are considered "not ready in one or more domains".

Exclusions. Similar to the approach adopted by Santos and his colleagues (2012), children with invalid PHINs, missing PHINs, invalid EDI assessment or postal code errors were excluded. All duplicate or erroneous records were also deleted. Since we needed to link each child to their mother for family-level information and use hospital data for individual-level information, it was necessary to excluded all children who were not born in a Manitoba hospital (i.e., no Hospital Discharge Abstracts) or without an identifiable mother (i.e, mothers with a missing PHIN). A detailed explanation of the number of exclusions is available in the Results section.

Analysis

Statistical analysis was accomplished using SAS 9.3. Preliminary analyses consisted of understanding the datasets by calculating central tendency measures (mean, median, range, standard deviation (SD)) and the distribution for each independent variable. This allowed us to clean the data by finding errors in the datasets, such as

missing variables. It was therefore possible to either correct the error or eliminate the particular case, such as eliminating outliers. As previously stated, many of the variables were subsequently categorised or dichotomised. Following these steps, the mean and standard deviation was recalculated for each of the independent variables to describe each of the four original school groups: "DSFM", "English", "Immersion" and "Other" (see Results chapter for summary table).

As for each of the five EDI outcomes, central tendency measures (mean, median, range, standard deviation (SD)) and distribution were also calculated. This was calculated for each of the original four school groups: "DSFM", "English", "Immersion" and "Other". In addition, the average score on each domain was also calculated for all non-DSFM children (i.e., all non-DSFM schools) for later comparison with DSFM children. See the following chapter for a summary of the results.

Multilevel Modelling. For this study, we used multilevel modelling (MLM) to consider the effect of individual, family and community factors on children's EDI scores. Specifically, MLM allowed us to estimate the community-level covariate effects while controlling for family and individual contributors to EDI scores. In addition, by using a two-tiered model, it was possible to consider between-community variability, as well as account for within-community influences (Conley, Pfeiffer, & Velez, 2007) while still including several other independent variables in the model. Thus, we were able to estimate the proportion of the variation in EDI scores that can be explained both within and between the neighbourhoods.

For the current study, a random intercept model was used. The assumption for this type of MLM is that the slopes are the same for all neighbourhoods (i.e., children are

affected the same way by a predictor variable) but that the intercepts are different between neighbourhoods ($\beta_0 + u_j$) compared to the overall average intercept (β_0) (Pillinger, 2011).

The following is the equation for the random intercept null model for i_j children nested (level 1) within each of $j = 1, \ldots, N$ neighbourhoods (level 2) and where Y = EDI score:

$$Y_{ij} = \beta_0 + u_j + e_{ij}$$

where $e_{ij} \sim N(0, \sigma^2_e)$

$u_j \sim N(0, \sigma^2_u)$

The following is random intercept model with one explanatory variable, which can be modified to add more predictor variables:

$$Y_{ij} = \beta_0 + \beta_1 x_{ij} + u_j + e_{ij}$$

where $e_{ij} \sim N(0, \sigma^2_e)$

$u_j \sim N(0, \sigma^2_u)$

The estimated parameters that are fixed are the regression coefficients $\beta_0, \beta_1, \ldots, \beta_n$. This means that for each one unit increase in x, there is a β increase in the y outcome. e_{ij} and u_j are the two random effects or multilevel residuals. $e_{ij} \sim N(0, \sigma^2_e)$ is the variance of the level 1 random term and $u_j \sim N(0, \sigma^2_u)$ is the a variance of the level 2 random term. The σ^2_u and σ^2_e are random estimated parameters. They are considered random because we allow for e_{ij} and u_j to vary. σ^2_u is the unexplained variation at level 2 after we control for the explanatory variables. And σ^2_e is the unexplained variation at level 1 after we control for the explanatory variables.

The intraclass coefficient correlation (ICC), also known as the Variance Partition

Coefficient (VPC), was calculated to estimate the variance that is explained by different levels in the model (Norwegian Social Science Data Services, 2013). To take into account the nested data structure, multilevel modelling should be used when the ICC of the null model is 0.05 or more. The following is the equation to calculate the ICC:

$$ICC = \rho_I = \sigma^2_u / (\sigma^2_u + \sigma^2_e)$$

The ICC for the null model (i.e., the variance attributed to the neighbourhood level) was also used to calculate the variance attributed to the individual level by subtracting the ICC from 1 (or 100% if reported in percentages). The variance at each level was also calculated for both the null and full models. The Hox or Raudenbush and Byrk R^2 is the percentage of variation that can be explained at each level compared to the null model (Raudenbush & Byrk, 2002). It is calculated as follows:

Level 1 explained variation = $R_1^2 = [(\sigma^2_{e(null)} - \sigma^2_{e(full)})/ \sigma^2_{e(null)}] * 100$

Level 2 explained variation = $R_2^2 = [(\sigma^2_{u(null)} - \sigma^2_{u(full)})/ \sigma^2_{u(null)}] * 100$

The Bickel or Snijders and Bosker R^2 estimates the reduction in the variance when adding all the covariates (Snijder and Bosker, 2012). Specifically, it is the total variance that can be explained when comparing the full model to the null model. It is calculated as follows:

Total explained variation = $R_T^2 = 1 - [(\sigma^2_{u(full)} + \sigma^2_{e(full)}) / (\sigma^2_{u(null)} + \sigma^2_{e(null)})] * 100$

It is possible to calculate the total variance explained at each level by multiplying the Raudenbush and Byrk R^2 to the variance attributed in the null model. For the total variance explained at the individual level, it is calculated by multiplying the variance attributed to the individual level (null model) by the R_1^2. For the total variance explained at the neighbourhood level, it is calculated by multiplying the variance attributed to the

neighbourhood level (null model) by the R_2^2. This can be added to give the total explained variation (R_T^2).

Proc MIXED was used for as the analysis procedure in SAS for all five continuous outcomes on the EDI. Proc GLIMMIX was used for binary outcomes (i.e., "ready" or "not ready"). For the current study, the first set of models included all children (which included DSFM children). The second set of models included only DSFM children. The third set of models included only the children who had information on their mother's education level (this included DSFM children). Finally, a fourth set of models, with only DSFM children, was run to add the "French not the first language" variable. Separate models were created for each of the five EDI domains and for each of the domains based on readiness, as well as one last model on "not ready on one or more domains".

Considerations. A two-level model was chosen to represent the influence of individual and family, as well as community factors on child development. The two levels that were included in the model were: 1) individual and family factors, and 2) community factors. The original proposal included a three-level model, where individual and family factors were considered as different levels. However, 87.25% had only one child with the EDI assessment in the available sample. This does not mean that these children had no siblings rather that they were the only child in their family that was evaluated on the EDI during the three-year period. Such a high percentage of single-child families does not respect the assumptions for the sample size that is required at each level of the multilevel model (Norwegian Social Science Data Services, 2013).

Although the EDI is administered in Kindergarten, this assessment was not

designed to evaluate the quality of the teachers or the school. The EDI was developed to measure population-level child development that occurred between ages 0 to 5 years (Janus et al., 2007). Hence, rather than focus on the characteristics of the school, researchers suggest that community factors of the neighbourhood where the child lives should be included in EDI analyses (Lloyd & Hertzman, 2009). Furthermore, given the difference in catchment area borders between DSFM schools and all other schools in Manitoba (resulting in a cross-group model), it was decided that the community would be used as the level 2 in the models.

Why use multilevel modelling? Although using a single-level regression model has historically been the approach to analyse this type of outcome (i.e., childhood educational achievement), it does not consider the dependence of the data. In fact, these single-level regression approaches make the assumption that all observations and all variables are truly independent of each other (Vittinghoff, Glidden, Shiboski, & McCulloch, 2005, p.260). Consequently, when using single-level models, it "may lead to erroneous conclusion, because independence assumptions are likely to be violated" (Snijders & Bosker, 2012, p. 6).

Furthermore, single-level regressions do not consider the inherent hierarchy or clustering of the data. When using a single-level regression with clustered data, the standard error estimates are inaccurate because they are being fitted to one intercept rather than multiple intercepts. Secondly, with hierarchical or clustered data being analysed with a single-level regression, the variation between individual cases cannot be explained at the clustered level, whatever that level may be.

Snijders and Bosker argue that researchers should use hierarchical linear models

because they are suited for multilevel data (2012). By using multilevel modelling, it is possible to "account for a) the dilemma of unit of analysis, b) the problem of dependencies of individual responses within groups, c) confounding variables at both within- and between-group levels, d) detection of cross-level interactions, and e) the manipulation of random coefficients" (Ma, 2001, as cited in Ma, Ma, & Bradley, 2008, p.64).

Ethics and Safeguards to Protect Privacy

A research protocol was submitted and reviewed by the Health Information Privacy Committee (HIPC) of the Government of Manitoba, the Health Research Ethics Board (HREB) of the University of Manitoba, as well as the Department of Family Services and Consumer Affairs of the Government of Manitoba, the Health Child Manitoba Office and Manitoba Education. Following review and approval, the data necessary for this study was extracted by a programmer from the Manitoba Centre for Health Policy.

Research was conducted in the Manitoba Centre for Health Policy's student office in T-155. This environment is secure and follows MCHP's, HIPC's and HREB's requirements for confidentiality and anonymity of administrative data. Consistent with MCHP's policy on privacy and confidentiality, data cells representing one to five individuals were suppressed or aggregated to another data cell.

Chapter 4: Results

Study Population

There were originally 30,651 children in the sample after merging the Research Registry, EDI, Enrolment and Census datasets. When merging, any duplicate observations were removed and only the children with valid EDI entries, correct birthday, valid postal codes, and who were registered in Manitoba at the time of the EDI were included. Subsequently, the sample reduced slightly to 30,592 children once these children were merged to data associated to their mother and family.

From the Hospital Abstracts dataset we could identify that there were 26,894 children born in a hospital in Manitoba, and these constituted the final study population. An additional 3,698 children were not born in hospital but had valid EDI scores (described below). It is to be noted that there were also 1,500 children that were born in Manitoba (i.e., in the Hospital Abstracts dataset), but did not have an associated EDI assessment.

Our final study population was comprised of children who were assessed on the EDI in 2006, 2007 and 2009. In our sample, 9,069 children were assessed in 2006, another 9,387 children in 2007, and finally 6,052 children in 2009. A breakdown of the number of children who were assessed on the EDI are presented in Table 2 by EDI year and by school language group.

Descriptive statistics

Excluded children. Twelve percent of children with valid EDI scores were excluded from the current study because they were not born in a Manitoba hospital. These excluded children were compared to all remaining children in the final sample on

continuous EDI domain scores, percentage not ready on each EDI score, as well as on individual, family and characteristics that were available for both groups. It is to be noted that 158 children who were excluded from the final population were evaluated in a DSFM school, 2635 in an English school, 890 in an Immersion school, and 15 in a school considered 'other'.

As seen in Table 3, when comparing excluded children to those included in the final study sample on EDI scores, one-way ANOVAs revealed differences. Though excluded children had a slightly higher average score on physical health and well-being ($F(1, 30{,}552) = 2.83$, $p < .10$) compared to the included children, their scores were significantly lower for all other domains. Most notably was a 0.74 point difference in average scores on communication and general knowledge ($F(1, 30{,}587) = 243.65$, $p < .001$). Given that these children are not born in Manitoba, differences on communication and general knowledge scores would be indicative of children whose mother tongue is not the language in which the child is evaluated. It is highly possible that these children are newcomers to Canada and do not have either English or French as their mother tongue. Excluding newcomers will be discussed further in the limitations of this study.

As seen in Table 4, when comparing children who are not ready on the EDI, excluded children were less likely to not be ready on physical health and well-being (10.2% vs 11.8%), χ^2 (1, n = 30,520) = 7.85, p = .005. Almost 19% of excluded children are not ready on communication and general knowledge compared to 10% of children included in the sample (χ^2 (1, n = 30,582) = 238.41, $p < .001$). One third of excluded children (34%) are not ready on one or more EDI domains compared to 27% of children who fit the inclusion criteria, χ^2 (1, n = 30,592) = 62.01, $p < .001$. Children in these two

groups do not differ on social competence, emotional maturity or language and cognitive development. As previously stated, differences between excluded children and children in the included sample on communication and general knowledge are suggestive of children whose mother tongue is not English or French.

Comparisons on individual, family and community characteristics (Table 5) show that the excluded children are significantly different from the children who fit the inclusion criteria of this study. For individual characteristics, one difference appeared. Excluded children were less likely to be taken into care by Child and Family Services (CFS) (1.08% vs 3.75%). For family characteristics, the percentage of excluded children with married mothers is almost 30% higher than the included sample (80.53% vs 52.33%). Excluded children come from families with a larger number of children (19.93% vs 17.22%). They have moved fewer times, on average, than children included in the sample (2.57% vs 7.10%). It should be noted that we were unable to know how many times a family had moved outside the province of Manitoba with the information provided in the datasets. Under 2% of excluded children come from families receiving income assistance compared to 23% for children in the sample.

Two family characteristics that are presented in Table 5 are interpreted with caution. Though the results indicate that excluded children have older mothers and less teen mothers at first birth, this information is based on the oldest child that is registered with the mother on her Manitoba Health registration card. If these excluded children are indeed of newcomer families, some families may have left older siblings behind, therefore we are calculating the age of the mother at her first birth based on the oldest child that came to Canada with her. In other cases, some siblings may be too old (i.e.,

adults) to be declared with Manitoba Health under the mother's name when arriving in Canada. Once again, the age of the mother at her first birth would be calculated based on the oldest child that can be registered on her Manitoba Health card.

For community characteristics, excluded children appear to live in communities of higher socio-economic status (SEFI-2 score: −0.032 vs 0.023) yet with less Francophones in those communities (3.88% vs 4.24%).

Children included in the study population. Children who met the inclusion criteria were categorised by the language of teaching at the school. Nine-hundred and forty-four children were categorised as "DSFM" (i.e., French first language schools), 19,431 as "English", 6,341 as "Immersion", and 178 as "Other" for a total of 26,894 children. Descriptive statistics for average EDI domain scores (Table 6), percentage not ready on each EDI domain and "one or more domains" (Table 7), as well as individual, family and community characteristics (Table 8) are presented by school language group. As seen in Table 6, the average EDI score on physical health and well-being is 8.70, M = 8.26 for social competence, M = 7.87 for emotional maturity, M = 8.14 for language a cognitive development, and M = 7.63 for communication and general knowledge. For each of the domains, between 10.09% and 12.43% of children across language groups are not ready. When considering children that are not ready on one or more domains, 27.45% are not ready.

Differences between these four school groups were not compared statistically, as this was not the focus of the study. However, some differences are worth mentioning (see Table 8 for all results). The average age of children in our population is 5.7. Both children in the DSFM and 'Other' schools are on average younger (M = 5.67). The

average percentage of children in care is 3.75%, with a greater representation from the 'English' school, where 4.62% of these children are, or have been, in care with Child and Family Services, compared to only 0.64% for DSFM children. Children from English schools have more siblings on average, and 20% come from a family with four or more children. Children in English schools have mothers who have had their first child at a younger age, and many more teen mothers than the other school groups. Furthermore, for those with information about their mother's education, 95% of DSFM children have mothers with a high school diploma whereas only 77% of English school children have mothers with a high school diploma. Only 6.5% of children in the DSFM are in families who receive income assistance (IA), whereas 26.4% of children from 'other' schools and 25.7% of children from 'English' schools come from families on IA. Furthermore, children from the DSFM and from French Immersion schools live in communities where the average household income is around 68,000$, whereas children from English and 'other' schools it is 59,000$ and 51,000$ respectively. This in part translates into negative SEFI-2 scores (i.e., higher socio-economic status) for DSFM and Immersion children, whereas it translates into positive scores for English and other school children. Interestingly, children from 'other' schools live in neighbourhoods where the average percentage of Francophones is 29%, compared to DSFM children where it is 22%. Not surprisingly, children who attend English or Immersion schools live in communities with an average of 3.1% and 4.5% of Francophones, respectively. For all children, the range of Francophones in their community ranges from 0% to 86.7%.

It is to be noted that given the difference between DSFM children and children in 'Other' schools, it further supports our reasoning to keep these two groups separate.

'English', 'Immersion' and 'Other' school groups were subsequently merged as "all other schools" and results were statistically compared to children from DSFM schools.

DSFM children versus all other children. Prior to answering the three research questions, DSFM children were compared to other children in Manitoba, without controlling for contributing factors to early childhood development, such as age, sex and all the individual, family and community characteristics included in this study. As seen in Table 9, when comparing average EDI domain scores, children from DSFM schools had statistically higher scores on physical health and well-being ($F(1, 26{,}859) = 156.00$, $p < .001$) and social competence ($F(1, 26{,}889) = 20.52$, $p < .001$). DSFM children scored higher for emotional maturity at $p < .10$, suggesting a possible difference between the two groups. Interestingly, prior to controlling for influential factors, there were no statistical differences between DSFM children and other children on language and cognitive development and communication and general knowledge.

Chi-square results on Table 10 show that, when comparing DSFM children to all other children, there were fewer children in the DSFM who are not ready on physical health and well-being (6% vs 12%) and social competence (7% vs 11%). No differences existed between both groups of children that are not ready on emotional maturity and language and cognitive development. However, 15% of DSFM children are not ready on communication and general knowledge compared to 10% for all other children ($p < .001$). Given that there were no group differences between average scores on communication and general knowledge, there are likely a greater number of DSFM children with high communication and general knowledge scores that balance out the high percentage of lower scores. No differences appeared for children not ready on one or

more domains.

As seen in Table 11, DSFM children, in most cases, appeared statistically different compared to all other children on individual, family and community characteristics. They are younger on average (5.67 years old vs 5.70 years old) and fewer boys are in these schools (47.35% vs 51.02%). They are not different from other children when comparing their health at birth. Some important differences however are apparent: DSFM children are quite different from other children, as less than 1% of their cohort has been in care with Child and Family Services (CFS) compared to almost 4% ($p < .001$) for all other children. Children in the DSFM have mothers who were older at their first birth and less than 10% were teen mothers at their first birth, compared to 24% for all other children. In both groups, there was an increase in reporting marriage between the child's birth and fifth birthday. However, there are 9% more children in the DSFM with mothers who are married (61% vs 52%). DSFM families have fewer children (2.50 children vs 2.62 children, $p < .01$) and are less likely to have four or more children (13.35% vs 17.36%). They have not moved as many times as families from other schools and less than 3% have moved 3 or more times (compared to 7%). DSFM families are much less likely to be on income assistance (6% vs 23%). For children in the cohort with maternal education data, almost all DSFM mothers have graduated high school (95%) compared to mothers of children from other schools (80%). DSFM families live in communities with a higher average household income ($68,000 vs $61,000). Additionally, DSFM children in our sample had a lower average SEFI-2 score (Socioeconomic Factor Index – Version 2) than other children, indicating that they live in communities with less unemployment, higher average household income, fewer single parent households and a higher high

school graduation rate. Not surprisingly, DSFM children live in communities with a higher percentage of Francophones (22%) compared to all other children (3.6%). The average percentage of Francophone in communities where other children live is comparable to the percentage of Francophones in Manitoba. The descriptive statistics show that, compared to all other children, DSFM children have families with higher socio-economic status and less risk factors for poor child outcomes.

Research Questions

As stated in the introduction, three research questions were investigated in this study. They are as follows:

1) After controlling for possible contributing factors, are Kindergarten children in the Division scolaire franco-manitobaine (DSFM) statistically different from other children on the five EDI domains?
2) a. What are the individual, family and neighbourhood factors that influence EDI scores among children in the DSFM?

   b. Are these factors different from those affecting other children in Manitoba?

Multilevel Models

The list and definition of variables included in all of the models are available in Table 1. For ease of comparison, results from the random intercept multilevel models are presented individually by EDI domain (in the same order: physical health and well-being, social competence, emotional maturity, language and cognitive development, and communication and general knowledge). Significance at $p < .05$ was selected. However, significance at the .10 level is also presented in these tables to suggest possible contributors to early childhood development. Four sets of comparisons are made and

described below. Though all three research questions can be answered with the first set of models (i.e., comparing all children to DSFM children only on continuous outcomes), analysis was conducted on the same set of models for the binary outcome of being 'not ready' on each of the five domains, as well as 'not ready on one or more domains'. Further analyses with two additional variables revealed interesting findings and are worth briefly presenting in this study. Each set of tables (with the exception of odds ratio tables) is followed by model performance tables to indicate the variance attributed to the neighbourhood level (level 2) and the individual level (level 1) from the null model, the explained individual-level and neighbourhood-level variation from the full model, as well as the calculated total variance explained by both levels.

The first set of models includes all children (including DSFM children) compared to DSFM children only. They are compared on each of the five continuous EDI scores. The only variable that differs between these two models is the individual variable "DSFM". This variable is present in the model with all children and not included in the model with DSFM children only. Results from this set of models can be found in Tables 12 through 21.

Secondly, the same two models (i.e., all children and DSFM children only) are compared on a binary outcome of not being ready for school. Results of these models are presented for each of the five domains, as well as not being ready on one or more domains. The DSFM children only model did not converge for the outcome of not being ready on one or more domains. Model estimates were transformed into odds ratios and are presented is these tables. Results from this set of models can be found in Tables 22 through 27.

The third set of models included the model with all children compared to a model with children who had information on their mother's education level. Fewer than 15,000 children (i.e., 14,870 exactly) had information about their mother's education level through the BabyFirst / FamilyFirst dataset. The "DSFM" variable appears in both models as the full model with all children, and the reduced model with maternal education included DSFM children in both models. Results from this set of models can be found in Tables 28 through 37.

Finally, the fourth set of models consisted of comparing the original model with DSFM children only to a second DSFM model with the addition of an individual variable: "French not first language". In this particular set of models, the same children were included in both models. Consequently, we can state that by including "French not first language", the model fit improved for each of the five EDI domains. It improved most notably for communication and general knowledge, where age-appropriate mastery of the language is a major driver of this outcome. Results from this set of models can be found in Tables 38 through 47.

Set #1 - All children compared to DSFM children only. As previously mentioned, the multilevel model results from this set of models can be found in Tables 12 through 16. The model performance (i.e., the explained variance) is presented for each domain in Tables 17 through 21, and will be discussed after answering the research questions.

Differences between DSFM children and all other children on EDI scores. Results from the models including all children show that DSFM children are statistically different from other children on physical well-being (Table 12), language and cognitive

development (Table 15) and communication and general knowledge (Table 16). Furthermore, results suggest that there is a possible difference between both groups on emotional maturity at a significance level of .10 (Table 14).

Specifically, results on Table 12 reveal that, when controlling for other contributing factors, DSFM children scored 0.451 points higher ($p < .001$) on average on physical health and well-being. According to our hypothesis, a difference between DSFM children and all other children on this particular domain was not expected. Results on Table 15 for language and cognitive development indicate that DSFM children score 0.238 points lower ($p < .001$) than all other children in Manitoba. This supports our hypothesis that DSFM children would have lower scores on language and cognitive development after controlling for contributing factors to early childhood development. After controlling for all other covariates in the model, Table 16 shows DSFM children have 0.314 points lower average scores ($p < .001$) than other children in Manitoba on communication and general knowledge. This supports our hypothesis that DSFM children would have lower scores on communication and general knowledge.

Factors that influence EDI scores among DSFM and other children. Research questions 2a and 2b are more easily answered together. In the models with all children, the majority of the included covariates are statistically significant, and this is apparent for each of the five EDI outcomes. Comparing across Tables 12 to 16, differences do appear between the models with all the children and the models with DSFM children only. Whether for all children or for DSFM children only, SEFI-2 score, age and sex are variables that consistently appear as statistically significant in determining EDI scores. Children living in communities of lower socio-economic status (i.e., a positive SEFI-2

score), have lower scores on all five EDI domains. With the exception of language and cognitive development, the estimate for children in the DSFM is much larger (as seen on Table 15). This would imply that the effect of socio-economic status on EDI scores is greater for children in the DSFM. However, given the smaller sample for the DSFM model, we must interpret this effect with caution.

There is a consistent association between older children and better EDI scores. For each EDI domain, the effect size appears to be the same for all children and DSFM children only. Male children have consistently lower scores on all domains. The effect size remains roughly the same when comparing all children to DSFM children only. The smallest effect is on physical health and well-being where boys score 0.398 points less ($p < .001$) than girls (and 0.367 points less for DSFM boys), as seen in Table 12. The greatest effects of sex on early childhood development outcomes are on two domains: social competence, and communication and general knowledge. Boys were associated with a decrease of 0.803 points ($p < .001$) compared to girls (a decrease of 0.914 points for DSFM boys) on social competence, as seen in Table 13. As seen in Table 16, they scored 0.812 points less ($p < .001$) than girls (and 0.861 points less for DSFM boys) on communication and general knowledge.

Children who are considered "at-risk" (i.e., children with teen mothers, living in families that were ever on income assistance, or children previously or currently in care) have statistically lower scores on all EDI domains for the model with all children. One exception is observed. Children whose mother was a teenager at her first birth do not have significantly different scores on social competence (see Table 13). For DSFM children only, the picture of at-risk children is quite different. Children in care do not

appear to have statistically significant lower scores on any EDI domain, with the exception of communication and general knowledge where children scored 2.429 points lower ($p < .10$) than other DSFM kids (see Table 16). Income assistance negatively affected children's scores on all EDI domains. Children of teen mothers were negatively affected on scores for social competence (Table 13) and communication and general knowledge (Table 16). Given the small number of children in the DSFM that would be considered at-risk (see Table 5), interpretation of the results are done with caution.

Tables 12 to 16 demonstrate that for all five EDI domains, family characteristics (i.e., 4 or more children, 3 or more moves, and mother's marital status at the child's fifth birthday) as well as birth order were all statistically significant predictors, with a few exceptions. Specifically, children in families of four or more children had lower scores than children in smaller families. Children who were born later had lower scores than children who were born earlier. Children who moved three or more times were also negatively impacted. Finally, children with married mothers at their fifth birthday had higher scores than children whose mother did not declare being married. The exceptions were observed for birth order and large family size as they did not have an influence on emotional maturity scores (see Table 14), nor did marital status have an association with communication and general knowledge (see Table 16). As for DSFM children only, none of these variables appeared to have a statistically significant influence on EDI scores, with the exception of birth order on physical health and well-being ($p < .05$) (see Table 12) and language and cognitive development ($p < .10$) (see Table 16). In terms of difference between effect size between all children and DSFM children on these variables, there appears to be no pattern and directionality of the relationship even

changes.

Poor health at birth was associated with poorer EDI scores for all children. However, preterm birth was only statistically significant for communication and general knowledge (see Table 16) and approached significance ($p < .10$) for physical health and well-being (see Table 12). It is to be noted that, for consistency and because preterm birth was significant at the .05 level for at least one EDI domain, this variable was kept in all models. According to the model with all children, there is very strong evidence that low birth weight had a statistically negative effect on EDI scores. Its greatest effect was on communication and general knowledge, where children scored 0.477 points less ($p < .001$) than children of normal birth weight. Children with low Apgar scores were significantly affected on all domains at $p < .001$ with the exception of emotional maturity at $p < .10$. For DSFM children, poor health at birth did not seem to have a negative effect on any scores with the exception of low birth weight on emotional maturity scores (-0.528, $p < .10$) and on language and cognitive development scores (-1.094, $p < .01$). In terms of difference between effect size between all children and DSFM children on these three variables, there appears to be no pattern or generalizability.

It was hypothesised that predictors that influence EDI scores for the general population would also affect the children in the DSFM. However, after comparing the models in details, results demonstrate that this may not entirely be the case. SEFI-2 score, age and sex are significant predictors of EDI scores in the same manner for all children and DSFM children. However, it appears that for many of the other variables in the DSFM model, predictors are not consistently statistically significant. Given the smaller sample in the DSFM model, interpretations of the results are made with caution. There is

no indication as to why DSFM children would be any different from the general population in terms these other predictors.

Once again comparing across Table 12 to 16, the proportion of Francophones in the child's neighbourhood (i.e., dissemination area) does not appear to influence EDI scores for all children, with the exception of language and cognitive development. Though it was not explicitly stated in the hypotheses, it was not expected that the proportion of Francophones would have any impact on EDI scores for the general population. Theories as to why the Francophone population appears to have a negative impact on language and cognitive development scores for all children (−0.691, $p < .01$) will be discussed in the next chapter (see Table 15). On the other hand, the proportion of Francophone positively affected DSFM children's EDI scores, with the exception of physical health and well-being. DSFM children who live in communities with almost all neighbours being Francophone (i.e., 86.7% Francophones) scored 0.703 points higher ($p < .05$) on social competence (see Table 13), 1.040 points higher ($p < .01$) on emotional maturity (see Table 14), 1.198 points higher ($p < .001$) on language and cognitive development (see Table 15) and 1.921 points higher ($p < .01$) on communication and general knowledge (see Table 16). It was hypothesised that DSFM children living in communities with a higher percentage of Francophones would have higher scores on the "language and cognitive development" and "communication skills and general knowledge" domains. Our findings support this hypothesis. Nevertheless, we did not expect that the proportion of Francophones would also positively affect the social competence and emotional maturity domains. The interpretation and importance of this finding will be discussed in the following chapter.

Model performance. Model performances are available in Tables 17 through 21, and follow the same order that the models for the EDI outcomes were presented in. Null models were run to determine the variance that is attributed at each level of the model (i.e, level 1 referring to individual level and level 2 referring to neighbourhood level). With the full model, it was possible to determine the explained individual and neighbourhood level variation and calculate the total explained variance. An explanation on how these were calculated is available in the methods.

The variance attributed to the neighbourhood level, also known as the neighbourhood intraclass correlation (ICC), varied between 6.9% and 10.7% across all five domains for the models with all children. Given that the ICCs were all more than 5%, this warranted using multilevel modelling for our study. The variance attributed to the individual-level therefore ranged between 89.3% and 93.1%. The language and cognitive development domain (as seen in Table 20) appears to be strongly influenced by the neighbourhood with 10.7% of the variance between children attributable to the neighbourhood level. Social competence and emotional maturity are the least influenced by neighbourhood with 6.9% and 7.1% of the variance attributable to this level (as seen in Tables 18 and 19, respectively). Physical health and well-being and communication and general knowledge are slightly more neighbourhood influenced, as 9.6% and 8.8% of the variance are attributable to neighbourhood, as seen in Tables 17 and 21 respectively.

After including all covariates to the null model, thus transforming the model into the full model, we were able to calculate the individual and neighbourhood variations that can be explained by the covariates. Comparing across all five model performance tables, between 23.7% and 62.0% of the neighbourhood variation can be explained (or 1.7% to

6.6% of the total variance). Predictors only explained 23.7% of the variance between neighbourhoods for emotional maturity (see Table 19). However, for three of the domains (physical health and well-being, social competence, and communication and general knowledge), approximately 40% of the neighbourhood level variation can be explained by adding early childhood outcome predictors, as seen in Tables 17, 18 and 21, respectively. The covariates appear to explain 62% of the variation between neighbourhoods for language and cognitive development (see Table 20). Comparing across all five model performance tables, we were able to explain between 7.8% and 10.3% of the variation between children (or 7.1% to 9.2% of the total variation) by adding all the covariates to the model. The total variation that can be explained by all covariates ranges from 10.4% to 15.8%. The model that explains the most total variation is for the language and cognitive development domain (see Table 20).

As for the models with DSFM children only, a comparison across all five model performances in Tables 17 to 20 showed that the performance did not vary compared to the models with all children, with a few exceptions. For physical health and well-being (see Table 17), less than 4% of the individual level variation could be explained by the full model. Consequently, only 7.3% of total variation could be explained compared to 11.3% for all children. For emotional maturity (see Table 19), almost 14% of the variance could be attributed to the neighbourhood level, based on the null model. This is double the variance that was attributed to the neighbourhood level for all children. Yet, only 16.3% of the neighbourhood variation could be explained by adding the covariates (compared to 23.7%), indicating that there are other factors that were not included in the model that may have a particular effect on DSFM children. Nevertheless, this translates

to a greater percentage of the total variance that can be explained. For language and cognitive development (see Table 20), only 7.6% of the variance could be attributed to the neighbourhood level (compared to 10.7%), based on the null model. However, roughly 68% of the variation could be explained at the neighbourhood level once covariates are added to the model. Nonetheless, this translates into a smaller percentage of the total variance that can be explained (11.3% versus 15.8% for all children). Finally, the biggest difference in model performance is for communication and general knowledge. More than 21% of the variance can be attributed to the neighbourhood level for the DSFM null model. That is much greater than the 8.8% attributed to the neighbourhood level for all children. Less of the individual level variation could be explained when adding the predictors to the model, compared to the model with all children. Consequently, less of the total variation was explained at the individual level. Though the same amount of variation could be explained at the neighbourhood level (i.e., roughly 42%), more of the total variation could be explained due to the neighbourhood level.

Set #2 - Odds of not being ready for school for all children compared to DSFM children only. As previously mentioned, results from this set of binary outcome models can be found in Tables 22 through 27. Results from the model including all children show that the odds of a DSFM child being 'not ready' on physical health and well-being is lower than other children in Manitoba (OR = 0.638, $p < .05$) (see Table 22). However, DSFM children are 1.289 times ($p < .05$) more likely to be not ready on language and cognitive development (see Table 25) and 2.116 times ($p < .001$) more likely to be not ready on communication and general knowledge (see Table 26),

compared to other children in Manitoba. Additionally, the odds of a DSFM child being 'not ready' on 'one or more domains' is 1.374 times ($p < .001$) greater than other children (see Table 27).

The odds ratios and significance of variables in the models will not be presented as extensively as the previous set of models. Nonetheless, some findings are worth mentioning. Similarly to the continuous outcome models, comparisons across Tables 22 to 27 demonstrate that age, sex and SEFI-2 score are consistent predictors of not being ready for school. After controlling for other variables, every month increase in a child's age is associated with decreased odds of being not ready on all EDI domains or one or more domains, ranging from an odds ratio of 0.909 to 0.960. Boys are 1.912 to 3.372 times more likely to be 'not ready' on each of the EDI domains and 'one or more domains'. With the exception of emotional maturity, a one unit increase in SEFI-2 score (i.e., lower neighbourhood socio-economic status) is associated with increased odds of being not ready (ORs = 1.122 to 1.273).

At-risk children (i.e., income assistance, teen mothers, or in care) are significantly associated with greater odds of not being ready for school. The odds are 1.535 to 2.244 times greater for children that come from families who are, or have previously been, on income assistance for each of the EDI domains and one or more domains. Children who have been or are currently in care are 1.304 to 1.886 times more likely than other children to be not ready, with the exception of physical health and well-being. Children of teen mothers appear to have greater odds of not being ready on physical health and well-being (see Table 22), language and cognitive development (see Table 25), as well as for one or more domains (see Table 27).

As for the models with DSFM children only, comparisons across Tables 22 to 27 demonstrate that the only variable that remains consistently significant is the sex of the child, with increased odds for boys. Odds ratios range from 2.387 times more vulnerable for communication and general knowledge (see Table 26) to 4.177 times more vulnerable for emotional maturity (see Table 23). Children of families on income assistant also had greater odds of not being ready, with the exception of social competence. The proportion of Francophones in the child's neighbourhood was associated with decreased odds of being not ready on emotional maturity (OR = 0.231) (see Table 23), language and cognitive development (OR = 0.301) (see Table 25) and communication and general knowledge (OR = 0.318) (see Table 26).

Set #3 - Model with mother's grade 12 education. A total of 14,870 children had information about their mother's education level. A reduced model, with only these children was run. The set of models of all children compared to this reduced model is available in Tables 28 to 32. The variable 'mother with Grade 12 education' was statistically significant across all five continuous EDI outcomes ($p < .001$), ranging from 0.245 points higher on emotional maturity (see Table 30) to 0.860 points higher on communication and general knowledge (see Table 32). Consistent with the results from the original models with all children, DSFM children had statistically higher scores on physical health and well-being (see Table 28) and statistically lower scores on language and cognitive development (see Table 31) and communication and general knowledge (see Table 32). When adding the mother's education level, the slight negative difference for DSFM children on emotional maturity no longer remained significant (see Table 30). Children of the general population who live in a community with a greater proportion of

Francophones were associated with lower score on language and cognitive development, and this remained true when adding mother's education (see Table 31). Most other variables remained significant or decreased slightly in significance, as mother's education may be confounded with other variables in the model. Model performance Tables 33 to 37 demonstrate that when including mother's education level, the total explained variance increases for all EDI domains.

Set #4 - DSFM model with children whose first language is not French. The last analysis was done by adding a language variable to the DSFM model. This language variable indicates if French is the child's first language or not. A frequency analysis showed that 638 children (68%) had French as their first language and 306 children (32%) did not have French as their first language.

In the models, we wanted to determine the effect if a child's first language was not French. Not having French as a first language was associated with lower scores on each of the five domains (see Tables 38 to 42). The two domains with the greatest effect were on language and cognitive development (see Table 41) and communication and general knowledge (see Table 42); two outcomes that are influenced by language. Children whose first language was not French scored 0.812 points less ($p < .001$) on language and cognitive development than children whose first language was French, when all other covariates were controlled for. Most notably, children whose first language was not French scored 3.134 points less ($p < .001$) on communication and general knowledge compared to their classmates who have French as their first language.

The positive influence of Francophone neighbours in the community on EDI scores for DSFM children remained the same for emotional maturity (see Table 40) and

language and cognitive development (see Table 41), even with the addition of the individual language variable in the model. However, by adding if the child's "first language is not French", there was a reduction in the effect size and significance (0.567, $p < .10$) of the estimate for social competence (see Table 39). Furthermore, though the proportion of Francophones was statistically significant and demonstrated an almost 2-point increase in EDI score for communication and general knowledge in the original DSFM model, the addition of the individual language variable reduced the effect size by half and the proportion of Francophones was no longer significant (see Table 42). This could suggest that the child's mother tongue, therefore the language in the home, is of much greater importance than the language spoken in the community. Or it could suggest that children who speak French at home regularly live in Francophone communities and there is a confounding effect of both variables in the model. This will be discussed further in the final chapter.

For physical health and well-being (see Table 43), social competence (see Table 44) and emotional maturity (see Table 45), the total variance that can be explained by all covariates increased slightly. This is due to the fact that when including "first language is not French", more of the neighbourhood variation can be explained. As for Table 46 which describes the model performance for language and cognitive development, the model performed much better as 15% of the total variance could be explained (rather than 11% with the original DSFM model). By adding "first language is not French" to the model, 84% of the neighbourhood-level variation could be explained. That is roughly 16% more than that of the original DSFM model. Finally, the greatest difference in model performance would be for communication and general knowledge (see Table 47). With

the inclusion of the individual language variable, 27% of the variation between children could be explained and 75% of the variation between neighbourhoods could be explained. The 23% increase in what can be explained at the individual level and the 33% increase in what can be explained at eh neighbourhood level translates into being able to explain 37% of the total variance, compared to 11% only with the original DSFM model. The addition of the "first language is not French" to the original DSFM model appears to explain much of the difference between children and between communities on communication and general knowledge, an early childhood outcome that requires age-appropriate mastery of the evaluation language, and will be discussed further in the next chapter.

Chapter 5: Discussion

Results from this study confirm our hypothesis that, in Manitoba, Kindergarten children who attend French first language schools are different from other Kindergarten children on EDI outcomes. After controlling for several predictors of early childhood development, DSFM children have statistically higher scores on physical well-being, yet have statistically significant lower scores on language and cognitive development and communication and general knowledge. Though the original model with all children suggested a possible association between DSFM children and lower scores on emotional maturity, the reduced model with the mother's Grade 12 education variable revealed that there was no difference between DSFM children and other children on this particular domain. Furthermore, DSFM children are less likely to be considered not ready on physical health and well-being, yet more likely to be not ready on language and cognitive development and on communication and general knowledge, compared to other children in Manitoba. DSFM children are also more likely to be not ready on one or more EDI domains than other children.

In general, our results are consistent with previous studies. Specifically, our research supports studies by Willms (2010), Chartier, Dumaine and Sabourin (2011), and Chartier, Finlayson and their colleagues (2012) that demonstrated lower scores for Francophone children on language and cognitive development. Our study is also in line with two studies (Chartier, Dumaine & Sabourin, 2011; Chartier et. al, 2012) that concluded that Francophone children had significantly lower scores on communication skills and general knowledge. Though Chartier, Finlayson and their colleagues (2012) concluded that Francophone children had statistically lower scores on emotional

maturity, our study, having included many more covariates to our models, does not support this previous finding. In terms of the unexpected higher scores on physical health and well-being, our study supports Willms (2010) who found that DSFM children had statistically higher scores compared to the Canadian average.

As for children who are not ready for school, our study confirms Willms' finding that DSFM children are less likely to be below the 10^{th} percentile on the physical health and well-being domain. Our study also support Chartier, Finlayson and their colleagues (2012) and Willms (2010) who concluded that Francophone children have higher rates of not being ready for school on communication and general knowledge. However, unlike Chartier and her colleagues (2012), DSFM children did not differ in terms of not being ready on emotional maturity. Finally, our study supports Chartier and her colleagues (2012) that found statistically higher rates of "not ready for school" in one or more of the five EDI domains among Francophone children compared to other children in Manitoba.

Predictors of Early Childhood Outcomes for Francophone Children

We must first state that, for all children, almost all the included covariates were statistically significant for each of the five continuous EDI outcomes. This was not surprising as the inclusion of these variables were based on the literature and used by Santos and his colleagues (2012) to evaluate important contributors to early childhood development. A few variables, namely SEFI-2 score, age and sex, remained consistently significant for models with all children (i.e., continuous outcome, binary outcome, and addition of maternal education). Furthermore, the addition of 'mother's Grade 12 education' demonstrates the importance of including parental education in models explaining early childhood outcomes. In many cases, parental education is not an

available variable and a community-level predictor is used as a proxy measure. Yet researchers have found that using a neighbourhood-level education rate was not associated with EDI outcomes and that a more direct measure of parental education should be used (Kershaw et al., 2007). The results from our model support existing studies that have established a significant correlation between maternal education and child development (Willms, 2002, as cited in Kershaw et al., 2007) and underline the importance of collecting such pieces of information as routinely as possible.

Though many of the early childhood development predictors were not statistically significant in the DSFM models, we have interpreted this difference with caution. For the most part, we do not believe that these children would be any different from the general population. An explanation for this occurrence is that, not only did we have a smaller sample for the DSFM model, but for many of the predictors, such as 'teen mom at 1st birth', '4 or more children', 'income assistance', '3 or more moves' and 'Child and Family Services', DSFM children have significantly lower rates than the other children (as seen in Table 11). Such low numbers of these predictors make it impossible for the model to determine the variation within a neighbourhood if only 1 child in the neighbourhood is considered 'at-risk'. In such cases, only the variation between neighbourhoods can be calculated. An alternative explanation to the small sample size is that DSFM children are more greatly affected by other variables and predictors that are typically associated with early childhood outcomes become insignificant.

The findings from our study demonstrate that Francophone children are influenced by other factors than those which influence the general population. These factors are relational community factors: one expressed at the community level (i.e,

proportion of Francophones in the neighbourhood) and the other at the individual level (i.e., first language is not French). Along with the influence of relational community factors, our findings support the TEAM-ECD framework that defines the different levels of a child's environment as having a bidirectional influence. Specifically, though 90% of the variation was attributed to the individual/family level in several models, the addition of "French not first language" to the DSFM model not only explained more of the variation at the child level, but also explained more of the variation at the neighbourhood level. This would suggest that there is a complex interaction between the child, the family and the neighbourhood.

Proportion of Francophones in the neighbourhood. We must first point out that for all children, a high proportion of Francophones in the neighbourhood negatively affected children's scores on language and cognitive development. Research has shown that it is important for parents to have access to resources during the early years for their children to have a positive development (Ewart & de Rocquigny, 2011; Irwin, Siddiqui, & Hertzman, 2007; Willms, 2010) It is necessary to have access to books, games, and other tools to develop literacy and numeracy. Given the importance of community resources in supporting parents to develop their children's literacy and numeracy abilities, it is hypothesised that in communities with a high concentration of Francophones, these resources, for example an early childhood education centre in Saint-Boniface, Winnipeg, may be available in French for Francophone families, yet may not be available in English for Anglophone families.

The model for DSFM children only, with the exception of physical health and well-being, demonstrated that the high proportion of Francophones in a child's

neighbourhood of residence positively affected EDI scores. Though it was hypothesised that this predictor would only have a positive effect on language and cognitive development and communication skills and general knowledge, we did not expect that the proportion of Francophones would also positively affect social competence and emotional maturity.

We were able to confirm that language and cognitive development and communication and general knowledge were both positively influenced by a greater proportion of Francophones in the child's community. Both of these domains are influenced by language, with communication and general knowledge being greatly influenced by the language in which the child is evaluated. Interactions with other Francophone families and opportunities for interactions appear to be important for a Francophone child's behavioural development (Ewart & de Rocquigny, 2011). This remains true for a child's cognitive and linguistic development. Our results support Chartier and colleagues (2011) findings that children engage in French community activities, as well as those who attend French child care services, have higher scores on communication and general knowledge. Furthermore, it supports Ewart and de Rocquigny (2011) who found that the primary motivation of Francophone parents to attend preschool literacy programs with their children is that they were offered in French, and as of result, they have adopted new strategies that they can use as home with their children. Such activities and resources are more common in communities with a higher proportion of Francophones. As a result, this positively affects children's language and cognitive development and communication and general knowledge. Nevertheless, the influence of the proportion of Francophones in a DSFM child's neighbourhood of

residence appears to change for the communication and general knowledge domain with the addition of an individual language variable, and will be discussed further.

Social competence and emotion maturity are both emotional and behavioural outcomes that are measured on the EDI. To develop positive emotional and behavioural skills, such as empathy, children need to interact with other children and have positive role models that demonstrate these behaviours. Since the increased proportion of Francophones in a community appears to have a positive impact on these scores, we hypothesise that it may have to do with social interactions, social cohesion and identity. Support from other Francophone parents, access to programs that offer opportunities for Francophone families to learn and interact, playing with other Francophone children in the neighbourhood and interacting with their parents are opportunities of social interactions that are important for the Francophone minority. Results from a recent study on French preschool literacy programs in the Franco-Manitoban community has shown that parents chose to attend these programs to be able to meet, share and socialise with other Francophone families and to create ties with the Francophone community (Ewart & de Rocquigny, 2011). A study of 151 high school Francophone students in Saskatchewan demonstrated an association between contact with the Francophone community, support from the community, Francophone identity and self-esteem (Gaudet & Clément, 2005). Further to these studies, our findings support Chartier and her colleagues (2011) who found that children who engaged in French community activities with their family had higher scores on emotional maturity compared to those who engaged in English or bilingual community activities. Furthermore, our results are suggestive that these opportunities are likely more common in communities with a higher proportion of

Francophones, thus positively affecting children's social competence and emotion maturity.

The results of our study show that DSFM children have statistically higher scores on physical health and well-being and are less likely to be considered not ready on this particular domain. This difference between DSFM children and other children however could not be explained by the proportion of Francophones in the community. Though it was never expected that this community-level predictor would have any association with physical health and well-being, we are unsure how to explain the more positive outcome for DSFM children. According to our models, there is no indication as to why DSFM would be different on this domain. However, our descriptive statistics do indicate that DSFM children come from families with a higher socio-economic status, with an educated mother, and with married parents, implying more resources (and two parents) to get children ready for school.

French is not the child's first language. Our results indicate that for DSFM children whose first language is not French, they have significantly lower scores on all five EDI domains compared to children whose first language is French. One third of children who arrive at a DSFM school are less comfortable or do not know the language of instruction. We posit that they are unable or less comfortable to communicate and interact with the teacher and other students, making them more vulnerable in all domains of child development.

Results from our study support Landry and Allard's (1990) theory of the *counterbalance model of bilingual development*, as well as Chartier, Dumaine, and Sabourin's (2011) study on the linguistic environment and its influence on EDI scores in

a small sample of DSFM children. In the counter balance model, both the family environment and the socio-institutional milieus are important for additive bilingualism (i.e., the second language is not learned to the detriment of the first). By adding the variable "French is not the child's first language", both this variable and the proportion of Francophone in the neighbourhood are statistically significant as predictors for language and cognitive development. Additionally, we observed a 16% increase in the explained variation between the neighbourhoods that DSFM children live in. This means that both the family environment (i.e., the first language learned at home) and the socio-institutional environment are important in predicting language and cognitive outcomes for DSFM children. Such a finding would imply that the French language needs to be developed at home prior to entering school and the neighbourhood environment must support language development as well.

On the other hand, once the individual language variable was added to the DSFM model for communication and general knowledge, the proportion of Francophones in the community no longer remained significant while "French not the first language" was strongly and negatively associated with this domain. Though this may seem contradictory to the results found for language and cognitive development, this is indicative of the nature of this particular developmental outcome. As previously stated, the communication and general knowledge domain is an evaluation of the child's ability to communicate his or her own needs in the language of the EDI assessment. In the case of DSFM children, the language would be French. Our results confirm that the language in the home is the most important predictor of this domain. Findings suggest that if a family speaks French at home, it does not matter if that child lives in a community with no

Francophone neighbours. Alternatively, there may be an indirect neighbourhood influence on families. Those who speak French at home may also choose to live in communities where French is spoken more often and where interactions with Francophone neighbour is more likely. For families who do not speak French at home, it might be due to the fact that it is difficult for parents to engage in French with their children and connect with other Francophone families, especially if their family lives in a neighbourhood or town that has no Francophones in the area.

The importance of adding the individual language variable to the DSFM model must be noted. By including "French not the child's first language", it was possible to explain 33% more of the variation between neighbourhoods and 23% more of the variation between DSFM children. This is indicative of an important predictor in explaining communication and general knowledge outcomes. In fact, a study in British Columbia found that the percentage of households using a foreign language at home (i.e., not English or French) was by far the most important predictor of lower scores on communication skills and general knowledge, as it explained 55.8% of the model (Kershaw et al., 2007). Our findings also support studies (e.g., Chartier, Dumaine, & Sabourin, 2011; Ewart & de Rocquigny, 2011; Landry & Allard, 1990) that encourage the use of the French language in the home prior to entering a French first language school.

The question remains, who are the children whose first language is not French, but attend a French first language school? Landry (2010) has claimed that in 2006, 78% of "ayant droit" children (0 to 4 years old) in Manitoba come from an exogamous family (i.e., one parent speaks French, the other usually English). In the DSFM, the

Understanding the Early Years study (UEY) revealed that 47% of families have one parent whose first language is French and the other parent whose language is English (Willms, 2010). Similarly, 48% of families who attended French preschool literacy programs have one parent whose mother tongue is not French but rather English or another language. For parents who enroll their children in the DSFM, at least one parent (or guardian), and in some cases grandparent, must have French as their first language still spoken. In no way does the Section 23(1) of the Canadian Charter of Rights and Freedoms require the child to have French as their mother tongue. Further to this claim, according to Landry (2010), only one "ayant droit" child out of two will have French as their mother tongue. It is not a guarantee that "ayant droit" families will pass down the French language to their children prior to sending them to a French first language school. In fact, research has shown that are relatively uninformed regarding language development (Deveau, Landry, & Allard, 2006).

Limitations

Twelve percent of children with valid EDI scores were excluded from this study because they did not have information about their health at birth through hospital records. We see this as a limitation because children in the excluded sample appeared quite different from the children that were included in the final study population. We believe that some of these children are newcomers to Canada. According to Willms (2010), roughly 4% of children in the DSFM are immigrants, whereas the National Longitudinal Survey of Children and Youth (NLSCY) data shows that for all children in Manitoba, 1% of children between the ages of zero and five were born outside of Canada. Research has shown that children of families that have recently immigrated to Manitoba have lower

scores on social competence, language and cognitive development and communication and general knowledge (Healthy Child Manitoba, 2011).

Because of the large amount of cases we were using for this particular study, we were bound to encounter missing data. A decision was made that all *valid* cases in our final sample that had missing data would not be included in the final models so as to have the same number of children in the null and full models. In the case of our study, for children who fit the inclusion criteria, missing data in this final dataset can be considered "missing completely at random" (MCAR). For example, a random child in our sample was missing their Apgar score. We could have decided to impute the missing data points, but decided rather to not include the incomplete cases. With the loss of a very small number of cases from a very large sample of children, we were not worried about the loss of statistical power (Snijders & Bosker, 2012, p.132).

In the model with all children, there were 37 dissemination areas (DAs) out of a total of 1638 DAs with only one child from the sample residing in that neighbourhood. The small number of single-child DAs in this model was not a concern, however, it was a concern for the model with DSFM children only. For the DSFM model, there were 147 DAs out of 299 DAs where only one child was in the neighbourhood. We could have run the models excluding all DAs with only one child, though we would have lost statistical power. The alternative would have been to cluster neighbourhoods that were similar in characteristics or select larger neighbourhood tracts. For example, Oliver and her colleagues (2007) ensured that there were no fewer than 25 children in each neighbourhood. Nonetheless, since we used multilevel modelling, it was still possible to include these children, as they were only considered for the variation between

neighbourhoods but not the variation within a neighbourhood (i.e., between children).

Our study made use of random intercept models. The assumption with this type of multilevel modelling is that a variable affects neighbourhoods in the same way (i.e., the slopes are the same). We could re-run the models with random intercepts and random slopes, to see if the effect of certain predictors is different for communities. Given the different profile of Francophone children, this might be an approach to explore the difference between these children and warrants further investigation.

Our study used SEFI-2 scores at the neighbourhood level as a composite measure of socio-economic status (SES). However, Kershaw, Forer, Irwin, Hertzman and Lapointe (2007) argue that it may be best to study the impact of several community factors that explain SES, as they discovered that different predictors are associated with different EDI domains. In the same way that the proportion of Francophones appeared to have a greater impact on language and cognitive development and communication and general knowledge, Kershaw and his colleagues identified neighbourhood variables that more strongly predicted not being ready on physical health and well-being, language and cognitive development and communication and general knowledge. As this study only used two predictors at the community level, a follow-up study could add more census-based variables to see if the models would improve and attempt to explain more of the variability between communities.

Canadian studies have consistently shown that Aboriginal status has a significant negative impact on EDI scores (Healthy Child Manitoba, 2011; Kershaw, Forer, Irwin, Hertzman, & Lapointe, 2007; Puchala, Vu, & Muhajarine, 2010). Given the lack of access to information about children's Aboriginal status, we are aware of the limitation of

not including such a predictor to the study.

Strengths

This topic was chosen because previous EDI studies on Francophone children in Manitoba found differences between this linguistic population and other Manitoban children. However, in many cases, researchers could not confirm why these differences occurred due to lack of supporting evidence. Our study made use of the population data housed at the Manitoba Centre for Health policy to control for multiple predictors of EDI outcomes. As such, our findings help to confirm much of the conclusions from previous research and shed light as to why Francophone children are different on the Early Development Instrument.

Rather than using a one-level regression model, we used multilevel modelling as our analysis method to consider the nested structure of children living in families who live in different neighbourhoods. We were able disentangle the variation that can occur between clusters of children and calculate the variance at both the neighbourhood and individual levels.

Finally, the greatest strength of our study was the inclusion two relational community factors. Though Chartier and her colleagues (2011) found that the language in the home was a determining factor for EDI scores, the proportion of Francophones in the community was not considered. These two variables shed some light on why DSFM children are different than other children, especially on domains that are related to language. This will help policy and decision makers, as well as community members in understanding the child development in a linguistic minority setting and developing a more supportive network in consequence.

Recommendations

Given the results of this empirical study, we believe that it is important for parents of young children who are considering sending their children to a DSFM school be knowledgeable about the factors that influence early childhood development. In the context of a linguistic minority, as is the case in Manitoba, information about additive bilingualism and developing language skills must be shared with families of young children. Landry (2010) states that in many cases, "ayant droit" families are not aware that transmitting a minority language to a child is much different than transmitting a majority language. Though we must be careful not to blame parents, we must find ways to encourage them to use the French language in the home be as much as prior to sending their children to a DSFM school.

Nevertheless, language transmission and development of language skills, especially in a minority context, is not the sole the responsibility of the parents. In many cases, families do not live in Francophone communities, suggesting fewer interactions with Francophones. As postulated in the counter balance model (Landry & Allard, 1990), communities must offer as many opportunities as possible for Francophone families to meet, learn, and socialise in French. Francophone families are fortunate to have the *Coalition francophone de la petite enfance du Manitoba*, a partnership between the DSFM, the *Fédération des parents du Manitoba* (FPM), the *Société franco-manitobaine* (SFM) and Healthy Child Manitoba – *Enfants en santé Manitoba* (HCM-ESM), that offers programs geared towards early childhood development within the Francophone community. However, as Ewart and de Rocquigny (2012) concluded from their study, the Coalition must not only attract families with Francophone parents who are highly

educated and born in Manitoba, as these are the families who have a greater chance to transmit the French language to their children (Landry, 2010). In order to contribute to the success of all children who attend French first language schools, the Coalition must develop more varied programs to reach out to families who do not feel supported in transmitting the French language, whether at home or in the community.

Given the influence of the community on EDI scores, the Coalition should also open an early childhood education centre in each of the DSFM elementary schools. For areas where Francophones are more dispersed, a satellite centre should be available so parents can have access to French resources.

Though the Francophone community must be informed of these results and should continue their efforts in supporting the development of the French language, they should not be alarmed. Studies have shown that children are resilient and many do catch up by Grade 3 (Chartier, Mayer, Morga, & Dumaine, 2009). Results from the 1997 Manitoba Birth Cohort Study showed that 20% of DSFM children went from not being ready for school in Kindergarten to having positive outcomes in Grade 3, compared to only 15% of all children in the sample who had the same trajectory. The lower scores on language and cognitive development and communication and general knowledge may also be due to the fact that the majority of these children are learning two languages at once. Though research has shown that bilingual children tend to know fewer words in each language, the total number of words that they know is greater than the number of words that unilingual children know (Hoff, 2005). For example, a child will need to know both the French and English word for *apple.*

Conclusion

In summary, our study has concluded that DSFM children are different from other children in Manitoba on physical well-being, language and cognitive development and communication and general knowledge. Our research raises the concern that DSFM children have lower scores on language and cognitive development and communication and general knowledge, even after controlling for several predictors of early childhood outcomes.

The most significant finding of this study is that both the proportion of Francophones in a child's community and the child's first language are associated with EDI outcomes for DSFM children. This demonstrates the importance of both developing the French language in the home, as well as the need for the Francophone community to provide a supportive network for child development, especially for the development of the French language. As modelled by the TEAM framework (Siddiqi, Irwin, & Hertzman, 2007), early childhood development is a collective effort. The responsibility of raising a child that is ready to encounter his or her scholastic years does not solely rest on parents but also on the ability of the community in providing access to early literacy programs, enriching and available child care, as well as safe and inviting neighbourhoods. As they say, "it takes a village to raise a child".

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Table 1

Definition of variables included in the final multilevel models

Variable	Type	Definition
Level 2 (neighbourhood)		
Proportion of Francophones in DA	Continuous	Proportion of Francophones in DA (calculated from the "percentage of minority language" variable available in the Census data)
SEFI-2 Score	Continuous	An index created using 4 variables (unemployment rate age 15+, average household income age 15+, proportion of single parent households (derived), proportion of population age 15+ without high school graduation (derived)) that are either directly or derived from Census data in a single factor analysis
Level 1 (family)		
Teen mom (<20yrs old) at first birth	Dichotomous	If the child's mother was a teen mother (<20 years old) at the age of her first child
4 or more children	Dichotomous	If the child is of a family of 4 or more children at the child's 5th birthday
Income assistance (IA)	Dichotomous	If a child's family ever received Income Assistance (IA) up to their 5th birthday
3 or more moves	Dichotomous	If the child is of a family that has moved 3 or more times up to the child's 5th birthday (based on change in postal code)
Mother married at child's 5th birthday	Dichotomous	Mother registered with Manitoba Health as married (includes common-law) at the child's 5th birthday
Mother has Grade 12 education	Dichotomous	If the child's mother has completed high school (i.e., Grade 12) based on the BabyFirst / FamilyFirst Screening
Level 1 (individual)		
Age (in months)	Continuous	The child's age in months, based on the EDI assessment date and the Registry birth date; Must be between 5 and 7

		years old on EDI date, or 60 to 84 months.
Male	Dichotomous	Sex of child based on Registry; Female (0), Male (1)
Birth order	Categorical	Based on the order a child was born in the family; Children who are 4th or later born are categorized as 4th born. Multiples have the same birth order.
Child and family services (CFS)	Dichotomous	If a child was ever involved with Child and Family Services (CFS) up to their 5th birthday
Low birth weight (<2,500g)	Dichotomous	If a child is of low weight at birth i.e., 0 - 2,499 g (1) or 2,500 g + (0); Weight in grams of child at birth
Preterm (<37 weeks)	Dichotomous	Based on the gestational age in weeks of child at birth. Less than 37 weeks (0) or 37 weeks or more (1)
Low Apgar score (<8)	Dichotomous	Apgar score of 7 or less (1) or 8-10 (0); based on APGAR score of child at birth
DSFM	Dichotomous	Based on the school the child was evaluated in. DSFM (1) or not (0).
1st language is not French	Dichotomous	Based on the EDI, teacher indicate if French is the child's first language (1) or not (2)

Table 2

Number of children assessed according to EDI year and by school language group

	Schools				
	DSFM	English	Immersion	Other	TOTAL
	(*n* = 944)	(*n* = 19,431)	(*n* = 6,341)	(*n* = 178)	(*n* = 26,894)
EDI year	*n* (column %)				
2006	300	6,621	2,082	66	9,069
	(31.78)	(34.07)	(32.83)	(37.08)	(33.72)
2007	337	6,758	2,229	63	9,387
	(35.70)	(34.78)	(35.15)	(35.39)	(34.90)
2009	307	6,052	2,030	49	8,438
	(32.52)	(31.15)	(32.01)	(27.53)	(31.38)

Table 3

Comparison of excluded children to children included in the study sample on EDI domain scores

	Excluded children (n = 3,698)	Children in sample (n = 26,894)		
	M			
Domains		(*SD*)	*F*	*p*
Physical health and well-being	8.74 (1.36)	8.70 (1.43)	2.83	.093
Social competence	8.20 (1.86)	8.26 (1.86)	4.11	.043
Emotional maturity	7.79 (1.55)	7.87 (1.57)	9.01	.003
Language and cognitive development	8.02 (2.02)	8.14 (2.03)	11.81	<.001
Communication and general knowledge	6.89 (3.00)	7.63 (2.63)	243.65	<.001

Table 4

Comparison of excluded children to children included in the sample on percentage not ready on each EDI domain and 'one or more domains'

Domains	Excluded children (n = 3,698)	Children in sample (n = 26,894)	χ^2	p
	%			
Physical health and well-being	10.19	11.77	7.85	<.01
Social competence	10.63	10.67	0.01	*ns*
Emotional maturity	12.04	11.56	0.72	*ns*
Language and cognitive development	13.14	12.43	1.50	*ns*
Communication and general knowledge	18.60	10.09	238.41	<.001
One or more domains	33.67	27.45	62.01	<.001

Table 5

Comparison of excluded children to all children included in the sample on individual, family and community characteristics

Variables	Excluded children (*n* = 3,698)	Children in sample (*n* = 26,894)	*p*
Individual characteristics			
Age (years)	5.70	5.70	*ns*
Male (%)	51.14	50.89	*ns*
Child and Family Services (CFS) (%)	1.08	3.75	<.001
Family characteristics			
Age of mother at first birth (years)	25.27	24.43	<.001
Teen mother at 1st birth (%)	14.60	23.35	<.001
Mother married at child's 5th birthday (%)	80.56	52.33	<.001
Number of children in the family	2.77	2.62	<.001
Four or more children (%)	19.93	17.22	<.001
Number of residences (in MB)	1.58	1.80	<.001
Three or more moves (%)	2.57	7.10	<.001
Receiving income assistance (IA) (%)	1.38	22.61	<.001
Community characteristics			
Average household income ($)	60,515	61,263	*ns*
SEFI-2 score	−0.032	0.023	<.01
Francophones in DA (%)	3.88	4.24	<.05

Table 6

Average EDI domain scores for children by school language group

	Schools				
	DSFM	English	Immersion	Other	TOTAL
	(*n* = 944)	(*n* = 19,431)	(*n* = 6,341)	(*n* = 178)	(*n* = 26,894)
EDI domains	*M (SD)*				
Physical well-being	9.26	8.63	8.82	8.97	8.70
	(1.07)	(1.47)	(1.32)	(1.36)	(1.43)
Social competence	8.53	8.18	8.47	8.50	8.26
	(1.71)	(1.90)	(1.72)	(1.71)	(1.86)
Emotional maturity	7.96	7.84	7.96	7.99	7.87
	(1.55)	(1.58)	(1.53)	(1.65)	(1.57)
Language and cognitive development	8.08	8.09	8.32	7.53	8.14
	(1.89)	(2.12)	(1.75)	(2.12)	(2.03)
Communication and general knowledge	7.55	7.48	8.09	7.78	7.63
	(2.87)	(2.69)	(2.33)	(2.71)	(2.63)

Table 7

Percentage not ready on EDI domains for children by school language group

	Schools				
	DSFM (n = 944)	English (n = 19,431)	Immersion (n = 6,341)	Other (n = 178)	TOTAL (n = 26,894)
EDI domain	%				
Physical well-being	6.04	12.82	9.43	10.67	11.77
Social competence	7.31	11.74	7.94	9.55	10.67
Emotional maturity	10.68	11.85	10.81	11.86	11.56
Language and cognitive development	12.00	13.62	8.67	16.85	12.43
Communication and general knowledge	15.15	11.20	5.90	11.24	10.09
One or more domains	27.75	29.02	22.52	30.34	27.45

Table 8

Individual, family and community characteristics by school language group (n missing in parentheses for "Mother's Grade 12 education")

	Schools			
Variables	DSFM (*n* = 944)	English (*n* = 19,431)	Immersion (*n* = 6,341)	Other (*n* = 178)
Individual characteristics				
Age				
in years	5.67	5.70	5.70	5.67
in months	68.04	68.41	68.42	68.08
Male (%)	47.35	51.48	49.53	52.81
In care with CFS (%)	0.64	4.62	1.59	too small to report
Low birth weight (%)	3.39	4.73	4.67	5.62
Preterm birth (%)	6.27	7.32	6.61	5.65
Low Apgar score (%)	3.72	3.33	3.95	5.08
Oldest child (%)	41.95	37.50	45.70	48.31
Family characteristics				
Age of mother at first birth (years)	25.78	23.95	25.72	24.15
Teen mother at 1st birth (%)	9.43	26.26	16.48	14.61
Mother married				
at child's birth (%)	57.63	49.61	51.00	47.75
at child's 5th birthday (%)	61.02	51.74	52.95	48.31
Number of children	2.50	2.73	2.31	2.34
Four or more children (%)	13.35	19.99	9.45	12.92

Number of residences	1.54	1.84	1.72	1.76
Three or more moves (%)	2.54	8.02	4.92	7.87
Income assistance (%)	6.46	25.66	15.57	26.40
Mother's Grade 12 education (%)	95.28 (329)	77.40 (8,858)	89.10 (2,764)	80.95 (73)
Community characteristics				
Average household income ($)	68,257	58,609	68,649	50,591
SEFI-2 score	−0.342	0.140	−0.281	0.081
Francophones in DA (%)	21.80	3.07	4.49	29.18

Table 9

Average score on EDI domains, comparing DSFM children to all other children

Domain	DSFM Schools (n = 944)	All other schools (n = 25,950)	F	p
	M (SD)			
Physical health and well-being	9.26 (1.07)	8.67 (1.44)	156.00	<.001
Social competence	8.53 (1.71)	8.26 (1.87)	20.52	<.001
Emotional maturity	7.96 (1.55)	7.87 (1.57)	3.08	.079
Language and cognitive development	8.08 (1.89)	8.14 (2.04)	0.91	.339
Communication and general knowledge	7.55 (2.87)	7.63 (2.62)	0.80	.372

Table 10

Percentage not ready on EDI, comparing DSFM children to all other children

Domain	DSFM Schools *n* = 944	All other schools *n* = 25,950	χ^2	*p*
	%			
Physical health and well-being	6.04	11.97	30.82	<.001
Social competence	7.31	10.80	11.62	<.001
Emotional maturity	10.68	11.60	0.73	.392
Language and cognitive development	12.00	12.44	0.17	.682
Communication and general knowledge	15.15	9.90	27.65	<.001
One or more domains	27.75	27.44	0.04	.832

Table 11

Comparison of DSFM children to all other children on individual, family and community characteristics

Variables	DSFM Schools (n = 944)	All other schools (n = 25,950)	p
Individual characteristics			
Age			
in years	5.67	5.70	<.01
in months	68.04	68.41	<.01
Male (%)	47.35	51.02	<.05
In care with CFS (%)	0.64	3.87	<.001
Low birth weight (%)	3.39	4.72	<.10
Preterm birth (%)	6.27	7.13	*ns*
Low Apgar score (%)	3.72	3.50	*ns*
Oldest child (%)	41.95	39.58	*ns*
Family characteristics			
Age of mother at first birth (years)	25.78	24.38	<.001
Teen mother at 1st birth (%)	9.43	23.84	<.001
Mother married			
at child's birth (%)	57.63	49.94	<.001
at child's 5th birthday (%)	61.02	52.02	<.001
Number of children	2.50	2.62	<.01

Four or more children (%)	13.35	17.36	<.01
Number of residences	1.54	1.81	<.001
Three or more moves (%)	2.54	7.26	<.001
Income assistance (%)	6.46	23.20	<.001
Mother's Grade 12 education (%)	95.28	80.36	<.001
Community characteristics			
Average household income	68,257	61,007	<.001
SEFI-2 score	−0.342	0.037	<.001
Francophones in DA (%)	21.80	3.60	<.001

Table 12

Fixed Effects Estimates for Models (all children and DSFM children only) of the Predictors of Physical Health and Well-Being

	Models			
	All children		Only DSFM children	
Number of DAs	1,638		295	
Number of children	26,073		933	
Parameters	Estimate (Standard Error)			
Intercept	6.450***	(0.162)	8.179***	(0.685)
Level 2 (neighbourhood)				
Proportion of Francophones in DA	0.020	(0.162)	0.085	(0.207)
SEFI-2 Score	−0.079***	(0.014)	−0.219***	(0.055)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	−0.142***	(0.024)	0.045	(0.128)
4 or more children	−0.159***	(0.030)	0.096	(0.130)
Income assistance (IA)	−0.515***	(0.027)	−0.568***	(0.159)
3 or more moves	−0.152***	(0.035)	−0.029	(0.236)
Mother married at child's 5th birthday	0.117***	(0.019)	0.057	(0.074)
Level 1 (individual)				
Age (in months)	0.039***	(0.002)	0.020*	(0.010)
Male	−0.398***	(0.016)	−0.367***	(0.068)
Birth order	−0.067***	(0.012)	−0.105*	(0.050)
Child and family services (CFS)	−0.135**	(0.050)	0.605	(0.547)
Low birth weight (<2,500g)	−0.360***	(0.047)	−0.196	(0.216)
Preterm (<37 weeks)	−0.065[1]	(0.038)	−0.044	(0.163)
Low Apgar score (<8)	−0.184***	(0.045)	0.034	(0.179)
DSFM	0.451***	(0.050)		

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 13

Fixed Effects Estimates for Models (all children and DSFM children only) of the Predictors of Social Competence

	Models			
	All children		Only DSFM children	
Number of DAs	1,638		295	
Number of children	26,103		934	
Parameters	Estimate (Standard Error)			
Intercept	5.469***	(0.211)	6.382***	(1.054)
Level 2 (neighbourhood)				
Proportion of Francophones in DA	0.224	(0.199)	0.706*	(0.312)
SEFI-2 Score	−0.084***	(0.017)	−0.285***	(0.084)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	−0.121	(0.031)	−0.393*	(0.198)
4 or more children	−0.103***	(0.040)	0.150	(0.201)
Income assistance (IA)	−0.563***	(0.035)	−0.682**	(0.245)
3 or more moves	−0.175***	(0.046)	−0.182	(0.363)
Mother married at child's 5th birthday	0.174***	(0.024)	−0.070	(0.114)
Level 1 (individual)				
Age (in months)	0.050***	(0.003)	0.038*	(0.015)
Male	−0.803***	(0.021)	−0.914***	(0.105)
Birth order	−0.034*	(0.015)	−0.044	(0.77)
Child and family services (CFS)	−0.647***	(0.066)	−1.047	(0.843)
Low birth weight (<2,500g)	−0.247***	(0.061)	−0.544	(0.333)
Preterm (<37 weeks)	−0.068	(0.050)	−0.312	(0.251)
Low Apgar score (<8)	−0.255***	(0.059)	−0.019	(0.276)
DSFM	0.028	(0.064)		

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 14

Fixed Effects Estimates for Models (all children and DSFM children only) of the Predictors of Emotional Maturity

	Models			
	All children		Only DSFM children	
Number of DAs	1,638		295	
Number of children	26,057		933	
Parameters	Estimate (Standard Error)			
Intercept	5.772***	(0.178)	5.495***	(0.936)
Level 2 (neighbourhood)				
Proportion of Francophones in DA	0.123	(0.179)	1.040**	(0.353)
SEFI-2 Score	−0.049**	(0.015)	−0.194*	(0.084)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	−0.070**	(0.026)	−0.345	(0.176)
4 or more children	−0.046	(0.033)	0.072	(0.178)
Income assistance (IA)	−0.335***	(0.029)	−0.460*	(0.219)
3 or more moves	−0.165***	(0.039)	0.125	(0.328)
Mother married at child's 5th birthday	0.173***	(0.021)	−0.091	(0.102)
Level 1 (individual)				
Age (in months)	0.038***	(0.003)	0.039**	(0.014)
Male	−0.767***	(0.018)	−0.847***	(0.093)
Birth order	−0.015	(0.013)	0.029	(0.068)
Child and family services (CFS)	−0.534***	(0.056)	−1.075	(0.758)
Low birth weight (<2,500g)	−0.138**	(0.049)	−0.528[1]	(0.297)
Preterm (<37 weeks)	−0.058	(0.042)	−0.264	(0.225)
Low Apgar score (<8)	−0.089[1]	(0.023)	−0.153	(0.248)
DSFM	−0.093[1]	(0.055)		

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 15

Fixed Effects Estimates for Models (all children and DSFM children only) of the Predictors of Language and Cognitive Development

	Models			
	All children		Only DSFM children	
Number of DAs	1,638		295	
Number of children	26,084		933	
Parameters	Estimate (Standard Error)			
Intercept	3.736***	(0.225)	3.126**	(1.188)
Level 2 (neighbourhood)				
Proportion of Francophones in DA	−0.691**	(0.213)	1.198***	(0.331)
SEFI-2 Score	−0.238***	(0.018)	−0.210*	(0.091)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	−0.201***	(0.033)	−0.255	(0.223)
4 or more children	−0.199***	(0.042)	0.212	(0.226)
Income assistance (IA)	−0.746***	(0.037)	−1.314***	(0.276)
3 or more moves	−0.222***	(0.049)	0.685	(0.407)
Mother married at child's 5th birthday	0.136***	(0.026)	−0.004	(0.128)
Level 1 (individual)				
Age (in months)	0.078***	(0.003)	0.078***	(0.017)
Male	−0.673***	(0.023)	−0.635***	(0.118)
Birth order	−0.172***	(0.016)	−0.143[1]	(0.086)
Child and family services (CFS)	−0.431***	(0.070)	−0.124	(0.947)
Low birth weight (<2,500g)	−0.421***	(0.065)	−1.094**	(0.375)
Preterm (<37 weeks)	−0.068	(0.053)	−0.162	(0.282)
Low Apgar score (<8)	−0.261***	(0.063)	0.491	(0.311)
DSFM	−0.238***	(0.069)		

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 16

Fixed Effects Estimates for Models (all children and DSFM children only) of the Predictors of Communication and General Knowledge

	Models			
	All children		Only DSFM children	
Number of DAs	1,638		295	
Number of children	26,105		934	
Parameters	Estimate (Standard Error)			
Intercept	2.954***	(0.299)	3.690*	(1.756)
Level 2 (neighbourhood)				
Proportion of Francophones in DA	0.068	(0.295)	1.921**	(0.678)
SEFI-2 Score	−0.235***	(0.025)	−0.585***	(0.160)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	−0.133**	(0.044)	−0.780*	(0.331)
4 or more children	−0.441***	(0.056)	−0.410	(0.334)
Income assistance (IA)	−0.752***	(0.049)	−1.210**	(0.412)
3 or more moves	−0.238***	(0.066)	0.163	(0.616)
Mother married at child's 5th birthday	−0.016	(0.035)	−0.121	(0.192)
Level 1 (individual)				
Age (in months)	0.085***	(0.004)	0.061*	(0.025)
Male	−0.812***	(0.030)	−0.861***	(0.175)
Birth order	−0.186***	(0.021)	−0.040	(0.128)
Child and family services (CFS)	−0.545***	(0.093)	−2.429[1]	(1.426)
Low birth weight (<2,500g)	−0.477***	(0.086)	−1.388	(0.557)
Preterm (<37 weeks)	−0.115*	(0.070)	−0.026	(0.422)
Low Apgar score (<8)	−0.353***	(0.083)	−0.029	(0.460)
DSFM	−0.314***	(0.092)		

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 17

Model performance for Physical Health and Well-Being models of all children and children in the DSFM only

	Models	
	All children (n = 26,073)	DSFM children (n = 933)
Model performance	%	
Null Model		
Variance attributed to the individual level	90.45	91.71
Variance attributed to the neighbourhood level (Neighbourhood ICC)	9.55	8.29
Full Model		
Explained individual-level variation	7.89	3.67
Explained neighbourhood-level variation	43.81	46.88
Total variance explained at individual-level	7.14	3.37
Total variance explained at neighbourhood-level	4.18	3.89
Total variance explained by all covariates	11.32	7.26

Table 18

Model performance for Social Competence models of all children and children in the DSFM only

	Models	
	All children (n = 26,103)	DSFM children (n = 934)
Model performance	%	
Null Model		
Variance attributed to the individual level	93.12	94.12
Variance attributed to the neighbourhood level (Neighbourhood ICC)	6.88	5.88
Full Model		
Explained individual-level variation	9.20	10.95
Explained neighbourhood-level variation	38.98	36.84
Total variance explained at individual-level covariates	8.57	10.31
Total variance explained at neighbourhood-level covariates	2.68	2.16
Total variance explained by all covariates	11.25	12.47

Table 19

Model performance for Emotional Maturity models of all children and children in the DSFM only

	Models	
	All children (n = 26,057)	DSFM children (n = 933)
Model performance	%	
Null Model		
Variance attributed to the individual level	92.92	86.41
Variance attributed to the neighbourhood level (Neighbourhood ICC)	7.08	13.59
Full Model		
Explained individual-level variation	9.38	11.53
Explained neighbourhood-level variation	23.70	16.26
Total variance explained at individual-level	8.72	9.97
Total variance explained at neighbourhood-level	1.68	2.21
Total variance explained by all covariates	10.40	12.18

Table 20

Model performance for Language and Cognitive Development models of all children and children in the DSFM only

	Models	
	All children (n = 26,084)	DSFM children (n = 933)
Model performance	%	
Null Model		
Variance attributed to the individual level	89.32	92.40
Variance attributed to the neighbourhood level (Neighbourhood ICC)	10.68	7.60
Full Model		
Explained individual-level variation	10.26	6.67
Explained neighbourhood-level variation	62.01	67.64
Total variance explained at individual-level	9.16	6.16
Total variance explained at neighbourhood-level	6.62	5.14
Total variance explained by all covariates	15.78	11.30

Table 21

Model performance for Communication and General Knowledge models of all children and children in the DSFM only

	Models	
	All children (n = 26,105)	DSFM children (n = 934)
Model performance	%	
Null Model		
Variance attributed to the individual level	91.19	78.69
Variance attributed to the neighbourhood level (Neighbourhood ICC)	8.81	21.31
Full Model		
Explained individual-level variation	7.77	4.00
Explained neighbourhood-level variation	42.43	41.78
Total variance explained at individual-level	7.09	3.15
Total variance explained at neighbourhood-level	3.74	8.90
Total variance explained by all covariates	10.83	12.05

Table 22

Odds of not being ready on Physical Health and Well-Being for all children and DSFM children only

	Models			
	All children		Only DSFM children	
Number of DAs	1,638		295	
Number of children	26,044		933	
Parameters	Odds Ratio (Confidence Interval)			
Level 2 (neighbourhood)				
Proportion of Francophones in DA	1.018	(0.523 - 1.980)	0.752	(0.206 - 2.737)
SEFI-2 Score	1.122***	(1.063 - 1.185)	1.899***	(1.309 - 2.755)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	1.141*	(1.031 - 1.264)	0.935	(0.380 - 2.301)
4 or more children	1.278***	(1.114 - 1.466)	1.039	(0.378 - 2.858)
Income assistance (IA)	2.244***	(2.007 - 2.508)	3.916**	(1.569 - 9.772)
3 or more moves	1.160*	(1.012 - 1.329)	0.314	(0.036 - 2.755)
Mother married at child's 5th birthday	0.755	(0.687 - 0.831)	0.961	(0.514 - 1.795)
Level 1 (individual)				
Age (in months)	0.960***	(0.949 - 0.971)	0.974	(0.898 - 1.057)
Male	1.912***	(1.761 - 2.075)	3.126***	(1.69 - 5.78)
Birth order	1.119***	(1.058 - 1.183)	1.360	(0.903 - 2.049)
Child and family services (CFS)	1.102	(0.922 - 1.316)	0.792	(0.044 - 14.10)
Low birth weight (<2,500g)	1.620***	(1.331 - 1.972)	1.554	(0.341 - 7.090)
Preterm (<37 weeks)	1.116	(0.942 - 1.322)	0.944	(0.260 - 3.431)
Low Apgar score (<8)	1.576***	(1.301 - 1.910)	1.533	(0.479 - 4.904)
DSFM	0.638**	(0.472 - 0.863)		

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 23

Odds of not being ready on Emotional Maturity for all children and DSFM children only

	Models			
	All children		Only DSFM children	
Number of DAs	1,638		293	
Number of children	25,885		926	
Parameters	Odds Ratio (Confidence Interval)			
Level 2 (neighbourhood)				
Proportion of Francophones in DA	0.948	(0.504 - 1.781)	0.231*	(0.059 - 0.904)
SEFI-2 Score	1.031	(0.977 - 1.088)	1.190	(0.863 - 1.641)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	1.053	(0.945 - 1.172)	1.387	(0.641 - 2.999)
4 or more children	1.039	(0.900 - 1.201)	1.464	(0.623 - 3.440)
Income assistance (IA)	1.535***	(1.365 - 1.726)	2.575*	(1.108 - 5.985)
3 or more moves	1.227**	(1.060 - 1.419)	0.593	(0.148 - 2.381)
Mother married at child's 5th birthday	0.767***	(0.699 - 0.842)	1.055	(0.648 - 1.717)
Level 1 (individual)				
Age (in months)	0.959***	(0.949 - 0.970)	0.948	(0.888 - 1.011)
Male	3.372***	(3.085 - 3.685)	4.177***	(2.532 - 6.891)
Birth order	1.024	(0.968 - 1.083)	0.846	(0.605 - 1.184)
Child and family services (CFS)	1.886***	(1.569 - 2.268)	12.006[1]	(0.88 - 163.32)
Low birth weight (<2,500g)	1.150	(0.930 - 1.423)	1.807	(0.555 - 5.883)
Preterm (<37 weeks)	1.104	(0.928 - 1.314)	1.143	(0.442 - 2.958)
Low Apgar score (<8)	1.234*	(1.007 - 1.512)	0.939	(0.304 - 2.896)
DSFM	1.189	(0.933 - 1.515)		

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 24

Odds of not being ready on Social Competence for all children and DSFM children only

	Models			
	All children		Only DSFM children	
Number of DAs	1,638		295	
Number of children	26,098		934	
Parameters	Odds Ratio (Confidence Interval)			
Level 2 (neighbourhood)				
Proportion of Francophones in DA	1.328	(0.696 - 2.537)	0.658	(0.167 - 2.601)
SEFI-2 Score	1.123***	(1.063 - 1.187)	1.545*	(1.056 - 2.260)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	1.091	(0.979 - 1.215)	1.944	(0.857 - 4.408)
4 or more children	1.145[1]	(0.990 - 1.324)	0.685	(0.239 - 1.965)
Income assistance (IA)	1.799***	(1.600 - 2.024)	1.952	(0.733 - 5.201)
3 or more moves	1.138[1]	(0.984 - 1.316)	1.160	(0.276 - 4.875)
Mother married at child's 5th birthday	0.765***	(0.694 - 0.844)	1.364	(0.758 - 2.456)
Level 1 (individual)				
Age (in months)	0.959***	(0.947 - 0.970)	0.967	(0.898 - 1.042)
Male	2.672***	(2.445 - 2.919)	4.010***	(2.216 - 7.259)
Birth order	1.043	(0.985 - 1.106)	0.977	(0.663 - 1.439)
Child and family services (CFS)	1.627***	(1.357 - 1.950)	1.290	(0.083 - 20.05)
Low birth weight (<2,500g)	1.312*	(1.060 - 1.625)	3.116[1]	(0.833 - 11.65)
Preterm (<37 weeks)	1.020	(0.852 - 1.221)	0.787	(0.243 - 2.541)
Low Apgar score (<8)	1.557***	(1.277 - 1.898)	0.821	(0.228 - 2.952)
DSFM	0.843	(0.636 - 1.116)		

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 25

Odds of not being ready on Language and Cognitive Development for all children and DSFM children only

	Models			
	All children		Only DSFM children	
Number of DAs	1,638		294	
Number of children	25,975		932	
Parameters	Odds Ratio (Confidence Interval)			
Level 2 (neighbourhood)				
Proportion of Francophones in DA	1.784¹	(0.978 - 3.256)	0.301*	(0.100 - 0.911)
SEFI-2 Score	1.273***	(1.208 - 1.342)	1.181	(0.887 - 1.572)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	1.210***	(1.095 - 1.338)	0.903	(0.424 - 1.921)
4 or more children	1.123¹	(0.982 - 1.285)	0.546	(0.233 - 1.276)
Income assistance (IA)	2.190***	(1.961 - 2.447)	6.243***	(2.913 - 13.38)
3 or more moves	1.178*	(1.029 - 1.350)	0.218¹	(0.039 - 1.205)
Mother married at child's 5th birthday	0.839***	(0.763 - 0.922)	1.167	(0.734 - 1.857)
Level 1 (individual)				
Age (in months)	0.909***	(0.899 - 0.920)	0.919**	(0.864 - 0.977)
Male	2.113***	(1.947 - 2.294)	3.326***	(2.117 - 5.227)
Birth order	1.264***	(1.196 - 1.335)	1.205	(0.886 - 1.637)
Child and family services (CFS)	1.304**	(1.097 - 1.552)	2.884	(0.226 - 36.87)
Low birth weight (<2,500g)	1.460***	(1.195 - 1.783)	3.123*	(1.047 - 9.319)
Preterm (<37 weeks)	1.179¹	(0.996 - 1.395)	0.950	(0.364 - 2.481)
Low Apgar score (<8)	1.370**	(1.122 - 1.674)	0.329	(0.076 - 1.433)
DSFM	1.289*	(1.017 - 1.632)		

*$p < .05$. **$p < .01$. ***$p < .001$.
¹ $p < .10$.

Table 26

Odds of not being ready on Communication and General Knowledge for all children and DSFM children only

	Models			
	All children		Only DSFM children	
Number of DAs	1,638		295	
Number of children	26,601		934	
Parameters	Odds Ratio (Confidence Interval)			
Level 2 (neighbourhood)				
Proportion of Francophones in DA	1.382	(0.755 - 2.531)	0.318*	(0.105 - 0.962)
SEFI-2 Score	1.238***	(1.172 - 1.308)	1.862***	(1.390 - 2.494)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	0.959	(0.858 - 1.071)	1.507	(0.805 - 2.821)
4 or more children	1.640***	(1.424 - 1.889)	1.586	(0.781 - 3.223)
Income assistance (IA)	1.794***	(1.588 - 2.027)	2.991**	(1.468 - 6.093)
3 or more moves	1.179*	(1.016 - 1.369)	0.858	(0.261 - 2.821)
Mother married at child's 5th birthday	1.014	(0.917 - 1.121)	1.015	(0.662 - 1.555)
Level 1 (individual)				
Age (in months)	0.944***	(0.932 - 0.955)	0.948[1]	(0.896 - 1.002)
Male	2.030***	(1.860 - 2.215)	2.387***	(1.598 - 3.566)
Birth order	1.098**	(1.036 - 1.164)	1.019	(0.766 - 1.356)
Child and family services (CFS)	1.457***	(1.210 - 1.755)	1.976	(0.159 - 24.57)
Low birth weight (<2,500g)	1.485***	(1.205 - 1.831)	2.424[1]	(0.870 - 6.752)
Preterm (<37 weeks)	1.135	(0.950 - 1.357)	1.239	(0.525 - 2.924)
Low Apgar score (<8)	1.247*	(1.006 - 1.545)	0.400	(0.126 - 1.270)
DSFM	2.116***	(1.699 - 2.636)		

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 27

Odds of not being ready on One or More Domains for all children and DSFM children only

	Models			
	All children		Only DSFM children	
Number of DAs	1,638			
Number of children	26,106			
Parameters	Odds Ratio (Confidence Interval)			
Level 2 (neighbourhood)				
Proportion of Francophones in DA	1.156	0.709 - 1.884	DID NOT CONVERGE	
SEFI-2 Score	1.165***	1.116 - 1.216		
Level 1 (family)				
Teen mom (<20yrs old) at first birth	1.189***	1.099 - 1.288		
4 or more children	1.239***	1.116 - 1.376		
Income assistance (IA)	2.096***	1.921 - 2.288		
3 or more moves	1.244***	1.108 - 1.396		
Mother married at child's 5th birthday	0.839***	0.784 - 0.899		
Level 1 (individual)				
Age (in months)	0.932***	0.924 - 0.94		
Male	2.405***	2.264 - 2.555		
Birth order	1.129***	1.083 - 1.177		
Child and family services (CFS)	1.597***	1.359 - 1.878		
Low birth weight (<2,500g)	1.432***	1.218 - 1.683		
Preterm (<37 weeks)	1.014	0.886 - 1.16		
Low Apgar score (<8)	1.350***	1.157 - 1.576		
DSFM	1.374***	1.155 - 1.635		

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 28

Fixed Effects Estimates for Models (all children and sub-population with mother's education level) of the Predictors of Physical Health and Well-Being

	Models			
	All children		Children with mother's education level	
Number of DAs	1,638		1,596	
Number of children	26,073		14,597	
Parameters	Estimate (Standard Error)			
Intercept	6.450***	(0.162)	6.068***	(0.211)
Level 2 (neighbourhood)				
Proportion of Francophones in DA	0.020	(0.162)	−0.020	(0.180)
SEFI-2 Score	−0.079***	(0.014)	−0.035*	(0.017)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	−0.142***	(0.024)	−0.059[1]	(0.032)
4 or more children	−0.159***	(0.030)	−0.124**	(0.040)
Income assistance (IA)	−0.515***	(0.027)	−0.510***	(0.037)
3 or more moves	−0.152***	(0.035)	−0.089[1]	(0.048)
Mother married at child's 5th birthday	0.117***	(0.019)	0.096***	(0.024)
Mother has Grade 12 education			0.273***	(0.034)
Level 1 (individual)				
Age (in months)	0.039***	(0.002)	0.042***	(0.003)
Male	−0.398***	(0.016)	−0.382***	(0.021)
Birth order	−0.067***	(0.012)	−0.063***	(0.015)
Child and family services (CFS)	−0.135**	(0.050)	−0.198**	(0.075)
Low birth weight (<2,500g)	−0.360***	(0.047)	−0.271***	(0.062)
Preterm (<37 weeks)	−0.065[1]	(0.038)	−0.088[1]	(0.050)
Low Apgar score (<8)	−0.184***	(0.045)	−0.152**	(0.057)
DSFM	0.451***	(0.050)	0.418***	(0.059)

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 29

Fixed Effects Estimates for Models (all children and sub-population with mother's education level) of the Predictors of Social Competence

	Models			
	All children		Children with mother's education level	
Number of DAs	1,638		1,596	
Number of children	26,103		14,617	
Parameters	Estimate (Standard Error)			
Intercept	5.469***	(0.211)	5.204***	(0.278)
Level 2 (neighbourhood)				
Proportion of Francophones in DA	0.224	(0.199)	0.238	(0.230)
SEFI-2 Score	−0.084***	(0.017)	−0.044*	(0.022)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	−0.121	(0.031)	−0.080[1]	(0.043)
4 or more children	−0.103***	(0.040)	−0.047	(0.052)
Income assistance (IA)	−0.563***	(0.035)	−0.558***	(0.049)
3 or more moves	−0.175***	(0.046)	−0.116[1]	(0.063)
Mother married at child's 5th birthday	0.174***	(0.024)	0.143***	(0.032)
Mother has Grade 12 education			0.262***	(0.045)
Level 1 (individual)				
Age (in months)	0.050***	(0.003)	0.051***	(0.004)
Male	−0.803***	(0.021)	−0.795***	(0.028)
Birth order	−0.034*	(0.015)	−0.035[1]	(0.020)
Child and family services (CFS)	−0.647***	(0.066)	−0.743***	(0.098)
Low birth weight (<2,500g)	−0.247***	(0.061)	−0.141[1]	(0.081)
Preterm (<37 weeks)	−0.068	(0.050)	−0.064	(0.066)
Low Apgar score (<8)	−0.255***	(0.059)	−0.319***	(0.075)
DSFM	0.028	(0.064)	0.058	(0.078)

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 30

Fixed Effects Estimates for Models (all children and sub-population with mother's education level) of the Predictors of Emotional Maturity

	Models			
	All children		Children with mother's education level	
Number of DAs	1,638		1,595	
Number of children	26,057		14,582	
Parameters	Estimate (Standard Error)			
Intercept	5.772***	(0.178)	5.466***	(0.239)
Level 2 (neighbourhood)				
Proportion of Francophones in DA	0.123	(0.179)	0.129	(0.207)
SEFI-2 Score	−0.049**	(0.015)	−0.009	(0.020)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	−0.070**	(0.026)	−0.040	(0.037)
4 or more children	−0.046	(0.033)	−0.002	(0.045)
Income assistance (IA)	−0.335***	(0.029)	−0.314***	(0.042)
3 or more moves	−0.165***	(0.039)	−0.102[1]	(0.054)
Mother married at child's 5th birthday	0.173***	(0.021)	0.150***	(0.027)
Mother has Grade 12 education			0.245***	(0.039)
Level 1 (individual)				
Age (in months)	0.038***	(0.003)	0.039***	(0.003)
Male	−0.767***	(0.018)	−0.764***	(0.024)
Birth order	−0.015	(0.013)	−0.010	(0.017)
Child and family services (CFS)	−0.534***	(0.056)	−0.593***	(0.085)
Low birth weight (<2,500g)	−0.138**	(0.049)	−0.097	(0.070)
Preterm (<37 weeks)	−0.058	(0.042)	−0.023	(0.057)
Low Apgar score (<8)	−0.089[1]	(0.023)	−0.179**	(0.065)
DSFM	−0.093[1]	(0.055)	−0.075	(0.067)

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 31

Fixed Effects Estimates for Models (all children and sub-population with mother's education level) of the Predictors of Language and Cognitive Development

	Models			
	All children		Children with mother's education level	
Number of DAs	1,638		1,596	
Number of children	26,084		14,609	
Parameters	Estimate (Standard Error)			
Intercept	3.736***	(0.225)	3.304***	(0.290)
Level 2 (neighbourhood)				
Proportion of Francophones in DA	−0.691**	(0.213)	−0.663**	(0.234)
SEFI-2 Score	−0.238***	(0.018)	−0.158***	(0.023)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	−0.201***	(0.033)	−0.101*	(0.044)
4 or more children	−0.199***	(0.042)	−0.112*	(0.055)
Income assistance (IA)	−0.746***	(0.037)	−0.672***	(0.051)
3 or more moves	−0.222***	(0.049)	−0.218***	(0.066)
Mother married at child's 5th birthday	0.136***	(0.026)	0.114***	(0.033)
Mother has Grade 12 education			0.481***	(0.047)
Level 1 (individual)				
Age (in months)	0.078***	(0.003)	0.079***	(0.004)
Male	−0.673***	(0.023)	−0.637***	(0.029)
Birth order	−0.172***	(0.016)	−0.178***	(0.021)
Child and family services (CFS)	−0.431***	(0.070)	−0.484***	(0.103)
Low birth weight (<2,500g)	−0.421***	(0.065)	−0.283***	(0.085)
Preterm (<37 weeks)	−0.068	(0.053)	−0.077	(0.069)
Low Apgar score (<8)	−0.261***	(0.063)	−0.255**	(0.078)
DSFM	−0.238***	(0.069)	−0.316***	(0.081)

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 32

Fixed Effects Estimates for Models (all children and sub-population with mother's education level) of the Predictors of Communication and General Knowledge

	Models			
	All children		Children with mother's education level	
Number of DAs	1,638		1,596	
Number of children	26,105		14,617	
Parameters	Estimate (Standard Error)			
Intercept	2.954***	(0.299)	1.898***	(0.393)
Level 2 (neighbourhood)				
Proportion of Francophones in DA	0.068	(0.295)	−0.019	(0.334)
SEFI-2 Score	−0.235***	(0.025)	−0.120***	(0.032)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	−0.133**	(0.044)	0.066	(0.060)
4 or more children	−0.441***	(0.056)	−0.362***	(0.074)
Income assistance (IA)	−0.752***	(0.049)	−0.578***	(0.069)
3 or more moves	−0.238***	(0.066)	−0.115	(0.089)
Mother married at child's 5th birthday	−0.016	(0.035)	−0.039	(0.045)
Mother has Grade 12 education			0.860***	(0.064)
Level 1 (individual)				
Age (in months)	0.085***	(0.004)	0.090***	(0.006)
Male	−0.812***	(0.030)	−0.807***	(0.039)
Birth order	−0.186***	(0.021)	−0.186***	(0.028)
Child and family services (CFS)	−0.545***	(0.093)	−0.712***	(0.139)
Low birth weight (<2,500g)	−0.477***	(0.086)	−0.405***	(0.115)
Preterm (<37 weeks)	−0.115*	(0.070)	−0.013	(0.093)
Low Apgar score (<8)	−0.353***	(0.083)	−0.456***	(0.106)
DSFM	−0.314***	(0.092)	−0.359**	(0.110)

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 33

Model performance for Physical Health and Well-Being models of all children and sub-population of children with mother's education level

	Models	
	All children (*n* = 26,073)	Children with mother's education level (*n* = 14,597)
Model performance	%	
Null Model		
Variance attributed to the individual level	90.45	90.62
Variance attributed to the neighbourhood level (Neighbourhood ICC)	9.55	9.38
Full Model		
Explained individual-level variation	7.89	8.64
Explained neighbourhood-level variation	43.81	41.14
Total variance explained at individual-level	7.14	7.83
Total variance explained at neighbourhood-level	4.18	3.86
Total variance explained by all covariates	11.32	11.69

Table 34

Model performance for Social Competence models of all children and sub-population of children with mother's education level

Model performance	All children (n = 26,103)	Children with mother's education level (n = 14,617)
	%	
Null Model		
Variance attributed to the individual level	93.12	92.43
Variance attributed to the neighbourhood level (Neighbourhood ICC)	6.88	7.57
Full Model		
Explained individual-level variation	9.20	10.00
Explained neighbourhood-level variation	38.98	36.07
Total variance explained at individual-level	8.57	9.24
Total variance explained at neighbourhood-level	2.68	2.73
Total variance explained by all covariates	11.25	11.97

Table 35

Model performance for Emotional Maturity models of all children and sub-population of children with mother's education level

Model performance	All children (n = 26,057)	Children with mother's education level (n = 14,582)
	%	
Null Model		
Variance attributed to the individual level	92.92	92.37
Variance attributed to the neighbourhood level (Neighbourhood ICC)	7.08	7.63
Full Model		
Explained individual-level variation	9.38	9.77
Explained neighbourhood-level variation	23.70	22.65
Total variance explained at individual-level	8.72	9.03
Total variance explained at neighbourhood-level	1.68	1.73
Total variance explained by all covariates	10.40	10.76

Table 36

Model performance for Language and Cognitive Development models of all children and sub-population of children with mother's education level

Model performance	All children (n = 26,084)	Children with mother's education level (n = 14,609)
	%	
Null Model		
Variance attributed to the individual level	89.32	89.58
Variance attributed to the neighbourhood level (Neighbourhood ICC)	10.68	10.42
Full Model		
Explained individual-level variation	10.26	11.27
Explained neighbourhood-level variation	62.01	60.42
Total variance explained at individual-level	9.16	10.10
Total variance explained at neighbourhood-level	6.62	6.30
Total variance explained by all covariates	15.78	16.40

Table 37

Model performance for Communication and General Knowledge models of all children and sub-population of children with mother's education level

Model performance	All children (n = 26,105)	Children with mother's education level (n = 14,617)
	%	
Null Model		
Variance attributed to the individual level	91.19	91.37
Variance attributed to the neighbourhood level (Neighbourhood ICC)	8.81	8.63
Full Model		
Explained individual-level variation	7.77	9.33
Explained neighbourhood-level variation	42.43	36.85
Total variance explained at individual-level	7.09	8.53
Total variance explained at neighbourhood-level	3.74	3.18
Total variance explained by all covariates	10.83	11.71

Table 38

Fixed Effects Estimates for DSFM children on Models of the Predictors (without and with "French not 1st language") of Physical Health and Well-Being

	Only DSFM children			
Number of DAs	295			
Number of children	933			
	Model 1		Model 2	
Parameters	Estimate (Standard Error)			
Intercept	8.179***	(0.685)	8.409***	(0.690)
Level 2 (neighbourhood)				
Proportion of Francophones in DA	0.085	(0.207)	0.045	(0.205)
SEFI-2 Score	−0.219***	(0.055)	−0.200***	(0.055)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	0.045	(0.128)	0.049	(0.128)
4 or more children	0.096	(0.130)	0.107	(0.130)
Income assistance (IA)	−0.568***	(0.159)	−0.546***	(0.159)
3 or more moves	−0.029	(0.236)	−0.012	(0.235)
Mother married at child's 5th birthday	0.057	(0.074)	0.066	(0.074)
Level 1 (individual)				
Age (in months)	0.020*	(0.010)	0.020*	(0.010)
Male	−0.367***	(0.068)	−0.360***	(0.068)
Birth order	−0.105*	(0.050)	−0.106*	(0.050)
Child and family services (CFS)	0.605	(0.547)	0.625	(0.546)
Low birth weight (<2,500g)	−0.196	(0.216)	−0.195	(0.216)
Preterm (<37 weeks)	−0.044	(0.163)	−0.037	(0.163)
Low Apgar score (<8)	0.034	(0.179)	0.055	(0.179)
French not 1st language			−0.174*	(0.076)

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 39

Fixed Effects Estimates for DSFM children on Models of the Predictors (without and with "French not 1st language") of Social Competence

	Only DSFM children			
Number of DAs	295			
Number of children	934			
	Model 1		Model 2	
Parameters	Estimate (Standard Error)			
Intercept	6.382***	(1.054)	7.006***	(1.056)
Level 2 (neighbourhood)				
Proportion of Francophones in DA	0.706*	(0.312)	0.567[1]	(0.301)
SEFI-2 Score	−0.285***	(0.084)	−0.229**	(0.083)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	−0.393*	(0.198)	−0.380[1]	(0.196)
4 or more children	0.150	(0.201)	0.175	(0.199)
Income assistance (IA)	−0.682**	(0.245)	−0.625*	(0.244)
3 or more moves	−0.182	(0.363)	−0.132	(0.359)
Mother married at child's 5th birthday	−0.070	(0.114)	−0.048	(0.113)
Level 1 (individual)				
Age (in months)	0.038*	(0.015)	0.039*	(0.015)
Male	−0.914***	(0.105)	−0.895***	(0.104)
Birth order	−0.044	(0.77)	−0.045	(0.076)
Child and family services (CFS)	−1.047	(0.843)	−1.001	(0.835)
Low birth weight (<2,500g)	−0.544	(0.333)	−0.532	(0.331)
Preterm (<37 weeks)	−0.312	(0.251)	−0.287	(0.249)
Low Apgar score (<8)	−0.019	(0.276)	0.038	(0.274)
French not 1st language			−0.492***	(0.116)

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 40

Fixed Effects Estimates for DSFM children on Models of the Predictors (without and with "French not 1st language") of Emotional Maturity

	Only DSFM children			
Number of DAs	295			
Number of children	933			
	Model 1		Model 2	
Parameters	Estimate (Standard Error)			
Intercept	5.495***	(0.936)	5.881***	(0.941)
Level 2 (neighbourhood)				
Proportion of Francophones in DA	1.040**	(0.353)	0.938**	(0.351)
SEFI-2 Score	−0.194*	(0.084)	−0.164[1]	(0.084)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	−0.345	(0.176)	−0.337[1]	(0.176)
4 or more children	0.072	(0.178)	0.086	(0.177)
Income assistance (IA)	−0.460*	(0.219)	−0.421[1]	(0.219)
3 or more moves	0.125	(0.328)	0.155	(0.326)
Mother married at child's 5th birthday	−0.091	(0.102)	−0.076	(0.102)
Level 1 (individual)				
Age (in months)	0.039**	(0.014)	0.039**	(0.013)
Male	−0.847***	(0.093)	−0.833***	(0.093)
Birth order	0.029	(0.068)	0.030	(0.068)
Child and family services (CFS)	−1.075	(0.758)	−1.055	(0.754)
Low birth weight (<2,500g)	−0.528[1]	(0.297)	−0.518[1]	(0.296)
Preterm (<37 weeks)	−0.264	(0.225)	−0.250	(0.224)
Low Apgar score (<8)	−0.153	(0.248)	−0.119	(0.248)
French not 1st language			−0.314**	(0.105)

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 41

Fixed Effects Estimates for DSFM children on Models of the Predictors (without and with "French not 1st language") of Language and Cognitive Development

	Only DSFM children			
Number of DAs	295			
Number of children	933			
	Model 1		Model 2	
Parameters	Estimate (Standard Error)			
Intercept	3.126**	(1.188)	4.159***	(1.176)
Level 2 (neighbourhood)				
Proportion of Francophones in DA	1.198***	(0.331)	1.025***	(0.303)
SEFI-2 Score	−0.210*	(0.091)	−0.115	(0.088)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	−0.255	(0.223)	−0.232	(0.218)
4 or more children	0.212	(0.226)	0.259	(0.222)
Income assistance (IA)	−1.314***	(0.276)	−1.209***	(0.271)
3 or more moves	0.685[1]	(0.407)	0.766[1]	(0.398)
Mother married at child's 5th birthday	−0.004	(0.128)	0.038	(0.125)
Level 1 (individual)				
Age (in months)	0.078***	(0.017)	0.079***	(0.017)
Male	−0.635***	(0.118)	−0.607***	(0.116)
Birth order	−0.143	(0.086)	−0.147[1]	(0.085)
Child and family services (CFS)	−0.124	(0.947)	−0.024	(0.928)
Low birth weight (<2,500g)	−1.094**	(0.375)	−1.092**	(0.368)
Preterm (<37 weeks)	−0.162	(0.282)	−0.121	(0.276)
Low Apgar score (<8)	0.491	(0.311)	0.588[1]	(0.306)
French not 1st language			−0.812***	(0.128)

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 42

Fixed Effects Estimates for DSFM children on Models of the Predictors (without and with "French not 1st language") of Communication and General Knowledge

	Only DSFM children			
Number of DAs	295			
Number of children	934			
	Model 1		Model 2	
Parameters	Estimate (Standard Error)			
Intercept	3.690*	(1.756)	7.548***	(1.523)
Level 2 (neighbourhood)				
Proportion of Francophones in DA	1.921**	(0.678)	0.811	(0.516)
SEFI-2 Score	−0.585***	(0.160)	−0.309*	(0.129)
Level 1 (family)				
Teen mom (<20yrs old) at first birth	−0.780*	(0.331)	−0.739**	(0.284)
4 or more children	−0.410	(0.334)	−0.253	(0.287)
Income assistance (IA)	−1.210**	(0.412)	−0.822*	(0.353)
3 or more moves	0.163	(0.616)	0.448	(0.524)
Mother married at child's 5th birthday	−0.121	(0.192)	0.017	(0.164)
Level 1 (individual)				
Age (in months)	0.061*	(0.025)	0.066**	(0.022)
Male	−0.861***	(0.175)	−0.729***	(0.150)
Birth order	−0.040	(0.128)	−0.041	(0.110)
Child and family services (CFS)	−2.429[1]	(1.426)	−2.180[1]	(1.213)
Low birth weight (<2,500g)	−1.388	(0.557)	−1.344**	(0.478)
Preterm (<37 weeks)	−0.026	(0.422)	0.137	(0.361)
Low Apgar score (<8)	−0.029	(0.460)	0.420	(0.396)
French not 1st language			−3.134***	(0.169)

*$p < .05$. **$p < .01$. ***$p < .001$.
[1] $p < .10$.

Table 43

Model performance for Physical Health and Well-Being models of children in the DSFM (without and with "first language is not French")

	Models (n = 933)	
	Original DSFM model	With "first language is not French"
Model performance	%	
Null Model		
Variance attributed to the individual level	91.71	91.71
Variance attributed to the neighbourhood level (Neighbourhood ICC)	8.29	8.29
Full Model		
Explained individual-level variation	3.67	3.86
Explained neighbourhood-level variation	46.88	51.04
Total variance explained at individual-level	3.37	3.54
Total variance explained at neighbourhood-level	3.89	4.23
Total variance explained by all covariates	7.26	7.77

Table 44

Model performance for Social Competence models of children in the DSFM (without and with "first language is not French")

	Models (n = 934)	
	Original DSFM model	With "first language is not French"
Model performance	%	
Null Model		
Variance attributed to the individual level	94.12	94.12
Variance attributed to the neighbourhood level (Neighbourhood ICC)	5.88	5.88
Full Model		
Explained individual-level variation	10.95	12.01
Explained neighbourhood-level variation	36.84	50.29
Total variance explained at individual-level	10.31	11.31
Total variance explained at neighbourhood-level	2.16	2.96
Total variance explained by all covariates	12.47	14.27

Table 45

Model performance for Emotional Maturity models of children in the DSFM (without and with "first language is not French")

	Models (n = 933)	
	Original DSFM model	With "first language is not French"
Model performance	%	
Null Model		
Variance attributed to the individual level	86.41	86.41
Variance attributed to the neighbourhood level (Neighbourhood ICC)	13.59	13.59
Full Model		
Explained individual-level variation	11.53	12.16
Explained neighbourhood-level variation	16.26	18.71
Total variance explained at individual-level	9.97	10.51
Total variance explained at neighbourhood-level	2.21	2.54
Total variance explained by all covariates	12.18	13.05

Table 46

Model performance for Language and Cognitive Development models of children in the DSFM (without and with "first language is not French")

	Models (n = 933)	
	Original DSFM model	With "first language is not French"
Model performance	%	
Null Model		
Variance attributed to the individual level	92.40	92.40
Variance attributed to the neighbourhood level (Neighbourhood ICC)	7.60	7.60
Full Model		
Explained individual-level variation	6.67	9.48
Explained neighbourhood-level variation	67.64	84.00
Total variance explained at individual-level	6.16	8.76
Total variance explained at neighbourhood-level	5.14	6.38
Total variance explained by all covariates	11.20	15.14

Table 47

Model performance for Communication and General Knowledge models of children in the DSFM (without and with "first language is not French")

	Models (n = 934)	
	Original DSFM model	With "first language is not French"
Model performance	%	
Null Model		
Variance attributed to the individual level	78.69	78.69
Variance attributed to the neighbourhood level (Neighbourhood ICC)	21.31	21.31
Full Model		
Explained individual-level variation	4.00	27.21
Explained neighbourhood-level variation	41.78	74.78
Total variance explained at individual-level	3.15	21.41
Total variance explained at neighbourhood-level	8.90	15.93
Total variance explained by all covariates	11.05	37.34

Appendix A

EDI Items by Domain and Sub-domain

Physical Health and Well-being Domain

A. Sub-domain: Physical readiness for school day
1. Over- or underdressed for school-related activities
2. Too tired/sick to do school work
3. Late
4. Hungry

B. Sub-domain: Physical independence
5. Independent in bathroom habits most of the time
6. Shows an established hand preference
7. Well-coordinated
8. Sucks a thumb/finger

C. Sub-domain: Gross and fine motor skills
9. Proficient at holding a pen, crayons, or a paintbrush
10. Ability to manipulate objects
11. Ability to climb stairs
12. Level of energy throughout the school day
13. Overall physical development

Social Competence Domain

A. Sub-domain: Overall competence with peers
1. Overall social/emotional development
2. Ability to get along with peers
3. Plays and works cooperatively with other children
4. Able to play with other children
5. Shows self-confidence

B. Sub-domain: Respect and responsibility
6. Follows rules and instructions
7. Respects the property of others
8. Demonstrates self-control
9. Demonstrates respect for adults
10. Demonstrates respect for other children
11. Accepts responsibility for actions
12. Takes care of school materials
13. Shows tolerance to someone who made a mistake

C. Sub-domain: Approaches to learning
14. Listens attentively
15. Follows directions
16. Completes work on time
17. Works independently
18. Works neatly and carefully
19. Able to solve day-to-day problems by him/herself
20. Able to follow one-step instructions

21. Able to follow class routines without reminders
22. Able to adjust to changes in routines

D. Sub-domain: Readiness to explore new things
23. Curious about the world
24. Eager to play with a new toy
25. Eager to play a new game
26. Eager to play with/read a new book

Emotional Maturity Domain

A. Sub-domain: Pro-social and helping behavior
1. Tries to help someone who is hurt
2. Volunteers to help clear up a mess someone else has made
3. Will try to stop a quarrel or dispute
4. Offers to help other children who have difficulty with a task
5. Comforts a child who is crying or upset
6. Spontaneously helps to pick up objects which another child has dropped
7. Invites bystanders to join a game
8. Helps other children who are feeling sick

B. Sub-domain: Anxious and fearful behavior
9. Is upset when left by a parent/guardian
10. Seems to be unhappy, sad, or depressed
11. Appears fearful or anxious
12. Appears worried
13. Cries a lot
14. Nervous, high-strung, or tense
15. Incapable of making decisions
16. Shy

C. Sub-domain: Aggressive behavior
17. Gets into physical fights
18. Bullies or is mean to others
19. Kicks, bites, hits other children or adults
20. Takes things that do not belong to him/her
21. Laughs at other children's discomfort
22. Disobedient
23. Has temper tantrums

D. Sub-domain: Hyperactive and inattentive behavior
24. Can't sit still, restless
25. Distractible, has trouble sticking to any activity
26. Fidgets
27. Impulsive, acts without thinking
28. Has difficulty awaiting turn in games or groups
29. Cannot settle into anything for more than a few moments
30. Inattentive

Language and Cognitive Development Domain

A. Sub-domain: Basic literacy skills

1. Knows how to handle a book
2. Able to identify at least 10 letters of the alphabet
3. Able to attach sounds to letters
4. Showing awareness of rhyming words
5. Able to participate in group reading activities
6. Experimenting with writing tools
7. Aware of writing directions in English
8. Able to write his/her own name in English

B. Sub-domain: Interest in literacy/numeracy and memory

9. Generally interested in books
10. Interested in reading
11. Able to remember things easily
12. Interested in mathematics
13. Interested in games involving numbers

C. Sub-domain: Advanced literacy skills

14. Able to read simple words
15. Able to read complex words
16. Able to read simple sentences
17. Interested in writing voluntarily
18. Able to write simple words
19. Able to write simple sentences

D. Sub-domain: Basic numeracy skills

20. Able to sort and classify objects by a common characteristic
21. Able to use one-to-one correspondence
22. Able to count to 20
23. Able to recognize numbers 1-10
24. Able to say which number is bigger of the two
25. Able to recognize geometric shapes
26. Understands simple time concepts

Communication Skills and General Knowledge Domain

A. Sub-domain: Communication skills and general knowledge

1. Ability to use language effectively in English
2. Ability to listen in English
3. Ability to tell a story
4. Ability to take part in imaginative play
5. Ability to communicate own needs in a way understandable to adults and peers
6. Ability to understand on first try what is being said to him/her
7. Ability to articulate clearly, without sound substitutions
8. Answers questions showing knowledge about the world

Appendix B

List of DSFM, French Immersion and Other elementary schools in Manitoba

DSFM elementary schools

1. École Christine-Lespérance
2. École / Collège régional Gabrielle-Roy
3. École communautaire Aurèle-Lemoine
4. École communautaire Gilbert-Rosset
5. École communautaire Réal-Bérard
6. École communautaire Saint-Georges
7. École élémentaire Notre-Dame-de-Lourdes
8. École Jours de Plaine
9. École Lacerte
10. École Lagimodière
11. École La Source
12. École Noël-Ritchot
13. École Pointe-des-Chênes
14. École Précieux-Sang
15. École régionale Saint-Jean-Baptiste
16. École Roméo-Dallaire
17. École Saint-Joachim
18. École Saint-Lazare
19. École Sainte-Agathe
20. École Taché
21. École communautaire Thompson

French Immersion elementary schools

1. École Marie-Anne Gaboury
2. École Opasquia School
3. École Riverside School
4. École Sacré-Coeur
5. École R.-W.-Bobby-Bend School
6. École J.-B. Mitchell School
7. École Centrale
8. École Garden Grove School
9. École McIsaac School
10. École New Era School
11. École R.H.G. Bonnycastle School
12. École Saint-Eustache
13. École Springfield Heights School

14. École MacNeill
15. École Varennes
16. École James-Nisbet Community School
17. École Swan River South School
18. École Guyot
19. École Assiniboine
20. École Harrison
21. École Henri-Bergeron
22. École Dieppe
23. École Bannatyne
24. École Crane
25. École Sainte-Anne Immersion
26. École Saint-Norbert Immersion
27. École St. Adolphe School
28. École Crescentview School
29. École Saint-Avila
30. École Powerview School
31. École Îles-des-Chênes School
32. École Neil-Campbell School
33. École Élémentaire Elmwood Elementary
34. École Lansdowne
35. École Beauséjour School
36. École Salisbury Morse Place
37. École Tuxedo Park
38. École Howden
39. École Laura-Secord School
40. École George V School
41. École O'Kelly School
42. École Riverview School
43. École Margaret-Underhill
44. École Dugald School
45. École Élémentaire Maple Leaf Elementary School
46. École La Vérendrye
47. École Robert-H.-Smith School
48. École Robert-Browning
49. École Belmont
50. École Sun Valley School
51. École Saint-Germain
52. École Van Walleghem School
53. École Stanley-Knowles School

54. École Van Belleghem
55. École Constable Edward-Finney School
56. École Leila North Community School
57. École Bonaventure
58. École Héritage Immersion
59. École Riverbend Community School
60. École Julie-Riel
61. École Lorette Immersion

Other elementary schools

1. Académie Islamique du Manitoba
2. École Provencher
3. École Laurier
4. École Somerset
5. Complex Scolaire Saint-Claude
6. École Saint-Malo

Appendix C

Domains, Databases, Data Years, and Variables

DOMAIN Database/Data Agency	**Data Years**	**Variables**
Health		
Hospital Abstracts [MH]	April 1/1998 to March 31/2006	Child's separation abstract: - birth weight - gestational age - Apgar score - mother's age at child's birth
Hospital Abstracts [MH]	April 1/1970 to March 31/2006	Mother's separation abstract: - record of child birth - child's gestational age
Education		
Manitoba Schools: Enrolment [ME]	2004/05 to 2008/09	- what school enrolled (ENG, FR IMM, FR, or OTHER)
Social		
Early Development Instrument [HCM]	2005/06, 2006/07, and 2008/09	- school registered - assessment date - EDI scores on each 5 domains - vulnerability on each 5 domains - first language
BabyFirst Evaluation [HCM]	2000 to 2003	- Mother's education level
FamilyFirst Screening [HCM]	2003 to 2005	- Mother's education level
Child and Family Services Information System (CFSA) [MFSCA]	1999/2000 to 2007/08	- Children in care
Income/Employment Assistance [MFSCA]	1999/2000 to 2008/09	- Receipt of IA
Census [DLI – SC]	2006	- Average neighbourhood household income - SEFI-2 score - % of Francophone pop in neighbourhood - dissemination area
Registry		
Research Registry [MH]	April 1/1970 to March 31/2009	- birth date - sex - postal code - number of moves (0-5yrs) - number of siblings (at 5th birthday) - birth order - age of mother at first birth - mother's marital status at birth - mother's marital status at 5th birthday